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Analysing the data accumulated in the last few years, one can add that in the Rumanian Carpathians the species has not been found breeding in forests but only in heterogeneous tree vegetation (often within man-made biotopes or even towns). There are four principal types of habitat, namely: (i) parks and cemeteries where Norway spruce is predominant (Radauti, Vatra Dornei); (ii) Scots pine plantations (Lucina, Pojorita); (iii) orchards (Humor Monastery, Ieud); and (iv) riverside coppices of sallows and/or poplars (Sighetul Marmatiei, Borzont). All the places mentioned are situated at a rather low altitude (between 270 m at Sighetul Marmatiei and 820 m at Vatra Dornei) and even when in mountainous country are always in the valleys or depressions.

As for breeding phenology, it has been ascertained that the eggs are usually laid between 20 April and 13 May but occasionally later, and that the young usually fledge between 22 May and 20 June, although fledglings from later clutches have been noted right at the end of June.

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# On the material evidence of *Hieraaetus pennatus* in southern Africa


*by R. K. Brooke*



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The occurence of the Booted Eagle *Hieraaetus pennatus* (Gmelin) in southern Africa has been known for 150 years. It was studied by Donnelly (1966) whose work was overlooked by Moreau (1972), perhaps through the relative obscurity of its place of publication. We now know that it breeds in the Cape Province (Martin & Martin, 1974, and in press for *Bokmakierie*) but believe that the majority of birds collected or seen in southern Africa are of palaearctic origin. It does not seem to be possible to distinguish palaearctic and southern Ethiopian breeding birds on morphological characters and, indeed this is not to be expected if *H. pennatus* has only been breeding in the Cape Province for a few hundred years. Following work on *Aquila nipalensis* and *A. pomarina* (Brooke *et al.*, 1972), most specimens of *H. pennatus* held in southern African museums have now been critically examined and this paper reports the findings. In addition, the nomenclature and distribution of subspecies are considered and, in the concluding section of the paper, the data on food taken by the species in southern Africa are reviwed.

## TAXONOMY AND NOMENCLATURE

Figure 1 in Brooke *et al.* (1972) shows that eagles placed in *Hieraaetus* Kaup, 1844, with genotype *Falco pennatus* Gmelin, 1788, have relatively longer hind claws (over 105 % of the length of the culmen) than those placed

*Aquila* Brisson 1760 with genotype *Falco chrysaetos* L., 1758, whose hind-claws are 80 – 105 % of the length of the culmen. This had been accepted by many authorities, e.g. recently Vaurie (1963) and Brown & Amadon (1968), despite difficulties of definition. It is accepted here.

Hartert (1914) gave a full synonymy for *H. pennatus* in which he recognised no races. Since then, *H. p. harterti* Stegmann, 1935; Kyakhta, south-western Transbaikalia, Siberia, has been described. It appears from Vaurie (1963) and Dementiev & Gladkov (1966) that the breeding range is disjunct, the main area being from extreme southwestern Europe to the Turkmen S.S.R. and the second area being around Lake Baikal. There is a clinal increase in wing length from west to east according to these authors and also in the proportion of dark to pale phase birds. Since the Baikal region birds are absolutely longer winged than those of western Europe (Table 1c), two races can be admitted. The type-locality of the species can either be regarded as France since the name is based on Brisson who wrote on French birds (Vaurie, 1963) or as Hungary as proposed by Grant & Mackworth-Praed (1934). It does not affect the argument of this paper but I believe that Vaurie (1963) is the better author to follow in respect of the type-locality of the species and thus of the nominate race.

TABLE 1

A. Data on specimens of *Hieraaetus pennatus peannatus* examined.

All measurements in mm.

| *Date* | *Piace* | *Sex* | *Age* | *Wing length* | *Culmen length* | *Hind claw length* | *Phase* | *Museum* |
|---|---|---|---|---|---|---|---|---|
| 10.5.33 | Asab, S.W.A. | ♂ | ad. | 345 | 20 | 23 | dark | T.M.P. |
| 24.2.09 | Umtamvuna R., C.P./Natal boundary | ♀ | ad. | 375 | 22 | 25 | pale | T.M.P. |
| 29.12.14 | Krugersdorp, Transvaal | ♀ | ad. | 425 | 26 | 31 | pale | T.M.P. |
| 28.11.15 | Pretoria, Transvaal | ♀ | ad. | 410 | 26 | 29 | pale | T.M.P. |
| 14.2.12 | Fretoria | ♀ | ad. | 380 | 25 | 28 | pale | T.M.P. |
| 24.12.01 | Vryburg, C.P. | ♀ | ad. | 410 | 25 | 30 | pale | T.M.P. |
| 14.10.29 | Golden Valley, C.P. | o♀? | ad. | 400 | 25 | 28 | pale | A.M.G. |
| n.d. | Aliwal North C.P. | o♀? | ad. | 400 | 24 | 29 | pale | A.M.G. |
| n.d. | Transvaal | o♂? | ad. | 385 | 24 | 27 | dark | T.M.P. |
| 19.8.37 | Klipfontein, C.P. | ♂ | imm. | 345 | 21 | 25 | dark | T.M.P. |
| 5.9.61 | Griquatown, C.P. | ♀ | imm. | 380 | 22 | 25 | pale | E.L.M. |
| 17.11.12 | Matatiele, C.P. | ♀ | imm. | 400 | 26 | 31 | pale | T.M.P. |
| n.d. | Transvaal | o♀? | imm. | 400 | 24 | 30 | pale | T.M.P. |
| –.4.13 | Durban, Natal | ♂♀? | juv. | 405 | 24 | 29 | pale | D.M. |
| –.9.03 | "Rhodesia" | o♀? | juv. | 380 | 24 | 29 | pale | T.M.P. |
| 31.10.07 | Bulawayo, Rhodesia. | o♀? | — | 370 | 24 | 27 | pale | N.M.B. |
| n.d. | Selukwe? Rhodesia. | ♀ | — | — | — | — | pale | N.M.B. |
| n.d. | Natal? | — | — | — | — | — | dark | N.M. PMB. |
| (n.d. | Roumania | o♂ | juv. | 330 | 22 | 25 | pale | T.M.P. |

B. Summary of measurements of birds of undoubted sex.

| *Wing length* | *Culmen length* | *Hind claw length* |
|---|---|---|
| ♂♂ 345, 345 | 20, 21 | 23, 25 |
| ♀♀ 375–425 av. (7) 397 | 22–26 av. (7) 24·6 | 25–31 av. (7) 28·4 |

C. Measurements from literature.

| | *Wing length* | *Culmen length* | *Source* |
|---|---|---|---|
| *H. p. pennatus* | | | |
| ♂♂ | 352–378 (361) | | Brown & Amadon 1968 |
| | 353–390 (11: 369) | 21–24 (27: 23·1) | Glutz *et al.* 1971 |
| | 352–386 | | Vaurie 1963 |
| ♀♀ | 375–403 (391) | | Brown & Amadon 1968 |
| | 380–428 (11: 409) | 24–26 (25·0) | Glutz *et al.* 1971. |
| | 355–411 | | Vaurie 1963 |
| *H. p. milvoides* | | | |
| ♂♂ | 388–395 | | Brown & Amadon 1968 |
| | 380–395 (388) | | Vaurie 1963 |
| | 370–412 | | Ali & Ripley 1968 |
| ♀♀ | 405–435 (420) | | Brown & Amadon 1968 |
| | 405–435 | | Vaurie 1963 |
| | 385–423 | | Ali & Ripley 1968 |

D. Abbreviations

| | | |
|---|---|---|
| ad. | = | adult as defined in the last paragraph of Distribution |
| A.M.G. | = | Albany Museum, Grahamstown |
| C.P. | = | Cape Province |
| D.M. | = | Durban Museum |
| E.L.M. | = | East London Museum |
| imm. | = | immature |
| juv. | = | juvenal |
| n.d. | = | no date |
| N.M.B. | = | National Museum of Rhodesia, Bulawayo |
| N.M.PMB | = | Natal Museum, Pietermaritzburg |
| Rhod. | = | Rhodesia |
| S.W.A. | = | South West Africa |
| T.M.P. | = | Transvaal Museum, Pretoria |
| – | = | data not available |

East of the Caspian Sea birds are longer winged and intermediate in size between west European birds and those of the Baikal region. They provided the type of *H. p. albipectus* (Severtzov), 1873: Turkmen S.S.R. They are placed in *H. p. milvoides* (Jerdon), 1839, by Dementiev & Gladkov (1966) since their range is essentially continuous with birds to the west, whereas there is a big break to the east, it seems better to place Turkmen birds with the nominate race and admit clinal increase in wing length to the east adumbrating the condition found after the gap in distribution in the Baikal region.

For the Baikal birds there are two names for consideration: *Spizaetus milvoides* Jerdon, 1839: Tiruchirapalli, Madras State, India, and *H. p. harterti* Stegmann, 1935: Transbaikalia. Vaurie (1963) has supported the use of the first and Brown & Amadon (1968) the seond. The use of *harterti* for Baikal region birds is unambiguous, but *milvoides*, although based on a specimen taken in winter quarters, surely came from the Baikal region. This is suggested by the eastern situation of the type-locality (Tiruchirapalli) and the fact that Jerdon (1862), who by then had accepted that it was a synonym of *pennatus*, gives the wing-length as males 420, females 435 mm which falls into the upper range of measurements for Baikal region birds (Table 1c). It would appear that Ali & Ripley (1968) erred in not recognising *milvoides* or its synonym *harterti* and that their measurements, quoted under *milvoides* in Table 1c, are a composite of both races. Presumably eastern segments of nominate *pennatus* as herein defined winter in India as well as *milvoides*. Whether the birds which breed in extreme northern India should be placed in nominate *pennatus* still needs to be determined by those who have access to such material as may be available. However, it does seem clear from the

measurements in Table 1 that only *H. p. pennatus* occurs in southern Africa; in any case, few Baikal region birds are believed to winter in Africa.

In the synonymy of *H. pennatus* Hartert (1914) cited two names used by Andrew Smith for South African birds: *Morphninus albescens* 1830: 115 (with a query) and *Butaetes lessonii* 1834: 287. An examination of Smith (1830, 1834) does not convince me that he was discussing *H. pennatus* under these names. His description of *M. albescens* is of a bird c.80 cm long with a heavily barred tail, whereas *H. pennatus* is just over 50 cm long and has an essentially unbarred tail. *B. lessonii* is described as having the upper shoulder (carpal joint) feathers margined with brown-white and the under shoulders feathers white spotted with black which is not true of *H. pennatus*. It seems to me that Smith's *M. albescens* is based on a juvenal *Spizaetus* (*Stephanoaetus*) *coronatus* L., 1766, as Layard (1867) held; it is the right size, has a well barred tail and the other characters Smith gave. Similarly, it seems that his *B. lessonii* is based on an adult *H. dubius* (Smith), 1830, as he himself on the next page (Smith 1834: 288) and Roberts (1936) held, since this is the only southern African eagle which has the shoulder pattern he describes. The corollary is that Clanwilliam and Outeniqua, long regarded as localities from which *H. pennatus* had been collected (Donelly, 1966), must be excised from the list of acceptably reported localities.

## IDENTIFICATION OF SPECIMENS

It appears from the measurements given in Brooke *et al.* (1972) and in Table 1 that while there is overlap in wing-measurements between *H. pennatus* and the larger *Aquila wahlbergi*, specimens may always be separated by the fact that in *H. pennatus* the chord of the hind claw is at least 3 mm larger than the chord of the culmen taken from the front of the cere whereas in *A. wahlbergi* these measurements are virtually identical. Critical study of Transvaal Museum specimens showed that two specimens of *H. pennatus* had been determined as *A. wahlbergi*. The old determinations had been used by Brooke (1966) in building his argument for the migratory behaviour of *A. wahlbergi*. The fact that they are *H. pennatus* strengthens his case, which is now widely accepted, e.g. by Snelling (1971), because it involves the deletion of the only May record he gave and also of an August record and the only one from the Cape Province. The July record in Brooke (1966) is in fact of a fledgling just out of the nest and is discussed in Brooke (1972).

Similarly the chord of the hind claw serves to distinguish *H. pennatus* from the larger *H. spilogaster:* in *H. pennatus* it does not exceed 31 mm whereas it does not fall below 34 mm in *H. spilogaster*. I agree with Dr. A. C. Kemp (*in litt.*) who points out that pale phase *H. pennatus* may be distinguished from immature *H. spilogaster* by the following plumage characters:—

*pennatus* has a streaked throat whereas *spilogaster* has not;

*pennatus* has obsolete barring in the rectrices whereas it is well developed in *spilogaster;*

*pennatus* has dark scapulars contrasting with the paler back whereas they are concolorous in *spilogaster;*

*pennatus* has plain scapulars, upper wing coverts and tertials whereas they are mottled in *spilogaster*.

I am unable to agree with Porter (1970) that immature pale phase birds are either more gingery below or have paler sides to the face. A study of specimens aged on moult characters (no moult of the primaries, descending, jumbled) shows this to be purely individual variation and that there seem to be no plumage characters for use as ageing criteria.

## MOULT

Adults showing active moult of the primaries and rectrices have been taken in November, December and February. The immatures taken on 19 August, 5 September and 17 November show interrupted moult of the primaries, as do adults taken on 10 May, 14 October and 14 February, though the May and February birds are still growing rectrices. Brooke (in prep.) will show that it is normal for southern African eagles to stop moulting their primaries in winter and to resume in October or thereabouts. The April juvenile from Durban has started its postjuvenal moult on the head but has yet to drop a primary.

One adult showed the three centre mode of rectrix moult as expected (Brooke *et al.*, 1972) but others seem to show a jumbled mode. The question needs further study to see what is the normal mode for adult *H. pennatus*. Standard modes for the moult of the primaries hold good, i.e. simple descending in immatures and jumbled in adults.

## DISTRIBUTION

Moreau (1972) remarks on how widely but thinly *H. p. pennatus* is distributed in the Ethiopian region during the northern winter. Regrettably, he and Backhurst *et al.* (1973) overlooked the perhaps obscure paper by Donnelly (1966) which suggests that it is by no means rare in southern Africa. It is clear from the ecological characteristics of the localities of the specimens examined that *H. pennatus* occurs throughout southern Africa except, possibly, in evergreen forest and that it does not shun arid regions where trees are few and far between.

Donnelly (1966) had to rely on data provided by other museums and the literature as well as on personal knowledge. This lead to minor weaknesses for which this pioneering study is not to be blamed when dealing with a species which is often misidentified both in museum and the field. Thus reference has already been made to the labelling of two very dark phase *H. pennatus* in the Transvaal Museum collection as *A. wahlbergi*.

If the details of Donelly's (1966) presentation are not always correct, no major conclusions are affected, but the following corrections may be noted. The Selukwe specimen in the National Museum, Bulawayo, has been kept in a cage or aviary and had its wings clipped: its date (October 1952) and provenance must be regarded as uncertain though, no doubt, it was trapped near Selukwe. As already explained the Clanwilliam and Outeniqua records are not acceptable. Donnelly overlooked the record in Sauer & Sauer (1960) of a road casualty at Sukses in South West Africa, the old records from that country in Rudebeck (1963), and the Rhodesian records in Chubb (1909). The Chibisa which he was unable to trace is Mbewe in the Chikwawa District of Malawi (see the Atlas to Reichenow's *Die Vogel Afrikas*). The Durban Museum's copy of Sharpe (1884) has annotations on specimens examined by A. D. Millar. In respect of *H. pennatus* he saw two Durban taken specimens: an unsexed pale phase bird taken on 18 January 1900 and juvenal female on 14 June 1897. These specimens no longer survive.

I am uneasy about the 1946 record from Willow Grange, near Estcourt in Natal (West, Wright & Symons, 1964, and cited via Clancey, 1964, by Donnelly, *op. cit.*). There is a specimen identified as *H. pennatus* from there dated November 1955 in the Natal Museum, Pietermaritzburg, which is an undoubted *A. wahlbergi* on measurements (wing 425, culmen 25, claw 25 mm). The Willow Grange record is only acceptable on the assumption that 1946 is not a *lapsus* for 1955 by West *et al.* (1964).

The specimen from "Rhodesia" in the Transvaal Museum was collected by J. van O. Marais whose collection was bought by that museum. Subsequently, in 1914, Austin Roberts had access to Marais's diary and wrote additional labels which give different particulars, doubtless more accurate, from those on the original labels made when the collection was purchased Most of the specimens are labelled "Sept. 03 Rhodesia". At that time Rhodesia covered all of what is now Zambia as well as Rhodesia in the modern sense. However, the supplementary labels show that certain specimens were obtained in German East Africa, i.e. Tanzania. I believe that despite the original labelling the whole of Marais's collection was obtained in Tanzania since a number of forms he obtained have their southern limits of distribution in that country, e.g. *Crinifer leucogaster*, *C. personata leopoldi*, *Trachyphonus e. erythrocephalus*, *Tricholaema lacrymosum* and *T. diadematum massaicum*. I, therefore, believe that the specimen of *H. pennatus* referred to by Donnelly (1966) was obtained in Tanzania and, since it is a first year bird, probably later than September (see below). This is the second record of a specimen from Tanzania (Backhurst *et al.*, 1973).

According to Dementiev & Gladkov (1966), the majority of *H. pennatus* are present in the U.S.S.R. between April and September. Porter (1970) adds that peak movement across the Mediterranean Sea is in the first two weeks of April and the middle two weeks of September. This means that palaearctic breeding birds could only be present in southern Africa between November and February, allowing a month each way for the migratory journey. Since birds have been collected here outside the midsummer months (Table 1) it appears that some are resident or overwinter. Three of the ten dated records for east Africa are of overwintering birds (Backhurst *et al.*, 1973). It will be noted that the May bird from Asab is an adult (Table 1). By an adult I mean an eagle showing the jumbled mode of moult in the primaries as discussed in Brooke *et al.* (1972). An immature bird is one showing a simple descending mode of moult in the primaries and a juvenile is a bird which has yet to moult a primary even if the postjuvenal moult of the contour feathers has started. A fledgling is a bird able to fly but still under the care of its parents and a nestling is a bird which has yet to fly the first time from its nest.

## FOOD RECORDS

Nothing specific on the food of *H. pennatus* is recorded in the southern African literature save domestic chicken eating by the Umtamvuna River bird (Davies 1910). I have seen two birds in company with *M. m. migrans* taking termite alates on the wing at Karoi in January and one with *A. nipalensis*, etc. doing likewise near Bulawayo in November: this is the basis for its inclusion in the list of occasional termitivores in Brooke *et al.* (1972). Incidentally, H. *pennatus* in southern Africa is not normally gregarious except when joining in termite alate feasts and on migration (Donnelly 1966). F. V. Tuer (*pers. comm.*) watched one capture a Laughing Dove *Streptopelia senegalensis* in the Famona suburb of Bulawayo in March. B. G. Donnelly (*in litt.*) saw one capture a Feral Pigeon *Columba livia* at 1400 hrs in the middle of Bulawayo in February. Mrs. P. Lorber (*pers. comm.*) observed one robbing a nest (with nestlings?) of the White-crowned Shrike *Eurocephalus anguitimens* in the Wankie National Park in January. H. A. Fry records on the label of the Krugersdorp specimen that it was "killed while eating a chicken". According to Glutz *et al.* (1971) and Dementiev & Gladkov (1966) it is primarily an eater of birds, to a lesser extent of rodents and other small mammals and to a limited extent of reptiles.

Jerdon (1862) supported by Ali & Ripley (1968) makes the point that *Milvus* spp. are often wrongly accused of taking domestic chickens when the culprit is the very similar looking dark phase *H. pennatus*. This could well apply also to some records of kites taking chickens in Africa.

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