

Home ranges of black eagles in the Natal Drakensberg

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Eight pairs of black eagles *Aquila verreauxii* were found in an area of about 520 km² in the Giant's Castle area of the Natal Drakensberg (65 km²/pair; 9,1 km between the nests of adjacent pairs). Six birds from four pairs were colour-ringed and window-marked. Their mean home-range size, from resightings, was 64,4 km² (range 50–73 km²). Non-breeding season (= summer) and breeding season (= winter) ranges were the same, as were the ranges of male and female birds, except that during the early stages of the breeding season females were confined mainly to their nesting areas. Home ranges of adjacent pairs overlapped on average by 16% (range 4–35%). Black eagles favoured broken, rocky habitat which supports their main prey, rock hyraxes *Procavia capensis*, over open grasslands. Open grassland constituted > 60% of the habitat within their ranges. Ranges overlapped mainly in this grassland habitat. An unusual, previously undescribed, hunting method of black eagles is described and related to the local habitat.

Agt pare witkruisarende *Aquila verreauxii* is gevind in ongeveer 520 km² van die Giant's Castle gebied in die Drakensberge van Natal (65 km²/paar; 9,1 km tussen pare). Ses voëls van vier pare is met gekleurde ringe en 'vensters' in die vlerke gemerk. Die gemiddelde grootte van hulle tuisgebiede, bepaal deur herhaalde waarnemings, was 64,4 km² (50–73 km²). Die grootte van nie-broeiseisoen- (= somer) en broeiseisoen (= winter) -tuisgebiede was dieselfde, asook die tuisgebiedgroottes van manlike en vroulike voëls, behalwe dat tydens die vroeë stadiums van die broeiseisoen die wyfie tot die onmiddellike omgewing van die nes beperk was. Tuisgebiedgroottes van aangrensende pare het gemiddeld met 16% oorvleuel (4–35%). Die witkruisarend het gebroke, rotsagtige habitat verkies bo oop grasvelde aangesien eersgenoemde hul hoofprooi, dassies *Procavia capensis*, huisves. Die habitat binne die tuisgebied het uit meer as 60% oop grasveld bestaan. Tuisgebiede het hoofsaaklik in dié oop grasvelde oorvleuel. 'n Nuwe, ongewone jagmetode van die witkruisarend word beskryf, wat verband hou met die plaaslike habitat.

Keywords: Black eagles, home range, hunting method, Natal Drakensberg, nesting density

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Introduction

Black eagles *Aquila verreauxii* are one of the best studied eagle species in the world (Rowe 1947; Brown 1976; Brown, Urban & Newman 1982; Steyn 1982). They have been most intensively studied in the Matobo (formerly Matopos), Zimbabwe, (e.g. Vernon 1965; Cargett 1970, 1971, 1972, 1975, 1977, 1984), and Steyn (1982) suggested that comparative observations from other localities in southern Africa would be of value. Siegfried (1968) has reported on aspects of their breeding biology in southern Africa while Allan (1984) and Tarboton & Allan (1984) have investigated aspects of their status, diet and conservation in the Transvaal.

In this paper I report on the nesting density, home range, range use and hunting methods of a small population of marked black eagles in the Giant's Castle area of the Natal Drakensberg.

Study area and Methods

Black eagles were studied opportunistically in an area covering about 520 km² of the Giant's Castle Game Reserve, the adjacent Department of Forestry Reserves of Highmoor and Mkomazi, and in Lesotho (Figure 1), from March 1980 to December 1982. This area encompasses a 28 km section of the Drakensberg escarpment and its foothills to the east, 1300–3350 m above sea level. Fire-climax grasslands predominate in all but the most protected valleys, which support

montane forest or riverine scrub. The area is described in more detail by Killick (1963) and Rowe-Rowe & Meester (1982).

Black eagle nests were located from the ground while systematically covering all parts of the study area during three consecutive breeding seasons. The high cliffs of the Drakensberg escarpment were also checked once from a fixed-wing aircraft.

Six black eagles were captured at two sites within the Giant's Castle Game Reserve (Figure 1). Two birds were caught by cannon net, three with an elasticized nylon noose trap and one with a padded-jaw gin trap. Each bird was marked with a numbered metal ring and two plastic coloured rings, and 'windows' were cut into their remiges. The positions of the windows, one on each wing, were unique to each bird and allowed easy identification when the birds were in flight. Birds were resighted on routine patrols through the study area and these were plotted onto 1:50 000 maps. My resightings were supplemented by those of the staff of the Natal Parks Board and of tourists.

Home-range sizes were calculated using the minimum area method (Mohr 1947). In addition, the home ranges of birds were gridded by dividing them into squares of 500 × 500 m. The number of sightings of birds per square was then calculated. The pattern of use of the home range was plotted using 'Plotcall', a mapping program distributed by Golden Software, Colorado, U.S.A. The habitat within the range of each pair was

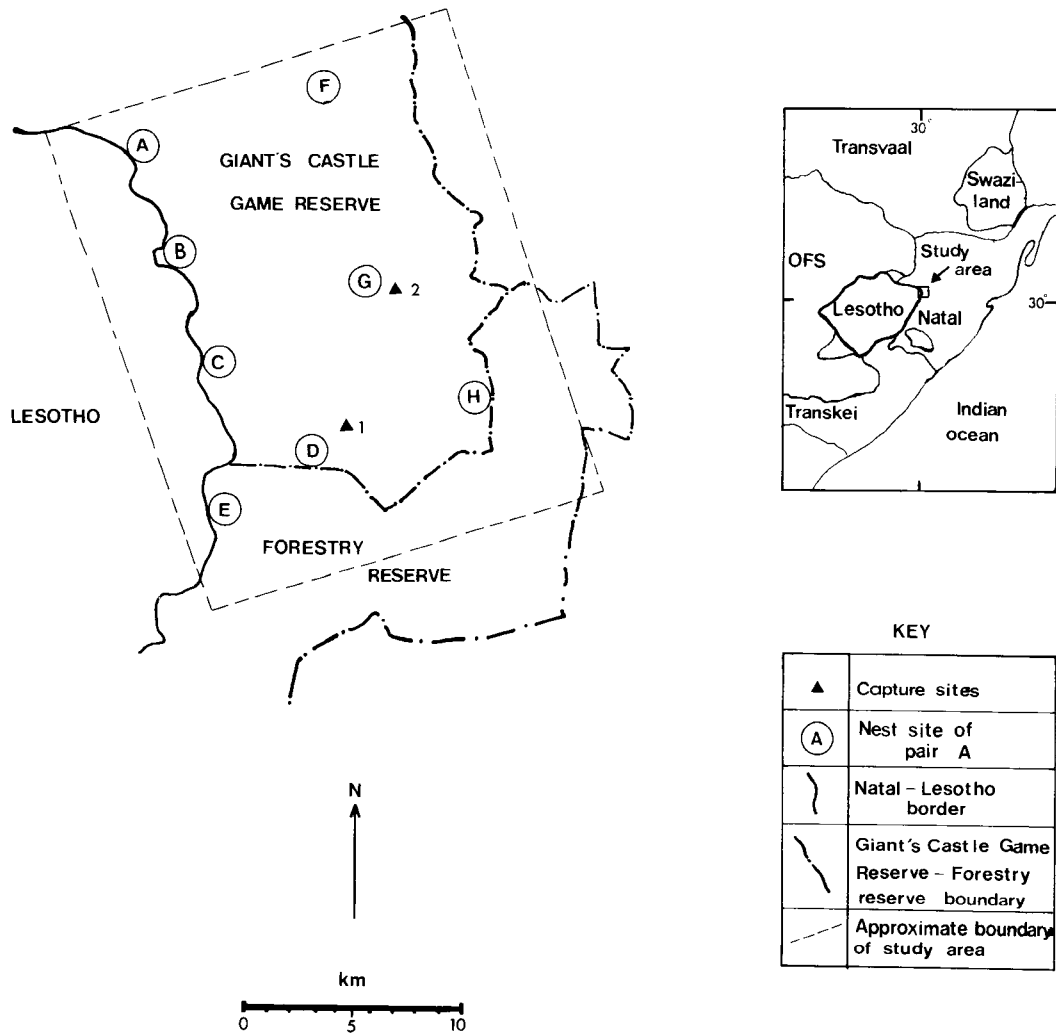


Figure 1 Black eagle study area in the Giant's Castle area of the Natal Drakensberg, showing the distribution of the nest sites of the eight pairs of birds, A-H.

divided into two types, (a) cliffs, scree, rocky hillsides and boulder streams, and (b) open grasslands. The use made by black eagles of these two habitat types was compared.

Results

Eight pairs of black eagles occupied the 520 km² study area throughout the three-year study. The mean area per pair (calculated by dividing the number of pairs into the total area) was therefore 65 km² (9,1 km between the nests of adjacent pairs). Five pairs (A-E) nested along the Drakensberg escarpment at a mean inter-pair distance of 5,8 km (range 4,8-6,5 km) and three pairs (F-H) were found in the Drakensberg foothills at a mean inter-pair distance of 8,6 km (8,3-8,9 km). These two groups of birds were approximately parallel to each other and ranged between 9 and 12 km apart (Figure 1).

Both birds of pairs D and G and one bird each of pairs C and H were captured and marked. Most resightings (91% of 311) were of birds in flight, identified from their window positions. Their home ranges are illustrated in

Figure 2, and their home-range areas are listed in Table 1. The mean home-range size of black eagles in the Natal Drakensberg, calculated from the actual areas covered by individual marked birds was 60,9 km² (standard deviation = 8,5 km²; range 50-73 km²). Combining the data for pairs where both birds were marked gave a mean home-range size of 64,4 km².

Where both birds of a pair were marked (pairs D & G) there was no significant difference between the overall sizes of male and female home ranges (Chi-square test). Also, summer (October-March) and winter (April-September) ranges, which coincide with non-breeding and breeding seasons respectively, showed no significant differences. During the early stages of the breeding season, however, few sightings of females were made and their plotted ranges were consequently considerably smaller than those of the males. This is because female black eagles are responsible for most of the nest duties whereas the males provide most of the food (Rowe 1947; Brown 1952; Gargett 1972).

Home ranges of black eagles in this study overlapped considerably between adjacent pairs (Table 2), ranging

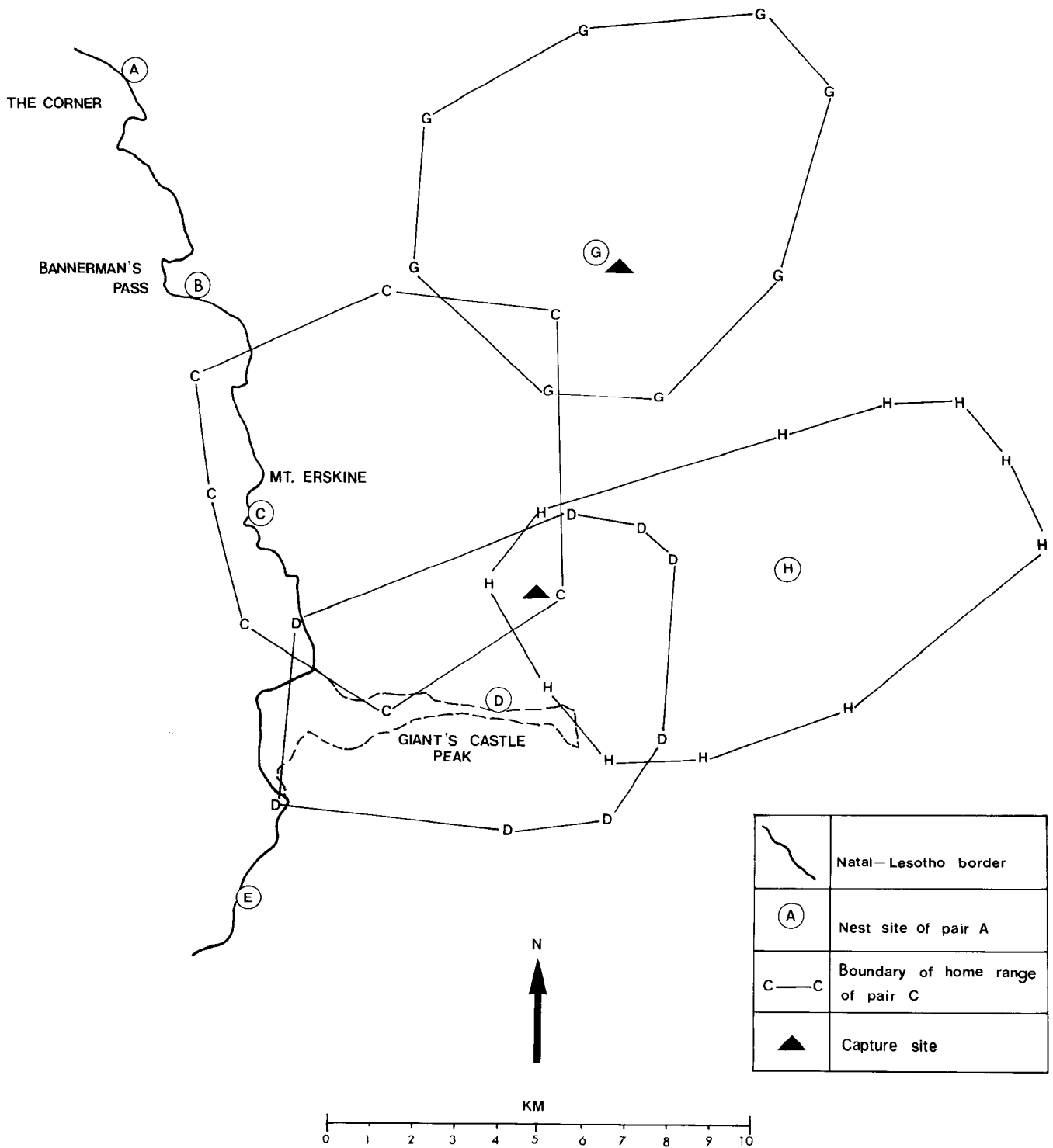


Figure 2 Home ranges of black eagle pairs C, D, G and H, calculated by using the minimum area method (Mohr 1947). High-altitude display flights were not included in the data used to plot these ranges. Note the extent of overlap between adjacent pairs.

from 4% to 35%, with a mean of 15,6%. Assuming that each pair is surrounded by four other pairs, then about 45% of the range of a pair would be shared with neighbouring pairs. Conversely, some areas were not used at all, e.g. between pairs G and H, where black eagles were never seen.

Black eagles did not use their home ranges in a uniform way. Most resightings were obtained in the immediate area of their nests (and in the case of pair G,

illustrated here, also in the area of the feeding site) (Figures 3a & 3b). In general, the time spent in an area was inversely proportional to its distance from the nest (Figure 4).

In Figure 3b the two dominant habitats are shown, i.e. (a) cliffs, scree slopes, rocky hillsides and boulder streams, and (b) predominantly open grasslands. Seventy-six per cent of black eagles were seen in the former habitat, which occupied only about 39% of the

Table 1 Home-range sizes of black eagles in the Natal Drakensberg based on resightings of colour-ringed and window-marked birds

Pair	Sex	No. of sightings	Range size (km ²)		
			Summer ^a (Oct-Mar)	Winter ^a (Apr-Sep)	Total ^b
C	M	39	-	-	65,2
D	M	46	-	-	52,9
D	F	28	-	-	50,2
D	Total	74	54,1	46,1	54,1
G	M	103	62,9	60,4	65,7
G	F	70	46,5	41,8	58,6
G	Total	173	62,9	61,4	65,7
H	F	25	-	-	72,6
Mean		51,8	58,5	53,8	60,9

^a Mean range size calculated from the total home-range figures for pairs D and G.

^b Mean range size calculated from the home-range figures per individual marked bird.

Table 2 Amount of overlap of home ranges by adjacent pairs of black eagles in the Natal Drakensberg

Focal pair	Overlapping pair	Amount of overlap	
		Area (km ²)	Percentage
C	G	3,5	5,4
C	D	14,7	27,2
C	H	3,2	4,9
D	C	14,7	22,5
D	H	18,8	34,8
G	C	3,5	5,3
H	C	3,2	4,4
H	D	18,8	25,9
Mean		10,1	15,6

overall home ranges of all the marked birds. With sightings in the nest areas (within 500 m of each nest) and at the feeding sites removed from the analysis, 72% of sightings were in the cliff-valley habitat; in both cases the eagles use of the broken, rocky habitat was significantly greater (Chi-square test; $p < 0,001$) than that of the grassland habitat.

Gargett (1984) stated that it was not possible to designate flights into various categories such as hunting, territorial flights, etc. because different flight patterns were components of most types of flight. During this study no attempt was made to categorize flight into detailed behavioural patterns. I recorded black eagles, however, flying in a manner suggestive of hunting on 233 of 364 sightings (64% – including unmarked individuals). These observations on birds potentially hunting resulted in my witnessing four kills, all large rock hyraxes

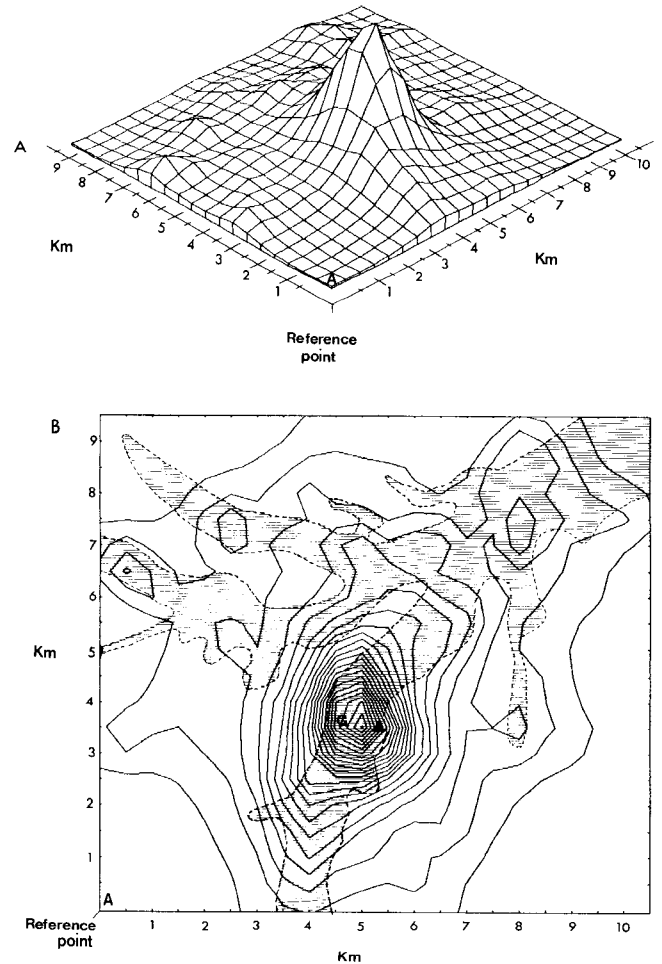


Figure 3 Pattern of use of the home range by black eagle pair G in the Natal Drakensberg. Figure 3A is a three-dimensional plot of the occurrence of the birds recorded in each 500 × 500 m grid block in their home range, and Figure 3B represents the same by contours. The peak of occurrence falls mid-way between the nest (G) and the capture site (▲). The shaded area represents the cliffs, scree slopes, rocky hillsides and boulder stream habitat, while the unshaded area represents the open grasslands.

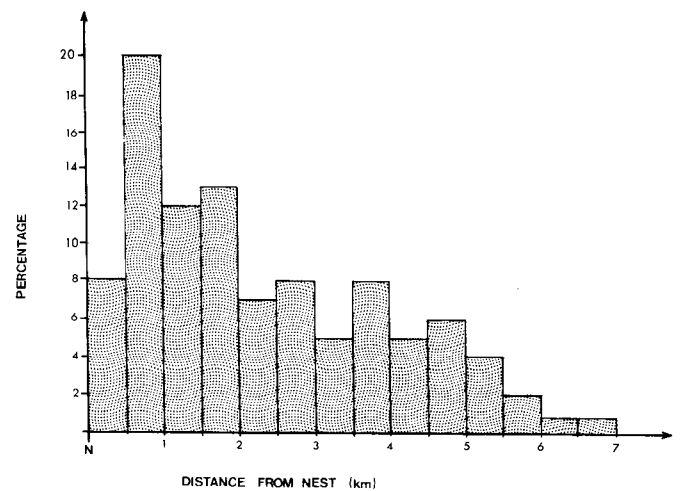


Figure 4 Percentage occurrence of six marked black eagles in the Natal Drakensberg at increasing distances from their nest sites ($n = 311$ sightings).

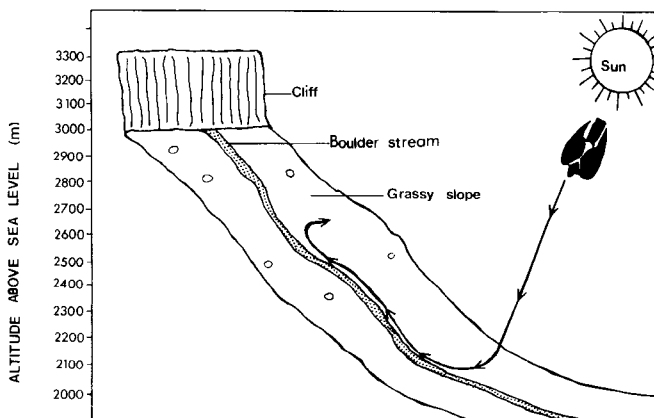


Figure 5 An unusual foraging method observed in black eagles in the High Drakensberg. The birds dived steeply to the base of a rocky gully or stream and swooped up it, keeping close to the ground.

Procapra capensis. Most of these flights consisted of birds flying fast and low, often down valleys, or contouring along ridges and cliffs, and three of the prey animals were surprised in this way. One of the kills, however, was made using a different method (Figure 5) that was seen on only 14 occasions (6% of all possible hunting flights). The bird would start from a position high above the ground (usually 1000 m or more), usually with the sun behind it. It would dive steeply to the base of a rocky gully or stream and swoop up, low to the ground and closely following the topography. Depending on the steepness of the ascent, it would cover up to about 800 m per swoop, thus approaching potential prey from below. On 10 (71%) of the observed incidences of this hunting method, both birds of the pair were present; in each case the male performed the swoop while the female circled high overhead. This hunting method was seen only along the Drakensberg escarpment, where long grassy slopes are intersected by boulder-strewn gullies and streams. One eagle repeated this behaviour three times in succession in three adjacent streams, soaring up after each swoop along the escarpment before starting the next dive.

Discussion

The mean range size of black eagles in the Giant's Castle area, calculated by dividing the number of pairs present into the area, fortuitously provided a remarkably accurate estimate of the actual ranges covered by the birds, despite the fact that home ranges were found to overlap considerably between adjacent pairs. This comparison relies, however, on there being similar areas unoccupied between pairs to areas of overlap between pairs. This is obviously a highly variable situation. Only in cases where the habitat is relatively uniform, fully occupied by a stable population and where ranges are mutually exclusive, can range size be accurately calculated in this way. In all other cases a marked population should be used to estimate home-range size.

The highest known density of black eagles occurs in

the Matobo, Zimbabwe, where 55 pairs were on average 4 km apart (Gargett 1975). In the Magaliesberg, Transvaal, 13 pairs spaced out along the escarpment were found to average 9,5 km apart (range 3–19,5 km) (Allan 1984), while figures calculated for suitable habitat in other areas of the Transvaal averaged from 7 to 13 km between pairs (Tarboton & Allan 1984). At the Waterberg, South West Africa/Namibia, seven pairs averaged 9,8 km apart (Brown & Cooper 1987). Limited available data would suggest that, in areas of suitable (but not exceptional) habitat, an inter-pair distance of about 9–10 km, as found in this study, is fairly common.

Newton (1979) stated that, under natural conditions, the availability either of suitable nest sites or of food govern the distribution of breeding raptors in any area. Where food is uniformly distributed and temporally stable, birds tend to maintain exclusive, highly-defended home ranges.

In the Matobo the average black eagle home range consists of < 40% open grassland and > 60% koppies (Gargett 1975). Pairs which had more koppies in their home ranges had smaller ranges on average than pairs with more open grassland. In this population home ranges were exclusive, at least at ground level.

In the Giant's Castle area there is considerably less suitable habitat for the black eagles' main prey, hyraxes, and this probably accounts for their home ranges being larger, in order to ensure an adequate supply of food. There is a large body of evidence to show that food availability influences breeding density and range size in raptors, e.g. European sparrowhawk *Accipiter nisus* (Marquiss & Newton 1981), peregrine falcon *Falco peregrinus* (Ratcliffe 1969), common buzzard *Buteo buteo* (Picozzi & Weir 1974), African fish eagle *Haliaeetus vocifer* (Bell-Cross & Vernon 1984).

Ranges of black eagles in this study overlapped considerably. While this might be a function of the range becoming too large to defend effectively, as has been reported for some mammalian carnivores (e.g. Kruuk 1972; Manning 1972; Gosling 1982), it is more likely that the large expanses of grassland, with little suitable prey for black eagles, are not worth expending energy to defend. This idea is supported by the fact that these areas of overlap contain significantly less (< 30%) of the cliff-valley habitat compared with areas where no overlap took place (> 45%) ($p < 0,05$).

Steyn (1982) suggested that black eagles usually hunt by locating a potential prey animal from a soaring position and then approach the animal while out of sight, suddenly appearing from behind a ridge or rocky outcrop. Jenkins (1984) reported that 14 of 15 hunting attempts seen in the Magaliesberg were from a perch. However, the unusual foraging method described here in which black eagles dive steeply to the base of a gully and then swoop up it, is probably related to the nature of the habitat. Broad bands of grassland are intersected by these vertical, narrow lines of hyrax-rich habitat. By swooping up these lines the eagles are covering the best hyrax habitat as well as surprising the animals by approaching from below.

In conclusion, the small and exclusive territories of

black eagles in the Matobo may be typical of optimal habitat, but are certainly not typical for the species in general. In all other studies to date pairs of black eagles were more widespread and had larger home ranges than in the Matobo and, as I have suggested, an overlap with adjacent pairs could exceed 40% of the range covered by any one pair. The Matobo and Drakensberg black eagle populations illustrate two different dispersion patterns in response to different prey densities.

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