PLUMAGES AND MEASUREMENTS OF THE BEARDED VULTURE IN SOUTHERN AFRICA

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SUMMARY

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Four different age classes of the southern African Bearded Vulture *Gypaetus barbatus* are recognized and their plumages described: juvenile (3–24 months old), immature (24–45 months), subadult (45–60 months) and adult (60+ months). There was no significant difference in size between adult male and female birds. Adults were larger than juvenile birds in bill width, beard length, wingspan and mass, and had a higher aspect ratio and wing loading, while juvenile birds were larger than adults in the length of their outer rectrices, tail area, wing breadth and wing area. These features are considered to be adaptive to young birds inexperienced in flying. Immature and subadult birds were intermediate in size between juveniles and adults. Bearded Vultures differ from other large raptors in two sets of physical characteristics, (a) those adapted to cold, mountainous habitat, e.g. feathered head and face, unusually long wings, a high aspect ratio and a particularly long tail, and (b) those adapted to their diet of mainly bones, e.g. wide gape, beard and relatively long talons for carrying food.

INTRODUCTION

With the exception of weights and wing dimensions of some African raptors (Biggs *et al.* 1979; Mendelsohn *et al.* 1989), the physical characteristics of most birds of prey have been poorly studied. The limited information available has been obtained mainly from museum specimens. The African race of the Bearded Vulture *Gypaetus barbatus meridionalis* is no exception. Delibes *et al.* (1984) located five specimens from southern Africa in the museums of Europe. I located 14 specimens in institutions in southern Africa and was granted access to 11 of these. Museum skins usually provide limited information, however, and although 21 wild birds captured during this study constitutes a relatively small sample, it represents the largest (and as far as I am aware, only) sample of live wild Bearded Vultures measured to date. The morphological characteristics of this bird form an integral part of our understanding of its ecology and biology.

STUDY AREA AND METHODS

Bearded Vultures were caught at a vulture feeding site in the Natal Drakensberg in the Giant's Castle Game Reserve (29 20 S; 29 31 E; 2 250 m above sea level). Birds were attracted to the site by meaty bones and were trapped by a cannon-net, padded-jaw gintraps and an elasticised nylon noose (Brown 1988). Periods of 5–6 days were spent trapping, usually once a month. The average rate of capture was one bird per 4,4 days.

All Bearded Vultures captured were photographed from at least four positions, (a) lateral and (b) dorsal views of head, (c) dorsal and (d) ventral views of body, with wing extended. Age classes were ascribed to each bird following Delibes *et al.* (1984). The presence or absence of the following 11 of their 22 characteristics were found to be sufficient and most useful.

Head region:

1. Brown-blackish feathers in the crown (Fig. 1A)
2. Brown semiplumes in the crown (Fig. 1B)
3. White semiplumes with a variable proportion of black bristles in the crown (Figs 1C & D)
4. Brown-blackish feathers in the occiput and the nape (Figs 1A–C)
5. White feathers in the occiput and nape (Fig. 1D)

Ventral region:

6. Brown feathers ventrally
7. White (rufous) feathers ventrally

Wing:

8. Sharp second primary (Figs 1E & F)

Eyebrow:

9. No differentiated eyebrow (Fig. 1A)
10. Incomplete dark brown eyebrow (Fig. 1B)
11. Complete eyebrow, well differentiated, black (Figs 1C & D)

Delibes *et al.* (1984) divided Bearded Vultures into four main age classes:

A. Juvenile birds, classed as birds from the time they leave the nest to the moulting of the first remiges (which are sharp in this plumage). These include specimens that have not started to moult, through to those which have started the contour moult. The ventral regions are brown. The head is brown-black and no eyebrow is apparent.

B. Immature birds, classed as specimens that have started through to those that have completed the moult of their remiges, i.e. those that have at least some rounded remiges. Birds in this category include those which have completed their first contour moult through to those which have started their second. The ventral regions are

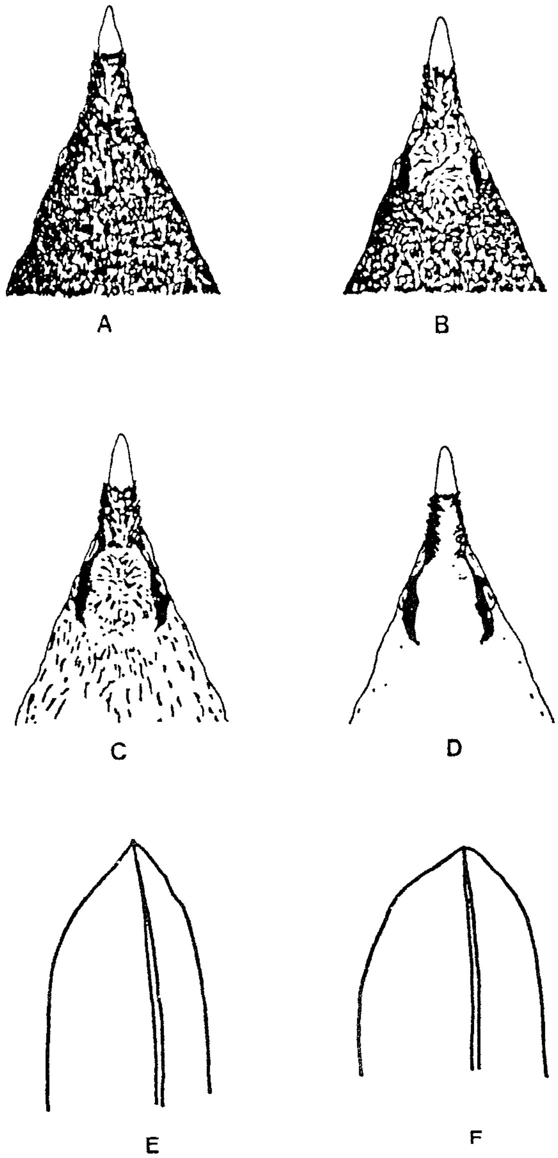

FIGURE 1

Age-related differences in the plumage in the head region and second primary feather of Bearded Vultures. After Delibres *et al.* (1984). A. Only brown-blackish feathers are present in the crown, the occiput and the nape. The "eyebrow" is not differentiated (Juvenile). B. Brown semiplumes are present in the crown, as is an incomplete dark-brown "eyebrow" (Immature). C. Brown and white semiplumes in the crown. Brown-blackish feathers and white feathers in the occiput and nape. Well differentiated black "eyebrow" (Subadult). D. White semiplumes only in the crown. White feathers in the occiput and nape. "Eyebrow" as in C (Adult). E. The first remiges acquired are sharply pointed. These start to moult out at about two years (Juvenile birds). F. Subsequent remiges have more rounded ends (Immature, subadult and adult birds).

brown. Brown semiplumes have appeared on the head and an incomplete dark brown eyebrow is present.
C. Subadult birds, classed as immature birds phenetically closer to adults than to juveniles. Birds in this category include those which have started their second moult of remiges and those which have finished it, but are still moulting contour feathers. The ventral regions are pale golden brown to white overlain with varying concentrations of rufous. The head has variable proportions of black bristles in the crown and the eyebrow is complete, well differentiated and black.
D. Adult birds, classed as specimens with complete adult plumage. Ventral regions are pure white, overlain with varying amounts of rufous (an external deposit of iron oxide — see Brown 1988), and the white head has no black bristles in the crown.

A photographic record of the plumage development of two Bearded Vultures of known age, from the time of their capture at four months old to adulthood, was used to ascribe ages to the different plumage categories. The two birds were rescued from young Basotho herders who were attempting to kill them following the birds' first flights from their nests about 40 km east of Maseru, Lesotho. The birds were injured to the extent that they could not be released, and were raised in a large garden (about 2 000 m^2) in Ladybrand, Orange Free State. They were fed on meaty longbones supplemented by incidental road kills.

Measurements and mass characteristics were determined for the 21 captured Bearded Vultures (within their respective age classes) as well as for 11 skins or mounted specimens held in the following collections: Natal Museum, Pietermaritzburg (2), Bloemfontein Museum (7), East London Museum (1) and Giant's Castle Game Reserve (1). Up to 24 measurements were taken per bird. The sex of adult birds was determined by recording whether that bird incubated at night (female) or not (male) (Brown 1988). The following measurements were taken.

1. Bill length (to nearest 0,1 mm), from the tip of the culmen to the distal dorsal margin of the cere.
2. Bill width (to nearest 0,1 mm), from the junction of the tomium of the upper jaw and the cere on one side to the same point on the other side.
3. Bill height (to nearest 0,1 mm), from the distal dorsal margin of the cere of the upper jaw to the distal ventral margin of the cere of the lower jaw, with the bill firmly closed.
4. Gape length (to nearest 0,1 mm), from the fold of the gape to the tip of the lower jaw.
5. Gape width (to nearest 0,1 mm), from the fold of the gape on one side, to the same point on the other, with the bill closed.
6. Standard wing length (to the nearest 1 mm), from the front of the folded wrist to the tip of the longest primary, following the curvature of the wing.
7. Longest rectrix (to nearest 1 mm), from the

posterior edge of the uropygial gland to the tip of the longest central rectrix.

8. Shortest rectrix (to nearest 1 mm), same as for 7, but to the tip of an outermost rectrix.
9. Tarsus length (to nearest 0,1 mm), from the depression behind the tibiotarsal-tarsometatarsal joint to the dorsal base of the hind toe, where the crease occurs when the toe is extended.
10. Toe lengths; toe I = hind, toe II = inner, toe III = middle and toe IV = outer (to nearest 0,1 mm), from the junction with the tarsometatarsus to the dorsal claw-skin junction along the dorsal surface, with the toe extended.
11. Claw length; claw numbers as for the toes (to nearest 0,1 mm), from the dorsal skin-claw junction to the tip of the claw, along the chord.
12. Total wing length (to nearest 1 mm), from the proximal end of the humerus to the end of the longest primary, with the wing stretched out so that the anterior margin formed as straight a line as possible, and measured on the dorsal surface across the curvature of the wing.
13. Shoulder width (to nearest 1 mm), from the proximal end of the humerus on one side to the same position on the other side.
14. Overall length (to nearest 1 mm), from the tip of the bill, over the head and following the contour of the body to the tip of the longest rectrix.
15. Wing area (to nearest 1 cm^2), measured by opening the wing as for 12 and tracing the outline onto high quality paper. The outline was traced up to the posterior and anterior points where the wing joined the body. The traced outline was cut out and weighed, and the area calculated from the standard g/m^2 value of the paper.
16. Tail area (to nearest 1 cm^2), measured by fanning the tail so that the outer rectrices formed an angle of 60° (tail about half spread). The outline was traced onto high quality paper, from the skin-feather junction on one side to the same point on the other side. The outline was cut out, weighed and the area calculted as in 15 above.
17. Body mass (to nearest 50 g), measured using a Pesola 10 kg spring balance. The balance was checked for accuracy before fieldwork started and again on completion.
18. Body temperature (to nearest 0,1 °C), taken with a clinical thermometer inserted 4–5 cm into the cloaca.

Wingspan, aspect ratio, wing and tail loadings were calculated from the measurements.

Two blood smears were taken from a leg of each bird captured, stained in Giemsa and examined for blood parasites. Birds were systematically searched for ectoparasites which, when found, were preserved in 70 % alcohol and sent to the South African Institute of Medical Research for identification.

RESULTS

Age classes

From colour transparencies of two Bearded Vultures of known ages the approximate ages at which the different plumages were acquired were determined (Table 1). These ages are very similar to those obtained by Delibes *et al.* (1984). Some variations in age at acquiring different plumages may be expected, because of geographic variation, food supply etc.

Some additional age-related characters are worth recording. The length of the beard of Bearded Vultures varied with age, from first projecting below the lower jaw in young birds, at about 10 weeks old, to a final length of 45–55 mm long in adults. Beard lengths at intermediate ages are given in Table 2.

The colour of the iris and surrounding scleral ring also changed as Bearded Vultures grew older. From the nestling stage through to the end of the first year young birds had a slightly opaque pale yellow-brown iris. The scleral ring was opaque browny-red until the young vulture was about eight months old, thereafter becoming an opaque dull red. By about 24 months old, the scleral ring was deep red, although still slightly opaque. By 36 months the iris was clear yellow, although still slightly darker than that of the adult birds. The scleral ring was no longer opaque but remained a deeper red than the blood red eyering of the adults until the subadult stage was reached.

Measurements

All live birds and skins measured were assigned

TABLE 1

AGES AT WHICH THE DIFFERENT PLUMAGES OF BEARDED VULTURES ARE ACQUIRED, DETERMINED FROM TWO KNOWN-AGE BIRDS PHOTOGRAPHED AT REGULAR INTERVALS FROM FOUR MONTHS OLD TO ADULTHOOD

Plumage type	Age (months) This study	Age (months) Delibes *et al.* 1984
A. Juvenile	3–24	3–21
B. Immature	24–45	21–43
C. Subadult	45–60	43–60
D. Adult	60+	60+

TABLE 2

LENGTH OF THE BEARD OF BEARDED VULTURES AT DIFFERENT AGES, MEASURED FROM THE DISTAL TIP TO WHERE IT JOINS THE LOWER JAW

Age (months)	Beard length (mm)
3,5 (on nest)	4,0
4,5	6,6
10–12	12,2
22–24	31,5
36	36,8
42–44	42,8
60+	45–55

TABLE 3

SOME PHYSICAL CHARACTERISTICS OF BEARDED VULTURES OF DIFFERENT AGE CLASSES. INFORMATION IS PRESENTED AS MEAN ± STANDARD DEVIATION (SAMPLE SIZE). STATISTICAL TESTS WERE DONE BETWEEN THE MEANS OF ADULT AND JUVENILE SAMPLES USING THE T-TEST, AND WHERE SIGNIFICANT DIFFERENCES WERE FOUND THESE ARE INDICATED AS FOLLOWS: * for $P < 0{,}05$; ** FOR $P < 0{,}02$ AND *** FOR $P < 0{,}01$

Variables	Juvenile birds	Immature birds	Subadult birds	Adult birds	Diff.
Bill length (mm)	73,8 ± 4,4 (7)	74,8 ± 4,4 (5)	74,7 (1)	73,1 ± 2,2 (10)	
Bill width (mm)	19,2 ± 1,2 (7)	19,4 ± 1,8 (5)	21,0 (1)	21,8 ± 3,4 (12)	***
Bill height (mm)	29,7 ± 1,6 (8)	30,4 ± 1,1 (5)	30,4 (1)	31,0 ± 1,3 (11)	
Gape length (mm)	92,1 (2)			95,2 ± 7,8 (5)	
Gape width (mm)	67,4 (2)			69,6 ± 4,0 (5)	
Std. wing length (mm)	755,0 ± 15,1 (8)	760,4 ± 21,6 (5)	765,0 (1)	782,4 ± 24,4 (11)	***
Tail centre length (mm)	478,1 ± 17,7 (8)	468,6 ± 15,9 (8)	470,0 (2)	473,5 ± 13,9 (11)	
Tail outer length (mm)	373,5 ± 16,6 (4)	364,7 ± 16,0 (7)	366,5 (2)	353,5 ± 13,5 (7)	*
Tarsus length (mm)	95,4 ± 7,0 (8)	96,6 ± 4,0 (5)	97,0 (1)	94,8 ± 6,2 (11)	
Toe length I (mm)	34,8 ± 3,9 (8)	35,6 ± 4,7 (5)	32,4 (1)	35,1 ± 3,2 (11)	
Toe length II (mm)	40,6 ± 2,0 (8)	43,0 ± 6,8 (5)	41,5 (1)	38,1 ± 4,2 (11)	
Toe length III (mm)	76,4 ± 4,1 (8)	80,6 ± 4,6 (5)	81,2 (1)	75,1 ± 5,9 (11)	
Toe length IV (mm)	47,0 ± 1,5 (8)	50,9 ± 3,4 (5)	54,2 (1)	47,9 ± 3,3 (11)	
Claw length I (mm)	34,2 ± 5,1 (8)	38,9 ± 3,0 (5)	41,0 (1)	36,9 ± 2,2 (11)	
Claw length II (mm)	35,6 ± 2,0 (8)	37,4 ± 2,5 (5)	37,9 (1)	35,4 ± 2,4 (11)	
Claw length III (mm)	25,9 ± 1,7 (8)	29,2 ± 3,1 (5)	29,7 (1)	26,4 ± 1,9 (11)	
Claw length IV (mm)	23,5 ± 2,1 (8)	25,4 ± 2,2 (5)	26,9 (1)	23,3 ± 2,3 (11)	
Total wing length (mm)	1 183,3 ± 13,3 (6)	1 188,3 ± 29,4 (9)	1 210,0 (1)	1 208,0 ± 39,6 (5)	
Shoulder width (mm)	85,8 ± 6,6 (6)	88,0 ± 4,5 (5)	85,0 (1)	107,0 ± 2,7 (5)	
Wingspan (mm)	2 538,3 ± 29,3 (6)	2 566,0 ± 36,5 (5)	2 595,0 (1)	2 630,0 ± 73,8 (5)	**
Overall length (mm)	999,2 ± 7,8 (5)	985,0 ± 31,6 (5)	1 070,0 (1)	1 035,0 ± 38,3 (6)	
Wing area (one wing; cm^2)	3 835,4 ± 163,6 (6)	3 654,9 ± 190,8 (8)	3 620,0 (1)	3 561,4 ± 205,0 (5)	*
Mean wing width (mm)	324,1 ± 13,3 (6)	306,9 ± 10,7 (8)	299,2 (1)	294,8 ± 10,7 (5)	***
Aspect ratio	7,8 : 1	8,4 : 1	8,7 : 1	8,9 : 1	
Tail area (cm^2)	1 393,6 ± 172,6 (6)	1 297,3 ± 130,0 (5)	1 114,5 (1)	1 233,8 ± 77,4 (5)	
Wing loading (N/m^2)	66,1	74,2	79,3	79,1	***
Wing and tail loading (N/m^2)	55,9	63,0	68,0	67,4	***
Mass (kg)	5,17 ± 0,7 (7)	5,53 ± 0,5 (5)	5,85 (1)	5,74 ± 0,4 (8)	*
Temperature (°C)	40,7 ± 0,3 (7)	40,4 ± 0,3 (4)	39,9 (1)	40,3 ± 0,7 (5)	

to age classes (Table 3), according to the criteria given above.

Sexual dimorphism

There was no significant difference between adult male and female birds in any of the characteristics measured (*t*-test) although females tended on average to be heavier than males. This is similar to the findings of other workers (e.g. Glutz von Blotzheim *et al.* 1971; Hiraldo *et al.* 1979; Cramp & Simmons 1980; Brown *et al.* 1982; Delibes *et al.* 1984) but the last mentioned authors found that the bill was significantly larger in the female than the male. This was not evident in the small sample in this study, where the male actually had a slightly larger bill on average. One subtle, but recognizable, feature separating the sexes when in flight, but not substantiated by mensural data was that females had slightly broader wings at the point of the primary/secondary junction than did males (Fig. 2). This could not be reliably used when single birds were seen, but a pair together could be sexed if the wings were clearly seen from underneath. The sexes of seven pairs were predicted in this way, and when checked against their colour ring codes or by observing which bird incubated at night, all predictions were found to be correct.

Age class differences

Adult and young Bearded Vultures differed in a number of characteristics. Statistical tests (*t*-test) were carried out between juvenile and adult age classes. Where these were found to be significantly different, immature and subadult measurements were invariably intermediate in value. The following measurements were significantly greater in adult than in juvenile birds: bill width, standard wing length, wingspan and mass. These characters are all associated with the normal growth of the young bird. Juvenile birds were significantly larger than adults in a number of characteristics related to flight. Their outer rectrices were 4 % longer than those of adults resulting in a tail area, when half-spread, of 11 % more than that of the adults. Their wings were 9 % broader on average but shorter than those of adults, and they had a 7 % larger wing area than adults. Immature birds (and the one subadult bird in the sample) were on average intermediate in size between juveniles and adults. Calculated flight characters were affected by the different wing and tail shapes of adult and juvenile birds. Adults had the highest aspect ratio (8,9 : 1) and juvenile birds the lowest (7,8 : 1). Likewise, adults had a significantly higher wing-and-tail loading (67,4 N/m^2) than juveniles (55,9 N/m^2) with immature birds 63,0 N/m^2) falling between the two.

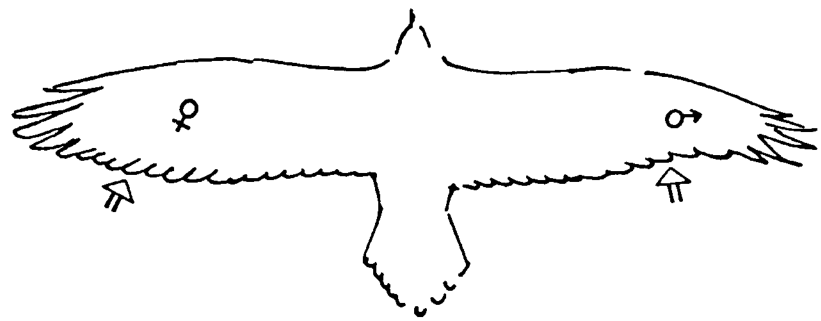

FIGURE 2

Wing shapes of adult male and female Bearded Vultures. The wings of females are slightly broader than those of males in the area of the first few primaries.

Parasites

Two species of feather lice (Insecta: Phthiraptera) were found, in almost equal numbers, on most birds examined: both male and female specimens of *Colpocephalum barbati* (Price & Beer 1963) and female specimens only of *Degeeriella punctifer* (Gervais 1844). A 2-min search usually resulted in the capture of 1–3 parasites (range 1–7), mainly about the head and around the cloaca. No blood parasites were found.

DISCUSSION

Bearded Vultures have a number of unusual features not shared with other large birds of prey.

Flight-related characters

Bearded Vultures have unusually long wings, a high aspect ratio and a particularly long tail. A high aspect ratio imparts improved gliding performance such as reduced minimum sinking speed and increased best-glide ratio, but it is a disadvantage in small thermals (Pennycuick 1971, 1972). Bearded Vultures, however, nest on cliffs and are confined largely to mountain massifs. They use mainly slope lift for foraging and rely less on thermals than other vulture species (Brown 1988).

The long tail of the Bearded Vulture may serve a number of different functions. When the tail is closed the combined wing and tail loading of an adult is about 73 N/m^2, but when spread, this decreases to about 62 N/m^2, a difference of 15 %. The difference for juvenile birds is greater still. By contrast, the equivalent figures for the Cape Vulture *Gyps coprotheres* are 104 N/m^2 and 99,5 N/m^2, a decrease of only 4 %. The tail of the Bearded Vulture can therefore alter the overall loading of the bird from fairly high to fairly low. This enables the bird to glide more slowly (Pennycuick 1975), to make better use of lift and to carry heavier food loads.

The tail is also used to correct small errors in pitch and yaw, an important consideration when flying at low levels over rough terrain in the gusty conditions typical of mountainous habitats. The tail is also used to direct the airflow vertically downwards during hovering; Bearded Vultures occasionally hover, mainly for bone dropping or for close inspection of possible food items. Finally, the tail is used as an air brake.

Food-related characters

Some of the unusual morphological features of the Bearded Vulture are directly related to their food and method of feeding. The gape is almost twice the width of that of the much larger Cape Vulture and 17 % wider than that of the 6,6 kg Lappetfaced Vulture *Torgos tracheliotus*. This is undoubtedly related to the Bearded Vultures' habit of swallowing large bones whole. Another unique feature is the beard which projects below the lower jaw of the Bearded Vulture. Unlike most other vultures the Bearded Vulture has a richly feathered head, which is probably important for thermoregulation in its cold mountainous habitat. Bearded Vultures feed on fresh carcasses when they can, particularly during the first few weeks of the nestling period of the breeding season. I suggest that the beard and bristles which extend from the black facial mask onto the cutting edge of the upper mandible function as tactile organs to prevent the bird from inserting its head too deeply into a fresh carcass and thereby matting its feathers with blood. Bearded Vultures were never seen with blood-stained faces even when bringing lumps of fresh meat to the nest.

Mundy (1982) has pointed out that the Cape Vulture has relatively short toes compared with those of the Whitebacked Vulture *Gyps africanus*. He attributed this to the cliff-nesting and roosting habits of the Cape Vulture as compared with the other vultures he studied, which nested and roosted on trees. The Bearded Vulture nests and roosts on cliffs, yet it has toes and claws of very similar proportions to those of the similar sized Whitebacked Vulture. It suggests that, because Bearded Vultures carry food with their feet, these are larger with longer claws than would be the case for a similar sized cliff-nesting scavenger that carried all its food in its crop.

Age class differences

Hiraldo *et al.* (1979) and Delibes *et al.* (1984) state that, whereas adult Bearded Vultures are on average slightly larger than young birds, this is statistically insignificant. These authors, however, looked at few characters and none of the ones that proved to be significantly different in this study. In addition, it appears from the description of their methods that all young birds were lumped into one group and the mean of this sample was tested against that of the adult sample. As can be seen from the measurements in this study, immature and subadult birds were usually intermediate in size between juvenile and adult birds and so, by grouping all the young-bird age classes, the degree of difference between juvenile and adult birds is reduced.

Differences in size between young and adult birds have been well documented for many species but their significance is not easily explained (Amadon 1980). Mendelsohn (1981) suggested that this may be related to different methods of hunting, but in the carrion-feeding Bearded Vulture no such differences were found (Brown 1988), and yet juvenile birds were significantly larger than adults in a number of characteristics related to flight.

The young of short-tailed species, which are often specialist fliers, usually have considerably longer tails than the adults, e.g. Augur Buzzard *Buteo augur* (Jackson & Sclater 1938), Bateleur *Terathopius ecaudatus* (Brown & Amadon 1968), Martial Eagle *Polemaetus bellicosus* (Amadon 1980). These become progressively shorter with each moult. Likewise, all the feathers, except the longest primaries, were measurably shorter in adult Peregrine Falcons *Falco peregrinus* than in first-year birds, amounting to "as much as half an inch on the secondaries and an inch on the tail" (Beebe 1960).

Young Bearded Vultures, during their first few months off the nest, are easily recognizable in flight by their clumsy, uncoordinated behaviour. By reducing the wing loading and increasing the tail area birds decrease their stalling speed and so are able to fly and land more slowly and manoeuvre themselves better. These features would be of considerable advantage to young, inexperienced birds, particularly for the somewhat specialized flying requirements of Bearded Vultures such as entering small cavities on cliffs, foraging at low levels above the ground and bone dropping, all of which usually take place in gusty wind conditions. These advantages are gained, however, at the expense of cross-country flying performance. Young birds, once independent, are not obliged to return to a nest site with food (as are adult birds during the breeding season) but can wander about and remain in areas where the food supply is good. They therefore do not have the same need for cross-country flying that adult birds do, and can afford to be built more for stability and manoeuvrability. In addition, there is some evidence that young birds move out of the main foraging areas used by adults during the breeding season (Brown 1988). Adult birds nest on the highest suitable cliffs available, and the most mountainous terrain is likely to support the most dense adult population. Young birds tend to concentrate in areas less heavily foraged by adults, and these are likely to be the less mountainous areas. Young birds may therefore be more dependent on thermals than adult birds, and this may also account for their lower aspect ratio.

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SHORT NOTE

First African Record of *Leucocytozoon anellobiae* (Apicomplexa: Leucocytozoidae) in Gurney's Sugarbird *Promerops gurneyi*

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A study on the local movements of Gurney's Sugarbird *Promerops gurneyi* in the Lydenburg district (*ca* 25 06 S; 30 33 E) (de Swardt 1987, *Wits Bird Club Newssheet* 139: 17–19) provided the opportunity to capture and take blood smears from a population of this species. The blood smears were fixed in 100 % methanol and stained in Giemsa's stain according to the protocols of Bennett (1970, *Can. J. Zool.* 48: 585–586) and then examined for blood parasites by the first author in Newfoundland, Canada. Blood smears were procured from 74 individuals between 5 September 1987 and 28 July 1989. Blood parasites were found in 38 individuals (51 % of the sample); 21 females, nine males and four immatures. All harboured light infections of *Leucocytozoon* sp.; three individuals also harboured unidentified microfilaria and one, a species of *Haemoproteus*. Four Cape Sugarbirds *P. cafer* were not infected.

Cleland & Johnston (1910, *Trans. Roy. Soc. S. Aust.* 34: 100–114) described *Trypanosoma anellobiae* from the Australian meliphagid, *Anellobia* (= *Anthochaera*) *chrysoptera* from southern Queensland, Australia. In 1911 (*J. Proc. Roy. Soc. N. S. Wales* 45: 415–444) they described and illustrated the "*Leucocytozoon*" stage of this trypanosome, thus continuing the error first propounded by Schaudinn (1904, *Arb. Kaiser. Gesund.* 20: 387–439) who confused the life cycles of the subphylum Apicomplexa with those of the subphylum Sarcomastigophora. However, Johnston (1912, *Emu* 12: 105–113) corrected this error and listed *Leucocytozoon anellobiae* as a separate species from *Trypanosoma anellobiae* in a checklist of the parasites of Queensland birds. This is the only leucocytozoid described from the Meliphagidae, an avian family with a distribution limited to the Australian zone.

The leucocytozoid found in Gurney's Sugarbird is entirely consistent with the description and illustrations provided by Cleland & Johnston (1911) and designated as *L. anellobiae* by Johnston (1912) and is similar to the leucocytozoids seen in blood smears from Australian meliphagids in the reference collection of the I.R.C.A.H. Therefore, the parasite seen in Gurney's Sugarbird is considered to be *L. anellobiae* and represents the first African record of this parasite and the first record outside continental Australia. Fallis *et al.* (1974, *Advances in Parasitology* 12: 1–67) stated that leucocytozoids are host family, not host species, specific. In as much as many of the species of *Leucocytozoon* in Africa (such as *toddi* in hawks, *ziemanni* in owls, *dubreuili* in thrushes, etc.) are cosmopolitan in distribution, the presence of this parasitic species in African sugarbirds raises some speculations on the origins, evolution and distributional pathways of the Meliphagidae. As with one exception all known vectors of the Leucocytozoidae are ornithophilic Simuliidae (and a number of such species occur in South Africa), there could also be some interesting studies undertaken on the relationships between South African and Australian Simuliidae.

Although Sibley & Alquhist (1974, *Ostrich* 45: 22–30) have suggested that the sugarbirds may be in a separate family, the Promeropidae, phylogenetically close to the Sturnidae, Sibley *et al.* (1988, *Auk* 105: 409–423), on the basis of DNA hybridization data, consider that they may be nearer the Nectariniidae. Transmission experiments are required to clarify whether *L. anellobiae* of the sugarbirds can be transmitted to members of the Nectariniidae and whether nectariniid leucocytozoids can be transmitted to sugarbirds. If such cross-transmission experiments can be carried out, the evidence will further support a close relationship of the sugarbirds and the nectarinids.