

# STATUS & BIOLOGY OF THE BEARDED VULTURE *Gypaetus barbatus aureus* IN MACEDONIA

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## ABSTRACT

A survey of the present status of the Bearded Vulture in Macedonia, together with the results of a detailed study of the species' biology (ecology and ethology) during the years 1980-1986. Particular attention is paid to the habitat, food, nesting and general behaviour of the species.

## INTRODUCTION

The Bearded Vulture (*Gypaetus barbatus*), or Lammergeier, as a unique, legendary and mighty bird of prey, has been and remains a subject of great interest and study for numerous ornithologists. However, because of its way of life, its biology has still not been studied in detail.

A number of articles and papers exist on the ecology and ethology of the Bearded Vulture. The species has been most thoroughly studied in the Pyrenees (Terrasse *et al.* 1961; J.-F. & M. Terrasse 1967, 1974, 1978; J.-F. Terrasse 1981; Suetens & Groenendaal 1972; Boudoint 1976, 1978; Heredia 1979; Clouet 1984). However, many data exist from other areas; from the Sierra de Cazorle (Cano & Valverde 1959), from Corsica (Bouvet 1981), the Alps (Girtanner 1870), the Balkans (Reiser 1894, 1905, 1939), Asia Minor (Kumerloev & G  roudet 1965), Thai-Shan (Stegmann 1961), India (Ali & Ripley 1968), Tibet and the Himalayas (Berg 1931; Sch  fer 1938), and from various parts of Africa (Newman 1969; Brown 1977, 1984). General details are further given in Dementjev & Gladkov 1951; Meinertzhagen 1959; G  roudet 1965; Brown & Amadon 1968; Glutz *et al.* 1971; Fischer 1974; Hiraldo *et al.* 1979; Cramp & Simmons 1980 and Jean 1980.

The biology of the species in Yugoslavian Macedonia is very little known although some details are to be found in Karaman 1950; Markatsch 1950; Matvejev & Vasič 1973; and Grubač 1983, 1985. Because of the lack of detailed knowledge and the great threat to the species' survival, the author studied the ecology and ethology of this bird in Macedonia in detail, and here presents data on its status, habitat, food, nesting and general behaviour.

## MATERIAL AND METHODS

The main material for this study was collected by the author during fieldwork in Macedonia in the period 1980 - 1986. The effective length of time during which the bird was observed totalled approximately 112 days.

The chief methods used were: census (a survey of the greater part of Macedonia was undertaken), observation (from distances of 35 - 700m., with and without hides), interviewing local villagers, shepherds and hunters (all information critically analysed and checked), and analysis and identification of food from the collected remains of prey.

Observations were made using 12 x 50 binoculars. The data obtained were compared with those in such literature as was available.

## RESULTS

### Survey of Findings

**No. 1: North-West Macedonia\*.** This nesting pair was observed from 19 - 23 July, 1980 (Grubač 1983); in the same place, during observation of the nest from 12 - 19 July, 1981, only a single bird was seen (a 2nd year immature). In the next valley, 1.2 km. away, a pair of *Gypaetus* was noted (an adult male + an immature female) and observed from 23 July - 4 August, 1982; in the same place, from 18 - 19 July, 1983, a pair was seen (an adult male + an immature female), together with their young which had just flown; two birds were seen in the same place from 17 - 18 July, 1984, both immature (a 5th year female + a 2nd year bird); on 22nd and 23rd July, 1986, only one immature bird was noted (a 3rd year bird, hatched in 1983).

**No.2: South Macedonia(1).** Detailed observations of this pair were undertaken in 1984 (when the pair successfully reared one young). An immature bird was also seen in the same locality (most probably that same pair's young). In March 1985 the female was poisoned (Grubač 1985) during a campaign against wolves; on 3rd May 1985, in the same place, two birds were seen together (an adult male + an immature bird); on 21 - 23 December 1985, 29 April 1986 and 18 January 1987 only one adult male was seen.

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\* Because of the poor protection of birds in Macedonia, the author does not give detailed information on Bearded Vulture sites.

No. 3: **South Macedonia(2)**. On 17 and 18 June and 7 July 1985, three birds (1 nesting pair + 1 immature) were seen at this site. On 3 May 1986, during a brief observation period, only one immature Bearded Vulture was seen.

No. 4: **South Macedonia(3)**. On 30 August 1986, one Bearded Vulture was seen flying not far from the Yugoslav-Greek border. It stayed round a limestone cliff for a short time at approximately 1700 m. a.s.l. before heading north into Yugoslav territory.

No.5: **South Macedonia(4)**. An immature Bearded Vulture was occasionally seen in this area (most probably the young bird reared by pair 2 or 3). It was noted on 27 - 28 January 1983, 6 - 8 March 1983 and 24 March 1985. An immature Bearded Vulture had been noted in this locality earlier (J.-F. & M.Terrasse 1961).

No.6: **South-West Macedonia**. On 8 August 1985, at a great distance, a bird of prey with the silhouette of a Bearded Vulture was sighted. It circled below a mountain cliff on the Yugoslav-Albanian border for a short time before heading westwards towards Albania. From 9 - 11 August this locality was investigated in detail but with no further sighting. 10km. distant, in Albanian territory, there exists an ideal nesting-site for this species.

## Habitat

No.1: **North-West Macedonia**. The territory of this nesting pair covered an Alpine region from 1400 - 2700 m a.s.l., with a variety of habitats. For the most part these consisted of inaccessible cliffs, rocky hillsides, alpine pastures (the greatest part), bare eroded terrain and wooded areas made up of pines (*Abies alba*, *Picea excelsa* and others) and beechwoods (*Fagus moesiaca*).

No.2: **South Macedonia(1)**. The territory of this nesting pair ranged from 350 - 1500 m a.s.l. The locality included huge areas of limestone cliffs, various rocky hillsides, bare eroded terrain, various kinds of pasture, steppe-like plateaux and areas more or less overgrown with bushes and woods, mostly of the sub-Mediterranean type; *Juniperus excelsa*, *Quercus macedonica*, *Carpinus orientalis*, *Arbutus andrachne*, *Pistacia terebinthus*, *Paliurus spinachristi*, *Fraxinus ornus* and others. There were also areas of oakwood (*Quercus confertae*, *Q. cerris*, *Q. pubescens*) and a small area of beechwood (*Fagus moesiaca*).

No. 3: **South Macedonia(2)**. This pair inhabited a mountainous area from 900 - 200 m a.s.l. of Yugoslav and Greek territory, comprising cliffs (numerous trees, with *Pinus nigra* and *Fagus moesiaca* dominant), rocky hillsides, large areas of alpine pasture and woods (dominated by beech *F.moesiaca* and black pine *P.nigra*, with, at lower levels, oak *Quercus spp.*).

No. 4: **South Macedonia (3)**. Even though only one adult bird was seen, it is believed that a nesting pair exists. The nest is probably located on Greek

territory (in an inaccessible gorge next to the Yugoslav border, at a height between 1200 and 1800m). The home range of this pair covers Greek and Yugoslav territory from 700 - 2500m a.s.l. and for the most part consists of limestone cliffs, rocky hillsides, alpine pastures, huge areas of forest (*Pinus nigra*, *P.heldreichii*, *Abies alba*, *Fagus moesiaca*, and at the lowest levels *Quercus spp.*), bare eroded terrain and dry mountain steppe pastures. Apparently the birds come down to a cattle settlement at 600m a.s.l. on Yugoslav territory, 10-15 km from where the single adult was seen.

**No 5: South Macedonia (4).** During detailed yearly observation, one bird, an immature, was occasionally to be seen in this area. This locality offered very suitable conditions for nesting (during questioning, it was found that Bearded Vultures had nested in this area in earlier times). The area covered by this bird was from 200 - 1100m a.s.l., and comprised a variety of habitats. The bird was mostly seen around the inaccessible cliffs in the gorge, flying over complexes overgrown with Mediterranean shrub vegetation or Sub-Mediterranean mountain woods and coming down to look for food in a low-lying steppe area *ca* 200m a.s.l. .

**No. 6: South-West Macedonia.** A bird with a typical silhouette was seen flying over the Yugoslav-Albanian border, at *ca.* 2000m a.s.l. It is possible that a pair nests in a nearby gorge on the Albanian side, and is occasionally to be seen searching for food on Yugoslav territory (from questioning shepherds it appears that a pair of these birds are sometimes to be seen on the Yugoslav-Albanian border). This locality covers an upland area from 900-2200m a.s.l. , with various habitats, chiefly cliffs, rocky hillsides, wide alpine pastures, bare eroded terrain and woods (beech and pine).

All of the aforementioned sites have very similar characteristics. They are 1) wild, inaccessible, precipitous mountain areas: 2) used extensively for stock-rearing, although this has been considerably reduced (flocks of sheep and cows are less often encountered); 3) there are relatively good numbers of those wild animals which are important in the species' diet (e.g. *Lepus europaeus*, *Canis lupus*, *Vulpes vulpes*, *Martes spp.*, *Felis silvestris*, *Sus scrofa* and *Capreolus capreolus* are to be found in all the areas mentioned; the chamois (*Rupicapra rupicapra*) is to be found in areas 1, 3, 4, and 6; *Ursus arctos* and *Lynx lynx* in areas 1 and 6; whilst tortoises (*Testudo hermanni* and *T. graeca*, with the former considerably more frequent) occur in all the areas mentioned, at lower mountain levels.

In Macedonia the Bearded Vulture thus inhabits wild, inaccessible, steep, rocky mountainous areas little affected by man. Whilst searching for food it may be seen at various heights from 200 - 2,700 m above sea level (most frequently between 350 - 2,500m). Its range comprises various different habitats; the most inaccessible cliffs and bluffs of mountain ridges, gorges (the nest site), various kinds of pastures (from steppe to Alpine), bare eroded or rocky terrain, woods of various types and sizes (mixed pine and deciduous



and areas with vegetation of the sub-Mediterranean type). On the whole, whilst searching for food, the birds prefer open mountain country (without trees). This corresponds to the habitat of the species in other parts of Europe as described in Glutz *et al.* 1971; Fischer 1974; Handrinos 1985.

### Food and Feeding.

Qualitatively and quantitatively, the food of the Bearded Vulture in Macedonia comprises:

- 1) domestic mammals (most frequently *Ovis* sp., *Bos* sp., *Equus* sp., *Capra* sp. and *Canis familiaris*) - 50 - 80%;
- 2) wild mammals (*Rupicapra rupicapra*, *Sus scrofa*, *Lepus europaeus*, *Capreolus capreolus*, *Vulpes vulpes* and *Felis sylvestris*) and birds (*Streptopelia turtur* and *Garrulus glandarius*) - 20 - 40%;
- 3) tortoises (*Testudo hermanni* and *T. graeca*) - 10 - 30%.

From the qualitative point of view this diet does not differ significantly from that of the bird in other parts of Europe (cf Glutz *et al.* 1971; Terrasse 1981). Quantitatively, the food of the Bearded Vulture in Macedonia is specific, although quite similar to that of birds in Greece (Reiser 1905; Glutz *et al.* 1971). Such a similarity is understandable as the ecological conditions are very much alike.

The bird feeds mostly on various remains of mammals and birds, consisting chiefly of bones, skin, meat and other parts. It also takes live tortoises.

Smaller pieces of food are swallowed whole. With larger items the bird tears off pieces with its beak and swallows them. Bones and tortoises are first broken up by being dropped from a height. The birds use regular sites ('ossaries') for the breaking of bones and tortoises; these are usually steep, rocky places (ravines with or without boulders or slabs of rock) covering 30 - 40m<sup>2</sup>. One pair studied in southern Macedonia had 5 'ossaries' at distances between 200m and 3000m from their nest. 'Ossaries' of all birds studied were found at heights of 400 - 2200 m.a.s.l.

The technique of breaking bones and tortoises is as follows:-

- 1) the bird glides or planes towards the 'ossary' with the prey in its claws;
- 2) when above the 'target' (a particular spot within the 'ossary') it drops the prey;
- 3) it immediately flies down in elliptical spirals (2 - 3 turns);
- 4) it looks for and finds the bone (if this is broken it swallows the pieces; if

not, it takes the bone in claws or beak, gnaws it, etc.);

5) if the bone remains unbroken it repeats the performance. One bird was observed dropping a bone 12 times in succession within a period of 28 minutes.

The bone is usually dropped from a height of 30 - 70m.; more rarely 70 - 100 m. The technique of bone-breaking in Macedonia does not differ from that observed in the Pyrenees (Boudoint 1976).

A young Bearded Vulture was first seen breaking (dropping) a tortoise at over two months after first flight. The most intensive bone-breaking was observed at the end of October (a young bird after three months of flying). This is very similar to observations from the Alps (Bogel & Mack 1986) where a young Bearded Vulture raised in captivity and released first broke bones after two months of free flight. These details undoubtedly show that bone-breaking fulfils an important role as play and learning from experience. However, it is not completely clear how much of this behaviour is instinctive and how much is learnt.

The taking of water by a young bird in the wild was observed. The taking of water by an adult bird has been recorded (Bouvet 1981).

The taking of fresh plant material (grass) by a bird in the wild was recorded for the first time. A female took plant material in her beak and then flew with it to the nest. It was not seen whether she ate it herself or fed it to the young bird. The taking of plant material by other vultures is known (e.g. *Aegypius monachus* and *Gyps fulvus*), according to Suetens & Groenendael 1967, and Jean 1980, in order to help regurgitate indigestible parts (hair, feathers etc.).

## Pair Formation

The formation of a pair between closely-related birds - father and daughter (immature) - was noted in north-western Macedonia. This inbreeding was brought about by the death of the old female, and was certainly due to the absence of another female in the vicinity. In this case, the young female (an immature in its fourth year) successfully raised a young bird with the adult male. This pairing of closely related birds and breeding by an immature female have been recorded for the first time in relation to the Bearded Vulture. The nesting of immature birds of other vulture species is known, for example the Black Vulture (*Aegypius monachus*) (Suetens & Groenendael 1967).

## Courtship

The courtship display takes place from the end of October, throughout November, December and January. Some aspects of it may be seen in other

months (noted in April, July, and September). The following elements of the courtship display were observed:-

- 1) both birds flying together (soaring or gliding);
- 2) chasing or following - both birds glide or dive one after the other (the female in front, the male behind on a higher flight-path);
- 3) 'wing to wing' flight - when diving or gliding the birds fly side by side, wing to wing;
- 4) 'playful attack' - whilst flying together the male stoops at the female who turns on her back with her claws upwards; both birds lock claws and fall together for several seconds before separating.

The male bird may perform some elements of the display flight alone (soaring, wing-flapping, planing, gliding and diving).

Similar courtship display flight has been noted in other areas also - Tibet, India and the Pyrenees (Schäfer 1938; Ali & Ripley 1968; Suetens & Groenendael 1972).

### **Nesting**

The nests of the Bearded Vulture in Macedonia are located on extremely inaccessible cliffs (in gorges or on rocky mountain ridges). Three were found on limestone cliffs and one on dolomite. The nest is located in a small cave (a niche or covered ledge) - three examples; or in a transverse crevice (a shelf) - one example. Three of the pairs were found nesting at 450, 1650 and 2200m a.s.l. The nest sites in Macedonia at 450 and 2200 m. above sea level represent the extreme limits for the Bearded Vulture in Europe. The exposures of the nests were ENE, SE, SSW and NNW. The pair in north-west Macedonia possessed two nests 1.2 km apart.

The repair and building of nests begins in November with the bringing of dry branches, and nest-building is completed by the end of December or beginning of January, when a layer of sheep's wool is put down (noted with a pair studied in south Macedonia). The basic fabric of the nest is dried branches of various lengths and thickness. The cup is lined with a layer of sheep's wool which is regularly replaced throughout incubation. On occasion rags may be found. The nest is 1.7m to 2.0m in diameter and about 0.7m deep. The cup measures 60 - 70cm in diameter and is 15 - 20cm deep, similar to details given in the literature (Glutz *et al.* 1971; Cramp & Simmons 1980).

### **Egg-laying**

The pair in south Macedonia (ca.450m a.s.l.) laid their eggs around 20 January, whilst the pair in north-western Macedonia (2200m a.s.l.) laid at the start of February. The eggs were of different colour. Even in the same clutch

in southern Macedonia one egg was light reddish-brown (covered with thick flecks and spots), whilst the other was covered with a darker reddish-brown. The eggs are oval. Similar data are known from Europe.

## **Incubation**

Observation of the start of incubation showed that with the pair in southern Macedonia both sexes shared the task equally. Details from the Pyrenees (Boudoint 1978) show both sexes sitting at the end of incubation, but with the female doing the larger share (70%). This difference in the amount of sitting done by the sexes is understandable given that the observations refer to different periods of incubation in Macedonia and the Pyrenees. However, these data do show that during incubation there is a change in the amount of time spent on the eggs by the sexes. In brief, both male and female take equal shares at the start of incubation, whilst the female does considerably more towards the end. The sexes change over on the nest once a day, rarely twice. When the female arrives at the nest the male immediately flies off, sometimes even while she is still approaching the nest. When the male comes to the nest, the female waits until he has landed. The birds were then seen to perform a 'greeting ceremony': with the birds standing in a horizontal position facing each other on the edge of the nest, the female suddenly projects her head and neck towards the male (downwards), when the male at once greets her by bobbing his head up and down. After this the female flies off and the male stays to incubate. This greeting behaviour before changeover on the nest is similar to the greeting of the birds before copulation (J-F. & M. Terrasse 1967). Whilst incubating, both sexes behave in the same way: mostly immobile, with wings folded (sometimes slightly spread) and the head regularly raised. The position is such that a watch may be kept on the surrounding terrain. Breaks in incubation differ in number and length: for example, between 3 and 11 breaks lasting altogether from a few minutes to 38 minutes daily. Breaks occur during changeover, defecation, turning of eggs, change of position and for rest. An interestingly long break occurred when the female rose from the eggs and stood in the nest watching the surroundings for 29 minutes. During these breaks the birds never leave the nest. When taking up their position on the eggs their movements are extremely slow and careful. They show no reaction to the sound of falling stones or the shouts of shepherds in the vicinity. One female left the nest only when a human intruder was about 20m below it. When humans are near the nest (at about 350 - 400m) the birds do not change over until the intruder has fully distanced himself.

## **Rearing of young**

Based on data from the pair in southern Macedonia, the parents are not present throughout the day when the young is more than six weeks old. This pair visited their young only three times a day at 6-7 weeks and only once or twice daily at (data incomplete) 8-9 weeks and 13 weeks. On the whole visits

are made to bring food (out of 22 visits, 16 were to bring food - 72%). Food is usually brought once, rarely twice a day (at 8-9 and 13 weeks old). Both parents visit the nest in this way. They stay only briefly at the nest with the young (for example: at 6-7 weeks old - 12 minutes; at 8-9 and 13 weeks old - 1-3 minutes). The female comes to the nest more frequently than the male (11 visits by the female - 73%; 4 visits by the male - 27%; for 7 other visits the sex was not determined). The female also brings food more frequently than the male; out of 10 visits where the sex was determined the female brought food 7 times (70%). The adults usually bring the prey in their claws, extremely rarely in the beak. Young birds at 13 weeks old do not have their food prepared by the parents, but tear off and swallow it themselves. During the feeding of young birds the parents tear off and give small pieces 'beak to beak'. For example, the process of feeding lasts: at 6-7 weeks old - 6 minutes; at 8-9 weeks old - around 3 minutes. The aforementioned data show that the length of time which an adult bird spends at the nest with a young bird (especially with an 8-9 week old) in southern Macedonia is noticeably shorter than the same period in the Pyrenees and Corsica (Suetens & Groenendael 1972; Bouvet 1981). This was due to greater disturbance of the bird at the nest in Macedonia (especially during the time of filming the 8 - 9 week old young with a T.V. camera). The other details - the number of daily visits, number of feeds, the role of the sexes, behaviour during feeding etc. are similar to the data in the literature (J-F. & M. Terrasse 1967; Suetens & Groenendael 1972; Jean 1980; Bouvet 1981).

## Behaviour of Young

The behaviour of the young bird changes as it develops. The unfeathered chick, at 6 - 7 weeks, mainly lies in the nest all day with little activity. It stands up only, for example, during feeding and defecation. The presence of a human intruder nearby causes a reaction of fear (rapid retreat to the corner of the nest and 'freezing'). At 8-9 weeks the young bird is noticeably more active (hypothetically 45-70% of daily activity): it searches for food in the nest, swallows small pieces of bone, gnaws bones, walks around the nest, watches the surroundings, arranges and cleans its feathers, suns itself, stretches, defecates and, more rarely, moves its wings. During this period it will perform a threat display when a large bird (*Neophron percnopterus*, *Corvus corax*, etc.) flies past the nest. At 13 weeks of age the young bird is very active (50-85% of daily activity): it walks around the nest looking for food, gnaws bones, swallows small bones, often flaps its wings, cleans and arranges its feathers, watches the surroundings, defecates, stretches etc. For the rest of the time it lies down (15-50%). It will also perform a threat display if another large raptor flies past the nest. The presence of humans near the nest, about 30 m. distant, causes no reaction. The foregoing corresponds with the data on behaviour in the literature (e.g. Jean 1980).

## Fledging of Young

By calculation, young birds in Macedonia leave the nest during July and the start of August, mostly depending on the height above sea level at which the nest is situated.

The parents bring food to the young bird for a long time after it has flown (still at *ca.* 4 months, noted in detailed observation of a pair in southern Macedonia). Food is generally brought once a day (up to *ca.* 2 months after fledging). It was noted that a young bird at 3 months after flying was brought food by the adults 2-3 times a day. This was the period in which the young bird was frequently observed breaking bones. This increase in the number of times food was brought might be attributed to a greater need for food by the young bird due to greater loss of energy through increased activity or chance. During the first period after flying (around 1-2 months) the adults bring food to the young at or near the nest. Later the adults give it food in the vicinity of the nest, on the cliffs - it depends where they meet. During the first period after flying (about 1 month) the young vulture continues to perform the 'begging display' when taking food from its parents. During this, it lies in the nest occasionally flapping its half-closed wings and cheeping continually ('*kviuu, kviuu, kviuu...*'). Later the food is taken without the 'begging ceremony' (occasionally it is stolen), but with a continual calling. Emancipation (complete cessation of food-bringing by the adults) occurs in November, when the young bird is about 8 months old. After emancipation the young bird still begs for food from its parents, following them (e.g., this was seen on 1st December). These details of the behaviour of the young bird after flying and its parents show deviation from data from the Pyrenees. According to data from the Pyrenees and some observations in their confines (J-F. & M. Terrasse 1967; Glutz *et al.* 1971), emancipation takes place during September (2-2 1/2 months after flying). Although this behaviour varies, one must take into account the fact that no details of observations of birds in the wild from other areas have yet been published.

After first flying (in the first months) the young bird mostly remains around the nest. Later, after 2-3 months of flying, it ventures further, and outside the territory. It is possible that during this period it takes food from the parents further from the nest (and perhaps even flies with them in search of food?)

## Post-fledging

After emancipation the young bird is seen in the neighbourhood of the nest (not only in December and March but also later). On occasion it is possible to see a bird (immature) raised 2 or 3 years earlier in the vicinity of the nest. Sometimes the young fly together with the parents in search of food. The adults (parents) mostly avoid them after emancipation. Immature birds wander on average about 10 km from the nest (but can, for example, occur

over 30 - 40 km away). It is possible to see them alone, or with Griffon Vultures (*Gyps fulvus*) searching for food. These details conform to data from other areas, e.g. the Pyrenees (Terrasse 1967, 1974).

Bearded Vultures mate for life. They tolerate their young on their "home-range". The distance between two nesting pairs (their nests) in southern Macedonia is 21.5 km.

### Interspecific Relations

These birds do not tolerate other large raptors on their territory and when they encounter them they attack with more or less aggression. Attacks on the following were observed: Golden Eagle (*Aquila chrysaetos*), Griffon Vulture (*Gyps fulvus*), Black Vulture (*Aegypius monachus*), Egyptian Vulture (*Neophron percnopterus*) and Raven (*Corvus corax*). Aggression in territorial defence varies, depending on several different factors (species attacked, distance from the nest, nesting season, weather conditions, the spatial relationship between the birds etc.). The greatest aggression towards intruders is shown in the immediate vicinity of the nest, within 200 - 300 m. The greatest distance from the nest at which an intruder was attacked was about 2.2 km. Greater aggression is shown during the breeding season, from the time of courtship display to the fledging of the young. Weather conditions appear to affect the degree of aggression: the Bearded Vulture seems to be most aggressive in windy weather and least aggressive in bad weather (rain, snow etc.). However, spatial relationships, the distance between birds, affects this behaviour in the same way as the other factors.

Young (post-fledging) and immature birds also display territorial behaviour. A young bird of 8 - 9 weeks was seen to perform a 'threat display' whenever a large raptor appeared in the vicinity of its nest. It would usually stand at the entrance to the nest, feathers bristling, watching the intruder (more rarely hopping from one foot to the other with claws spread). This behaviour is similar to that of other raptors (e.g. it is reminiscent of the threat display of *Aegypius monachus*).

Other birds of prey and *Corvidae* attack or mob the Bearded Vulture when it flies over or near their nest, or during aerial encounters. The following species were seen to attack or mob the vulture: Imperial Eagle (*Aquila heliaca heliaca*), Peregrine Falcon (*Falco peregrinus*), Short-toed Eagle (*Circus gmelini*), Egyptian Vulture (*Neophron percnopterus*) Common Buzzard (*Buteo buteo*), Kestrel (*Falco tinnunculus*), Lesser Kestrel (*Falco naumanni*), Sparrowhawk (*Accipiter nisus*), Hooded Crow (*Corvus corone cornix*) and Choughs (*Pyrrhocorax pyrrhocorax* and *P. graculus*). Attacks by these birds offer no threat to the Bearded Vulture and are skillfully avoided or pass without reaction.

The alarmed flight of a Wild Boar (*Sus scrofa*) during an encounter with a Bearded Vulture was merely a reaction of fear on finding the bird unexpectedly overhead. No attempts whatsoever were observed by a Bearded Vulture on live prey, although some dubious data obtained by questioning referred to such attempts (on very young *Ovis* and *Capra*).

The behaviour of the Bearded Vulture towards man varies. Adults, nesting birds, generally circle round or fly off when a man appears in the vicinity of their nest. The birds sometimes show their agitation and aggression by gliding or stooping over the man's head, sometimes to within 40 m. Once, in this situation, a bird let out a piercing whistle (like 'fiiiiiijjjj'). During encounters on mountain ridges somewhat away from the nest, the bird will often fly indolently close to a man, but sometimes it will turn away to avoid an encounter. Immature and young birds will fly without fear over a man, watching him (sometimes approaching within about 30m of him).

### **Territory.**

The territory of a pair of Bearded Vultures in southern Macedonia (Figure 1) is directly related to the configuration of the terrain. It covers the cliffs and bluffs around the nest from several hundred metres to a distance of 2 km. That is the complete area in which the pair are often seen, rest, break bones, chase intruders etc. The size of the territory was taken as being the area in which (albeit very rarely) the bird would chase an intruder. The home range of this pair was about 350-450 km<sup>2</sup>, and the total range about 450-500 km<sup>2</sup> (Figure 2). This territory is greater than that of birds in the Pyrenees (Terrasse 1961; Suetens & Groenendaal 1972).

### **Daily Activity**

The duration of daily activity of Bearded Vultures in Macedonia varies according to the season, the weather conditions, the current needs of the birds for food etc.. Hypothetically, calculated on the basis of the length of time between first morning flight to last evening flight, the total length of daily activity is: in the summer months (around midsummer) - about 12-14 hours; at the equinoxes (vernal and autumnal) - about 9-12 hours; in the winter months (around midwinter) - about 5 - 9 hours. The birds generally take off with the sun's first rays and return at dusk (after sunset). The birds avoid very bad weather conditions (snow, storms and rain) when they remain on the cliffs. They can be seen (not always, however) flying in mist and light rain. On very muggy days (without wind, very hot with high humidity) they might not fly until 10.00a.m. (e.g. on 03.05.1985). And in very low temperatures (no wind) until 11.45a.m. (e.g. on 23.12.1985). In windy weather the birds fly much earlier, at daybreak itself (e.g. at 05.20 a.m. on 31.07.1982 a vulture was already in flight).



The greater part of the day is spent wandering in search of food. Part of the time is spent on the cliffs (sunning, preening and resting), breaking bones, etc..

## CONCLUSION

The Bearded Vulture in Macedonia (Yugoslavia) is virtually extinct. In the period 1980-1986 a census covering a large part of the territory of Macedonia confirmed that there were only three nesting pairs remaining (two in the south and one in the north-west); in addition, one adult was located on the border between Yugoslavia and Greece, where a nesting pair may well exist; one bird was seen on the Yugoslavia-Albanian border; and one solitary immature bird in south Macedonia. Of the three nesting pairs discovered, two no longer exist today (only one bird of the pair remains). On the basis of our research, the Bearded Vulture may still be found in Macedonia, but only extremely sporadically, singly or in pairs.

## ACKNOWLEDGEMENTS

Many thanks are due to: Nenad Vidojković (Paraćin) and Toma Lisičanec (Kavadarci) for their help with the field research and the provision of data; Zoran Milanović (Popovac) for help with the field research; Goran Ivanović (Paraćin) for help with the identification of some of the osteological material; David A. Hill (The British Council, Milano) for his special commitment with regard to the translation of the text into English; Dr. Ivan Čado (Head of the Republican Institute for the Protection of Natural Rarities, S.R. Macedonia, Skopje) and Radoslav Grubač for the limited financial help they gave for the research.

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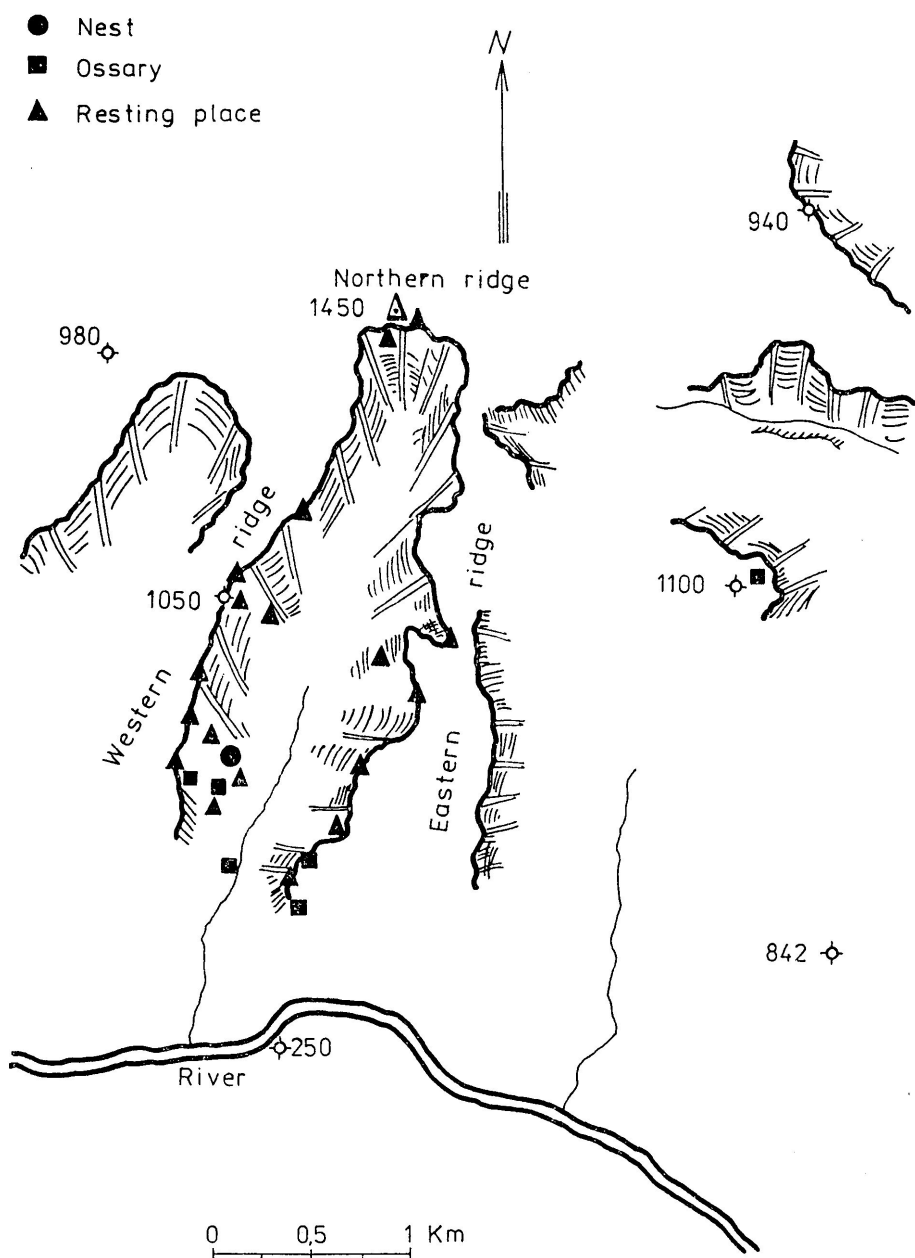
fauve, du Percnoptère et du Gypaète barbu dans les Basses-Pyrénées. *Alauda* 28: 241 - 257.

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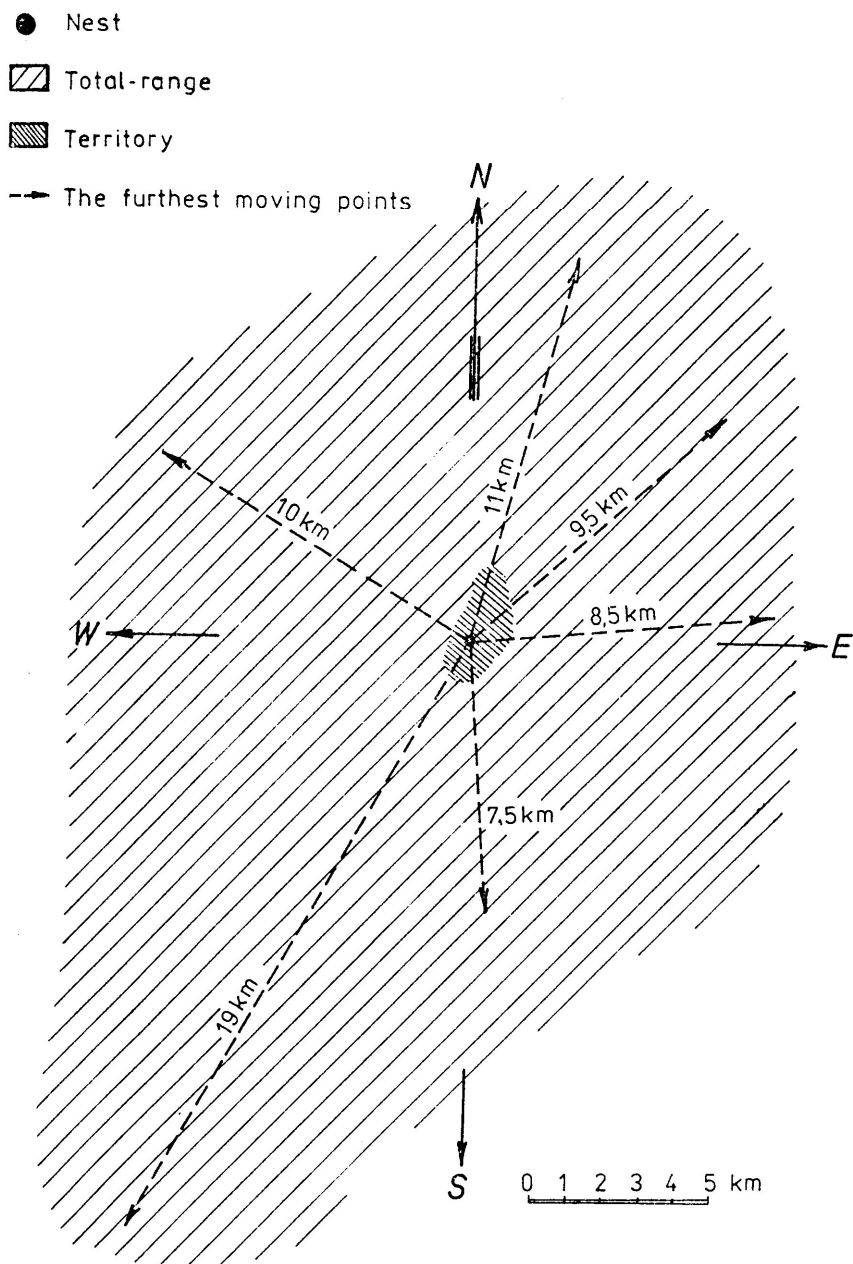


Bearded Vulture *Gypaetus barbatus*, Mongolie, 2 June 1980. Photo: B.-U. Meyburg

**Figure 1: The territory of Bearded Vulture (*Gypaetus barbatus aureus*) pair No. 2 in South Macedonia.**



**Figure 2: The furthest points at which Bearded Vultures (*Gypaetus barbatus aureus*) were seen, moving in search of food (pair No. 2, 1984 - 1986)**





Juv. Booted Eagle *Hieraaetus pennatus*, light morph, Department of Gers, France, August 1968. Photo: Pierre Petit