

Hooded Vulture (*Necrosyrtes monachus*) and African White-backed (*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, including other vulture species, 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 located 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/annum in 2013 and 0.50-0.67 offspring/pair/annum 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 nests. Nesting density of this species ranged from about 1.0 to 1.2 nests/km and nests were predominantly placed in *Ficus sycomorus* trees.

Introduction

Although tree-nesting vulture populations are relatively well known in north-eastern South Africa (Mundy et al. 1992), surveys have been patchy. For example 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 km², but dropped to 3.9 pairs/100 km² 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 km² (1979) to 7.9 pairs/100 km² (1968) (Kemp and Kemp 1975, Tarboton and Allan 1984), whereas it ranged from a low of 1.6 pairs/100 km² to a high of 10.1 pairs/100 km² 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 *Trigonoceps occipitalis* and Lappet-faced *Torgos tracheliotos* Vultures 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 imbavati 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 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 wide 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 PTT devices, also solar powered. All four devices had battery back-ups and all four were fitted via backpack harness with teflon material inside tubing. From the signals received from these tracking devices, it was 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*)

Hooded Vulture nests were predominantly situated in *Diospyros mespiliformis* trees, with fewer nests in *Ficus sycomorus*, *Breonadia salicina* and *Combretum imberbe* (Table 1). The 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 (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 2), 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 2). One nest failed. In the 2014 breeding season, six out of the 12 known active nests fledged successfully (Table 2). Four nests failed and the outcome at two nests was unknown, although successful fledging was thought likely due to the sighting of recently fledged birds near the nest site (Table 2). Hence, in the best case scenario, breeding 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.

Table 1. Characteristics and outcomes 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
OR001	<i>Diospyros mespiliformis</i>	12	16	In lateral branch fork, below crown
OR005	<i>Diospyros mespiliformis</i>	12	19	In main fork, below crown
OR007	<i>Diospyros mespiliformis</i>	11	13	In lateral branch fork, in crown
OR008	<i>Diospyros mespiliformis</i>	13	24	In main fork, below crown
OR009	<i>Ficus sycomorus</i>	14	19	In lateral branch fork, in crown
OR011	<i>Diospyros mespiliformis</i>	9	13	In main fork, in crown
OR014	<i>Diospyros mespiliformis</i>	15	18	In crown of crown
OR023	<i>Breonadia salicina</i>	14	18	In main fork, below crown
OR024	<i>Diospyros mespiliformis</i>	17	18	In narrow fork, below crown
OR025	<i>Combretum imberbe</i>	13	16	In main fork, below crown
OR027	<i>Ficus sycomorus</i>	8	14	In lateral fork, in crown
OR034	<i>Diospyros mespiliformis</i>	12	18	In main fork, below crown

Table 2. Outcome of Hooded Vulture nests at Olifants River Private Nature Reserve in the 2013 and 2014 breeding seasons.

Nest code	2013	Outcome	2014	Outcome
OR001	Active	Successful	Active	Successful
OR005	Active	Chick hatched	Active	Successful
OR007	Active	Chick hatched	Active	Successful
OR008	Active	Failed	Active	Failed
OR009	Active	Chick hatched	Active	Successful
OR011	Active	Successful	Active	Failed
OR014	Active	Successful	Active	Unknown
OR023	Active	Chick hatched	Active	Successful
OR024	Active	Successful	Active	Failed
OR025	-	-	Active	Failed
OR027	-	-	Active	Unknown
OR034	-	-	Active	Successful

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

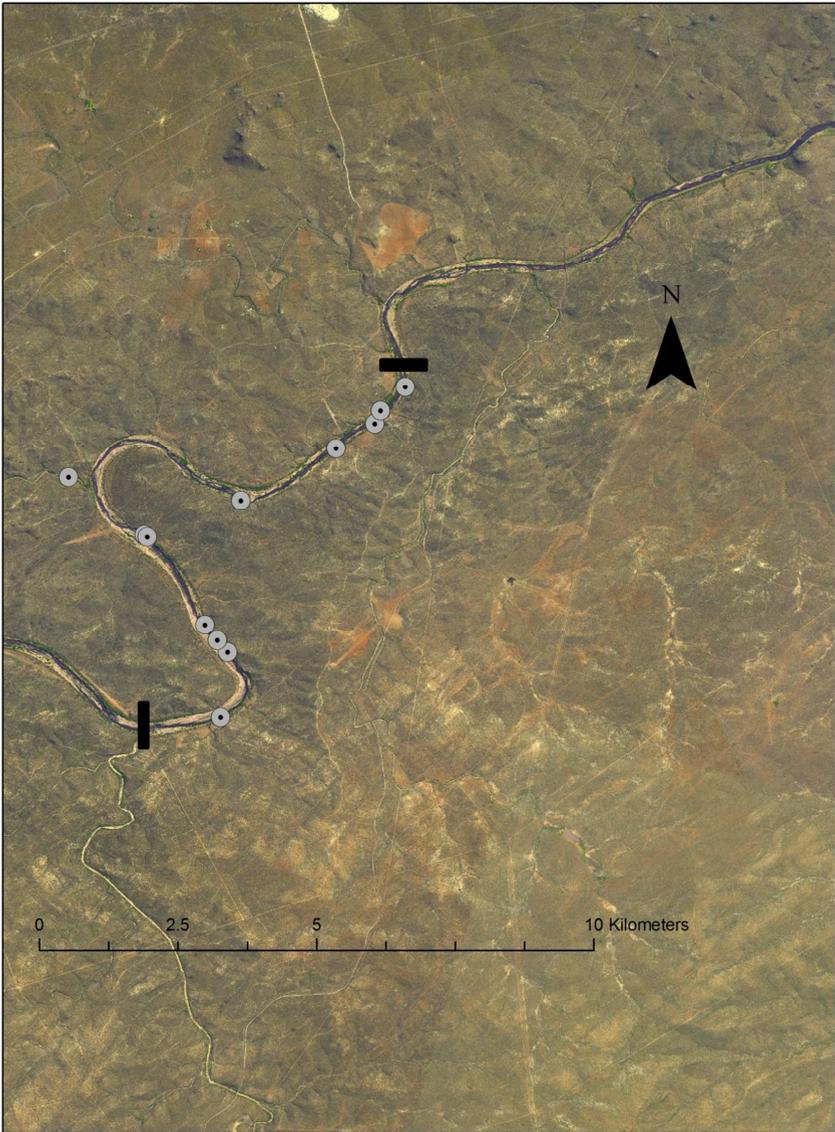


Figure 2. Distribution of African White-backed Vulture nests along the Olifants River and elsewhere within the Olifants River PNP in the 2013 and 2014 nesting seasons. The boundary of the survey along the Olifants River is

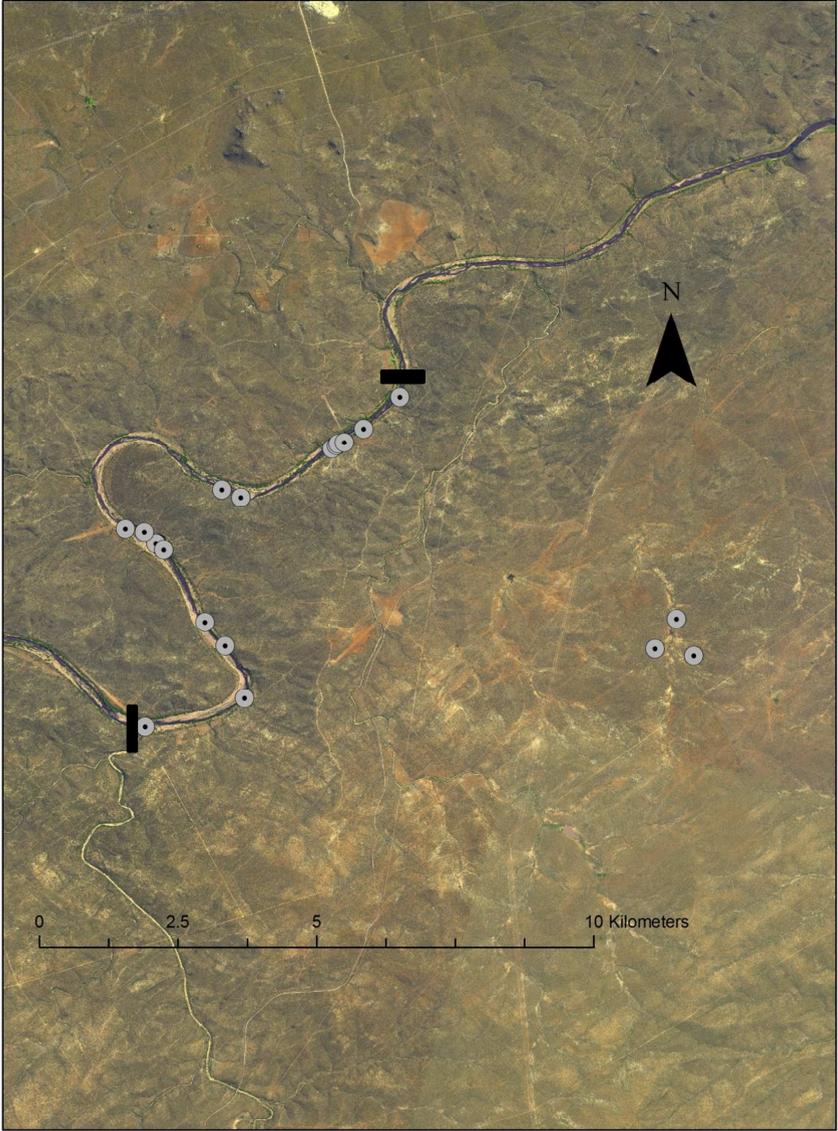


Table 3. Outcome of African White-backed Vulture nests at Olifants River Private Nature Reserve in the 2013 and 2014 breeding seasons.

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>Acacia nigrescens</i>	-	Active
OR042	<i>Acacia nigrescens</i>	-	Active

OR043	<i>Acacia nigrescens</i>	-	Active
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African White-backed Vulture (*Gyps africanus*)

A total of 24 African White-backed Vulture nests were located 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 3). During the 2013 breeding season, 15 active nests were located, compared with 21 active nests in the 2014 breeding season.

The density of active African White-backed Vulture nests along the Olifants River was 1.0 nests/km (15 active nests along 14.5 km of river front) in 2013, and 1.2 nests/km (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 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 the Olifants River PNR. This is rather surprising since 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 sub-canopy 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 vulture nests (Monadjem and Garcelon 2005), 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 4724 km²). A direct comparison with our study is not possible since 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). *D. iospyros mespiliformis* has a dense, leafy canopy which 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 the trees in this study was only 17.2 m (Table 1), which would explain the lower height of these 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/annum in 2013, and 0.50-0.67 offspring/pair/annum 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/annum (Hustler and Howells 1988), but is higher than that reported by Mundy (1982) of 6 birds fledging from 15 nesting attempts or 0.40 offspring/pair/annum. 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) was slightly lower than that along the Siphiso River (1.7 nests/km) in north-eastern Swaziland (Monadjem 2001).

The preference for nesting in *F. sycomorus* trees (Table 3) has not been reported before. 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 *A. nigrescens*, *A. galpinii* and *A. erioloba*) are favoured (Mundy et al. 1992), which is also the situation in Swaziland when the birds nest away from rivers and drainage lines (Monadjem 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 *A. nigrescens*.

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