

Hooded Vulture *Necrosyrtes monachus* and African White-backed Vulture *Gyps africanus* nesting at the Olifants River Private Nature Reserve, Limpopo province, South Africa

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Basic ecological information is still lacking for many species of African vultures. The Hooded Vulture *Necrosyrtes monachus* is known as a rare breeding resident in north-eastern South Africa. This study set out to monitor the nests of Hooded Vultures and, secondarily, White-backed Vultures *Gyps africanus* in the Olifants River Private Nature Reserve over two breeding seasons in 2013 and 2014. A total of 12 Hooded Vulture nests, placed mostly in the tree *Diospyros mespiliformis*, were found along the Olifants River, with an average inter-nest distance of 0.76 km. Nest success was estimated to be between 0.44–0.89 offspring pair⁻¹ y⁻¹ in 2013 and 0.50–0.67 offspring pair⁻¹ y⁻¹ in 2014, which are the first estimates for Hooded Vultures in South Africa. It is thought that nests of this species have been under-reported due to the fact that they are placed within or below the canopy of densely leafed trees and hence difficult to view from aerial surveys. African White-backed Vultures also bred along the Olifants River, with nests placed in clusters of up to six. Nesting density of this species ranged from about 1.0 to 1.2 nests km⁻¹ and nests were predominantly placed in *Ficus sycomorus* trees.

Keywords: Hooded Vulture, nesting ecology, South Africa

Introduction

Although tree-nesting vulture populations are relatively well known in north-eastern South Africa (Mundy et al. 1992), surveys have been patchy. Parts of the Kruger National Park, and neighbouring Klaserie Private Nature Reserve (PNR) and Timbavati PNR have been extensively surveyed (Tarboton and Allan 1984; Murn et al. 2013). In 1977, the nesting density of African White-backed Vulture *Gyps africanus* in the Timbavati-Klaserie protected area was 46 breeding pairs in 470 km² or 9.8 pairs 100 km⁻², but dropped to 3.9 pairs 100 km⁻² in 1979, probably as a result of different parts of the study area being surveyed (Tarboton and Allan 1984). Nesting densities in the Satara area of Kruger National Park ranged from 5.1 pairs 100 km⁻² in 1979 to 7.9 pairs 100 km⁻² in 1968 (Kemp and Kemp 1975; Tarboton and Allan 1984), whereas nest density ranged from a low of 1.6 pairs 100 km⁻² to a high of 10.1 pairs 100 km⁻² in different parts of Kruger National Park (Murn et al. 2013). The most recent total population estimate for this species in Kruger National Park is 904 pairs (Murn et al. 2013).

Far less is known about the populations and breeding ecology of other tree-nesting vultures in the region. Recent work has provided estimates for the White-headed Vulture *Trigonoceps occipitalis* and Lappet-faced Vulture *Torgos tracheliotos* in Kruger National Park (Murn et al. 2013), and reviewed the breeding biology of the former species

(Murn and Holloway 2014). By contrast, little is known about the Hooded Vulture *Necrosyrtes monachus* in north-eastern South Africa. Up until the 1990s, only six nesting attempts were documented from the former Transvaal province of South Africa, all within Kruger National Park (Kemp 1969; Tarboton and Allan 1984; Anderson 2000). Since then, a further four nests have been recorded from protected areas adjoining Kruger National Park in the west: two in Timbavati PNR and two further south in Sabie-Sands PNR (Simmons 1994; Roche 2006). The total breeding population in Kruger National Park is estimated at 64 pairs (Kemp et al. 2001), with 50–100 pairs occurring in South Africa (Anderson 2000). This species shows a preference for nesting in a fork of the jackal-berry tree *Diospyros mespiliformis* situated in the riparian zone (Roche 2006). Most southern African nests are incubated in winter (June–August) (Hockey et al. 2005), and nesting success in Hwange National Park, Zimbabwe, was recorded as 0.54 offspring pair⁻¹ y⁻¹ (Hustler and Howells 1988). Nesting success in South Africa (at the southern extremity of the species distribution) is not known.

This study reports on a relatively large number of nests of Hooded Vulture that have been monitored over a two-year period. The objectives of this study were to (1) present information on the nest site locations of Hooded and African White-backed Vultures in Olifants River PNR, and

(2) provide the first account of nesting success of Hooded Vultures breeding in South Africa.

Study area

The Olifants River PNR (24°09'46" S, 31°01'27" E) is 6 200 ha in extent and is situated in Limpopo province approximately midway between the towns of Hoedspruit and Phalaborwa. It comprises a variety of woodland and savanna habitat types supporting myriad diversity of associated wildlife species, including the 'Big Five'.

Methods

Vulture surveys were established in Olifants River PNR in 2013, in order to obtain baseline data on the breeding numbers of Hooded and African White-backed Vultures within this protected area. We surveyed the total length of the Olifants River within the protected area, approximately 14.5 km, by means of a ground survey. The survey was concentrated on the river due to the availability of suitable nesting trees for these vulture species (Mundy et al. 1992). We also searched for nests away from the river frontage, including in close proximity to other water bodies such as dams.

For each nest, we determined the species of vulture using the nest, the tree species within which the nest was situated, the date of observation and a GPS location of the nest site. For the Hooded Vulture, we collected additional information, such as a detailed description of the location, the height of the nest, and the height of the tree. Nesting success was determined for Hooded Vulture nests only, using the following criteria. A nest was deemed successful if (1) a chick was tracked fledging from the nest (applied to four nests where nestlings were fitted with tracking devices; see below), (2) a chick was observed fledging (applied to three nests with camera traps; see below) and (3) a recently fledged bird, alongside the breeding pair, was sighted at the nest.

In the 2013 breeding season, four Hooded Vulture nestlings were fitted with tracking devices as part of another study. Of these, two were Cellular Tracking Technology (GSM solar powered) devices and two were PTTs, also

solar powered. All four devices had battery back-ups and all four were fitted via a backpack harness with teflon material inside tubing. Signals received from these tracking devices made it possible to determine whether these birds successfully fledged or not. In the 2014 breeding season, camera traps (Bushnell Trophy model 119576) were deployed at three nests and based on these images it was possible to determine whether these chicks fledged successfully or not.

Results

Hooded Vulture *Necrosyrtes monachus*

The total of 12 Hooded Vulture nests were predominantly situated in *Diospyros mespiliformis* trees, with fewer nests in *Ficus sycomorus*, *Breonadia salicina* and *Combretum imberbe* (Table 1). Nests were invariably placed in a large fork, usually between two-thirds and three-quarters (mean = 0.72) of the way up the tree (Table 1). None of the nests were in the canopy, although many of the nests were in the well-foliaged crown of the tree (Table 1).

The density of Hooded Vulture nests along the surveyed section of the river was 0.83 nests km⁻¹ (12 nests along 14.5 km of river front). The mean distance between nests was 0.76 km, with the greatest distance being 1.68 km and the nearest nests being just 60 m apart (Figure 1). All active nests in 2013 were also active in 2014 (Table 1), suggesting the re-use of nests by pairs and regular annual breeding attempts.

During the 2013 breeding season, we located nine active Hooded Vulture nests of which four definitely fledged a chick (based on tracking data), and a further four nests had one-month-old (or older) chicks on the nest that probably fledged successfully (Table 1). One nest failed for unknown reasons. In the 2014 breeding season, six out of the 12 known active nests fledged successfully (Table 1). It is believed that this increase in the number of active nests was due to greater search effort in 2014 rather than any intrinsic increase in breeding by the birds. Four nests failed, again for unknown reasons, and the outcome at two nests was unknown, although successful fledging was likely due to the sighting of recently fledged birds near the nest sites (Table 1). Hence, in the best-case scenario, breeding

Table 1: Characteristics and outcome of 12 Hooded Vulture nests at Olifants River Private Nature Reserve located during the 2013 and 2014 breeding seasons. The crown refers to the leafy, well-foliaged part at the top of the tree

Nest code	Nesting tree	Nest height (m)	Tree height (m)	Description of nest position	2013	Outcome	2014	Outcome
OR001	<i>Diospyros mespiliformis</i>	12	16	In lateral branch fork, below crown	Active	Successful	Active	Successful
OR005	<i>Diospyros mespiliformis</i>	12	19	In main fork, below crown	Active	Chick hatched	Active	Successful
OR007	<i>Diospyros mespiliformis</i>	11	13	In lateral branch fork, in crown	Active	Chick hatched	Active	Successful
OR008	<i>Diospyros mespiliformis</i>	13	24	In main fork, below crown	Active	Failed	Active	Failed
OR009	<i>Ficus sycomorus</i>	14	19	In lateral branch fork, in crown	Active	Chick hatched	Active	Successful
OR011	<i>Diospyros mespiliformis</i>	9	13	In main fork, in crown	Active	Successful	Active	Failed
OR014	<i>Diospyros mespiliformis</i>	15	18	In crown of crown	Active	Successful	Active	Unknown
OR023	<i>Breonadia salicina</i>	14	18	In main fork, below crown	Active	Chick hatched	Active	Successful
OR024	<i>Diospyros mespiliformis</i>	17	18	In narrow fork, below crown	Active	Successful	Active	Failed
OR025	<i>Combretum imberbe</i>	13	16	In main fork, below crown	–	–	Active	Failed
OR027	<i>Ficus sycomorus</i>	8	14	In lateral fork, in crown	–	–	Active	Unknown
OR034	<i>Diospyros mespiliformis</i>	12	18	In main fork, below crown	–	–	Active	Successful

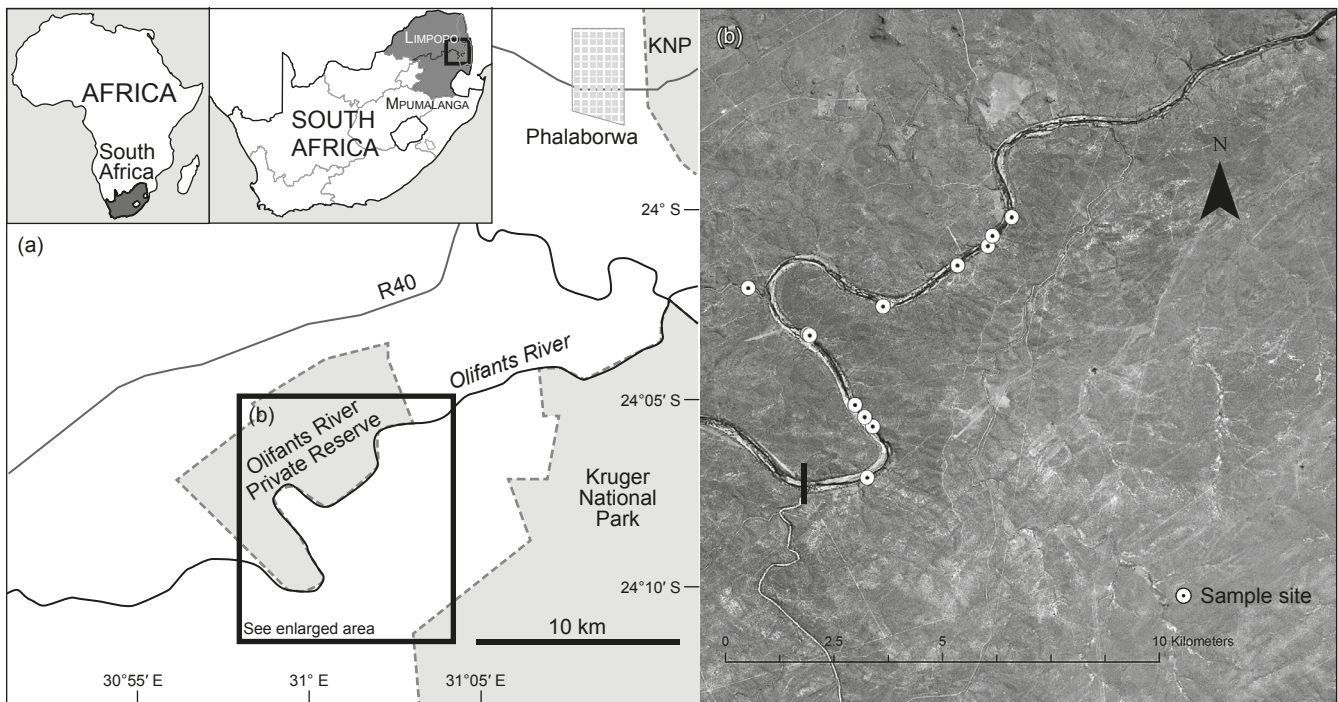


Figure 1: Distribution of Hooded Vulture nests along the Olifants River within Olifants River Private Nature Reserve in the 2013 and 2014 nesting seasons. The boundary of the survey along the Olifants River is shown by black bars

success was 89% in the 2013 breeding season, and 67% in the 2014 breeding season. In the worst-case scenario, breeding success was 44% and 50%, respectively.

African White-backed Vulture *Gyps africanus*

A total of 24 African White-backed Vulture nests were found during this study, of which 15 were situated in *F. sycomorus* trees, and the rest in *Kiggelaria africana*, *Senegalia nigrescens* (*Acacia nigrescens*), *B. salicina* and *D. mespiliformis* (Table 2). During the 2013 breeding season, 15 active nests were found, compared with 21 active nests in the 2014 breeding season. As for Hooded Vultures, it is believed that this increase in the number of active nests of African White-backed Vultures was due to greater search effort in 2014.

The density of active African White-backed Vulture nests along the Olifants River was 1.0 nests km⁻¹ (15 active nests along 14.5 km of river front) in 2013, and 1.2 nests km⁻¹ (17 active nests along 14.5 km of river front) in 2014. Most birds nested in one of three loose clusters along the river or a fourth cluster around a dam away from the river (Figure 2). About two-thirds of the African White-backed Vulture nests that were active in 2013 were again active in 2014 (11 out of 15 nests), suggesting re-use of the same nest and breeding in consecutive years for these pairs.

Discussion

This study reports on an important population of Hooded Vultures breeding at the southern limit of the species distribution (Mundy et al. 1992). This species has recently undergone a major decline across its sub-Saharan African

Table 2: Outcome of African White-backed Vulture nests at the Olifants River Private Nature Reserve in the 2013 and 2014 breeding seasons

Nest code	Nesting tree	2013	2014
OR002	<i>Ficus sycomorus</i>	Active	Active
OR003	<i>Ficus sycomorus</i>	Active	Active
OR004	<i>Ficus sycomorus</i>	Active	Active
OR006	<i>Ficus sycomorus</i>	Active	Active
OR010	<i>Ficus sycomorus</i>	Active	Active
OR012	<i>Ficus sycomorus</i>	Active	?
OR015	<i>Ficus sycomorus</i>	Active	–
OR016	<i>Ficus sycomorus</i>	Active	–
OR017	<i>Ficus sycomorus</i>	Active	–
OR018	<i>Kiggelaria africana</i>	Active	Active
OR019	<i>Ficus sycomorus</i>	Active	Active
OR020	<i>Kiggelaria africana</i>	Active	Active
OR021	<i>Ficus sycomorus</i>	Active	Active
OR022	<i>Breonadia salicina</i>	Active	Active
OR026	<i>Diospyros mespiliformes</i>	Active	Active
OR030	<i>Ficus sycomorus</i>	–	Active
OR032	<i>Ficus sycomorus</i>	–	Active
OR033	<i>Ficus sycomorus</i>	–	Active
OR036	–	–	Active
OR038	<i>Ficus sycomorus</i>	–	Active
OR039	–	–	Active
OR041	<i>Senegalia nigrescens</i>	–	Active
OR042	<i>Senegalia nigrescens</i>	–	Active
OR043	<i>Senegalia nigrescens</i>	–	Active

distribution (Ogada and Buij 2011), and there is concern for its long-term persistence. We show that this species breeds at an apparently high density of approximately one nest every 1.2 km along the Olifants River, at least within

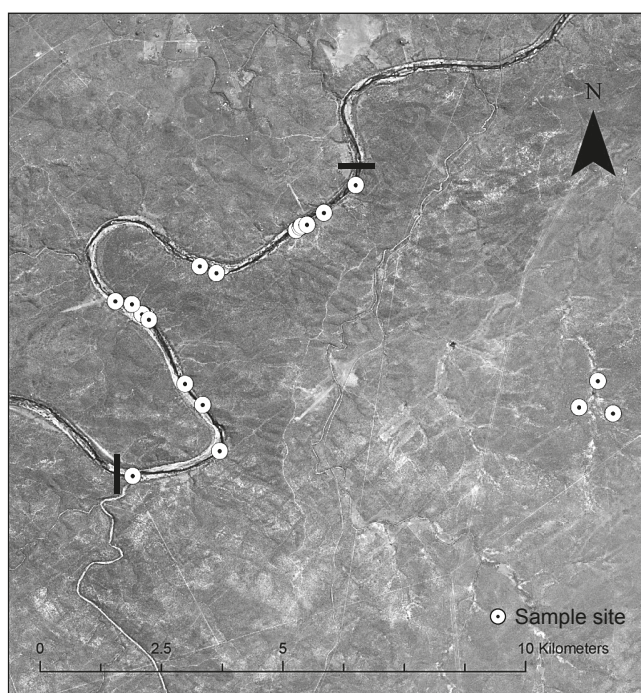


Figure 2: Distribution of African White-backed Vulture nests along the Olifants River and elsewhere within Olifants River Private Nature Reserve in the 2013 and 2014 nesting seasons. The boundary of the survey along the Olifants River is shown by black bars

the Olifants River PNR. This is rather surprising because just nine nests of this species had been recorded in South Africa (Roche 2006) prior to this survey. We suspect that the nesting activity of this species has been under-reported in the region, possibly as a result of the subcanopy placement of the nest, as has been noted elsewhere (Mundy 1982; Hustler and Howells 1988). None of the 12 nests recorded in this study were situated in the canopy (Table 1), presumably making them difficult to detect from the air. Aerial surveys have become popular for locating tree-nesting vulture nests (Monadjem and Garcelon 2005; Murn et al. 2013); however, we recommend that ground surveys be employed in the case of Hooded Vultures.

It is difficult to compare our reported nest densities with those of previous studies. For example, Hustler and Howells (1990) reported 12 nests on basaltic soils within Hwange National Park (an area covering 4 724 km²). A direct comparison with our study is not possible because the distribution of the nests was not described or mapped, and the birds may have only bred within a limited area of this zone (e.g. along drainage lines). In another study, two nests in northern Zimbabwe were separated by between 50 m and 350 m over a five-year period, and another two nests were 1 km apart (Mundy 1982). The nests along the Olifants River were 0.76 km apart, which falls between these values. Interestingly, our nearest nests were a similar distance apart to those reported by Mundy (1982). Regarding the species of tree in which the nests were located, *D. mespiliformis* dominated in our study (Table 1). This species was also reported as the most commonly used tree for nesting in South Africa (Roche 2006) and Zimbabwe (Mundy

1982), although it was rarely used in Hwange National Park (Hustler and Howells 1988). *Diospyros mespiliformis* has a dense, leafy canopy that effectively conceals Hooded Vulture nests, possibly explaining why they are selected by these vultures. The average height of nests in this study (12.5 m) was lower than that reported for nests in Zimbabwe (18.1 m) (Mundy 1982). The mean height of trees in this study was only 17.2 m (Table 1), which would explain the lower height of nests.

Due to uncertainty surrounding the fledging of some of the chicks in this study, breeding success could only be given within limits (0.44–0.89 offspring pair⁻¹ y⁻¹ in 2013, and 0.50–0.67 offspring pair⁻¹ y⁻¹ in 2014). These are the first estimates of breeding success for Hooded Vultures in South Africa, and they compare well with estimates from Hwange National Park (Zimbabwe) where 35 breeding attempts (across multiple years) resulted in the fledging of 19 birds or 0.54 offspring pair⁻¹ y⁻¹ (Hustler and Howells 1988), but is higher than that reported by Mundy (1982) of six birds fledging from 15 nesting attempts or 0.40 offspring pair⁻¹ y⁻¹. We noted that active nests in 2013 were being re-used in 2014. Hooded Vultures are known to re-use nests in consecutive breeding seasons for up to 12 years (Hustler and Howells 1988). However, not all pairs breed every year (Mundy 1982). The proportion of non-breeding pairs was not quantified in this study.

At Olifants River PNR, African White-backed Vultures nested predominately along the Olifants River in clusters of up to six nests. This clustering has been reported before and is well known for this species (Mundy et al. 1992; Monadjem 2001). Nesting density along the Olifants River (between 1.0 and 1.2 nests km⁻¹) was slightly lower than that along the Siphiso River (1.7 nests km⁻¹) in north-eastern Swaziland (Monadjem 2001) and in Masai Mara National Reserve (mean nesting distance of 511–1 071 m) (Virani et al. 2010). The preference for nesting in *F. sycomorus* trees (Table 2) has not been reported before in southern Africa, but has been reported from Masai Mara National Reserve in East Africa (Virani et al. 2010). In Swaziland, African White-backed Vultures selected non-thorny, leafy crowned trees (in order of preference: *Scotia brachypetala*, *C. imberbe* and *F. sycomorus*) in preference to thorny acacias when breeding along rivers (Monadjem 2003). Elsewhere, acacias (particularly *S. nigrescens*, *S. galpinii* [*Acacia galpinii*] and *Vachellia erioloba* [*Acacia erioloba*]) are favoured (Mundy et al. 1992), which is also the situation in Swaziland when the birds nest away from rivers and drainage lines (AM unpublished data). It would appear that African White-backed Vultures prefer non-thorny, leafy trees for breeding along rivers and drainage lines, but will use thorny acacias when non-thorny alternatives are not available (Monadjem 2003). This was evident in this study where the small clusters of nests away from the Olifants River were all situated in *S. nigrescens*.

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References

- Anderson MD. 2000. Hooded Vulture *Necrosyrtes monachus*. In: Barnes KN (ed.), *The Eskom red data book of birds of South Africa, Lesotho and Swaziland*. Johannesburg: BirdLife South Africa.
- Hockey PAR, Dean WRJ, Ryan PG (eds). 2005. *Roberts birds of southern Africa* (7th edn). Cape Town: The Trustees of the John Voelcker Bird Book Fund.
- Hustler K, Howells WW. 1988. Breeding biology of the Hooded and Lappet-faced Vultures in the Hwange National Park. *Honeyguide* 34: 109–115.
- Hustler K, Howells WW. 1990. The influence of primary production on a raptor community in Hwange National Park, Zimbabwe. *Journal of Tropical Ecology* 6: 343–354.
- Kemp AC. 1969. A record of the Hooded Vulture breeding in South Africa. *Ostrich* 40: 24.
- Kemp AC, Herholdt JJ, Whyte I, Harrison J. 2001. Birds of the two largest national parks in South Africa: a method to generate estimates of population size for all species and assess their conservation ecology. *South African Journal of Science* 97: 393–403.
- Kemp AC, Kemp MI. 1975. Observations on the White-backed Vulture *Gyps africanus* in the Kruger National Park, with notes on other avian scavengers. *Koedoe* 18: 51–68.
- Monadjem A. 2001. Observations on the African White-backed Vulture *Gyps africanus* nesting at Mlawula Nature Reserve, Swaziland. *Vulture News* 45: 3–10.
- Monadjem A. 2003. Nest site selection by African White-backed Vultures *Gyps africanus* in Swaziland. *Vulture News* 48: 24–25.
- Monadjem A, Garcelon DK. 2005. Nesting distribution of vultures in relation to land use in Swaziland. *Biodiversity and Conservation* 14: 2079–2093.
- Mundy PJ, Butchart D, Ledger J, Piper SE. 1992. *The vultures of Africa*. Johannesburg: Acorn Press.
- Murn C, Combrink L, Ronaldson GS, Thompson C, Botha A. 2013. Population estimates of three vulture species in Kruger National Park, South Africa. *Ostrich* 84: 1–9.
- Murn C, Holloway GJ. 2014. Breeding biology of the White-headed Vulture *Trigonoceps occipitalis* in Kruger National Park, South Africa. *Ostrich* 85: 125–130.
- Ogada DL, Buij R. 2011. Large declines of the Hooded Vulture *Necrosyrtes monachus* across its African range. *Ostrich* 82: 101–113.
- Roche C. 2006. Breeding records and nest site preference of Hooded Vultures in the greater Kruger National Park. *Ostrich* 77: 99–101.
- Simmons R. 1994. Conservation lessons from one of Africa's richest raptor reserves. *Gabar* 9: 2–13.
- Tarboton WR, Allan DG. 1984. The status and conservation of birds of prey in the Transvaal. *Transvaal Museum Monograph* No. 3. Pretoria: Transvaal Museum.
- Virani M, Kirui P, Monadjem A, Thomsett S, Githiru M. 2010. Nesting status of African White-backed Vultures *Gyps africanus* in the Masai Mara National Reserve, Kenya. *Ostrich* 81: 205–209.