SHORT NOTES

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The southern African specimen of the Longtoed Flufftail *Sarothrura lugens*: a case of misidentification

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The Longtoed Flufftail *Sarothrura lugens* is included in the southern African avifauna on the basis of a female specimen obtained on 16 February 1966 at Inyanga in the eastern highlands of Zimbabwe (Irwin 1981; Maclean 1985; Keith 1986). Details of the characters on which the identification was made are given by Benson & Irwin (1966). The bird is in the ornithology collection of the Natural History Museum in Bulawayo (N.M. No. 62717). During a recent detailed examination of all the *Sarothrura* material at Bulawayo this specimen was found to differ from the other *S. lugens* material in a number of important characters and we compared it with female Redchested Flufftails *S. rufa*.

A number of hitherto undescribed characters may be used to separate females of *lugens* and *rufa*. Although no immature female *lugens* were available for comparison the diagnostic characters did not vary significantly between adult and immature *rufa* females, and are unlikely to do so in *lugens*.

1. There is a marked difference in the wing formula of the two species. Numbering the primaries (P1 to P10) from the outside inwards and taking measurements from the naturally closed wing (Williamson 1968) gives the differences shown in Table 1. Fig. 1 shows that *lugens* has a blunt-ended wing with P2–P6 almost equal in length, while *rufa* has a more pointed wing with a relatively short P2.

2. The primary tips of *lugens* are noticeably more tapering and pointed that those of *rufa*, which are broader and more rounded (Fig. 1), and this difference also applies to the alula feathers. In *rufa*, as in other members of the genus, the primary tips of immatures are more pointed than those of adults, but the feathers still differ markedly in shape from those of *lugens*.

3. The feathers of the sides of the lower neck and upper breast of female *rufa* are patterned with two pale crescentric bands, the inner band sometimes being reduced to a central pale spot; in *lugens* feathers the outer band is either a straight-edged "V" or is, like the inner band, irregularly broken into spots (Fig. 2). These differences give a scalloped effect to the markings of *rufa* in this region, while *lugens* shows spots or streaks.

4. Immature female *rufa* are more heavily marked on the belly than adults, but all have a more extensive pale area on the belly than do adult female *lugens*. This character should also hold good for *lugens* immatures, which are likely to be even more heavily marked than adults.
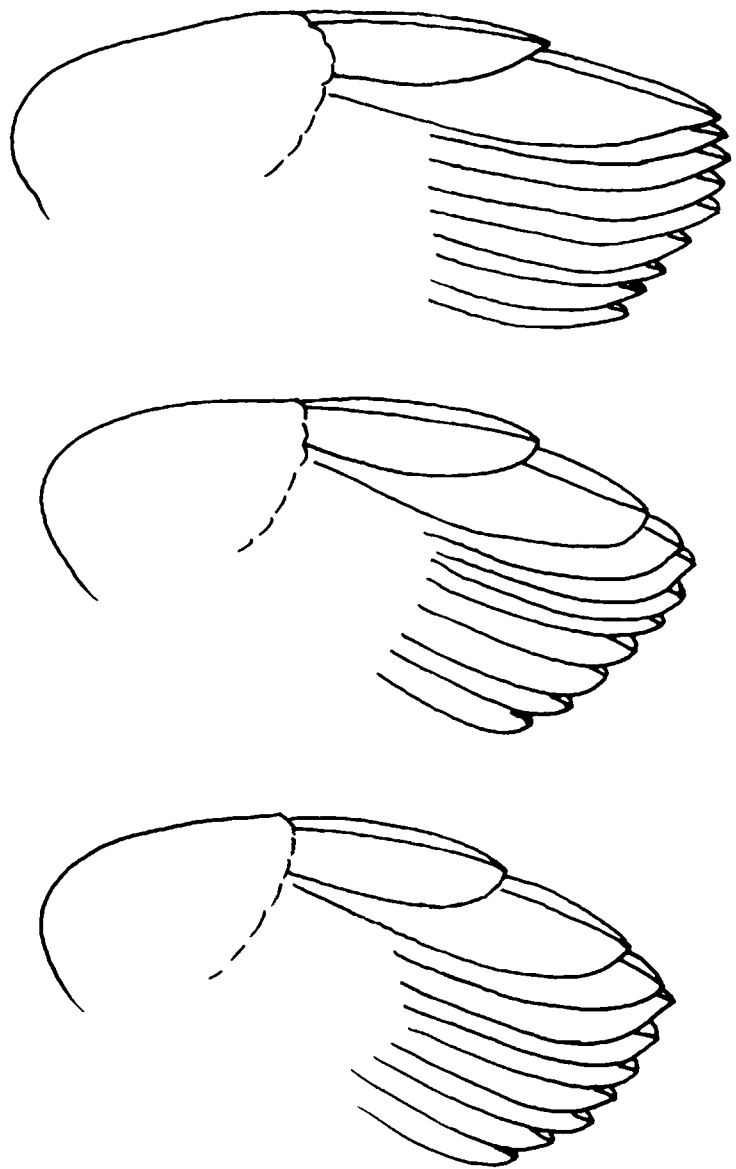

FIGURE 1

Underwings of adult *Sarothrura lugens* (top), adult *S. rufa* (centre) and the Inyanga female (bottom), showing relative length and shape of primaries.

5. The ear coverts and cheeks of female *rufa* are often paler and less heavily patterned than those of *lugens*.

6. The culmen of *lugens* shows a marked curvature over its distal half, while that of *rufa* is often curved less deeply and over a shorter distance from the tip. This character seems most obvious in males, but is also apparent in some females.

The Inyanga female is an immature which has almost completed its post-juvenile moult and, from moult studies of several flufftail species (P. B. Taylor unpubl.), is estimated to be less than four months old, i.e. hatched early in the 1965-66 rains. The most obvious character identifying it as

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TABLE 1
COMPARISON OF THE WING FORMULAE OF *SAROTHRURA LUGENS* AND *S. RUFA*.

Character	*S. lugens*	*S. rufa*
Wing point	P3 to P5	P4 (occasionally P3)
Position of P2 tip	Between P5 and P6 tips	Between P7 and P8 (adults), or P8 and P9 (immatures)
Length of P2 relative to wing point	Almost as long as P3–P5	5 mm shorter than P4

P = primary (numbered ascendently)

an immature is the retention of the almost unpatterned juvenile greater upperwing coverts, this being a reliable ageing character for flufftails (P. B. Taylor unpubl.). It shows the more pointed primary tips characteristic of am immature (Fig. 1) and its remiges are fresh, whereas those of an adult female in February should be abraded.

The original identification of the bird as *S. lynesi* (now synonymous with *S. lugens lynesi*) was made after comparison with five female *lynesi* and at least three females of each of the other *Sarothrura* species, including *rufa* (Benson & Irwin 1966). Differences from *rufa* are given as the white, rather than buff, colour of the markings on the upperside, and the absence of any buffy wash on the underside (Benson & Irwin 1966). Our examination of 19 female *rufa* skins, including 10 immatures, and PBT's experience of *rufa*, suggest that these characters are variable, both individually and with age, and are not diagnostic. The Inyanga specimen does not conform to any of the plumage features which we find characteristic of *lugens* but does conform in every respect to the characters shown by immature female *rufa*. Differences from adult female *rufa* include the greater extent of the markings on the underparts, while the upperparts have a darker ground colour and paler, less numerous spots from head to tail. The wing formula is identical to that of *rufa* (Fig. 1). The measurements of the specimen (given in Benson & Irwin 1966 and Keith *et al.* 1970) fall within the range for females of both species given by Keith (1986) except that the wing length (70 mm) is 1 mm shorter than the minimum given for *rufa*. However, it falls within the range of measurements of immature *rufa* taken by PBT. The tail length (40 mm) is within the range for *rufa* but falls short of the known range for *lugens* (Benson & Irwin 1966; P. B. Taylor unpubl.).

We are of the opinion that the only specimen of *S. lugens* claimed for southern Africa is an immature female *S. rufa* and that the Longtoed Flufftail should be removed from the southern African list.

When the Inyanga bird was collected it was not known that flufftails have an immatue plumage which is distinct from both juvenile and adult plumages, and such differences have only recently been clarified (P. B. Taylor unpubl.). In the light of the Inyanga bird's immature characters, and since no flufftail is known to breed until the season following hatching, the question of the bird's breeding condition should be considered. On the basis of the finder's report on the specimen (M. P. S. Irwin *in litt.*) Benson & Irwin (1966) judged it

"not very far from breeding, since the ovary held an oocyte of diameter as much as 3 mm, while the oviduct was straight and somewhat distended". In seasonally breeding birds follicles in the size range of 1-5 mm are regarded as "resting" and further development may take months or even years; only the deposition of yolk vacuoles in the enlarged oocyte is indicative of ovarian recrudescence (Murton & Westwood 1977). Thus an oocyte of 3 mm diameter almost certainly does not indicate breeding and a straight oviduct confirms this conclusion, since that of a breeding bird increases markedly in length (Murton & Westwood 1977) and is usually convoluted (G. L. Maclean pers. comm.); in the absence of further details such as measurements of the oviduct diameter, the breeding condition of the bird is not established.
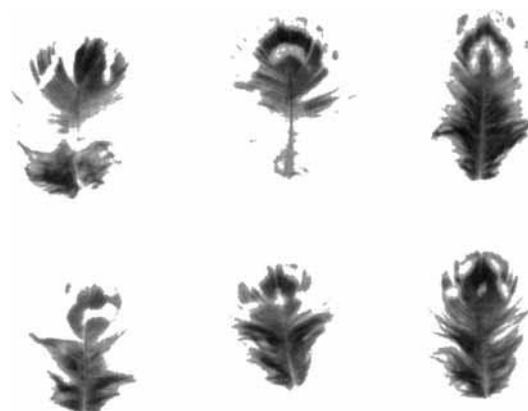
FIGURE 2
Feathers from the lower neck of three females, showing typical patterning. L to R: adult *Sarothrura lugens*; immature *S. rufa*; the Inyanga immature.

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Nest orientation of Orangebreasted Sunbirds in South Africa.

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Endemic to South Africa, Orangebreasted Sun-
birds *Nectarinia violacea* are nectarivorous birds
that inhabit protea-heath vegetation of the south-
ern Cape Province from Cape Town to Port Eliza-
beth (Skead 1967). Unlike most birds, they breed
during the winter with a peak of breeding in June
and July, presumably because many species of
plants bloom at this time providing a rich nectar
resource. In the southwestern Cape region, these
birds experience relatively cool temperatures and
frequent rain storms during the breeding season
(Jackson & Tyson 1971). Mean daily tempera-
tures average around 12-15 °C with nighttime lows
of near 6-8 °C during June and July, and, on aver-
age rain falls on about 12 days of each of the two
months (Knox 1911; Thompson 1975).

Because they breed during the winter, these
small birds (8g) are likely to have high energy ex-
penditures (Williams 1990), owing to the energy
cost associated with raising young coupled with
high thermoregulatory costs of adults. Moreover,
eggs and nestlings will cool rapidly when parents
leave the nest unattended, which occurs often, at
least during incubation (Broekhuysen 1963). Ad-
aptations of nest construction, that reduce the rate
of heat loss from eggs and young, and that reduce
thermoregulatory costs of incubating females
(only the female incubates), are likely to influence
reproductive performance in this species. There
has apparently been strong selection in Orange-
breasted Sunbirds to build nests that minimize
heat loss; they build well insulated, oval, fully en-
closed nests with a side entrance. Referring to the
nest of Orangebreasted Sunbirds, Skead (1967)
wrote, "no other sunbird's nest is as firmly built or
as densely packed".

The orientation of the nest entrance could also
have a pronounced influence on the rate of cool-
ing of eggs and young, and on the metabolism of
the incubating female. When temperatures of
eggs and young fall below normothermic levels,
development is slowed and the length of the incu-
bation and nestling period may be increased. As

these developmental periods lengthen, the prob-
ability of predation increases, and fitness can be
affected (Clark & Wilson 1981; Williams 1990).

In this study, I have tested the hypothesis that
female Orangebreasted Sunbirds construct their
nests with entrances orientated away from the di-
rection of the prevailing wind to reduce the pen-
etration of wind into the nest. In the southwestern
Cape, prevailing winds are northwesterly during
June and July (Weather Bureau of South Africa
1960). Moreover, the frequent storms that sweep
across this region are typically driven by winds
from a westerly or northwesterly direction (Jack-
son & Tyson 1971). Thus females in this area
might be expected to orient their nest entrances in
an easterly or southeasterly direction.

I studied Orangebreasted Sunbirds from April
to August, 1989, in the Kleinmond Nature Re-
serve and the Mountain Range Flora farm, both
near Kleinmond, South Africa (34 01 S, 18 03 W).
Nests were often discovered by following females
carrying nesting material or by following females
that had a distinctive bend in their tail feathers, a
trait commonly found in incubating females
(Skead 1967). To determine nest height, I
measured the distance from the ground to the bot-
tom of the nest entrance with a tape measure (to
the nearest cm). Broekhuysen (1963) followed the
same protocol; these data are directly comparable
with his results. The orientation of each nest en-
trance was determined to the nearest 5° by means
of a hand-held compass.

To test whether Orangebreasted Sunbirds
oriented their nest in a preferred direction, I com-
pared my data with a theoretical model of unifor-
mity by Chi-square (Batschelet 1965; Zarr 1984). I
subdivided the data into 6 equal intervals with an
expected frequency in each interval of 4,83 (29/6).

To determine a mean angle of a circular distri-
bution, one cannot simply calculate an arithmetic
mean of the observed angles, the result depending
on the zero point of reference (Batschelet 1965).
Therefore, to determine the mean direction of
nest orientation, I have used a calculation for the
centre of mass of the data (Batschelet 1965). This
technique provides a test of whether data points
are uniformly distributed about a circle, and pro-
vides a relative index (r) of dispersion around a
mean vector of orientation, with 0.0 representing
a high degree of dispersion and 1.0 indicating that
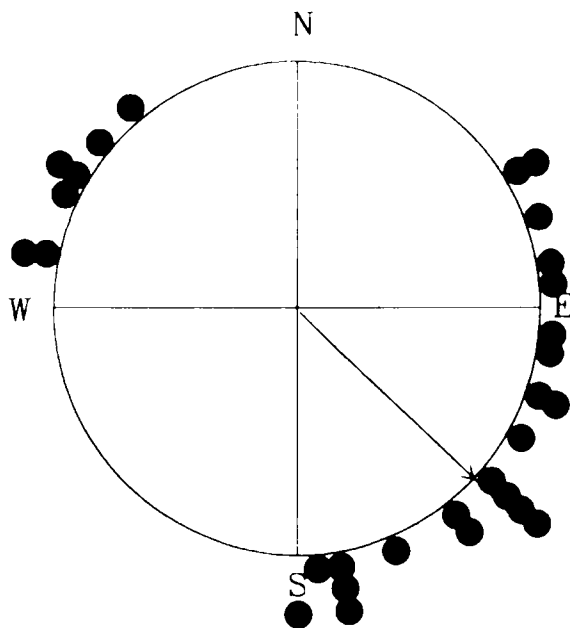all points are orientated in the same direction.

FIGURE 1

The compass orientation of nest entrances of Orangebreasted Sunbirds in the southwestern Cape region.

TABLE 1

HEIGHT AND COMPASS ORIENTATION OF NEST ENTRANCES CONSTRUCTED BY ORANGEBREASTED SUNBIRDS IN SOUTHERN AFRICA

Nest	Height (mm)	Orientation[a] (degrees)	Clutch size	Date (1989)
1	100	120	2	15 April
2	930	80	1	20 July
3	370	130	2	20 July
4	400	95	2	21 July
5	601	130	2	21 July
6	542	130	2	21 July
7	440	295	2	21 July
8	665	320	2	22 July
9	290	60	2	22 July
10	825	160	2	22 July
11	655	170	1	24 July
12	710	300	2	24 July
13	860	170	2	24 July
14	800	300	2	24 July
15	540	280	2	27 July
16	330	170	2	27 July
17	740	310	2	27 July
18	540	280	2	29 July
19	920	70	2	1 August
20	1210	140	2	1 August
21	820	140	2	1 August
22	290	60	2	2 August
23	542	130	2	3 August
24	790	180	2	3 August
25	820	100	2	4 August
26	570	85	2	5 August
27	410	175	2	6 August
28	540	110	2	6 August
29	640	120	1	7 August
Mean	617	128,3[b]	1,9	
SD	(239)		(0,3)	

[a] Determined with a compass, North equalling 0°.
[b] See methods for calculation.

The equation for this calculation is:

$$r = (1/n) [(\Sigma \cos \theta_i)^2 + (\Sigma \sin \theta_i)^2]$$

where n is the number of observed angles, and θ_i is the ith angle of nest orientation. Means are presented ± 1 SD.

During the breeding season of 1989, I found 29 Orangebreasted Sunbird nests (Table 1). The height of these nests ranged from 100 to 1210 mm and averaged 617 ± 239 mm, a result that agrees with Broekhuysen (1963) who reported that 76% of nests were placed less than 1m above the ground. Clutches of 2 eggs accounted for 90% of all nests, with only 3 nests containing one egg.

Orangebreasted Sunbirds constructed nests with entrances that typically faced in an easterly or southeasterly direction, away from prevailing winds (Table 1; Chi^2 = 20,9; N=29; d.f. = 5; P < 0,001). The mean vector of orientation was 128,3°, or southeast with an r value of 0,378 (Fig. 1).

The data support the hypothesis that Orangebreasted Sunbirds construct nests with entrances in directions away from the prevailing winds. Advantages of such orientation likely include (1) minimization of heat loss from incubating females, (2) reduction in the rate of heat loss from eggs and nestlings when the female is away from the nest, and, (3) provision of a more effective shelter for the parent-young complex during rain storms.

Orientation of nest entrances away from prevailing winds may increase the reproductive suc-cess of Orangebreasted Sunbirds. Austin (1976) showed that Verdins Auriparus flaviceps built nests with entrances pointing away from prevailing winds during the early spring when temperatures were relatively low, and that nest orientation significantly affected reproductive success.

Seven Orangebreasted Sunbird females positioned nest entrances in a northwesterly direction, in apparent conflict with the anti-prevailing wind hypothesis. Two of these nests were built in a ravine along a stream where winds would have been significantly attenuated. In light of Austin's study, it would have been interesting to know if the reproductive success of the other five birds was different from birds that orientated their nests away from prevailing winds. It would also have been instructive to know if these five birds were young, and inexperienced. If this were true, it would suggest that nest orientation has a learned component. Such hypotheses await further study.

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Alpine Swifts opportunistically feeding on cicadas

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On 15 and 17 November 1991, while walking 1 km transects through Karroid dwarf shrubland at Tierberg (33 10 S, 22 17 E), Prince Albert, I was accompanied by one to three Alpine Swifts *Tachymarptis melba* and, briefly, two Whiterumped Swifts *Apus caffer*. Both species remained in close attendance, but only Alpine Swifts flew close to me to catch cicadas (Homoptera: Cicadidae) that I flushed from shrubs. On 15 November, the Alpine Swifts were present intermittently for about 50 mins over a distance of 3 km. Initially, one Alpine Swift was present, and was joined by a second bird after 15 mins. After 20 mins, a third Alpine Swift arrived, and 10 mins later two Whiterumped Swifts arrived and remained with me for <2 mins. On 17 November, at 07h20, one Alpine Swift arrived after I had been walking for 5 mins and for the remainder of the transect I was accompanied sporadically by at least one Alpine Swift. A second Alpine Swift arrived after 10 mins, and swifts were present intermittently until 10h45, when I was completing the last of eight 1 km transects. Two Whiterumped Swifts were briefly present at 09h00.

Cicadas were first noticed emerging on 4 November 1991 at Tierberg and by 15 November a large number of adult cicadas were calling from perches on shrubs on the plains. Two species of cicada in approximately equal numbers were present; an apparently undescribed species, *Quintillia* cf. *conspersa*, length *ca* 20 mm, weighing 0,152 ± S.D. 0,02 g (males, n = 10) and 0,418 (females, n = 7, range 0,370-0,478 g; Dean & Milton 1991) and *Quintillia* cf. *peregrina*, *ca* 22 mm in length, weighing 0,357 ± 0,09 g (males, n = 10) and 0,514 ± 0,1 g (females, n = 7). The estimated density of cicadas on 15 November was 3225 ± S.D. 1524 cicadas ha^{-1}, calculated from walked transects of 1 km (n = 7). On 17 November, the estimated density was 4070 ± S.D. 1912 cicadas ha^{-1} (n = 8). A third species of cicada, *Henicotettix hageni* Stål, length *ca* 16 mm, weight <0,10 g, was also present in low numbers in drainage lines and was not included in the counts.

Although cicadas have been recorded as food of the Alpine Swift in Europe (Cramp 1985; Fry *et al*. 1988) there is no record of Alpine Swifts feeding on cicadas in southern Africa. Males of both species of cicada on the plains at Tierberg mostly remain at their call-sites, unless disturbed by foraging mammals or man. Without disturbance, there is always some movement by males over short distances, probably in search of optimal call-sites. Male cicadas at Tierberg tend to perch and call from the the tallest shrubs. In *Q*. cf. *conspersa*, females are attracted to calling males (Dean & Milton 1991) so there are always cicadas flying low over the shrubland during the intense calling and courtship phase of a cicada emergence. I could not separate the two species of cicadas in flight in the field but observations of perched cicadas suggested that both species had similar mating systems. When disturbed, both species of cicada flew 5-10 m, rarely exceeding 2 m in altitude, and the number of cicadas in the air increased considerably.

Alpine Swifts were seen to catch cicadas flying low over the shrubland and were apparently not dependent on a beater to flush cicadas. However, the swifts moved much closer to me when I was walking and flushing cicadas. At times the birds caught cicadas within 2 m of me and it was possible to see the insect actually caught and held, since the swifts were obliged to slow their flight speed in order to intercept their prey. The Alpine Swifts appeared to have sporadic foraging bouts, catching cicadas intensively for 2-5 minutes and then flying off. The intermittent appearance of the swifts on the Tierberg study site and the periodic absences suggest that they were breeding in the area, and taking food-balls back to an incubating female or nestlings.

The Alpine Swift may be considered a generalist aerial insectivore in that it takes a wide range of prey (Cramp 1985) and it is opportunistic in that it attends fires and feeds on prey flushed by the

flames (Frost 1984; Dean 1987). The association between the Alpine Swifts and a walking man was clearly opportunistic and not unexpected in such a species (Vernon & Dean 1988).

I thank Richard Brooke and Roy Siegfried for comments on a first draft of this note.

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The type-locality of the Crested Barbet

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The description of the Crested Barbet *Trachyphonus vaillantii* Ranzani, 1821, is based on "Le Promepic" of Levaillant as published in his *Hist. Nat. Ois. d'Afr.* 3, 1806, plate 32: 78, or in *Promerops*, part 1, 1813: 32 (*vide* Rookmaaker 1989). Levaillant said that he found this species to the north of the Orange River, that is in Great Namaqualand, southern Namibia. Prof. C.A. Ranzani (1775-1841) simply gave the provenance of his *T. vaillantii* as "South Africa". Later Vincent (1935), noting that in the south of its range the species only occurred over the eastern parts of the Southern African Subregion, proposed a restricted type-locality of the "south-eastern Cape Province". On the basis of the original Levaillant data, Mackworth-Praed & Grant (1955) proposed the "Ham R., in Great Namaqualand" as a more acceptable type-locality for this barbet. Type-locality proposals must be in strict accord with the established range and known movements of the species; they should also be in line with the original data furnished by the describer, and take into consideration such relevant historical evidence as is available.

Neither of these two type-locality restrictions is acceptable, since at no stage during his southern African travels did Levaillant come anywhere near the established range of the Crested Barbet. The species' southern African range in Levaillant's time was probably more restricted that it is today, as it has adapted to a life in parks and gardens in urbanized localities over the eastern plateau. Levaillant often embellished his African ornithological discoveries so that no credence need be given to his statement that he found *T. vaillantii* in the south of the present Namibia, a region which is ecologically unsuitable for this species.

At that time a lucrative trade in natural history specimens existed in conjunction with maritime commerce along the African coast, linked to the spice trade with the Far East. Levaillant's interests in African ornithology were promoted by C.J. Temminck (1778-1858), director of the natural history museum in Leiden, Netherlands, which was supported by Dutch shipping interests with the East. There is no evidence that Levaillant encountered the Crested Barbet in the field, but he probably purchased skins from sailors or had access to them through his association with the Leiden museum. I suggest that the type of "Le Promepic" probably came from the region of Delagoa Bay in southern Mozambique, already an established supply point on the main trade route between the East and Europe in Levaillant's time, and where the species occurs commonly at sea level. The nominate subspecies of the Crested Barbet reaches the southern limits of its range about Durban, Natal (Clancey 1974; Goodwin & Clancey 1978). Fixation of the type-locality of *T. v. vaillantii* as "the region of Delagoa Bay, southern Mozambique" would therefore be acceptable on taxonomic, distributional and historical grounds.

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The diet of nestling Cattle Egrets in the Transvaal.

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The Cattle Egret *Bubulcus ibis* is primarily insectivorous although the diet is extremely diverse (reviewed by Fogarty & Hetrick 1973). The diet of nestlings closely resembles the diet of independent birds (Siegfried 1971; McKilligan 1984). This note reports on analyses of food samples of nestling Cattle Egrets in the Transvaal.

Samples, boluses of undigested food regurgitated by nestlings or boluses left by parents, were collected during December 1978 and January 1979 in the afternoon at eight heronries. The heronries were Bosmont, Union Settlements and van Wyks Rus on the Witwatersrand, and at Pretoria, Ermelo, Orkney, Settlers and Vaalwater. The majority of invertebrate items were classified only to family or ordinal level, based on the CSIRO (1970) system. The majority of vertebrate items was identified to generic or specific level. The body length of each completely intact prey item was measured. The measurement of invertebrates was from the head to the abdomen, of anurans included the legs, of Squamata included the tail, and of mammals excluded the tail. To obtain a composite average length of prey objects for each locality, food items were arranged in 5 mm interval length classes. The wet weight of each food category was determined for each locality.

The single most important constituent by weight and number was Orthoptera, with most of the remainder of the bulk made up by vertebrates, other insects and arachnids (Table 1). The remainder of the number was made up by other insects and arachnids. The size of prey ranged from 2-200 mm. The modal class of prey size was 5,5-10,5 mm. At Ermelo, vertebrates (all frogs) occurred in 45,9% of the samples, and contributed 38,1% by weight but only 1,8% by number. Thus a large proportion of chicks received mainly a few large frogs for a single feed. In contrast, vertebrates formed only 4,8% by weight and 0,6% by number of the diet on the Witwatersrand, and occurred in only 21,1% of the samples.

The composition of individual food samples suggested that birds had foraged in more than one habitat type in the course of a day. Foraging adults were primarily associated with cattle, particularly in the Springbok Flats/Waterberg region, but a wide range of habitats was utilized in the Witwatersrand/Ermelo region.

The predominance of Orthoptera in the diet of all the heronries agrees with previous research. The diet of Cattle Egrets (by weight for adults and nestlings respectively) in Queensland feeding mainly in pastures was predominantly orthopteran (75,8% and 50%), although cicadas (11,4% and 8,5%) and skinks (0,3% and 19,9%) were also important prey categories, with the remainder mainly invertebrates (McKilligan 1984). In South Africa, grasshoppers were the most important prey in the eastern Cape (Skead 1966). In the western Cape, the diet of nestlings was (by weight) 36% Orthoptera, 32% Lepidoptera, and 13% frogs, although adult birds at the same time (December-January) consumed only 19% Orthoptera but 37% lepidopterans, 20% beetles, 10% frogs and 11% mammals (Siegfried 1971). Earthworms became the major prey category of adults in winter (67,5%) while the importance of Orthoptera (12,3%) and Lepidoptera (1,6%) declined (Siegfried 1971). The importance of lepidopterans and frogs in the southwest Cape reflected the habitat of irrigated pastures. Many of the pastures available to Cattle Egrets in Florida were low-lying wetlands and open grasslands, and accordingly the diet at four different heronries contained a high proportion of frogs (30-38% by volume) although Orthoptera were still the main food category (57-65% by volume) (Jenni 1969, 1973). This is similar to the diet of the Ermelo heronry, which was also an area containing many shallow wetlands. Another study in Florida recorded that the diet of adults was mainly Orthoptera (81% by volume), Vertebrata (almost all frogs, 7%) and spiders (5%), although the foraging habitat was not described (Fogarty & Hetrick 1973). The strong influence of foraging habitat on the diet of this species is shown by the diet of birds feeding in rice fields in Japan (Ikeda 1956, not seen, in Fogarty & Hetrick 1973). Although insects made up 74% of the diet the contribution of orthopterids was only 2%, whereas the contribution of spiders was 26% and of aquatic beetle larvae 33%.

The differences in diet between South Africa, Florida and Queensland are mainly of quantity rather than kind. These differences can be attributed to the nature of the foraging habitat. Insights into the variation in the diet of Cattle Egrets might therefore be gained from an understanding of the behavioural mechanisms which influence both the range of habitats used by individual birds and the selection of prey items within a single habitat.

As in this study, spiders were a common constituent of the diet in Florida (Fogarty & Wallace 1973), where Lycosidae were also the most common spiders, and in Queensland (McKilligan 1984). Lycosidae were also the most important prey category in California (Foster & Tiller 1973). The high frequency of occurrence, and often considerable contribution to the diet, of ticks in this study was noteworthy, as a number of studies have recorded either no ticks (Jenni 1969, 1973; Fogarty & Hetrick 1973) or a minimal number (Siegfried 1966, 1971). Fogarty & Hetrick (1973) question whether Cattle Egrets ever peck ticks off cattle or only take engorged ticks which have fallen off, although Cattle Egrets were confirmed to peck ticks off livestock in Queensland (McKilligan 1984). In this study, many regurgitates contained large numbers of ticks (up to 128), and on one occasion a bird was seen pecking livestock. Further evidence of pecking off livestock was the presence of some ticks, not yet fully engorged, with hair and skin attached to the mouthparts.

TABLE 1

THE DIET OF NESTLING CATTLE EGRETS IN THE TRANSVAAL, BASED ON 10 201 PREY ITEMS AND A MINIMUM OF 192 REGURGI-
TATES. THE FREQUENCY OF OCCURRENCE OF A PREY CATEGORY REPRESENTS THE PERCENTAGE OF REGURGITATIONS IN WHICH
THE CATEGORY WAS RECORDED; THE WEIGHT AND NUMBER OF EACH CATEGORY IS, RESPECTIVELY, A PERCENTAGE OF THE TOTAL
WEIGHT AND TOTAL NUMBER OF PREY ITEMS.

Prey category	% weight	% number	Frequency
ANNELIDA — Oligochaeta	0,39	0,26	3,13
MYRIAPODA — Chilopoda	0,69	0,21	6,25
CRUSTACEA — Decapoda	0,35	0,06	2,08
ARACHNIDA — Araneae	1,60	4,28	46,87
— Acarina	8,64	12,07	37,50
— Scorpiones	0,09	0,01	0,52
INSECTA			
ODANATA[1]	0,30	0,43	—
BLATTODEA — Blattidae	0,28	1,17	20,31
ISOPTERA — Hodotermitidae	0,26	0,57	3,65
MANTODEA — Mantidae	1,95	2,84	37,50
DERMAPTERA — Forficulidae	0,05	0,18	0,47
ORTHOPTERA			
— Stenopelmatidae	0,66	0,17	3,65
— Tettigonidae	2,82	4,20	33,85
— Gryllidae	10,87	6,29	46,35
— Gryllotalpidae	0,25	0,06	1,56
— Pyrgomorphidae	2,49	2,90	42,19
— Acrididae	42,30	39,61	82,81
— Tetrigidae	0,39	2,06	18,23
PHASMOTODEA	0,06	0,07	2,60
HEMIPTERA[2]	0,26	0,88	—
NEUROPTERA[3]	0,01	0,04	2,02
COLEOPTERA[4]	0,67	1,15	—
DIPTERA — Muscidae	1,24	9,79	33,33
— Other[5]	1,97	4,93	—
LEPIDOPTERA	4,47	3,76	—
HYMENOPTERA[6]	0,01	0,08	—
VERTEBRATA —Anura	12,70	1,04	26,56
— Sauria	1,86	0,25	5,21
— Serpentes	0,04	0,02	1,04
— Passeriformes	0,07	0,01	0,52
— Rodentia	3,28	0,12	2,60

[1] Includes Zygoptera, Aeschnididae and Libelludidae.
[2] Includes Cicadidae, Reduvidae, Jassidae, Alydidae, Hydrometridae, Coreidae, Nepidae and Cercopidae.
[3] Includes Myrmeleontidae and Ascalaphidae.
[4] Includes Cicindelidae, Carabidae, Staphylinidae, Dytiscidae, Gyrinidae, Hydrophilidae, Scarabaeidae, Elateridae, Tenebrionidae and Curculionidae.
[5] Includes Tipulidae, Tabanidae, Stratiomyidae, Asilidae, Pyrogotidae, Syrphidae, Bombylidae, Bittacidae, Calliphoridae, Sarco-phagidae and Tachinidae.
[6] Includes Megachilidae, Formicidae, Sphecidae and Pompylidae.

None of the 183 caterpillars taken were hairy.
None of the Pyrgomorphidae taken were species
known to sequester cardiac glycosides or pyrollo-
zine alkaloids from plants. Egrets were likely to
have encountered both these prey types, and ap-
parently avoided them because of their defence
mechanisms.

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Levels of DDT in the liver tissue of two duck species from the Pongolo floodplain

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The Pongolo River forms a floodplain of some 10 000 ha along the eastern foot of the Lebombo Mountains in northern Zululand (Heeg et al. 1980). p,p–D(1,1'–(2,2,2–trichloroethylidene) bis [4–chlorobenzene]) (WHO 1989) has since 1946 been used in the intradomiciliary control of the anopheline mosquitos responsible for the transmission of malaria in this area (Sharp et al. 1988).

Very little information is available as concerns DDT and metabolites in the Pongolo floodplain and adjacent environment. Bouwman et al. (1990) examined the muscle tissue of three fish species caught in different pans comprising different areas of exposure within the Pongolo floodplain system. The piscivorous tigerfish Hydrocynus vittatus was found to contain the highest levels of ΣDDT (91,8 µg kg^{-1}) and its metabolites in muscle tissue. The omnivorous butter catfish Eutropius depressirostris contained the second highest levels (ΣDDT 33,4 µg kg^{-1}) with the herbivorous blue kurper Oreochromis mossambicus containing the lowest levels (ΣDDT 26,4 µk kg^{-1}) of the three fish species examined. These findings indicate that the process of bioaccumulation is occurring in the system (Bouwman et al. 1990).

This report deals with the levels of p,p'–DDE (1,1'–(2,2–dichloroethenylidene)–bis[4–chlorobenzene]), p,p'–DDD (1,1'–(2,2–dichloroethylidene)–bis[4–chlorobenzene]), DDT and total DDT, herein after referred to as DDE, DDD, DDT and ΣDDT respectively, in the liver tissue of the Whitefaced Duck Dendrocygna viduata and Yellowbilled Duck Anas undulata found in the Pongolo floodplain (WHO 1989).

The ducks were collected by shooting in June 1987 at Nomaneni and Mzinyeni pans. Liver subsamples of between one and two grams were weighed, wrapped in foil and frozen separately in capped test tubes on the day of hunting. Samples were transported and stored frozen. Sixteen liver samples were collected for the Whitefaced Duck and six for the Yellowbilled Duck.

Standards of p,p'–DDE, p,p'–DDD and p,p'–DDT were obtained from the Environmental Protection Agency. The standards were used to prepare stock solutions in toluene and working and spiking solutions in hexane. The extraction method was validated in the following way. Commercially available unfrozen chicken liver was obtained. Eighteen 1,5g subsamples of liver were weighed and placed into 18 separate vials. Six of the vials were set aside as control group to determine background levels of DDE, DDD or DDT. Six of the liver subsamples were spiked with a DDE, DDD and DDT solution so as to give a concentration of 50 µg kg^{-1} wet weight and the remaining six so as to give a concentration of 500 µg kg^{-1} wet weight. The solvent was immediately evaporated with a gentle stream of air. The spiked subsamples were allowed to equilibrate for 8 hours and subsequently frozen for three weeks before analysis.

The extractions were done according to a slightly modified method developed by Bouwman et al. (1990). For extraction the samples were transferred to 25 ml screw cap glass vials. For the column extraction the eluent was taken up in 5 ml of hexane. The silica gel columns were prepared as described by Bouwman et al. (1990). Chromatography was done with a Varian 3300 using ECD (^{63}Ni). Those extracts that contained compounds which gave a response outside the linear range were diluted with toluene. Integration was done with a Varian 4290 integrator. Results were not corrected for recovery. The values obtained were calculated on a wet weight basis.

Table 1 gives the results obtained from recovery studies. No significant differences were found when comparing the recovery of DDE, DDD and DDT at either spiking concentration (Table 1). Significant differences existed when comparing the recoveries of DDE, DDD and DDT between spiking concentration of 50 µg kg^{-1} and 500 µg kg^{-1} liver tissue. Recovery of DDE, DDD and DDT decreased with an increase in the spiking concentration. The coefficient of variation increased with an increase in spiking concentration for DDE,

TABLE 1
MEAN VALUES OF TWO DETERMINATIONS OF RECOVERY

	DDE	DDD	DDT	ΣDDT
Added[a]	0	0	0	0
Recovered[a]	0	0	0	0
Added[a]	50	50	50	150
Recovered[a]	34,4	43,3	38,2	115,9
% recovery	68,8	86,5	76,4	77,3
Sd[b]	9,0	12,5	8,8	10,1
% CV[c]	13,1	14,4	11,5	13,1
Added[a]	500	500	500	1 500
Recovered[a]	166,1	222,5	189,7	577,3
% recovery	33,0	44,5	37,9	38,5
SD[b]	23,1	44,7	30,3	32,7
% CV[c]	70	100,4	79,9	84,9

a µg kg^{-1}
b standard deviation of recovery
c coefficient of variation

TABLE 2

MEAN LEVELS OF DDT AND METABOLITES IN DUCK LIVER SAMPLES. THE CONCENTRATIONS ARE EXPRESSED IN $\mu g \ kg^{-1}$ WET WEIGHT AND ARE NOT CORRECTED FOR RECOVERY. LIVER SUBSAMPLES WITH NO DETECTABLE CONTAMINATION WERE EXCLUDED. (SD = STANDARD DEVIATION, MIN-MAX = MINIMUM AND MAXIMUM VALUES OF EACH DATA SET).

Whitefaced Duck (n^a = 16)

n^b	DDE	SD	Min–Max
16	21,7	16,4	3,8–46,5
n^b	DDD	SD	Min–Max
5	1,82	0,7	1,1– 2,9
n^b	DDT	SD	Min–Max
2	3,3	0	3,3
n^b	ΣDDT	SD	Min–Max
16	22,7	17,4	1,1–46,5

Yellowbilled Duck (n^a = 6)

n^b	DDE	SD	Min–Max
6	42,6	26,5	2,7–93,2
n^b	DDD	SD	Min–Max
3	10,9	11,5	3,6–24,2
n^b	DDT	SD	Min–Max
2	1,7	1,5	0,6– 2,7
n^b	ΣDDT	SD	Min–Max
6	48,6	35,4	0,6–93,2

n^a indicates the total number of birds analyzed.
n^b indicates the number of birds containing detectable liver concentrations of DDE, DDD, DDT and ΣDDT.

DDD, DDT and ΣDDT. There was therefore a greater variation (Table 1) in the results obtained at the higher concentration when compared with the results at the lower concentration. The levels determined in this study, however were all less than 50 µg kg⁻¹ (Table 2).

All sixteen Whitefaced Ducks and six Yellowbilled Ducks analyzed contained detectable levels of DDE in their liver tissue. Yellowbilled Ducks contained almost twice as much DDE and almost five times as much DDD in their liver tissue than Whitefaced Ducks. No significant difference (p > 0.05) was found in the liver concentration of DDT between Whitefaced Ducks and Yellowbilled Ducks. The ΣDDT level of Yellowbilled Ducks was almost twice as much as that for Whitefaced Ducks, the difference being significant (P < 0.05).

The two duck species considered in this study are at no risk from their DDE, DDD, DDT, ΣDDT liver levels. As suggested by Bouwman et al. (1990) the three fish species should be periodically monitored to ensure that the system is not further polluted. As far as monitoring a bird species in the area is concerned, both the Yellowbilled Duck and the Whitefaced Duck are not suitable candidates as indicator organisms due mainly to their very mobile lifestyle (Maclean 1985).

Results obtained can be seen as representative of the mean for the entire system, for the species involved, and not of mean levels at any single localities within the Pongolo floodplain system. A comparative study involving different localities within the Pongolo floodplain may be conducted with less mobile and more resident species such as the Pied Kingfisher Ceryle rudis.

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NOTICE

WILDFOWL TAGGING PROJECT

A five-year monitoring project is in progress on the ducks and geese in the Rondebult Bird Sanctuary, Germiston Lake, and Vlakplaas area. For all sightings of tagged birds, the following information is required: date, locality, species, colour of tag, and number of tag (if visible). Please contact:

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