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## OBSERVATIONS ON MACKINDER'S EAGLE OWL

*BUBO CAPENSIS MACKINDERI* SHARPE

### ON A KENYA FARM

By

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### INTRODUCTION

This paper amplifies the previous notes on this bird (Sessions 1966) and is primarily based on field observations made in the Mau Narok district of Kenya over the last eight years. It also aims to be a corollary to the paper on the distribution and systematics of *Bubo capensis* Smith by Benson & Irwin (1967), providing additional information on habits, and discussion of various points that arise.

There appears to be no published work entirely on the habits of *B. capensis*, let alone on the race *mackinderi*, and details given in all the standard works of reference are scanty. To quote from McLachlan & Liversidge (1970) on the Cape Eagle Owl *B.c. capensis* Smith: "remarkably little has been recorded about its habits. Data are urgently required." These notes are taken from a large number of short observations made on this farm and environs to within a radius of 15 km. A description of the situation and topography of this area was given in Sessions (1966).

### DISTRIBUTION

#### General

Benson & Irwin (1967) show Mackinder's Owl to occur sparsely on high ground over the 3000 km separating *B.c. dillonii* Des Murs & Prevost in the north from the nominate race at the Cape, the heaviest concentration being across the Kenya Highlands from Mt. Kenya to Mt. Elgon. Thirty years ago it was confirmed only on Mt. Kenya itself (Jackson 1938); Priest (1933) made no mention of the owl in his work on the birds of Southern Rhodesia, nor did Belcher (1930) record it from Malawi. Mackinder's Owl has now been collected from both these territories and may eventually be found to be quite common in suitable localities.

It has been suggested by Benson & Irwin (1967), also Moreau (1966) that the populations of this owl are likely to be isolated and static, but this may not be strictly the case. So far the bird has not been found breeding below 2500 m, and although breeding birds tend to be resident throughout the year, there are a number of records from as low as 1800 m, generally in the vicinity of a higher land mass.

One would expect the immatures of such large birds of prey, which have dense local breeding populations, to incur fairly wide distributional movements, and that young birds

would make individual flights from their own area to an adjacent one. Bent (1961) implies that the Great Horned Owl or American Eagle Owl *B. virginianus* (Gmelin), whose habits appear similar to those of *B. capensis*, wanders up to 30 km within a year of being banded as nestlings. Birds could travel in stages between the two most distant breeding areas in Kenya, Mt. Kenya and Mt. Elgon (c. 500 km) without descending below an altitude of 1800 m. This might account for non-breeding records by Brown (pers. comm.) who saw one bird at Nyeri, of another seen at Limuru, and by Forbes-Watson who told me that he picked one up on the main road at the foot of the Kijabe escarpment. All were at altitudes of about 1800 m and within 30 km of known breeding areas. Further south similar climatic conditions occur at lower elevations, and Benson & Irwin (1967) quote records at Dedza (1550 m) and Bambata Hill (1472 m).

Mackinder's Owl may occur in large numbers on the moorlands of Mt. Kenya up to the base of the main peaks at 4270 m and down to 2440 m on the north-eastern slope where there is open land. On the other sides of the mountain the forest extends much lower and the owl does not occur again in numbers until the Aberdare range, where Williams (1966) reports it as common. I have seen it on the eastern slopes above Ngobit at 2440 m. Its range is interrupted again to the west by the Rift Valley, and the owl is then found on the plateau of the Mau. Here it occurs regularly through Mau Narok to Turi 2440 m, Molo 2600 m and Timboroa 2750 m, west to Lumbwa at 2450 m, thence to Mt. Elgon itself to the northwest. It may be expected on the Cherangani range.

It will be seen that in Kenya the owl's distribution covers most of the larger land masses which exceed 2400 m and occurs at lower altitudes only in the vicinity of those masses. Where it does occur, it may be very common for such a large owl.

### **Mau Narok**

The district of Mau Narok comprises an area of forest and mixed farming land of about 12000 ha, and has been described elsewhere (Sessions 1966). Lengetia Farm is situated at the western end, and it is this area which includes four farms totalling 2000 ha that has been most closely observed. Here ten nest sites have been found, and as most of these are used each year, it would seem that there are ten pairs of resident Mackinder's Owls.

Over the remainder of the district, owls have been seen and reported regularly, some of them for many years. Illuminated by car headlights, these birds are seen mainly on telephone poles and occasionally their flight lines to the hunting perches are seen. Assuming the owls breed near water, it is possible to deduce their approximate breeding area, although the nests have not been seen, and there are definitely at least ten pairs of owls here. As most of the observations have been made from the road, it is possible that the total number may be two or three times as many.

Considering the western area again with its ten confirmed nest sites, there is an average territory of 200 ha per breeding pair. The land is cut by streams running from north to south, and these valleys are from 1-2 km apart. The nest sites, which are always besides the water, are separated by distances of 1-2 km. Taking an average territory where the streams are 2 km apart and the nest sites separated by 1 km, the area would be 2 sq. km or 200 ha. There is no reason to suppose that the area which has been more closely studied is different to the remainder, except perhaps that it is rather better watered. One may therefore infer that Mackinder's Owl has a similar population density over the whole district.

Birds from most of these territories have been observed regularly over the last 18 years and it seems that the population has remained remarkably static. A steady increase in the number of resident birds would not be apparent however, without very careful observation of all breeding sites. I had known of one pair breeding regularly on a 11 km section of stream. One year I found two pairs nesting on this section, and the following year there were three pairs, but it will take further study to find out if this increase is temporary or permanent, and if similar increases are occurring on other

sections of streams. The pairs that have been observed in the permanent territories have nested regularly in the same vicinity and continue to use the same hunting area and vantage posts year after year.

To the south-west of Mau Narok lies thick forest and Mackinder's Owl is probably unusual here. To the north and south are open plains with patches of forest and local tribesmen confirm that the owl is common in this area. To the east is the Rift Valley escarpment, covered in forest and scrub; above this line is the lower limit of Mackinder's Owl's range. Below the forest, on the Rift Valley plain, the Spotted Eagle Owl *B. africanus* (Temminck) is a resident species, and there appears to be no overlap.

The distribution and density of Mackinder's Owl in the Mau Narok farming area seems to have remained constant before and after the land was developed. It may be supposed that the population in the undeveloped land to the north and south would be of the same order. Thus on the 8000 ha comprising this part of the Mau plateau as far as Molo and Turi there may be 300 breeding pairs or more. The only other bird of prey which occurs here in numbers of this order is the Augur Buzzard *Buteo rufofuscus* (Forster) and their population would be about the same.

### HABITAT

It has been shown that the habitat of the owl comprises a fairly extensive piece of grassland together with a section of valley down which water flows, at least temporarily. Light timber is favoured as well as some rocky places, but either or both may be dispensed with; if the latter case, small bushes or heather are required for nesting sites and roosting.

I have not found the bird in deep forest, about 45 m being their maximum penetration; one pair actually nests in a thick patch of heavy timber on the bank of a stream, but it is a narrow spur, and the owls fly clear of the trees with a few quick wing-beats. The owl will make full use of exotic trees such as pines, cypress, gums and wattles for daytime roosts and hunting perches at night (cf Benson & Irwin (1967), p. 4, re *B. africanus*).

Altitude seems to be a major criterion for the lowest limit of their breeding range, and from personal observation this would seem to be about 2440 m near the equator. Of the two roads that run down to the Rift Valley from Mau Narok, one runs east, the other north; both pass through thick forest on the escarpment. Above this forest I have seen *B. capensis*, and below it, from 2100 m, only *B. africanus*.

Regardless of the terrain which the various local populations of *mackinderi* inhabit, there is one common factor, and that is the presence of water, near which the owl makes the centre of its territory and the base of its breeding site. I have found no exception to this pattern.

### OTHER SPECIES OF STRIGIFORMES

An important aspect concerning any owl is its toleration of other species of night predators. These have more specialised requirements than diurnal ones or the number of their species would be greater; hence there must be a lower interspecific tolerance. Brown (1970) says that the Mountain (Mackinder's) Eagle Owl has the field to itself, and this is largely true. Besides some 20 pairs of *mackinderi* on Mau Narok there are only three pairs of Verreaux's Eagle Owls *B. lacteus* (Temminck) a pair of Wood Owls *Ciccaba woodfordii* (Smith) and a single Barn Owl *Tyto alba* (Scopoli). The first two seem rather more restricted to the forest so that *mackinderi* faces competition mainly from itself. The same applies on Mt. Kenya and probably in other montane areas, but one cannot say if this numerical superiority is due to the aggressiveness of *B. capensis* to other owls, such as is shown by the European Eagle Owl *B. bubo* (Linn.) (Bannerman 1955) or to the lack of adaptability in them. *B. africanus* might be expected to occur, but it is more insectivorous, prefers a lower altitude, and would probably be repulsed by *mackinderi*.

However, the three pairs of Verreaux's Owls that inhabit Mau Narok latterly have appeared to nearly overlap the hunting territories of Mackinder's Owls. Both myself and another local farmer, T. Hamilton-Fletcher, have seen them making nightly forays onto the open ploughed land, although no open conflict has been seen to occur. However, the Verreaux's Owl spends the daytime deep in the forest, which is also where it nests, so there is no question of rivalry over breeding sites. Also, Brown (1965) states that this owl has a very catholic diet, which may mean a different hunting routine. For all that, Brown shows that the life habits of this owl are very similar to those of Mackinder's, and as the former appear to be comparative newcomers to this area, there may be an eventual trial of strength when the numbers of both species reach saturation.

## DESCRIPTION

Adequate descriptions are found in works of reference to *B. capensis mackinderi*, but it seems reasonable to add some points of field identification, as this bird has been continually mistaken, generally with *B. africanus*, and sometimes with *B. lacteus*. These are essentially greyer birds, with finer barring below.

From above, Mackinder's Owl looks medium to dark brown, with a distinctly tawny band across the neck, and blackish and grey markings on mantle and wings; as it flies away it may show a white patch on wings or tail. Underneath the bird appears paler, with a band of dark blotches on a tawny background across the chest, a conspicuous white throat patch and a pale grey or white belly lightly blotched to the vent with brownish markings. The "socks" are creamy white or grey. The underparts are variable, some very tawny, others much paler. The male is nearly always paler than the female and when together with the female, can be seen to be smaller; it also has the habit of flying off first when disturbed. These details agree with those of Forbes-Watson (Benson & Irwin 1967 p. 10).

Distinguishing features of this owl are its ear tufts. They are larger and more conspicuous than in other species, being always visible and are generally held horizontally; vertically only when excited. The eyes are a brilliant fiery orange, distinct from *B. africanus* with its yellowish or brownish eyes, and *B. lacteus* which has black eyes, the lids only being orange. The voice, which most often indicates the presence of an owl, is distinctive, and is described in detail later. Verreaux's Owl has a much deeper note, more of a grunt (Brown 1966), while the Spotted Eagle-Owl has a softer call, though rather similar.

## HABITS

Typical of many eagle owls, Mackinder's Owl is not entirely nocturnal and is often seen hunting before sunset and again in the early morning; sometimes one may see it sunning itself by day on an exposed rock or branch.

The usual routine is, at sundown, the owl gives a preparatory hoot from its daytime roost, sometimes giving a few answering calls to its mate. It then flies up the valley in short stages, pausing *en route* on suitable posts, until it finally reaches its hunting ground on the ridge top. Here it will utilise a favourite perch such as a tall tree or telephone pole, or even a chimney top, from which to spot its prey, which may be eaten on the ground or on the perch. After a couple of hours' hunting, the birds return to the roost site in the valley, where they appear to spend a considerable part of the night settled on the ground near the water. The purpose of this habit is not clear, but it may be in order to catch frogs and crabs. Before dawn they are back hunting again on top of the ridge, returning to roost as the sun comes up.

The hunting area of each pair is apparently from the nest/roost base up to the centre of the ridge on either side of the valley, where it meets the owl from the next territory. *B. virginianus* is believed not to battle with its own kind, but forms its boundaries by

vocal display (Ardrey 1960), and it is probable that *B. capensis mackinderi* does the same. Sometimes a prolonged hooting goes on through the night, and this may have a territorial function; normally they only hoot continuously when they have newly fledged young.

The roosting sites of breeding birds are generally within a short distance of the nest area, whether it is in a tree, rock or grassy bank, and the female at least seldom moves far from here. While the pair remain together, they may be found in the same place year after year. Immature and single birds are found elsewhere, on this farm usually in a clump of trees some way from the stream bed. When roosting by day the pair often share the same tree, the larger female sitting upright and close to the trunk, the male perched a little out along the branch. As one approaches the male will slip away first, dropping down to just above the water for a hundred yards, then swooping up to another tree to perch in full view and stare at the intruder. The female sits much closer, and one can sometimes walk right under her before she will fly; their tree perch is about 3 to 5 m above ground and not in dense foliage. Where trees are not available, they will use a small cave or rocky overhang in the same way, and failing even this facility, they will crouch under some low bush or tuft of grass. When disturbed from the nest, the female will fly a few yards to alight on the ground and stare until one departs.

## FOOD

One of the requirements of Mackinder's Owl appears to be a superabundance of food, and where this occurs, it usually means that the food is of one kind. For instance on Mau Narok and the rest of the Mau range, it is the mole-rat *Tachyoryctes splendens* (Rüppell) that provides most of its diet, while at the head of the Teleki Valley on Mt. Kenya I found nearly every owl pellet to contain the bones of the rock hyrax *Procavia johnstoni mackinderi* Thomas. At Bale, Brown (pers. comm.) found the Ethiopian race, *B. capensis dillonii*, was feeding mainly on mole-rats, although one nest contained large numbers of skulls of a frugiverous bat.

Again, *B. virginianus* shows a similarity. Errington (1940) in his studies on the prey of this owl reported that remains of Leporidae were represented in 3315 pellets and stomachs, out of 4838 examined. The main member of the family, the cotton-tail rabbit, made up to 80 per cent by volume of the owl's diet. Brodie & Maser (1967) showed that in six collections of owl pellets from one area, *Microtus* formed 77 per cent to 91 per cent of the food items, although in another area the meadow mouse and beetles were taken equally. Errington (1932) summed up: "From the examination of 1900 pellets I feel justified in saying that choice plays a minimal role in the horned owl's hunting routine. The horned owl goes out with the intention of getting something to eat, to take what it encounters first and is able to get."

So although the total species of prey listed indicates that *B. capensis* enjoys a wide range of diet, it is also apparent that each owl tends to adapt itself to preying on one particular animal and then maintaining an almost exclusive diet. At the high altitudes frequented by *dillonii* and *mackinderi* the number of species of small mammals is low, although populations of individual species may be high and also constant. An idea of the mole-rat numbers on this farm may be deduced from the 600 that were trapped from a 12 ha grass ley in one month, and 220 out of the 800 ha on this farm contain this density of mole-rats.

Brown (1970) believed that no class of avian predator would have anything better than a local effect on controlling the numbers of their prey, and this would certainly include Mackinder's Owl. There are 5 or 6 pairs on the farm, and probably an average of 15 individuals throughout the year each requiring about one mole-rat per night. The annual supply of mole-rats needed by these owls is therefore in the region of 5500 to be drawn from a population of many times this figure, and which is constantly reproducing itself. On the other hand although this predation does not have any diminishing

effect, the absence of this owl might allow the mole-rat to reach plague proportions. This rodent is about 20 cm long and an adult might weigh up to 250 g. From the number of skulls I have found in their casts I reckon the owl kills up to three in one night, for they may of course only eat the head.

At the top of the Teleki Valley on Mt Kenya, hyrax are very numerous, the piles of rocky moraine appearing to come alive with these animals at times. Coe (1967) estimated a population of 80 hyrax to 20 ha, but this seems a conservative estimate for the more favourable areas where the runs are worn bare and smooth like a footpath, and the smell of their faeces hangs everywhere. Close to one of the colonies there was a thin forest of tree groundsel *Senecio keniodendron* R. E. Fr. & Th. Fr. Jr., where in June 1969 I found large numbers of Mackinder's Owl roosts. About 25 per cent of the trees had been used at one time or another and under each of these trees were a collection of pellets all containing hyrax bones. Pellet sizes compared with those found on Mau Narok, i.e. up to 100 mm × 35 mm. The hyrax weighs up to 3.5 kg and the smaller ones should provide an easy prey. The weaker Augur Buzzard was observed to take them readily (Coe 1967). When eating hyrax the owl leaves the head. Many skulls were found lying bleached beside the pellets. *B. virginianus* was also found to dispense with the skull of a young beaver, presumably an animal of similar size, in the same way. (Brodie & Maser, 1967: p. 12). The *Otomys* rat is similar in size to the mole-rat, and is also abundant in places on the mountain.

Other items of food include the smaller rats and mice as well as larger mammals such as the African Hare, *Lepus capensis* L. On the four occasions that I know of it being taken, three of them at least occurred while the owl was breeding. Once the owl was seen by A. Forbes-Watson (pers. comm.) to make its kill by the headlights of his car; another time the attack was made in mid-morning and a third time the bird killed at dawn, bringing the hare straight to the nest where I found it still warm and limp at 9.00 a.m. The fourth hare I found on a slab of open rock-face near the river and c. 100 m from the nest; it looked as if the animal had been killed elsewhere and the bird was too exhausted to carry it further for the hare was broken up piecemeal and carried to the nest over the next four days. The hare is nowhere very common, suffers from many predators, and cannot form a large part of the owls' food supply, but it would appear a useful addition when more food is required quickly to feed growing nestlings.

Birds are also an unusual part of the diet; a Black-winged Plover, *Stephanibyx melanopterus* (Cretzschmar), was seen killed and carried off to some pine trees in the middle of the day and two nests were found containing feathers of the Montane Francolin, *Francolinus psilolaemus* Grey. I have also recorded kills of the Pink-breasted Dove, *Streptopelia lugens* (Rüppell) and Hammerkop, *Scopus umbretta* (Gmelin). L. H. Brown (pers. comm.) found a leg bone of a domestic fowl in the roost of *mackinderi* on the escarpment at Kijabe.

Evidence of insects in the casts are not frequent, although I have found the wing cases of a large beetle. The most frequent remains other than those of small rodents found in pellets on Mau Narok are those of a fresh-water crab, which is common in the mountain streams here. In about a quarter of the pellets examined crab shells have been found. Sometimes a whole carapace of up to 25 mm across, or a claw of up to 30 mm long. Other crab shells are found alone, where the friable parts of the pellets have been washed away by rain. The crabs are also brought to nestlings. On one occasion a pile of shell was found on a "feeding block" about 5 m from the nest; the crabs had not been eaten whole as they would have been by an adult, but the meat had been picked out and the shell discarded. It is worth noting that there are no records in Witherby (1946) or Bannerman (1955) of *Bubo* eating crabs, but *B. virginianus* is known commonly to take crayfish; see Bent (1961 p. 309), Errington *et al* (1940: p. 807), Marti (1969: p. 166), Brodie & Maser (1967: p. 11), but not to any great extent, and according to Marti (*op. cit.*) these are rather small crustaceans, of the genera *Reithrodontomys* and *Perognathus* weighing only between 5 and 12 grams. Curiously, the Great Horned Owl does not assimilate them as easily as Mackinder's Owl does the crab, for often the skeleton of

the crayfish is found separately to the pellet. Only in the case of juvenile owls have I found the crabs to have had the flesh pecked out of the shell.

Otters are common on the streams which the owls haunt and frequently leave crab shell as remains of their meal. However, the remains are easily distinguished from those eaten by the owl, as they occur as neat piles of finely ground shell generally on a rocky track used by the otter. The owl pellets contain whole claws, shells and other parts of the crab, and even when the rain has washed the friable parts of the pellet away, the crab shell still lies in the outline of the original cast.

*B. bubo* is known to take large numbers of frogs (Bannerman 1955) and it is more than likely that Mackinder's Owl does the same, for frogs and tadpoles are exceedingly common all along the streams where the owls spend long hours, but their remains are not easily visible in a cast (Errington, 1940: p. 764).

Marti (*op. cit.*) has shown that the mean prey weight for the American Horned Owl is 220 grams, and Errington *et al* (*op. cit.*) have shown that the average meal for that bird is six large mice or half a large rat, but what is not shown by any researcher is the number of meals taken in 24 hours by a bird, or the number of pellets brought up. Examples from captive birds do not necessarily prove what happens in the wild.

It was stated earlier that the owl eats from one to three mole-rats per night, judging from teeth and skulls found in the pellet, but it has been shown that eagle-owls eat the head of rodents first, and it may be that not all the prey were consumed entirely. Conversely, if the owl has ejected more than one pellet, it may have eaten more than three moles. It appears that the owl does a twice-nightly hunt for rodent prey, at dusk and dawn presumably successfully, and also spends some of the intervening hours looking for frogs and crabs by the river bank. This is rather in contradiction to that of Errington *et al* (*op. cit.*: p. 810) who consider that *B. virginianus* takes the first convenient prey that comes its way. I consider that *B. capensis* is more methodical, and although an opportunist on occasions, would hunt a particular area for a specific prey.

## VOICE

Two common sounds made by the adult owl are a resonant hoot and a short bark; both sexes make either sound, although the female has a deeper hoot. Before the evening hunt commences, the bird makes a single long "hoooooo", (cf. Meinertzhagen (1954) on the call of the Egyptian Owl *B. ascapalus* Savigny.) While hunting it makes a double note, either short-long or long-short, i.e. "hu-hoooooo" or "hoooooo-hu", or less often a triple note, "hu-hoooooo-hu". If the bird has a "song" (q.v. Whitherby (1938) for *B. bubo*) it is a quick, high-pitched triple hoot, rapidly repeated; I heard this once from a displaying bird (see Display).

The alarm call is a sharp "wak wak" like the bark of a jackal comparable to the "kvek kvek" call for *B. bubo* (Whitherby 1938), and the "whok whok" of Verreaux's Owl (Brown 1965). When danger diminishes the adult may call a softer "werp werp" to reassure mate or young, and this too is the call heard at night when the young are being trained to hunt. Hoots and barks are often mixed at random, especially when the birds are startled or upset. Sometimes one of the pair will hoot, while the other barks, or again an individual may make both sounds. Other occasional sounds are a mewling noise by the female under extreme excitement, and a soft croak by the male, which is probably a warning note. The nestlings' hunger call is a whining "kleeeee kleeeee" and when alarmed they hiss. By the time the young is nearly fledged it develops a churring noise which finally becomes a loud snarl, "scrrreecer", often uttered in daytime, and usefully indicating where the young birds are hiding after leaving their nest. In common with other eagle owls, both young and adults click and snap their bills when under provocation.

## DISPLAY

None of the daylight aerial displays described for *B. bubo* (Bannerman 1955, p. 173) have been observed, and indeed one would not expect them from a pair of birds which are resident, share the same hunting territory, roosts throughout the year and where climate and food supply scarcely vary. It is probable that some arboreal form of pre-nuptial display takes place at dusk or by night. I have seen it occur once by day, apparently triggered off by fright. The pair had been roosting in a low cedar tree and when disturbed flew off to settle close together on a branch of another nearby cedar. Both birds then made a series of rapid triple hoots "cu-coooo-cuk", the female sitting bolt upright, the male bowing with each hoot and facing the female. A few days later I found this female sitting on eggs. This display is similar to that of *B. bubo* described by Witherby (1938). The only record I have of coition is that observed by Mr. and Mrs. Philip Mau Narok, who saw a pair mating on the road near their house in July 1971; the time was shortly after dark and the birds were quite unperturbed by the car headlights.

The Mackinder's Owl is generally by no means as fierce as it looks; normally I can approach and examine a nest containing egg or young while the parent birds quietly watch me from a tree or rock close by. In fact they are easily the tamest and most confiding of the large birds I know. One pair varied slightly by flying from tree to tree around the nest, peering and craning their necks whilst they hooted and barked; doubtless a sort of distraction display. The only exception occurred when I was looking for a nest on another farm, whose location I could only roughly guess. A person had reported a variety of frightening noises from an unseen bird and had been unwilling to investigate: I suspected a pair of breeding Mackinder's Owls. On approaching the site, I disturbed an owl in a tree which flew off a short distance. As I searched for the nest it returned to the first tree and, drooping its wings, barked at me. As I got nearer to the young (without knowing) the bird got more and more frantic, flying from tree to ground to post, all the time trailing its wings, apreaching its tail and dilating its startling orange eyes. Judging from its size and colouring, the bird was a female. She kept up a continual clacking of her bill, hissing, barking and growling, occasionally making deep throaty hoots, puffing out her white throat feathers as she did so. In between these sounds she made thin mewling noises. Eventually I crossed the stream to look back, and saw her two owlets safe on a rocky ledge over the stream, protected by an overhang of the bank on which I had been standing. The bird then became even more furious, and, alighting in the thick tussock grass, she advanced on me, trailing her extended wings, bill and eyes open wide. It was quite the most remarkable display I have seen by any bird, and I would class it as one of intimidation rather than distraction; one can imagine why the young are comparatively safe from small predators even if their ground nests are so exposed.

Errington (1932) found "in general the parents displayed the most toward their young about the time the latter were ready to leave their nest . . . . The old birds would fly off and leave downy owlets. . . . without apparent reluctance." This observation on *B. virgimianus* coincides with those I have made on *B. capensis*. Tyler & Saetveit (1969) made the same conclusions.

The male bird seems the more retiring of the pair, slipping away quickly at the approach of danger, and generally maintaining a greater distance than his mate. His prime role seems that of watchdog, signalling the alarm to his mate sitting on the nest.

## BREEDING

(a) **Dates.** Mackinder's Owl breeds on Mau Narok from July to March, the peak laying dates being from September to December. Working back from known incubation and fledging periods, the laying dates for 26 nests in this district are as follows:

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July August September October November December January February March  
 1 2 4 4 6 5 1 2 1

There are no indications that the local owls breed outside these months, although the later dates tend to be for pairs inhabiting the more open land in the centre of the plateau. A number of pairs have shown a tendency to breed at 10 to 11 months' interval, which may mean eventually that there will be breeding records for all the months of the year. The only breeding date given in Praed & Grant (1952) was for January on Mt. Kenya.

(b) **Nesting.** Nuptial display has already been described, but normally the first indication that breeding is about to commence is that the pair roost closer together during the day, often side by side, usually in a tree or on the ground very close to the prospective nest site. This behaviour compares with that of *B. virginianus*, (Errington *et al op. cit.*: p. 765). Finally the female flies down to lay and brood. No actual nest is made, but care is taken that the site is suitable and has remained undisturbed over a long period. If the owls notice that their chosen spot is too frequented they will mark down another place. 24 of the 26 nests so far found have been at ground-level although there are adequate sites in trees all over the farm, including trees with old bird of prey nests said to be favoured by the other races e.g. Priest (1948): "in disused nest of Buzzard or Eagle", Praed & Grant (1952): "in the disused nests of Crows and other large birds". The nests are merely a shallow scrape or hollow formed by the brooding bird's body, and contain no down or grass lining. The siting of the nest seems almost haphazard at times, but there is usually some protection at the back of the sitting bird, even if it is only a small bush. Often it is at the base of a large cedar tree *Juniperus procera* or slab of rock, but, wherever it is, there are two common factors; the nest is nearly always at ground level and it is always within a stone's throw of water. The latter point seems inexplicable; however it is a great help when trying to locate a nest. Two nests were actually found over the water on the top of leaning tree stumps, others right on the grassy bank of the stream, quite exposed. The following table describes the situation of 25 nests found within 8 km of the farm:

- 1 In fork of tree, 15 m above ground.
- 6 On or against a bare rock face.
- 6 At the base of a large cedar tree.
- 6 In grass, with or without light bush protection.
- 2 On top of large tree stumps, placed on a bank and level with ground.
- 4 Under logs.

These nests belonged to eight different pairs, and only two nests were used consecutively, in one case twice, the other for three years. Otherwise the nests would be within 10-50 m of the previous year's, generally the lesser distance.

The one occasion when I found the owl nesting in a tree was of particular interest, since it was the exception to prove the rule. The pair involved had nested regularly at the base of a large cedar for at least three years, and as I had known them to frequent that tree for at least fifteen years they may have used the nest site for much longer. In order to obtain confirmation of incubation, brooding by sexes, egg size etc., I made fortnightly inspections of the nest site from about one month prior to the expected laying date, which was usually at 11 month intervals. It was with some surprise that I found the nest in a deep fork of the same tree, some 15m above the ground, with two white-downed nestlings in it. I have no doubt that the owls had been worried by my visits, but had no intention of forsaking their well-loved tree, and compromised by nesting above my head. A week later the two young owlets were somehow transferred into the old nest at the base of the tree. This action convinced me that Mackinder's Owl is basically a groundnester by preference. It was notable also, that the bird did not choose one of many available old buzzard or eagle nests or a hole in a tree, but used a crotch formed by a large branch which was similar to a ground nest; no material was used to embellish the nest.

For comparative behaviour in the Great Horned Owl, Errington (1932) has shown that very small owlets can safely reach the ground from great heights long before they can fly; in America this would occur when the actual stick nest collapses and the chick has no option. He goes on to say that the grounded chick makes its way to the base of the nearest tree where it continues to be cared for by the adults: "it may make scant difference in the end whether the young spend their full time in the nest or not." However in the case quoted above, one of the owlets disappeared soon after it reached ground, whereas it might have survived in its original nest. Errington also pointed out that the Great Horned Owl is a very poor nest builder, seldom even refurbishing old hawk nests it takes over, so that collapse of the nest is not infrequent. With the knowledge we have of *B. capensis mackinderi*, it might be that all *Bubo* were originally ground nesters and only some species and races have recently taken to nesting in trees, *B. virginianus* and *B. bubo* still retaining both habits.

Referring again to transfer of nest-site, this occurred again about the same time with another pair which had nested regularly in a stream bank within about a 20 m radius over 10 years. Again I made regular checks for about two months in this area, only to find it sitting on eggs on a ledge in a vertical cliff-face over a large pool, 100 m away. The two young were transferred in stages, possibly even carried, back to their old nesting area, whilst still in their downy plumage.

In spite of the exposed nature of the nest sites, the sitting bird seems remarkably secure and only two instances of desertion have been noticed, when I found the broken shells of two eggs, probably trampled on by a flock of sheep which were grazing by the river bank. The parent birds in one case, the male being recognised by a white tail feather, continued to occupy the nest tree for two months afterwards, then finally bred some distance away ten months later. Repeat laying seems unlikely and the birds keep to a laying interval of ten to twelve months.

The brooding bird relies on its camouflage for protection whilst the mate keeps guard from a nearby tree or promontory to give warning of approaching danger. When the bird on the nest hears the single warning hoot it freezes and closes the lids over its brilliant orange eyes and only when one is a few feet away will it fly off to a nearby branch or rock. The camouflage is very effective. Numerous people have failed to discern a sitting bird at close quarters and in full view until it is pointed out. As the young grow, so the nest enlarges into a muddy cake of excrement and pellets of bone and fur, trampled around for several square feet. The nest becomes more conspicuous and danger then increases from predators until the young can fly.

(c) **Eggs.** Of five nests examined with eggs, three had clutches of three eggs, and the others of two. All the nests found with young had two or three chicks, except those with large young, where sometimes there was only one survivor out of what was probably a larger brood. It would seem that 2-3 would be the rule, the larger figures being more common. Of 10 eggs measured, the largest was 59 mm × 46 mm and the smallest 46 mm × 45 mm; giving an average of 57.5 mm × 45.4 mm. The South African race *B.c. capensis*, the only one for which egg measurements are available, has an average of 51.5 mm × 43 mm according to Priest (1948), and rather smaller according to Roberts (1940). The average for *B. b. bubo* is 59.8 mm × 49.7 mm.

The eggs appear to be laid on successive days, brooding commencing with the laying of the first egg; incubation takes about 36 days. One pair under observation before nesting roosted together for some weeks in the nest tree. On 26th October, only one bird was in the tree and the mate was found sitting on the nest, which was empty. Two days later there were two eggs. When the nest was visited on 1st December there were two chicks, lax and immobile, with naked patches on the back. Neither could have been more than one to two days old. At another nest, two newly hatched young and one egg were found. When the nest was visited the next day the third egg had hatched. Incidentally, the third egg was much smaller than average. The chick was weakly and died after a fortnight.

The male and female may be recognised as such when together. But it is not always possible to get a sufficiently good view of the sitting bird to identify its sex with certainty.

However, on all occasions when good views were obtained, the female was invariably the brooder of the eggs. Conclusions are limited by the fact that the sitting bird cannot be identified by night, but I am sure the male relieves her to hunt during this time, as Masai shepherds tell me that they see her leave the nest about an hour before dawn. Once I have put the male off the nest in the early morning when the chicks were very small. At the actual time of hatching, when one would not expect the female to leave, I found on two occasions a pile of freshly killed mole rats lying right besides her, no doubt brought by an assiduous mate.

(d) **Chicks.** For the first three or four weeks the chicks are brooded continuously. Thereafter the female broods less and less but sits in a tree or bush only a few yards away, alert for danger. The male stations himself in another tree to watch in the opposite direction. Only once have I found an owl asleep by day and that was a non-breeding bird. When worried they utter a warning hoot or bark, and the young crouch and freeze at the back of the nest, huddling up together. If the young are molested, they puff up their downy feathers until they look twice their natural size and quite formidable. As a last resort they lie on their backs and strike out with the bill and claw, hissing hard. At six to seven weeks from hatching the young move around the nest site, exploring and perhaps avoiding the hot sun or the muddy nest if it has been raining much.

At two months the owlets may take up a position on a low branch or rock which might be a feeding block as well. Here they spend much of the day preparatory to their first flight. This may depend on how secure and undisturbed they are: some have not flown during ten weeks. Other nests I have found deserted at seven weeks. Twice I have probably instigated their first flight by alarming them suddenly when the juveniles fluttered off, only to flop into the long grass after a dozen wing beats. At this stage they must be very vulnerable. These intervals compare with Tyler & Saetveit (1969) on the Great Horned Owl, viz. 6-7 weeks to leave the nest and flying short distances in 9-10 weeks.

The chicks are hatched almost naked with a little white down which soon covers them all over. After a week the down turns to a dirty grey colour, which gets darker and browner until their first feathers appear. At six weeks they are a grey—brown colour with dark brown barring on the upper parts, and a week later they show developed feathers on wings and tail, with tufts of down scattered all over; the young would be about half the size of an adult at this stage. The eye of the nestling is a bright chrome yellow with a large vivid blue pupil, altogether as striking a feature as that of the adult's eye. The bill and claws are dark horn; the ear tufts are always apparent, even in the downy stage.

(e) **Fledging** Generally by the time the young leave the nest there are only one or two survivors. Only once did I see three fly. Assuming the average clutch size is 2.5, and an average of 1.5. leave the nest, the survival of fledglings is 60 per cent of eggs laid. Of those that die during this period, there is little to indicate what causes the casualties, which occur evenly throughout. Possibly the very young ones are devoured by their parents or nest mates if they die or become weakly. The larger ones are probably taken by ground predators which are very numerous. But the biggest factor noticed so far has been the human one. I have known of five large nestlings being killed by superstitious Africans and three taken captive by farmers as pets.

As soon as the young leave the nest the adults take them into light bush or small trees for cover and for a week or two there is not much sign of their presence. However as soon as the juveniles are flying strongly they are taken further afield at night and given their first hunting lessons. It is at this time that they are most noisy and no-one can then fail to be aware of their presence in the neighbourhood. As soon as it is dark the whole family flies up from the valley to their hunting ground, specially favouring the rows of pine trees characteristic of this farming land. Here they are probably taught to catch the smaller prey such as rats and mice which occur here, rather than the mole-rats and larger mammals which they will later hunt on the open land. Their arrival is announced by much hooting and barking from all directions, and this goes on for two or three hours until all are replete.

As the young become less dependent on their parents, they take less care over concealment and two months after leaving the nest they may be found basking in the midday sun on an exposed branch of a bare tree. There is no indication as to where they disperse but single owls are found roosting in trees away from the valleys at all seasons, which I suspect are the immature birds of the year. Some of those found way out of their normal habitat may be immatures. Probably there is a high mortality among fledged birds, as with all birds of prey and the majority of this normally sedentary species may not travel far, but act as local replacements. The parent birds themselves are less in evidence for a couple of months before they finally recommence their breeding cycle.

At four months the immature owl looks similar to the adult except the ear tufts are smaller. The crown is grey and fluffy with dark stripes and there are long lax feathers over the head. The underparts are rather more barred, and the chest is dark brown rather than tawny. L.H. Brown, (pers. comm.) suggests that eagle owls probably mature very quickly compared to diurnal birds of prey of similar size.

A nestling was found on 2.1.72 which had fallen from the tree nest and it was decided to rear it by hand.

*Habits.* During the 5½ months it spent around the house the owlet was always left at liberty. Until it could fly to the roof it spent the hours of darkness in the house, to protect it from night predators, otherwise there were no restrictions on its movements.

Errington (1932), referring to the Great Horned Owl, said that only recently-hatched owlets came to recognise their human attendants as they would their parents, and Bent (1961) inferred that these owls were only tame if allowed full liberty for those kept in cages grew sullen and ugly tempered. Both these statements on handreared eagle owls were borne out by our experience. The owlet made a responsive and intelligent pet that always took a keen interest in all around it. Although quite content to perch on one's arm or shoulder it never liked being handled. It was quite unafraid of the house-dogs which were rough with it, never minding being knocked over or pushed about, but a strange dog would immediately produce a fierce reaction. I only saw it run or fly from danger once and that was from an attack by an Augur Buzzard before it could fly, when it ran across the lawn to shelter actually tripping over as it tried to keep an eye on the hawk. Much later it was attacked repeatedly by a large female Peregrine (probably *F.p.peregrinus* Tunstall) as it perched on a high roof, but it responded by spreading its wings in a great bow in front of its body and fluffing up its feathers, and the falcon eventually sheared off. From a month old it kept an eye on all birds of prey including Marabou Storks *Leptoptilos crumeniferus* (Lesson) that flew overhead and was very quick to spot them even when they were nearly out of human vision. But it was only perturbed by the Augur Buzzard which attacked it several times and would probably have killed it but for our intervention.

Bright sunlight was tolerated comfortably and it had no hesitation in looking directly into the sun to watch a hawk, the pupil of its eye contracting to a pinhead in an instant. Heat had a greater effect, and it quickly moved into the shade when it became hot, especially when it was very young. If it found the heat uncomfortable at nearly 3000 metres, one could see why the species is unlikely to be found breeding near the Equator at a much lower altitude. Cold and wet did not worry it, except when it was caught in its first heavy storm, and came to be let in to dry in front of the fire. Otherwise it enjoyed showers and would run on to the middle of the lawn with its wings inverted to wet itself thoroughly. It never drank, although once it jumped on to the bird bath and experimentally paddled and dipped its bill into the water.

A point of interest was the lack of routine in the owlet's life which may have some survival value in the wild. Both before and after it could fly the bird explored a little further and in a different direction each day and would carefully select new day and night perches. By the time it was nearly full grown and had covered its environs its habits became more predictable.

Although the owlet was never able to deal with the live mice or mole-rats that were offered to it, it regularly practised making attacking jumps. Before it was a month old,

the bird would make a series of swift runs across the carpet finishing with a two-footed jump and clenching its claws, sometimes on nothing, at other times on a moth or a bit of paper. As it grew it would do the same action in the garden, running half a dozen steps, then leaping; this appeared to be the way it would eventually catch mole-rats, its staple diet. The owlet was very excited by my wife, as substitute parent, gardening on her knees and turning earth over; the owlet would go at her with a lot of noise just as it would when hungry and about to be fed. It appeared that there was an instinct for catching mole-rats and for begging from its parent when hunting these rodents, although in other parts of its range the mole-rat might not be included in the diet of Mackinders' Owl at all.

The chick was very weak when found, but after three days was able to stand up and take a few steps; after seven days it explored the room, began to preen itself and would voluntarily open its bill for food, instead of being force-fed. After 2 weeks it could clamber up steps, using its wings to help, and by a month it could flutter enough with its little wings to get onto the sofa. It indulged in a lot of wing-flapping exercises each morning, holding tight onto its sheepskin rug as it got stronger, but it was not until 2 months after arrival, i.e. at about 10 weeks old, that it could fly on to the house roof for the first time, and after that its powers of flight developed rapidly.

As the owlet grew to full size, the garden was visited nightly by a number of Mackinder's Owls from various directions. It did not appear as if the owlet took much notice, although at 5 months it may have been following them on their hunts. Almost certainly some of these owls were the tree-nesting family from whence it came, and at just six months old the owlet flew off with them one night, not to return again. Two days later it was seen not far from its original nest, perched conspicuously in a cedar tree and calling continuously.

*Food.* The chick was fed almost entirely on mole-rats from the beginning and after the first week its appetite slowly increased from one to two a day. Without viscera, head and feet this meant about 100 g to 180 g of meat, but even this had to be cut up into small pieces, as it never learnt to tear up its food. As the owlet grew it was offered live prey, but did not seem to associate it with food, and made no attempt to attack. Errington (1932) said that even at 7 months a hand-reared owl was incapable of catching its own food.

For the first few days the chick was fed at 2 to 3 hour intervals, or even less, then on 4 or 5 feeds until it could fly, when it was only fed as and when it came to the feeding block. By the time it was 3 months it fed mainly in the morning and evening. It quickly reached satiety, and would not eat more than 100 g even when full grown. Warm, fresh meat was preferred to stale, and anything "high" was refused, although it was never hungry enough to try.

When found, the chick weighed 500 g and then increased its weight by an average of 30 g per day, so it was presumed that it was 10 to 14 days old then. Three weeks after arrival it weighed 1120 g and when 3 months it was 1400 g, but by then appeared almost full grown and flying well. At this stage it was difficult to weigh accurately, and recordings discontinued.

Pellets were cast up from the third day onwards, usually in the morning. The first weighed 23 g, and a few days later another measured 70 mm × 32 mm, but they were generally smaller than this. They might be brought up anywhere, for one day the owlet flew to my arm, and after two or three wide gapes it put its claw to its bill as if to pull something away and then produced a pellet (52 mm × 32 mm) which it held at the tip of its bill a moment and then let drop.

*Plumage.* The down of the baby chick was a finely barred light grey, and the back, thighs and under-wing were still bare at two weeks old. The irides were chrome yellow and the pupils blue, becoming quite dark at two months. The significant changes are given here, dated from the hatching date, assuming it was two weeks when found.

- 3 weeks: wings acquire more clearly defined bars and flight feathers start to shoot.
- 4 weeks: white area around gape very apparent and operculum now visible.

- 5 weeks: first four tail feathers break sheaths and first signs of downy "ear-tufts" seen.
- 6 weeks: has 20 fine grey bars on underparts and the well-grown flight feathers are brown with pale tawny spots.
- 8 weeks: losing down fast, tail and wings growing rapidly.
- 11 weeks: most of down moulted except on thighs and "ear-tufts", and dark brown feathers appearing on chest.
- 14 weeks: downy "ear-tufts" now moulted, but the feathered ones did not appear until a month later, and still growing at six months.

At six months old it was difficult to distinguish the bird from an adult and it was disappointing that the bird unexpectedly flew off before final measurements were taken to discover if it was male or female; at that time the measurements were in the overlap between a large male and a small female. At three months the wing was 375 mm and the tail 240 mm; three weeks later the wing was 400 mm and it weighed 1400 g, and it may well have gone on growing. Benson & Irwin (1967) show a maximum of 402 mm for male wings and a minimum of 406 mm for females, and the weight of a male as 3lb 1 oz (1387 g). The tail length is significant as Benson & Irwin (op. cit.) showed four males to have an average tail length of 209 mm. Two factors may be relevant: the bird was probably a female with a longer tail anyway, and possibly juvenile birds have much longer tails than adults as in many birds of prey such as the Augur Buzzard. Hence the tail length would be a convenient method of determining if a specimen was immature as there is very little otherwise in which it differs from an adult.

During the time that the owllet was reared, a watch was kept on the nestling left in the tree nest, and it was noted that all plumage changes and growth rate occurred in the two young birds at the same times. They even learnt to fly simultaneously.

*Voice.* At two weeks old the chick only made soft cheeping noises, especially when hungry or being covered. A week later it gave its first squawk, and this was its main cry until it left. This call is difficult to describe but might be written as "shreer", and was generally rather short and sharp. The call was used to indicate everything from hunger to annoyance and excitement, or even nothing at all, being purely reflex. Sometimes it called all day long, even when asleep or preening.

When five weeks old it gave its first triple hoot, but this was seldom heard until it was nearly six months old, when it began to answer the many owls calling round the house. It was also able to give the alarm bark, "wak wak", at an early age when upset by the appearance of a strange dog, but again this was seldom used. Bill snapping was a regular sign of annoyance, although sometimes it would clack softly just to call attention to itself as it glided round the garden at dusk just above one's head.

## DISCUSSION

From the foregoing notes, taken with those of Benson & Irwin (1967), a significant number of questions for discussion would appear to arise.

(a) There have been *lacunae* in the observations of a number of large birds of prey in Kenya, but none so obvious or inexplicable as for Mackinder's Owl. During the last ten years, the author has recorded the presence of some 300 species of birds on this 800 ha farm and nearby surroundings. All of these birds except the very rare stragglers have been listed correctly for locality either by Jackson (1938) and/or Praed & Grant (1952) with the sole exception of Mackinder's Owl; yet it has been shown that there are probably several hundred in the locality. Prior to Benson & Irwin's summary (1967), the only genuine locality given by both Praed & Grant, and Jackson was Mt. Kenya. More recently Williams (1967) adds Mt. Elgon and the Aberdare range. The most recent survey by Benson & Irwin (1967) adds Timboroa, Lumbwa and Turi, all lying to the north of the

Mau plateau. Betts (1966) in a survey of the breeding birds of S.W. Kenya, which included the actual Mau Narok area itself, omitted Mackinder's Owl.

The omission does not apply to Kenya only. Roberts (1940), did not mention even the existence of another race of *B. capensis* although his work described the distribution of races of all other birds. Belcher (1930) did not include it in his *Birds of Nyasaland*, although it is now known probably to occur regularly throughout the highlands of that country (Benson 1953: 42). Priest (1933) in his *Birds of Southern Rhodesia* did not include it either, yet here again it has been accepted as having a fairly widespread distribution (Benson & Irwin 1967). It is worth considering whether the reasons for its oversight in the past were due to (i) a more restricted range, or (ii) confusion with the smaller African Eagle Owl *B. africanus* whose range is contiguous, even if it does not overlap, or (iii) merely having evaded observation. The latter seems unlikely, as the bird is well known to farmers and the surrounding African population. From the description of its habits and voice it will have been seen that the bird almost forces its presence on one's attention. It is also doubtful if the owl has radically extended its range, especially in view of the experience in this area, where the land has been converted from its primaevial state into a fully developed farm in the last eighteen years and the population and territories of Mackinder's Owl appear virtually to have remained unchanged.

Concerning the confusion with *B. africanus*, there can be no doubt that this has occurred for it has actually happened with museum specimens *vide* Benson & Irwin (1967) for four mis-identifications. It was even thought that the type specimen of *B.c. dillonii* had been mistaken for the Spotted Eagle Owl, but Benson & Irwin (1969) confirmed that it was indeed *B. capensis*. If there can be confusion over skin specimens, there can be little doubt that all the more mistakes must have occurred in the field.

The conclusion may be reached that a combination of all these circumstances have invalidated a true assessment of the distribution and status of Mackinder's Owl. Even so, there lingers an element of mystery as to how the bird should have been first found and described so thoroughly some seventy years ago from one of the least visited and frequented areas of the country, the alpine zone of Mt. Kenya, and yet remained overlooked in the populated regions of the East and Central African farming lands.

(b) Why is there so little information on the habits, breeding, etc., of such a large and numerous bird?

Praed & Grant (1952) give no description of the eggs of either *dillonii* or *mackinderi*, and the only nest described was that found in a cave on Mt. Kenya by the late Myles North. They quote that *dillonii* is reported to use old tree nests, but this seems unlikely and probably it was *B. lacteus* that was referred to. Nevertheless, the nests are not difficult to find, especially when there are young in them and it is odd that they have not been found more often in the past. It may have been that some of the early information of the habits of birds in this country was obtained with the assistance of African collectors and hunters (see Jackson, Archer etc.) whose superstitions concerning owls may have made them rather more reticent about this bird.

(c) Why has this owl such an affinity for water?

Of the nineteen nests inspected around this farm, all were found to be situated within a short distance of water, the maximum distance being 50 m away but the majority much closer. Of a similar number of pairs breeding locally whose nests have not been found, observations of their lines of flight to hunting posts show them to be probably nesting very close to water in each case. It is difficult to tell if this is just a regional habit as there is little information from other areas and about other races of *B. capensis*, but one *dillonii* "was shot on a rocky ledge overhanging a stream" (Benson & Irwin). From notes on breeding given above, it could be assumed that this bird might have had its nesting site somewhere in the vicinity of this water. To speculate on the answer to this feature of breeding involves some conjecture. It is fair to assume that an owl which has a definite preference for living in a cooler climate would choose to rear its young in a place which has the least hours of direct sunlight and the coolest night temperatures and it is in the valleys that these conditions will be found. As nearly every valley in the montane regions

in which *mackinderi* occurs has running water for at least part of the year, it may be coincidental that the owl nests near water. But generally there is more support for the theory that this bird must have water for breeding, although the reasons for this will only be found by further study in the field.

(d) Is it significant that the owl has a partiality for crabs?

Fresh water crabs occur commonly all down the highland streams where there is a rocky bed. Where a pair of owls have a territory on this section, one might find 20 per cent of their pellets to contain crab shells. It might be thought that these represent otter faeces; these also occur commonly and eat many crabs, but these are crushed into small fragments, unlike the owl pellets where the carapace and claws are often intact. On one particular occasion I saw an owl about 1 km from the river at 2.00 a.m.,—a few hours later there were pellets containing crab remains below the post on which it had been sitting. The noteworthy point in this connection is that there is no other record of a large owl including crabs in its diet, but whether this is an essential part of its diet remains to be seen. If it is, then it would have a direct bearing on the owl's distribution and choice of breeding ground. Frogs and toads are extremely numerous in these streams and further observation may show that they too form a part of the bird's food. Along the rocky banks may be found many large white faecal splashes made by the owls showing where they must spend many hours during the night when not hunting. It may be, although unlikely, that they just prefer to sit here to devour and digest their prey and rest; or perhaps it is in order to listen for, and catch the crabs (and possibly frogs) which they relish.

(e) What are the ecological requirements posed by Benson & Irwin?

These authors infer that there is a lack of a clear understanding of the precise ecological requirements of *B. capensis*. Some deductions may be drawn from this paper, at least as far as the Mau plateau and *mackinderi* are concerned. Some wider conclusions may be considered as well.

First there is a misconception, stated mainly in works of reference on European birds, that altitude *per se* is a significant factor in bird life. The two direct effects of higher altitude are less oxygen and lowering of temperatures. Unlike mammals, birds do not appear to be affected by shortage of oxygen, for it is commonly known that they fly and live at altitudes which would leave most mammals prostrate. In equatorial altitudes, temperatures remain temperate up to 3000 m or more, and are unlikely to have a direct effect on most birds. The main effect is the indirect one of the change in the plant and insect life which changes their food and environment. Those birds that are not dependent on plants or insects for food, such as the larger birds of prey, are found in Kenya from sea level to 3000 m or more. Some owls, notably Woodford's Owl, *Ciccaba woodfordii*, occur over the same range, and some species of *Bubo* also have a wide altitudinal range, but in tropical regions this does not include *B. capensis*, which has not yet been found to breed below 2400 m. However, the further from the equator that *B. capensis* occurs, the lower the altitudes at which it is found, until at more than 30°S at the Cape it is found at sea level. If the mean day and night temperatures for *B. capensis* are studied, they might be found to be isothermal to a narrow limit. The possible reason for this will be discussed under (f).

In the section on Food it was noted that the tastes of Mackinder's Owl are not catholic, nor indeed has it always a wide variety of food available: but its food requirements are high. To rear three chicks from an exposed ground nest in the shortest possible time and in the presence of a large number of predators, suitable food must be permanently available in large and accessible quantities. (Predators on this farm include leopard, hyena, serval and genet cats, civet, jackal, most of the larger birds of prey, as well as superstitious, malicious and inquisitive humans.)

Moreau (1966) regarded *B. capensis* as a component of the Afroalpine moorland community in E. Africa and Ethiopia, but this does not appear to be totally valid, as the bird has not been found in many of the alpine zones, and yet is common in other areas which are not alpine. Clearly, altitude is not the only factor involved.

Broadly then, the requirements for Mackinder's Owl are as follows:

- (i) A super-abundance of suitable prey in a restricted area.
- (ii) The presence of water.
- (iii) A relatively cool climate.
- (iv) Generally the presence of trees, rocks or large boulders, which may provide roosting and nesting sites, as well as look-out perches for hunting: i.e. any broken country that is not a bare steppe or thick forest.

These inferences concerning the ecological requirements are based primarily on the Mau Narok observations, but in June 1969 I visited the Teleki Valley of Mt. Kenya with my son, Lt. M.P.N. Sessions R.N. taking particular note of the haunts of Mackinder's Owls we found there. The following week my son went up the north side of Mt. Kilimanjaro through the forest, past the moorland and scree to the peak, with the special intention of finding signs of Mackinder's Owl, and to take note of suitable localities. Although he is well acquainted with the call note of the owl, he heard no sound of it on the mountain, nor any traces of its casts. The food supply appeared small with none of the teeming colonies of hyrax or the innumerable rodent runs that are found on Mt. Kenya. Furthermore, above the forest line water was scarce and tree and rock cover limited. Thus few of the requisite conditions were met with, and this might apply to other montane areas of East Africa where the owl is inexplicably missing.

A further ecological factor may be taken in conjunction with that of the Augur Buzzard *B. rufofuscus*. This factor has been studied by Bent (*op. cit.* p. 296) and Tyler & Saetveit (*op. cit.* p. 78) in regard to the Great Horned Owl and the Red-tailed Hawk, *B. jamaicensis*, the North American counterparts. Tyler & Saetveit showed that the two species co-existed in the area, described as "river bottom, forest and hilly fields", i.e., typical Mackinder's Owl country, with roughly the same size of territories; owls nested  $1\frac{1}{2}$  km apart, buzzards 2 km apart, although owl and buzzard would nest as close as 300 m from each other. On Lengetia Farm one may find owl and buzzard nests within a few hundred metres, but seldom find two owls' or buzzards' nests within 1000 m. The interspecific relevance seems fairly remarkable considering they are using an almost identical food supply. Often I have seen an Augur Buzzard leave a particular telephone pole which it has been using as a hunting perch right until dusk, to be replaced on the very same pole within a few minutes by a Mackinder's Owl.

(f) What have been the effects of agricultural and human population changes on the status of this owl?

When the writer first arrived on this farm, it was in a complete virgin state, the land being covered in rough grass, heather and light bush and occupied by herds of zebra and eland where now there are cattle, sheep and crops. Although detailed notes have been made only over the last ten years, the localities of several pairs of owls can be remembered for 18 years and there seems to have been very little change since then the owl appears to have more than held its own. Possibly the increase in human interference (the population has increased from nil to 150), has been offset by the reduction in the number of larger predators, particularly leopard, hyena and jackal. In 1956, at the base of an old olive tree in some open bush land, a pair of owls bred regularly. The bush was cleared and the land ploughed for crops and later a plantation of gum trees established. In 1969, an owl laid three eggs in the middle of this small plantation; so it would appear that even if the owl is disturbed, it will eventually re-establish itself in its old territory. From rather more superficial observations, this pattern would appear to hold good for the rest of Mau Narok district.

(g) Are there grounds for considering *B. capensis mackinderi* as a race of *B. bubo*??

Two owls, the Barn Owl, *Tyto alba*, and the Long-eared Owl, *Asio otus* (L.), both have Palaearctic and Ethiopian races; the former, with its wide ecological tolerance has spread throughout the continent, whilst the latter has a distribution in Africa similar to *B. capensis*, but even narrower. There seems to be sufficient evidence to consider the case of *B. capensis* being conspecific with *B. bubo* in the same way. Certainly if *B. b. ascalaphus* Savigny and *B. b. desertorum* Erlanger come under the nominate species, both birds of very

different habitat, size and plumage, it would seem consistent to include *B. capensis* as well. The illustrations by George Lodge of *mackinderi* in Meinertzhagen (1959) and of *B. bubo* in Bannerman (1955) show their similarity. In Nicoll's *Birds of Egypt* (1930) Meinertzhagen refers to *B.b. mackinderi* from Mt. Kenya, and adds that the *B.b. dillonii*-*B.b. capensis* group can also be treated as forms of *Bubo bubo*. In addition, Dr. Bannerman, at the end of his essay on the Eagle Owl, says. . . "the truth is that all the eagle owls are very closely related and an equally good case can be made out for allying some of the African species with *Bubo bubo*, though I think it is a mistake to do so." (Bannerman 1955).

The distribution records of *Bubo capensis* shown on map 1 in Benson & Irwin's paper shows a typical flight line of an east Palaeartic migrant following the Rift Valley down to the Cape. If the Cape Eagle Owl had established itself in very early times, one would expect an east-west picture covering other African montane habitats. It might be inferred that the bird had only recently become a resident breeder at the end of the last cold phase when less clement conditions prevented it spreading. It has been shown in this paper that the owl is well capable of holding its own under normal conditions, and one would have expected it to have spread at least to the Ruwenzori range.

A table is set out below to show differences and similarities between *B.b. bubo* and *B.c. mackinderi*. Abbreviations of references are: (B) for Bannerman (1955), and (W) for Witherby *et al.* (1941). (P & G) for Praed & Grant (1952) and (Will) for Williams (1967). Unmarked details are taken from this paper.

|                                | <i>B. bubo</i>  | <i>Bubo capensis mackinderi</i>  |
|--------------------------------|---|--|
| <b>Size</b>                    |   |  |
| Female wing measurement in mm. |   |  |
| ( <i>B.b. bubo</i> )           | max 495<br>av. 458  |  |
| ( <i>B.b. ascalaphus</i> )     | max 430<br>av. 387  | max. 428<br>av. 402  |
| ( <i>B.b. desertorum</i> )     | max. 372<br>av. 349   |  |
| <b>Colour</b>                  |   |  |
| Above:                         | Mottled blackish and tawny (W)<br>Black and reddish brown (B)   | Blackish brown, mottled tawny (P & G)<br>Mottled orange-buff, dark brown and white (Will)                        |
| Below                          | Fine, wavy bars, boldly streaked on breast (W)  | Blackish and white blobs and bars, breast to belly (P & G)   |
| "Ear-tufts"                    | Horned  | Horned   |
| Eyes                           | Deep orange (B)   | Fiery-orange (Will)  |
| Voice                          | Hoo-oh (B. p. 174)<br>oo - oo - oo (W)<br>( <i>ascalaphus</i> )<br>u - huuu (Meinertzhagen)<br>Kveck kveck (B. & W)<br>mewing (B) | Hooo - hu<br>uh - hooo<br><br>wak wak<br>mewing<br>kleeeeee - kleeeeee   |
| (nestlings)                    | cleeee - clee - clee (B)  |  |
| Display                        | Song duet, one bird bowing to other (B)   | Ditto  |
| Nest                           | Ground, on hillside, cliff etc.<br>hollow scratched out of ground (B)<br>(ditto W. plus sometimes old bird of prey nests).        | Ground, on riverbank slope etc.  |
| Eggs                           | White, av. size 59.8 mm × 49.7 mm (W) Clutch size 2 - 3 (W)   | White, av. 57.5 mm × 45.4 mm. Clutch size 2 - 3  |
| Incubation                     | 35 days, brooding by female   | 36 days, brooding by female.   |
| Fledging                       | 6 - 7 weeks (B)   | 6 - 7 weeks  |
| First flight                   | 8 weeks (B)   | 7 - 10 weeks   |
| Food                           | 75 per cent small rodents plus birds, fish and beetles (B)  | mainly mole-rats, hyrax, plus birds crabs and beetles  |
| Pellets                        | Size 126 × 41 mm<br>93 × 31 mm (B)  | 95 × 30 mm<br>98 × 40 mm   |
| Habitat                        | . . . cliffs, ravines and rocky ground in wooded and open country (W)<br>River gorges (B)   | See text.<br>high altitude . . . in habits rocky cliffs and escarpments, and hunts in more open country. (Will). |

|                     |   |          |
|---------------------|---|----------|
| <b>Distribution</b> | Very common where conditions suitable as in Spain and Norway (over 1,000 killed annually for many years). (B) | See text |
| <b>Habits</b>       | Sedentary (B & W).<br>Younger birds wander (B)<br>Largely nocturnal (B)                                       | See text |
|                     | Does not mind full daylight (W)<br>See also Bannerman pp. 172 - 179 Vo. 4.                                    |          |

There may be morphological or anatomical discrepancies unknown to the writer which invalidate these comparative similarities, but otherwise the two species seem to be so remarkably alike as to warrant a review of their systematics.

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