Koedoe (13): *1-21* (1970).

THE PYGMY FALCON *POLIHIERAX SEMITORQUATUS*

by

G. L. MACLEAN*

Introduction

Since Sir Andrew Smith first collected the pygmy falcon near Kuruman in 1836 (Smith, 1849) the subspecific variations of this little raptor have been the subject of some debate (Bowen, 1931; Friedmann, 1930; Grant and Mackworth-Praed, 1934; Oberholser, 1904; Sclater, 1924; Swann, 1922). Its myology has been dealt with in considerable detail by Berger (1956). Otherwise, except for a good account of its biology by Hoesch (1935), it has not figured widely in the ornithological literature. This is not altogether surprising when one considers the relative paucity of ornithologists in the Kalahari and other centres of pygmy falcon distribution. Most of the biological notes on this bird have been of a most general nature (e.g. Braine and Braine, 1968; Grossman and Hamlet, 1964; Mackworth-Praed and Grant, 1952, 1962; McLachlan and Liversidge, 1957; Smithers, 1964; Von Erlanger, 1904), so that the present study is intended to fill, in part at least, the gaps in our knowledge of the pygmy falcon.

The study was an incidental one conducted in the Kalahari Gemsbok National Park from late 1964 to early 1966 during a 19-month investigation of the sociable weaver *Philetarius socius*, a species with which the pygmy falcon lives in close association.

Range and Taxonomy

The pygmy falcon *Polihierax semitorquatus* has an interesting, discontinuous distribution in Africa (Fig. 1). The southern population inhabits the dry western parts of the northern Cape, South West Africa and Botswana and is referable to the subspecies *semitorquatus;* another southern subspecies, *homopterus*, was made by Oberholser (1904), but the grounds for his claim are too slender to regard this division as valid. The northern population inhabits East Africa and constitutes the subspecies *castanonotus* (sometimes written *castanotus*); this northern population has been divided into three different subspecies namely: *castanotus*, *deckeni* and *major* (Bowen, 1931), but Friedmann (1930) and Grant and Mackworth-Praed (1934) have shown that only two subspecies are recognizable, *semitorquatus*

**Department of Zoology, University of Natal, P.O. Box 375, Pietermaritzburg*

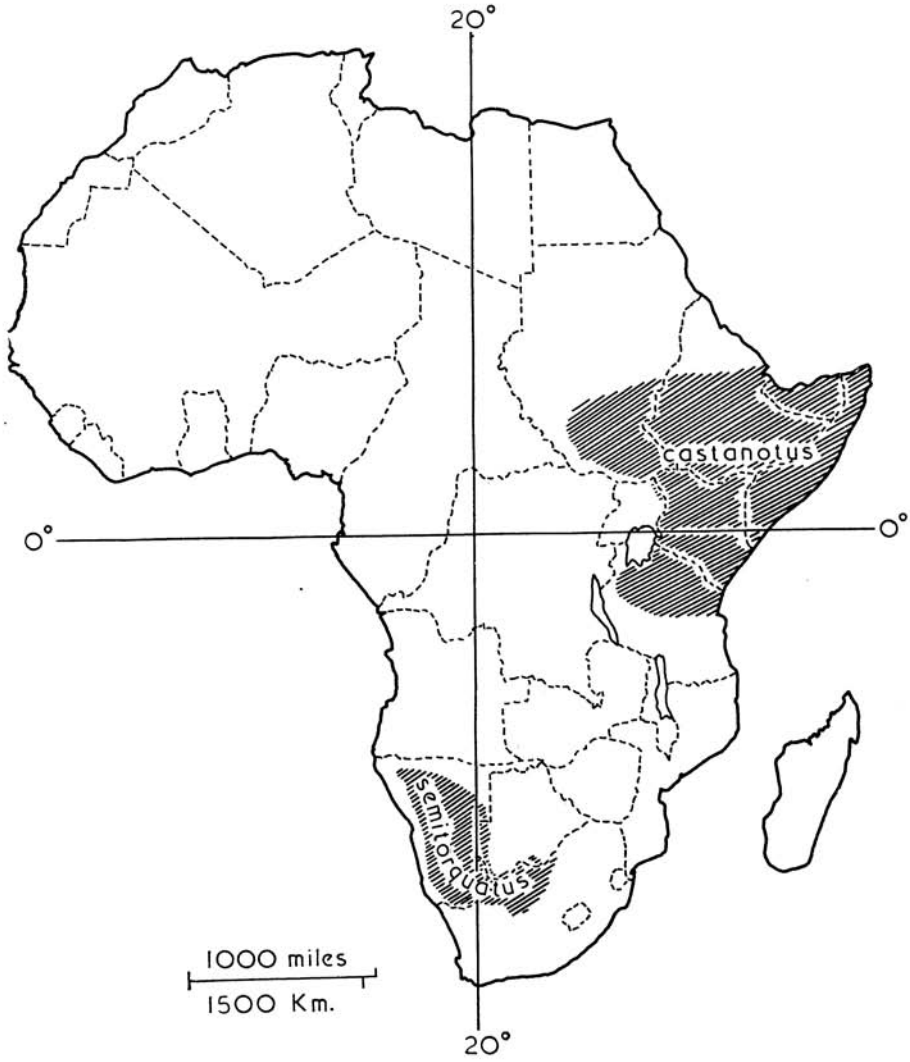

Fig. 1. Map of Africa showing the distribution (cross-hatching) of the two subspecies of pygmy falcon, *Polihierax semitorquatus castanotus* in East Africa and *P. s. semitorquatus* in western South Africa.

in the south and *castanotus* in the north. Most authors today are agreed on this latter subdivision.

The range of *P. s. semitorquatus* corresponds almost exactly with the range of the sociable weaver (Smithers, 1964) and this in turn corresponds roughly to the drier *Acacia* savanna of which *A. giraffae* and, in some places, *A. haematoxylon* are the dominant trees. The habitat of *P. s. castanotus* in East Africa is also *Acacia* savanna (Von Erlanger, 1904) in which various species of so-called "sociable" weavers (Plocepasserinae), buffalo weavers (Bubalornithinae) and true weavers (Ploceinae) are common. In both populations, the falcons are dependent on the weaver nests for roosting and breeding purposes.

The genus *Polihierax* is monotypic and confined to Africa. Another species, *P. insignis*, has been described from India (Baker, 1927), but this bird is now placed in the genus *Neohierax* (Grossman and Hamlet, 1964). Berger (1956) has shown on myological grounds that *Polihierax* is very closely related to *Falco* and does not warrant its own subfamily, although Grossman and Hamlet (1964) still place this genus in the subfamily Polihieracinae along with *Spiziapteryx*, *Neohierax* and *Microhierax* (they remove *Gampsonyx* to the subfamily Elaninae in the Aquilidae, although Berger included it with the Polihieracinae).

The purpose of this brief taxonomic outline is merely to indicate the systematic position of *Polihierax* within the Falconidae. The bird with which the rest of this paper is concerned is the southern pygmy falcon *P. s. semitorquatus*.

Nest Associates and Distribution

Of the East African pygmy falcons it is stated that it nests mainly in the nests of "Weavers, Sociable Weavers and Glossy Starlings, sometimes in the middle of a colony" (Mackworth-Praed and Grant, 1952). In southern Africa it is primarily associated with the sociable weaver, but is also known to nest in "Buffalo Weaver and starling nests" (McLachlan and Liversidge, 1957), while I have seen it using the double-entrance nest of a white-browed sparrow-weaver *Plocepasser mahali* for roosting purposes in the Kalahari Gemsbok National Park.

The range of the pygmy falcon is so closely governed by the range of the sociable weaver that it does not occur in what appears to be otherwise suitable country, such as Botswana (Smithers, 1964); the distribution map for the pygmy falcon in McLachlan and Liversidge (1957) is therefore quite inaccurate. Hoesch (1935) also said: "Im Damaraland bewohnt der Zwergfalke—und zwar nach meinen bisherigen Feststellungen ausschliesslich—die Nester des Siedelwebers (*Philetairus socius*)."

The presence of pygmy falcons in a sociable weaver nest mass is always indicated clearly by the white faecal deposit at the entrance to whichever chamber they are occupying (Fig. 2). The number of chambers occupied by a pair of falcons varies from two (one for breeding and one for roosting) to four, but may be as high as ten in exceptional instances. When such a

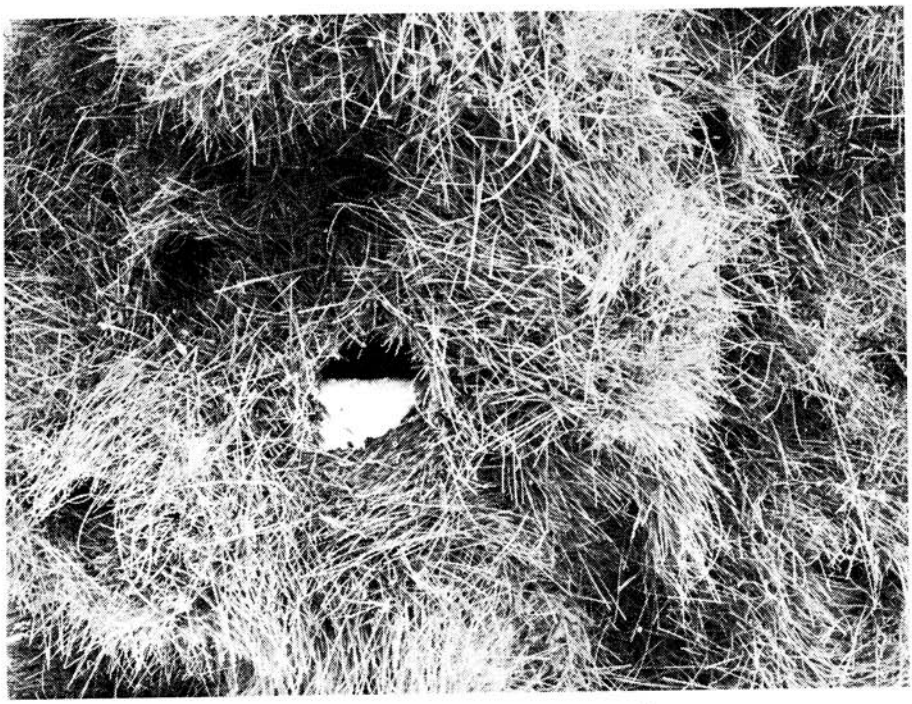

Fig. 2. The under surface of a sociable weaver nest mass showing the white faecal deposit at the entrance to a chamber occupied by a breeding pair of pygmy falcons. The chamber to the upper left of the falcon nest contained young sociable weavers.

large number of chambers is taken over by the falcons, the sociable weavers may abandon the entire nest mass and move off elsewhere.

In my experience there was never more than a single pair of falcons in one weaver colony, but Braine and Braine (1968) have found at least two and perhaps three breeding pairs in a single nest mass. This must be unusual, since Hoesch (1935) also found only one pair of falcons per nest mass, each pair occupying two chambers.

In the Kalahari Gemsbok National Park study area (Fig. 3) there were ten pairs of pygmy falcons representing slightly less than 25 % occupation of the available weaver colonies. These pairs occupied the colonies shown in Table 1, which shows also that the falcons will use nest masses whether or not they are occupied by the weavers. The percentage occupation of weaver colonies by pygmy falcons given by Hoesch (1935) is also nearly 25 % (7 out of 30), but in this instance, six out of seven pairs were using occupied nest masses. The percentage of nest masses unoccupied by weavers was not given, so that there may have been relatively fewer than I found in the Kalahari Gemsbok National Park.

Nest masses occupied by pygmy falcons were seldom less than half a mile apart (Fig. 3) indicating a considerable degree of territoriality. This makes the observations of Braine and Braine (1968) all the more intri-

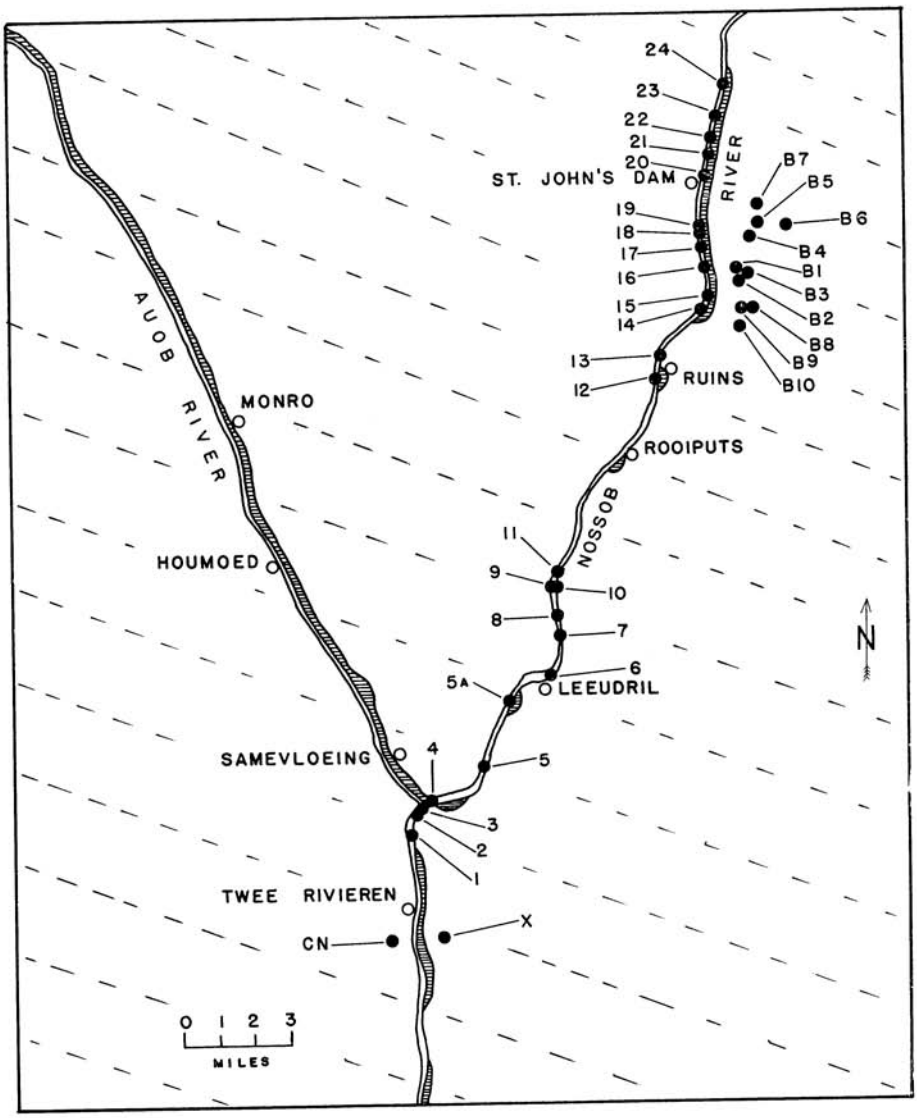

Fig. 3. Map of the study area in the southern Kalahari Gemsbok National Park showing the game wells (open circles) and the sociable weavers nests (solid circles with nest numbers). The broken diagonal lines indicate the extent and direction of the dune country, while the small hatched areas on the east banks of the Auob and Nossob Rivers show the extent of the stony calcrete.

Table 1

Distribution of Pygmy Falcon Pairs showing occupation of Sociable Weaver Colonies in the Kalahari Gemsbok National Park Study Area (Fig. 3)

Pygmy falcon pair number	*Sociable weaver colony number*	*Nest occupied (+) or unoccupied (—) by sociable weavers*
1	6 and 7	—
2	8	—
3	11	+
4	12 and 13	—
5	16 and B1	+
6	17	+
7	19	+
8	20 and 21	—
9	22	+
10	24	+

guing. Although I have never observed any actual territorial conflict between adjacent pairs, it must at times occur.

By ringing falcons with coloured plastic rings it was possible to identify certain individuals in the field. Altogether 32 pygmy falcons were ringed in the study area and, although the colours were bright enough to be seen clearly with field glasses, the rings soon became soiled so that re-identification of a bird was often possible only by retrapping and examination in the hand. Of the 32 ringed birds, three were adult males, six were adult females, four were juvenile males, seven were juvenile females and 12 were unsexed chicks. All the chicks and juveniles were ringed while still in the nest; adults were caught either in mist nets or in the nest chambers.

It has been claimed that "the Social Weavers do not seem to resent these little hawks" (McLachlan and Liversidge, 1957) and conversely that the sociable weavers desert their nests during occupation by the pygmy falcon (Roberts, 1940). The truth lies somewhere in between. If weavers are in occupation of a nest mass into which a pair of pygmy falcons move, they will not desert unless the falcons take over too many chambers. Although the weavers will stay on after falcon occupation and will even breed in adjacent nest chambers, they most definitely resent the falcons' intrusion. Whenever a pygmy falcon appears, the weavers immediately utter alarm calls until the falcon is out of sight inside a nest chamber or right away from the nest tree. As long as the falcons are not visible to the weavers, they go about their activities as usual.

It has also been said that the pygmy falcons do not molest the weavers (Grossman and Hamlet, 1964) and by and large this is probably true. However, I have indirect evidence that a falcon will take young sociable

weavers if it encounters them in a nest chamber that it is investigating with a view to using it for breeding purposes. Furthermore 14 out of 333 (4.2 %) pygmy falcon pellets contained sociable weaver feathers. It was not possible to say whether the weavers eaten were adults or young. Pygmy falcons may be trapped using live adult sociable weavers as bait, so they may indeed catch adult weavers as part of their natural diet, at least at times. Molestation of the weavers must, however, be minimal.

Hoesch (1935) says that flying young of the sociable weaver are not molested by the pygmy falcons, but that the approach of a falcon is announced by the "erregte Warnrufe" of the adult weavers. He also mentions (and my own observations confirm this) that the falcons take no notice of the weavers.

Food and Feeding

The food of the pygmy falcon was determined by (*a*) detailed analysis of regurgitated pellets found in and under nests, (*b*) examination of larger pieces of prey animals dropped below nests and (*c*) direct field observations on hunting and feeding falcons.

Many hundreds of pellets were collected in the Kalahari Gemsbok National Park, but to date only 333 have been analysed. These pellets measure about 17.9 mm by 8.6 mm (means of 20 randomly selected pellets) and contain the remains of insects, reptiles, mammals and birds in the proportions shown in Table 2. Further analysis of pygmy falcon pellets will appear in a later publication.

Table 2

Analysis of Regurgitated Pygmy Falcon Pellets in the Kalahari Gemsbok National Park Study Area (*Fig.* 3)

	Insects only	*Lizards only*	*Mixed insects and lizards*	*Mixed rodent and lizards*	*Mixed rodent and insects*	*Mixed bird and insects*
No. of pellets	122	38	123	7	29	14
Percentage	36.7	11.4	36.9	2.1	8.7	4.2

The pellets contain only keratinous, chitinous or enamel remains. Bones of vertebrate prey seem to be completely digested as they do not figure in the pellets at all. Insects remains are mainly those of larger carabid beetles and grasshoppers; these remains await a more detailed identification. Insects occur in a total of 288 pellets (86.5 %) and comprise the bulk of the diet. Second most important item on the food list are lizards which occur in a total of 168 pellets (50.5 %). These remains are

almost exclusively those of the ocellated sand-lizard *Eremias lineo-ocellata*, although I have found dismembered parts of the spiny agama *Agama hispida* and the common striped skink *Mabuya striata* below pygmy falcon roosts, so these lizards are also taken occasionally.

The identification of sociable weavers from the few feathers found in the pellets is still somewhat tentative, even though the feathers do agree in colour and sometimes in pattern with those of sociable weavers. The small numbers of these feathers in each pellet is curious and perhaps indicates that the falcons seldom feed on the weavers. Similarly rodent remains are scattered sparsely through the pellets; there were no pellets consisting entirely of rodent fur or bird feathers.

The pygmy falcon, then, is primarily insectivorous. About half the pellets contained some lizard remains, while the frequency of rodent remains was only 10.8 %. The rarity of bird remains indicates that birds form an insignificant part of the pygmy falcon's diet.

The collection of pellets on a systematic chronological basis was not possible in the rather short study period, since the falcons move about to some extent in the winter. It was therefore not possible to determine seasonal variations in the proportions of prey taken. However, the falcons were seen eating lizards far more often in summer than in winter, no doubt because the lizards were more active and therefore available in the warmer weather. It is therefore probable that the proportion of insect food in winter is higher than in summer. That insects are available in the Kalahari during the winter months has already been indicated (Maclean, 1967).

Pygmy falcons hawk their food from a perch like a shrike. They do not hover. When the prey is spotted, the falcon dives from the perch; as it nears the ground it holds the wings stiffly at a high dihedral and dangles the legs. The strike is made and the falcon returns to its perch to consume the food. Prey is carried either in one foot or in the bill while the bird is in flight. The prey is then held in one foot and the falcon begins to feed at the head end.

Calls and Displays

There are six basic calls in the pygmy falcon. At least three of these calls have two main functions, depending upon their intensity and the context in which they are uttered. The interpretation that follows is necessarily tentative in so incomplete a study. The basic calls are:

1. "tsip tsip" or "tsee tsee" (thin and squeaky)
2. "kiki *kik*" or "twee twee *twip*" (sharp or mellow with the last syllable accented)
3. "*ki* kikik" (sharp with the first syllable accented)
4. "ki-ki-ki-ki-ki-ki-ki-" (very sharp and ringing)
5. "krrr krrr krrr" (soft and purring)
6. "seee seee" (squeaky begging call of chicks).

Calls 1, 2 and 3 are arranged in order of increasing intensity. They are

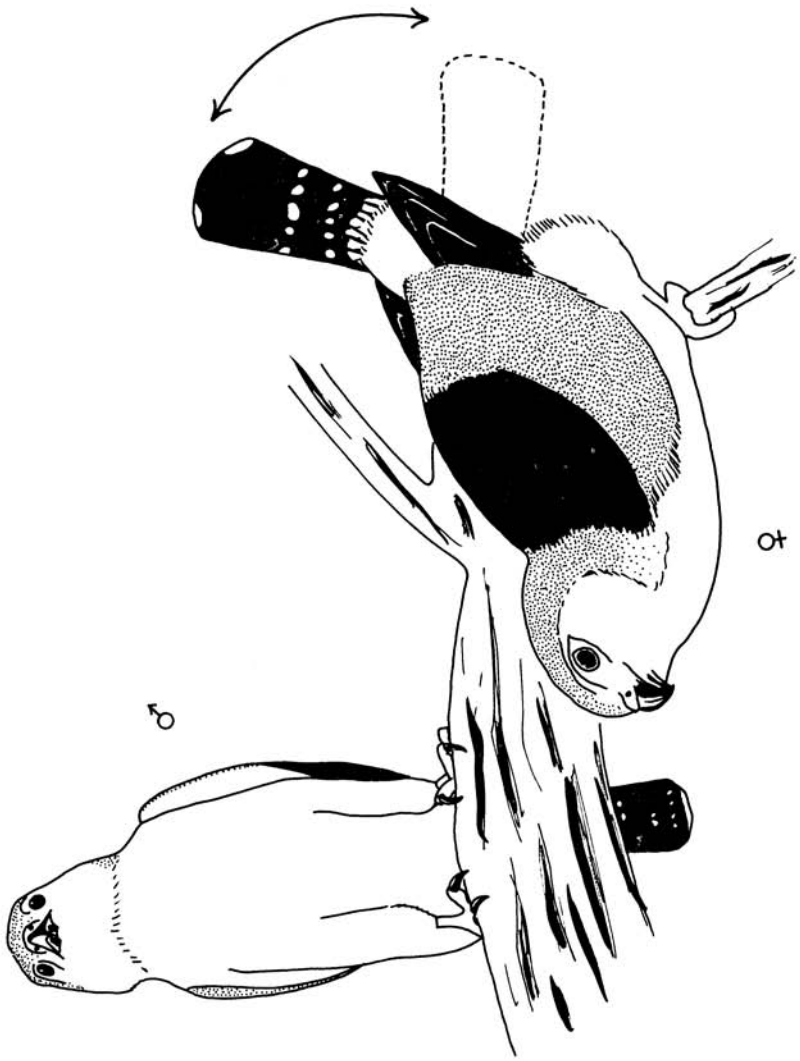

Fig. 4. The greeting display of a female pygmy falcon to her mate; she is in the submissive posture which presents the chestnut back patch to the male. At the same time the tail is wagged up and down as shown by the arrow.

essentially contact calls and may be used as alarm notes, greeting calls or contact calls according to context. Call 1 may precede call 2 in an alarm situation, in which case both are rather harsher and of higher intensity. At lower intensities these two calls accompany a tail-wagging display, usually by the female as she greets the male with a submissive posture(Fig. 4). Call 2 is always used by the male to call an incubating female from the nest chamber in order to be fed. It may also be uttered by the female as she flies to the nest chamber with food for the chicks.

Call 3 uttered loudly is the highest intensity alarm call in adult pygmy falcons, but I have heard a muted version of this call from a nest chamber, which a pair of falcons had just entered to roost; in the latter case it could have constituted a greeting call. Calls 2 and 3 are therefore probably just variations of the same basic theme.

I have heard call 4 only from young, almost fully fledged falcons as they adopt the threat posture (Fig. 5). It is of indefinite duration with each note equally accented. It is interesting that adult pygmy falcons do not usually adopt threat postures or utter threat notes when handled; they usually remain quiescent even when being extracted from a mist net or being held for ringing purposes.

Call 5 is heard only from mated adult pygmy falcons during copulation or in the pre-copulatory and pre-egg-laying phases of the breeding cycle when both members of the pair perform the tail-wagging greeting ceremony to each other. It may have the function of appeasement.

The tail-wagging greeting ceremony is of particular interest. It is most commonly performed by the female towards the male as he lands next to her on a perch, often with a lizard which he offers her as part of the courtship ritual. Feeding, however, is not essential to release greeting in the female. She invariably bows forward during this display and may erect her white rump feathers (Fig. 4). The forward bow serves to display her chestnut dorsal patch to the male which lacks the dorsal coloration and does not bow during the tail-wagging display. Tail-wagging in both sexes effectively accentuates the black-and-white tail pattern.

Exaggerated head-bobbing may accompany the greeting ceremony in the male, but not (apparently) in the female. Head-bobbing also precedes take-off in both sexes, particularly when a bird appears to be judging the flight path to the entrance of a nest chamber from a perch below the nest.

Call 6 is uttered by the chicks in response to the arrival of a parent with food. Since the context here is one of solicitous appeasement, the begging call may be cognate with call 1, which has a similar tonal quality and probably similar functions of appeasement, submission and solicitation.

Breeding Biology

1. *Pre-egg-laying phase*

The breeding season of the pygmy falcon in the Kalahari is an attenuated one, lasting from August to March. It is thus an exclusively