




# How far and how old: Longevity and displacement records from the South African Bird Ringing Scheme for Ardeidae, Threskiornithidae and Ciconiidae



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**Background:** Understanding the movement and displacement of individuals within avian species is important for conservation. Herons, Storks and Egrets are especially important as they are migratory species and are potential indicator species. It is therefore valuable to set life history baselines to understand survival.

**Objectives:** To establish baseline longevity and displacement values for the avian families Ardeidae, Threskiornithidae and Ciconiidae using the South African Bird Ringing Scheme (SAFRING) data for Africa and to highlight gaps in the SAFRING database for these families.

**Method:** We used data archives of ringed and subsequently reported individuals to determine maximum displacement and longevity from the past seven decades for each species within these three families. Displacement was estimated by the straight-line distance between subsequent records for the same individual. Longevity is the measure of time elapsed in records for the same individual.

**Results:** Displacement and longevity data were available for 17 of the 24 species in the focus families. Individuals of most of the species were ringed as nestlings so displacement records may represent dispersal. Displacement ranged from a maximum of 10 114 km for a White Stork (*Ciconia ciconia*) to 2.5 km for a Little Bittern (*Ixobrychus minutus*). Several species are poorly sampled, resulting in longevity records of just a few days. Despite that, longevity values were > 5 years for 16 species, and the highest value was 25.3 years for a White Stork.

**Conclusion:** It was possible to determine longevity values for most of the species within the three families investigated. Based on the displacement profiles for species with sufficient records, there are large differences in movement between species. Certain common species such as Purple Heron (*Ardea purpurea*) have very few ringing records, which indicate a need for further species-specific research as the longevity values are not representative. This could greatly benefit studies aiming to use these species as ecosystem health indicators as well as identify which species are at risk.

## Introduction

The families Ardeidae, Threskiornithidae and Ciconiidae are small to large birds, typically associated with wetland habitats. Some species migrate whilst others are resident with most species being nomadic to some extent, following rainfall patterns and seasonal habitat distribution (Hockey et al. 2005). This adaptable group, with species that have large global distributions, can colonise novel and anthropogenically altered environments. Nest site flexibility in White Storks (*Ciconia ciconia*), for example, has enabled them to utilise urban chimneys and telephone poles (Tryjanowski et al. 2008).

Understanding avian dispersal, migration and survival is crucial for species conservation as it informs which members of the population are most vulnerable and helps identify important nesting, feeding and resting locations. This is particularly important as globally certain historical migration behaviours are changing, driven by factors such as altered food sources (Rotics et al. 2017), earlier onset of spring (Jenni & Kery 2003) and rapid land alteration (Lemoine et al. 2007). For example, a recent study found that some juveniles of the White Stork are opting to remain in Europe, closer to their natal grounds, as they can exploit the open-air dumps (Rotics et al. 2017). This has important implications for land-use management practices if these storks are to be protected.

In the past few decades dispersal has been widely studied either through Global Positioning System or satellite tracking (e.g. Berthold et al. 2002; Chevallier et al. 2011; Rotics et al. 2017; Van der

Winden, Poot & Van Horssen 2010). Although highly effective, this method can be costly, which constrains sample sizes. Ringing is an alternative, less costly method. It is cruder, only indicating the initial and final location; however, it is still very useful, and several studies still use it for dispersal analysis (e.g. Bartolome 1996, Little Egrets [*Egretta garzetta*] in Spain; Fasola et al. 2002, Little Egrets in France).

Here we summarise seven decades of data from the South African Bird Ringing Scheme's (SAFRING) database on displacement and longevity for the families Threskiornithidae, Ardeidae and Ciconiidae. Although a few single-species studies have been published with respect to dispersal and longevity in these families (Kopij 2017, Cattle Egret [*Bubulcus ibis*], Clark & Clark 1979, African Sacred Ibis, [*Threskiornis aethiopicus*]), a broader assessment of the species is lacking. Such an assessment will identify gaps in the data and provide insights into where further research could be focused and could clarify whether or not movement is dispersal or migration by noting age at ringing and subsequent records.

## Methods

The ringing, recapture, resighting and recovery records of Ardeidae, Threskiornithidae and Ciconiidae were extracted from the SAFRING database in October 2017. Twenty-four species in these families that occur in southern Africa were included in the assessment. From these data the maximum displacement and longevity values were determined. Maximum displacement was calculated as the greatest direct distance (in kilometres) between the initial ringing and subsequent reporting for an individual. To understand if displacement represents postnatal dispersal or migration, the age associated with the records was noted. Longevity is the time elapsed between date of ringing and final subsequent report for the individual. Consequently, longevity values are minimum values. All maximum records were verified by the original reports submitted to SAFRING. Records noted as only 'rings found' or well-decomposed carcass found, were not used because of the uncertainty of the date of death.

The final data set included some records of birds originally ringed in Europe. Location of ringing is indicated in the 'ring number' column of Table 1 by the country name in brackets. To give an indication of how many ringed individuals were re-recorded, a reporting rate was calculated for each species. This rate is simply the percentage of initial ringing records reported at least once (distinct records) after the ringing event. A high percentage would indicate that ringed birds of a particular species are likely to be located at a later point. Many of the secondary records for the three families do not clearly state whether records are resightings or retraps. As these species are rarely retrapped, most of these secondary records are probably resightings.

Displacement profiles were generated for those species with more than 100 subsequent reports (retraps, resightings and recoveries) to investigate the distance moved by individuals

at a finer level. These included the African Sacred Ibis, Hadedda Ibis (*Bostrychia hagedash*), Black-headed Heron (*Ardea melanocephala*) and Cattle Egret. As a result of a limited number of adult initial records, only records where the initial report involved pulli (nestlings, chicks ringed in the nest) and juvenile birds were used for the profiles.

## Results

A total of 29 842 records (26 651 initial, and 3191 records made up of retraps, resightings and recoveries) were reported for all 24 species within Ardeidae, Threskiornithidae and Ciconiidae (Table 1). Black-headed Heron, Cattle Egret, White Stork, African Sacred Ibis and Hadedda Ibis are the most ringed species, with over 1000 ringing records each (Table 1). Species with no subsequent records were Slaty Egret (*Egretta vinaceigula*), Little Blue Heron (*Egretta caerulea*), Dwarf Bittern (*Ixobrychus sturmi*), White-backed Night-heron (*Gorsachius leuconotus*), Eurasian Bittern (*Botaurus stellaris*), Saddle-billed Stork (*Ephippiorhynchus senegalensis*) and Yellow-billed Stork (*Mycteria ibis*) and as a result no displacements or longevity values could be calculated (Table 1).

The greatest distances travelled were 10 114 km for White Stork, 4233 km for Cattle Egret and 1465 km for African Sacred Ibis (Table 1). The species for which the smallest maximum displacement was measured (2.5 km) was the Little Bittern (*Ixobrychus minutus*) (Table 1). Longevity records of > 5 years exist for 16 species, with the maximum longevity being 25.3 years (White Stork) (Table 1).

Most initial records were pulli or chicks and juveniles (90.3%,  $n = 24\ 070$ ) with the remainder listed as either 'unknown' or adults (9.7%) (Appendix 1 and 2). For Saddle-billed Stork, Black Heron (*Egretta ardesiaca*), Abdim's Stork (*Ciconia abdimii*), Dwarf Bittern, Squacco Heron (*Ardeola ralloides*), Green-backed Heron (*Butorides striata*), Little Bittern and Hadedda Ibis, most individuals ringed were recorded as adults (Appendix 1 and 2).

Most Ardeidae and Threskiornithidae chicks were reported again close (< 50 km) to the original ringing site. 90.4% of the displacement records for storks were over 500 km. For individuals reported dead, 28.2% had known finding details: sick or injured subsequently died (17.5%), shot (16.8%), collision (fence, line or wire) (15.6%), victim of weather (5.1%), killed or attacked by bird (4.3%) and electrocuted (2.9%).

## Discussion

This study attempted to provide maximum longevity and displacement values for the 24 species of Ardeidae, Threskiornithidae and Ciconiidae occurring in southern Africa. Longevity data were available for 17 species (see Appendix 2 for top three values). In addition, this study updated some of the data published in Underhill et al. (1999). For example, longevity values for two species were updated: Green-backed Heron (0–12 years) and Hadedda Ibis (5–10 years).

**TABLE 1:** Maximum longevity and displacement records of southern African Ardeidae, Threskiornithidae and Ciconiidae species from ringing records of the South African Bird Ringing Scheme.

Species	Longevity (years)	Ring number	Displacement (kilometres)	Ring number	Nestlings ringed	Adults ringed	Total ringed	Total retrapped	Total recovered	Reporting rate (%)
<b>Family Ardeidae</b>										
Grey Heron ( <i>Ardea cinerea</i> )	12 y 7m 13d ± 15	C01003	1466.67 ± 5	813008	475	57	532	12	24	6.8
Black-headed Heron ( <i>Ardea melanocephala</i> )	21y 2m 19d	810732	794.11	5253009	1248	106	1354	7	104	8.2
Goliath Heron ( <i>Ardea goliath</i> )	4y 7m 8d	G01804	287.55	65802102	16	9	25	0	12	48.0
Purple Heron ( <i>Ardea purpurea</i> )	0y 0m 20d	793605	0.00	793605	26	11	37	1	0	2.7
Great Egret ( <i>Egretta alba</i> )	1y 8m 14d ± 15	824263	56.73	824263	80	3	83	0	1	1.2
Little Egret ( <i>Egretta garzetta</i> )	9y 10m 24d	52500273	1766.74	55505305	160	29	189	0	17	9.0
Yellow-billed Egret ( <i>Egretta intermedia</i> )	9y 11m 11d	D00232	2143.67 ± 15	55501389	174	8	182	3	21	13.2
Slaty Egret ( <i>Egretta vinaceigula</i> )	-	-	-	-	0	1	1	0	0	Not applicable
Little Blue Heron ( <i>Egretta caerulea</i> )	-	-	-	-	0	0	0	1	0	Not applicable
Cattle Egret ( <i>Bubulcus ibis</i> )	23y 4m 2d ± 3	64500592	4233.19 ± 5	644157	9581	598	10 179	37	436	4.7
Squacco Heron ( <i>Ardeola ralloides</i> )	1y 0m 21d	55306426	2294.85 ± 350	55306426	12	32	44	0	2	4.6
Green-backed Heron ( <i>Butorides striata</i> )	12y 6m 12d	682810	1.67	682810	6	99	105	8	0	7.6
Black Heron ( <i>Egretta ardesiaca</i> )	0y 2m 30d	58601664	469.16	58601664	3	8	11	0	1	9.1
Dwarf Bittern ( <i>Ixobrychus sturmii</i> )	-	-	-	-	2	16	18	0	0	Not applicable
Little Bittern ( <i>Ixobrychus minutus</i> )	6y 9m 6d	PA14663	2.53	5A01607	4	264	268	28	2	11.2
Black-crowned Night-heron ( <i>Nycticorax nycticorax</i> )	10y 9 m 5 d ± 15	52400899	6995.78	H02801 (Romania)	481	43	524	1	41	8.0
White-backed Night-heron ( <i>Gorsachius leuconotus</i> )	-	-	0.00	No data.	0	1	1	0	0	Not applicable
Eurasian Bittern ( <i>Botaurus stellaris</i> )	-	-	0.00	No data.	0	3	3	1	0	33.3
<b>Family Ciconiidae</b>										
Marabou Stork ( <i>Leptoptilos crumeniferus</i> )	7y 10m 23d ± 15	G25906	1396.17	G23668	202	38	240	31	5	15.0
African Openbill ( <i>Anastomus lamelligerus</i> )	0y 5m 16d	1K00331	1174.31	1K00331 (Zambian)	15	2	17	0	2	11.8
Saddle-billed Stork ( <i>Ephippiorhynchus senegalensis</i> )	-	-	-	-	2	3	5	0	0	Not applicable
Yellow-billed Stork ( <i>Mycteria ibis</i> )	-	-	-	-	0	4	4	0	0	Not applicable
Woolly-necked Stork ( <i>Ciconia episcopus</i> )	0y 8m 0d	PS00864	2.45	PS00864	0	16	16	2	0	12.5
Abdims Stork ( <i>Ciconia abdimii</i> )	9y 1m 1d	59701887	3021.58	59703444	2	15	17	0	4	23.5
Black Stork ( <i>Ciconia nigra</i> )	2y 11m 18d ± 15	52600351	4452.36	DER AN653 (Denmark)	45	5	50	1	2	6.0
White Stork ( <i>Ciconia ciconia</i> )	25y 3m 14d	16	10114.78 ± 5	VIB00465 (Denmark)	755	202	957	100	678	81.2
<b>Family Threskiornithidae</b>										
African Sacred Ibis ( <i>Threskiornis aethiopicus</i> )	21y 1m 6d	52601770	1465.87 ± 5	59702492	8538	440	8978	88	344	4.9
Southern Bald Ibis ( <i>Geronticus calvus</i> )	5y 5m 4d ± 15	812185	42.76	864579	604	31	635	1	5	0.9
Glossy Ibis ( <i>Plegadis falcinellus</i> )	12y 9m 27d	710750	1292.22	710061	596	40	636	0	10	1.6
Hadada Ibis ( <i>Bostrychia hagedash</i> )	10y 4m 21d	836378	148.07	878488	407	487	894	1064	43	124.0
African Spoonbill ( <i>Platalea alba</i> )	14y 0m 28d	903022	1036.48	816817	636	10	646	18	33	8.0
<b>Totals</b>	-	-	-	-	<b>24 070</b>	<b>2581</b>	<b>26 651</b>	<b>1404</b>	<b>1787</b>	<b>12.0</b>

Note: Values displaying a ± symbol indicate level of uncertainty in days as exact date or location was not known. Records belonging to foreign schemes are indicated in the ring number column in brackets. Reporting rate is a percentage of ringed individuals located again as retraps, resightings or recoveries.

Most individuals for all species were ringed as chicks, with very few ringing records for adults, so it was not possible to investigate the relationship between age and displacement. The lack of ringing records for adult individuals could well be explained by their large size, which makes these species difficult to trap in mistnets. As most ringers in southern Africa are hobbyists who typically use mistnetting, members of the Ardeidae, Threskiornithidae and Ciconiidae are rarely caught. Species in Ciconiidae have high European ringing totals but they were also ringed mainly as chicks. Bittern species are also difficult to locate, resulting in few casual ringing events. As some species in these families, such as Little Egret and Grey Heron, are common, it would be beneficial to establish baseline data sets for them to use as indicators of ecosystem health changes such as has been done elsewhere.

There is some evidence for movement of pulli in all three families based on displacement records (Table 1). As the

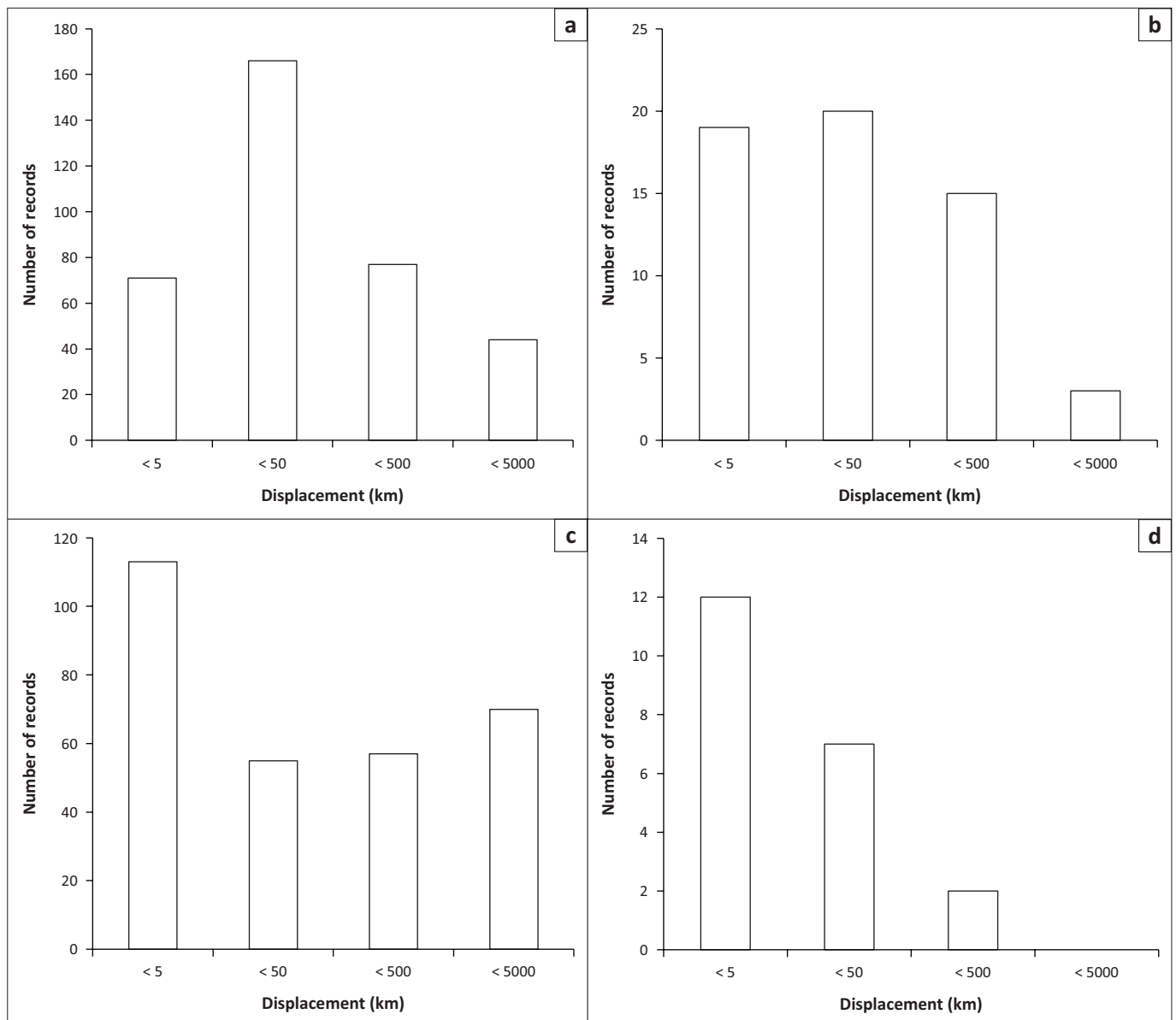
data are biased towards ringed chicks, with poor adult representation it was not possible to determine whether the dispersal of young birds represents postnatal dispersal or migration. Puglisi and Bretagnolle (2005) found that Great Bittern chicks from sites in Italy and France moved at most 5.5 km from a nest, which they argued was far given that the average distance between nests measured at two sites was 148 m and 149 m. This suggests that the scale of dispersal could be very small in some species. In a southern African context, little is known about the migration or movement of many species in the three families, with the exception of those in the family Ciconiidae, which are known to migrate large distances. Some movement traits are known in the same species occurring in Europe, for example overwintering Eurasian Bitterns in England have been noted to return to the same wetland (Gilbert, Tyler & Smith 2005). For species like the Purple Heron, the picture appears to be complex. Although Palearctic migrants make it to

North and West Africa (Van der Winden et al. 2010), there is no evidence to suggest that they migrate to southern Africa (Hockey et al. 2005; Martin 1997).

The displacement profiles generated were unsurprising (Figure 1); Hadedea Ibis are known not to migrate as a rule although young may disperse (Skead 1951). The high number of chicks recovered less than 5 km from the site of ringing in African Sacred Ibis could represent pulli that die at a colonial nesting site. There is a clear indication of some movement of Cattle Egret in Figure 1, which supports the knowledge that this species does not regularly migrate, although it may track seasonal rainfall (Hockey et al. 2005). Juvenile Egrets may disperse short distances from the nesting roost whilst foraging although tracking of individual birds will provide a clearer picture. No clear pattern emerged for the Black-headed Heron, although few travelled more than 500 km.

The increase in urban populations of some species such as Sacred Ibis and Hadedea Ibis has raised concerns about noise and water pollution. As a result, various efforts are made to control or cull populations, such as egg-oiling in Australia (Martin et al. 2007). For these methods to be effective and managed responsibly, the life history of these birds needs to be well understood. It is also important to establish which range changes are caused by direct human intervention and which are 'natural' in response to habitat change.

Where longevity data do exist, individuals in several species such as Grey Heron, Black-headed Heron and Cattle Egret appear to be long-lived, which justifies the effort in trapping, ringing and monitoring. Many of the species included in the study are also found in Europe, where intensive ringing programmes have been operating since the early 1900s. Greater ringing effort over a longer period of time seems to



km, kilometres.

**FIGURE 1:** Number of (a) Cattle Egrets (*Bubulcus ibis*), (b) Black-headed heron (*Ardea melanocephala*), (c) Sacred Ibis (*Threskiornis aethiopicus*) and (d) Hadedea Ibis (*Bostrychia hagedash*) trapped, sighted or recovered having travelled 1 km – 5 km, 6 km – 50 km, 51 km – 500 km and 501 km – 5000 km, after being ringed as pulli or juveniles. These four species were selected based on having sufficient records to generate these figures.

have translated into greater longevities in many instances and in several species, long lifespans have been recorded where no reasonable value exists in the SAFRING data. For example, European data for Purple Heron gives longevity as 25 year 5 months, for Squacco Heron as 5 year 10 months, for Eurasian Bittern as > 11 years 4 months and for Black Stork as 18 years 7 months (Fransson et al. 2010). Only one species, the Cattle Egret, has a greater value in South Africa of 23 year 4 months (Table 1) compared to the European value of 18 years 5 months (Fransson et al. 2010). Cattle Egrets in South Africa were the focus of an intense effort to ring many individuals in the 1970s, indicating that dedicated projects could deliver worthwhile data.

## Conclusion

Using ringing data from SAFRING, longevity and displacement values are presented for avian families Ardeidae, Threskiornithidae and Ciconiidae. Longevity data exist for 17 of the 24 species, although some of the values are not realistic because of poor sample sizes. The data set is biased towards juvenile and chick data, which leaves many questions around adult movement and longevity unanswered. Dedicated research is required to better understand the basic biology of species in the three families as well as how these species are responding to land use and climate change.

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## Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

## Authors' contributions

The motivation for the study was initiated by all authors. D.P. did most of the data extraction and analysis. S.R. did most of

the data verification. S.R. wrote the bulk of the manuscript. H-D.O. assisted with the entire process.

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## Appendix 1

**TABLE 1-A1:** Top three displacement records of southern African Ardeidae, Threskiornithidae and Ciconiidae species from ringing records from the South African Ringing Scheme.

Family	Species	Displacement (kilometres)	Initial Coord.	Second Coord.	Ring number	Initial age	Secondary age	Sex
Ardeidae	Grey Heron ( <i>Ardea cinerea</i> )	1466.67 ± 5	1850S1650E	3035S2327E	813008	Pullus	Unknown	Unknown
		1224.33 ± 5	1850S1650E	2833S2230E	813058	Pullus	Juvenile	Unknown
		530.64	1550S2721E	2035S2750E	1K0137	Pullus	Juvenile	Unknown
	Black-headed Heron ( <i>Ardea melanocephala</i> )	797.55	2610S2818E	2012S3238E	52503009	Pullus	Unknown	Unknown
		694.43 ± 5	2610S2818E	3223S2737E	810878	Pullus	Unknown	Unknown
		670.00	2611S2826E	3139S2532E	5253962	Juvenile	Juvenile	Unknown
	Goliath Heron ( <i>Ardea goliath</i> )	287.55	2633S2536E	2908S2528E	65802102	Pullus	Juvenile	Unknown
		186.61	2551S2718E	2633S2536E	65802041	Unknown	Unknown	Unknown
		182.24	1900S3014E	1901S2830E	52704804	Unknown	Unknown	Unknown
	Purple Heron ( <i>Ardea purpurea</i> )	0.00	3403S1829E	3403S1829E	793605	Pullus	Pullus	Unknown
	Great Egret ( <i>Egretta alba</i> )	56.73	2015S3100E	2003S3030E	824263	Pullus	Unknown	Unknown
	Little Egret ( <i>Egretta garzetta</i> )	1766.74	3404S1830E	2502S3334E	55505305	Juvenile	Unknown	Unknown
		147.23	3404S1830E	3432S2000E	55403748	Pullus	Adult	Unknown
		127.34	3404S1830E	3300S1900E	52402641	Pullus	Unknown	Unknown
	Yellow-billed Egret ( <i>Egretta intermedia</i> )	2143.67 ± 15	3404S1830E	1515S2309E	55501389	Pullus	Unknown	Unknown
		1379.00	2508S2822E	3405S1828E	A02395	Adult	Adult	Female
		150.10	3404S1830E	3432S2002E	55406280	Juvenile	Adult	Unknown
	Cattle Egret ( <i>Bubulcus ibis</i> )	4233.19 ± 5	2725S2710E	1028N2317E	644157	Pullus	Unknown	Unknown
		3762.16 ± 5	2936S3023E	0409N2754E	54309342	Pullus	Adult	Unknown
		3491.00	2611S2817E	0436N2154E	58502523	Pullus	Adult	Unknown
	Squacco Heron ( <i>Ardeola ralloides</i> )	2294.85 ± 350	2918S2958E	0900S2600E	55306426	Pullus	Unknown	Unknown
	Green-backed Heron ( <i>Butorides striata</i> )	1.67	2535S2820E	2535S2819E	682810	Adult	Adult	Unknown
		0.00	2941S3104E	2941S3104E	614479	0.0–0.5 year	Adult	Unknown
		0.00	2941S3104E	2941S3104E	614472	adult	Adult	Unknown
	Black Heron ( <i>Egretta ardesiaca</i> )	469.16	2009S2836E	1605S2725E	58601664	Juvenile	Unknown	Unknown
	Little Bittern ( <i>Ixobrychus minutus</i> )	2.53	2116S2731E	2115S2732E	5A01607	Adult	Adult	Male
		0.00	2619S2721E	2619S2721E	686354	Adult	Adult	Unknown
		0.00	2619S2721E	2619S2721E	PA14663	Adult	Adult	Female
	Black-crowned Night-heron ( <i>Nycticorax nycticorax</i> )	6995.78	4505N2805E	1730S3510E	H02801 (Romania)	Unknown	Adult	Unknown
		1954.14 ± 15	2611S2818E	0838S2720E	729541	Pullus	Unknown	Unknown
Ciconiidae	Marabou Stork ( <i>Leptoptilos crumeniferus</i> )	1396.17	2612S3152E	2933S1810E	G23668	Pullus	Unknown	Unknown
		1257.37	2612S3152E	3341S2204E	G25335	Pullus	Unknown	Unknown
		523.00	2612S3152E	2211S2910E	G23700	Unknown	Unknown	Unknown
	African Openbill ( <i>Anastomus lamelligerus</i> )	1174.31	1550S2721E	1745S1630E	1K00331	Pullus	Juvenile	Unknown
		0.00	2017S2614E	2017S2614E	65703578	Pullus	Unknown	Unknown
	Woolly-necked Stork ( <i>Ciconia episcopus</i> )	2.45	2950S3050E	2949S3051E	PS00864	Adult	Adult	Unknown
	Abdim's Stork ( <i>Ciconia abdimii</i> )	3021.58	1745S3110E	0415N1500E	59703444	Adult	Adult	Unknown
		2329.01 ± 5	1750S3110E	0303N2932E	59701887	Adult	Adult	Unknown
		128.91 ± 5	1746S3105E	1640S3042E	732449	Immature	Adult	Unknown
	Black Stork ( <i>Ciconia nigra</i> )	4452.36	5015N0622E	1310N1208W	DER AN653 (Denmark)	Pullus	0.5–1.0 year	Unknown
		50.36 ± 5	2033S2830E	2034S2801E	5260351	Pullus	Unknown	Unknown
	White Stork ( <i>Ciconia ciconia</i> )	10114.78 ± 5	5613N0959E	3340S2624E	VIB00465 (Denmark)	Pullus	Adult	Unknown
		10049.35 ± 5	5720N2528E	3302S2700E	A143151 (Latvia)	Pullus	Juvenile	Male
		10025.08	5613N2444E	3348S1849E	4920 (Lithuania)	Pullus	Adult	Unknown
	Threskiornithidae	African Sacred Ibis ( <i>Threskiornis aethiopicus</i> )	1465.87 ± 5	2800S2644E	1516S2303E	59702492	Juvenile	Adult
1451.54			2759S2642E	1522S2305E	59702497	Pullus	Adult	Unknown
1335.37			2610S2826E	1519S2255E	52504862	Pullus	Adult	Unknown
Southern Bald Ibis ( <i>Geronticus calvus</i> )		42.76	2655S3005E	2701S2940E	864579	Juvenile	Immature	Unknown
		26.11	2647S3013E	2655S3000E	812185	Unknown	Adult	Unknown
		11.00	2707S3008E	2710S3002E	801548	Pullus	Unknown	Unknown
Glossy Ibis ( <i>Plegadis falcinellus</i> )		1292.22	2611S2818E	1539S2302E	710061	Pullus	Adult	Unknown
		154.24 ± 5	2611S2818E	2622S2646E	710750	Pullus	Adult	Unknown
		75.19 ± 5	2611S2818E	2554S2737E	710599	Pullus	Juvenile	Unknown
Hadedda Ibis ( <i>Bostrychia hagedash</i> )		148.07	3403S1826E	3248S1753E	878488	Pullus	Adult	Unknown
		91.56 ± 15	2606S2800E	2520S2820E	840407	Unknown	Unknown	Unknown
		67.00	3401S1827E	3338S1901E	871585	Pullus	Unknown	Unknown
African Spoonbill ( <i>Platalea alba</i> )		1036.48	3254S1820E	2645S2625E	816817	Pullus	Unknown	Unknown
		1030.92 ± 5	2610S2826E	1731S2450E	52501481	Pullus	Juvenile	Unknown
		790.44 ± 5	2017S2614E	2723S2637E	65700561	Pullus	Unknown	Unknown

Note: Values displaying a ± symbol indicate level of uncertainty because exact location was not known. Records belonging to foreign schemes are indicated in the ring number column in brackets. Initial Coord. refers to location of ringing and Second Coord. refers to the location where the individual was subsequently recovered.

## Appendix 2

**TABLE 1-A2:** Top three longevity records of southern African Ardeidae, Threskiornithidae and Ciconiidae species from ringing records at the South African Ringing Scheme.

Family	Species	Longevity (days)	Longevity (years)	Initial date	Final date	Ring number	Initial age	Sex
Ardeidae	Grey Heron ( <i>Ardea cinerea</i> )	4609 ± 15	12y 7m 13d	18-09-1951	01-05-1964	C01003	Pullus	Unknown
		4290 ± 15	11y 8m 30d	21-02-1974	20-11-1985	824278	Pullus	Unknown
		3160	8y 7m 24d	07-04-1974	01-12-1982	903461	Juvenile	Unknown
	Goliath Heron ( <i>Ardea goliath</i> )	1683	4y 7m 8d	02-04-1975	10-11-1979	G01804	Pullus	Unknown
		1554	4y 3m 1d	02-11-1968	03-02-1973	50801948	Pullus	Unknown
		1031	2y 9m 27d	19-08-1969	15-06-1972	65804968	Pullus	Unknown
	Black-headed Heron ( <i>Ardea melanocephala</i> )	7751	21y 2m 19d	10-04-1971	29-06-1992	810732	Juvenile	Unknown
		6799	18y 7m 12d	03-11-1969	15-06-1988	64604643	Pullus	Unknown
		6559	17y 11m 16d	28-11-1969	13-11-1987	64604922	Pullus	Unknown
	Purple Heron ( <i>Ardea purpurea</i> )	20	0y 0m 20d	11-11-2003	01-12-2003	793605	Pullus	Unknown
	Squacco Heron ( <i>Ardeola ralloides</i> )	387	1y 0m 21d	09-12-1959	30-12-1960	55306426	Pullus	Unknown
	Cattle Egret ( <i>Bubulcus ibis</i> )	8523 ± 3	23y 4m 2d	08-01-1966	10-05-1989	64500592	Pullus	Unknown
		6753	18y 5m 27d	06-01-1974	03-07-1992	644700	Pullus	Unknown
		5920 ± 15	16y 2m 15d	08-11-1957	23-01-1974	55303890	Unknown	Unknown
	Green-backed Heron ( <i>Butorides striata</i> )	4579	12y 6m 12d	21-03-2003	03-10-2015	682810	Adult	Unknown
		546	1y 5m 28d	01-03-1992	29-08-1993	614472	Adult	Unknown
		367	1y 0m 1d	18-01-2012	19-10-2013	PA14151	Adult	Unknown
	Great Egret ( <i>Egretta alba</i> )	621 ± 15	1y 8m 14d	21-02-1974	04-11-1975	824263	Pullus	Unknown
	Yellow-billed Egret ( <i>Egretta intermedia</i> )	3626	9y 11m 11d	20-11-1951	24-10-1961	D00232	Pullus	Unknown
		2155	5y 10m 25d	19-10-1956	13-09-1962	55501312	Unknown	Unknown
		1532	4y 2m 10d	26-11-1957	05-02-1962	55403937	Unknown	Unknown
	Black Heron ( <i>Egretta ardesiaca</i> )	0~91	0y 2m 30d	16-03-1969	15-06-1969	58601664	Juvenile	Unknown
	Little Egret ( <i>Egretta garzetta</i> )	3616	9y 10m 24d	18-11-1954	12-10-1964	52500273	Unknown	Unknown
		3368 ± 15	9y 2m 20d	26-10-1957	15-01-1967	55403748	Adult	Unknown
		2094	5y 8m 26d	28-11-1953	23-08-1959	52400480	Unknown	Unknown
	Little Bittern ( <i>Ixobrychus minutus</i> )	2471	6y 9m 6d	23-01-2010	29-10-2016	PA14663	1.0–2.0 year	Female
		1043	2y 10m 6d	17-03-2007	23-01-2010	686354	adult	Unknown
994		2y 8m 19d	23-04-2011	11-01-2014	PA11368	0.5–1.0 year	Male	
Black-crowned Night-heron ( <i>Nycticorax nycticorax</i> )	3931 ± 15	10y 9m 5d	17-10-1953	22-07-1964	52400899	Unknown	Unknown	
	3750 ± 3	10y 3m 5d	17-11-1955	22-02-1966	54304461	Unknown	Unknown	
	2978	8y 1m 26d	20-11-1949	15-01-1958	D00270	Unknown	Unknown	
Threskiornithidae	Hadeda Ibis ( <i>Bostrychia hagedash</i> )	3793	10y 4m 21d	20-02-1989	11-07-1999	836378	Juvenile	Unknown
		3294	9y 0m 7d	20-02-1989	27-02-1998	836385	Juvenile	Unknown
		3150	8y 7m 20d	24-08-2007	08-04-2016	871610	Pullus	Unknown
	Southern Bald Ibis ( <i>Geronticus calvus</i> )	1981 ± 15	5y 5m 4d	11-11-1972	15-04-1978	812185	Unknown	Unknown
		317	0y 10m 13d	01-12-2006	14-10-2007	864579	Juvenile	Unknown
		101	0y 3m 9d	16-10-2004	25-01-2005	801548	Pullus	Unknown
	African Spoonbill ( <i>Platalea alba</i> )	5142	14y 0m 28d	17-10-1970	14-11-1984	903022	Pullus	Unknown
		4937	13y 6m 7d	14-11-1970	21-05-1984	812729	Pullus	Unknown
		4388	12y 0m 5d	30-11-1974	05-12-1986	904691	Pullus	Unknown
	Glossy Ibis ( <i>Plegadis falcinellus</i> )	4684	12y 9m 27d	15-01-1972	11-11-1984	710750	Pullus	Unknown
		1644	4y 6m 4d	04-03-1972	03-09-1976	728940	Pullus	Unknown
		1292 ± 180	2y 8m 28d	21-11-1970	15-08-1973	710061	Pullus	Unknown
	African Sacred Ibis ( <i>Threskiornis aethiopicus</i> )	7707	21y 1m 6d	20-12-1952	26-01-1974	52601770	Unknown	Female
		5845	16y 0m 1d	20-10-1956	21-10-1972	52500494	Unknown	Unknown
		5692	15y 7m 0d	04-03-1972	04-10-1987	58602786	Unknown	Unknown
Ciconiidae	African Openbill ( <i>Anastomus lamelligerus</i> )	169	0y 5m 16d	30-07-1974	15-10-1975	1K00331	Pullus	Unknown
		37	0y 1m 7d	21-04-1974	28-05-1974	65703578	Pullus	Unknown
	Abdim's Stork ( <i>Ciconia abdimii</i> )	3319	9y 1m 1d	11-01-1967	12-02-1976	59701887	Unknown	Unknown
		3318	9y 0m 30d	06-01-1976	05-02-1985	732449	Immature	Unknown
		95	0y 3m 4d	24-01-1968	28-04-1968	59703444	Unknown	Unknown
	White Stork ( <i>Ciconia ciconia</i> )	9238	25y 3m 14d	25-06-1979	09-10-2004	16 (Germany, Helgoland)	Pullus	Unknown
		8326	22y 9m 17d	17-06-1975	03-04-1998	K00899 (Germany, Hiddensee)	Pullus	Unknown
		7314 ± 3	20y 0m 14d	29-06-1963	08-07-1983	H07579 (Germany, Helgoland)	Pullus	Unknown

Table 1-A2 continues on the next page →

**TABLE 1-A2 (Continues...):** Top three longevity records of southern African Ardeidae, Threskiornithidae and Ciconiidae species from ringing records at the South African Ringing Scheme.

Family	Species	Longevity (days)	Longevity (years)	Initial date	Final date	Ring number	Initial age	Sex
	Woolly-necked Stork ( <i>Ciconia episcopus</i> )	243	0y 8m 0d	29-12-2014	29-08-2015	PS00864	Adult	Unknown
		119	0y 3m 29d	29-12-2014	27-04-2015	PS00864	Adult	Unknown
	Black Stork ( <i>Ciconia nigra</i> )	1083 ± 15	2y 11m 18d	28-08-1965	15-08-1968	52600351	Unknown	Unknown
		263	0y 8m 18d	15-06-2014	05-03-2015	DER AN653 (Denmark)	Pullus	Unknown
	Marabou Stork ( <i>Leptoptilos crumeniferus</i> )	2883 ± 15	7y 10m 23d	26-09-2008	18-08-2016	G25906	Pullus	Unknown
		1896	5y 2m 9d	04-11-2004	13-01-2010	G23626	Pullus	Unknown
		1184	3y 2m 27d	25-08-2011	21-11-2014	S162	Pullus	Unknown

Note: Values displaying a ± symbol indicate level of uncertainty because exact date was not known. Records belonging to foreign schemes are indicated in the ring number column in brackets. y, years; m, months; d, days