

THE GENUS *SAROTHRURA*
(AVES, RALLIDAE)

STUART KEITH, C. W. BENSON, AND M. P. STUART IRWIN

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FIG. 1. Males of *Sarothrura* species. Top row, left to right: *pulchra*, *elegans*, *rufa*, *lugens*, *boehmi*. Bottom row, left to right: *affinis*, *insularis*, *ayresi*, *watersi*.



FIG. 2. Females of *Sarothrura* species. Top row, left to right: *pulchra*, *elegans*, *rufa*, *lugens*, *boehmi*. Bottom row, left to right: *affinis*, *insularis*, *ayresi*, *watersi*.

INTRODUCTION

THE PRESENT PAPER is an attempt to combine in one volume all that is known about the rails in the genus *Sarothrura*. Practically every known specimen has been examined by one of the authors, and six of the nine species have been studied in the field. Unfortunately, the authors have not studied the two species in Madagascar, nor have they seen the rare *Sarothrura ayresi* of Ethiopia.

As is the case with most rails, there is still very little known about the life history and behavior of *Sarothrura* spp., and our work has been mainly concerned with vocalizations. With the exception of the specimens in the American Museum of Natural History, the material was examined by Benson and Irwin, who jointly were able to examine the very large collections in Paris, Brussels, and Tervuren.

The sections on voice and behavior were written by Keith and the other sections were written by Benson and Irwin, but responsibility for the whole paper is accepted by all of the writers. Keith has seen the paper through to press.

The cutoff date for inclusion of published information in the present paper is December 31, 1968.

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Keith wishes to thank Mr. George Foley and Dr. Richard Zweifel of the Department of Herpetology, the American Museum of Natural History, for their assistance in operating the Sona-graph machine.

GENERAL REMARKS ON THE GENUS

INTRODUCTION

The genus *Sarothrura* is a rather distinctive, compact group of small Rallidae (rails), seven species of which are confined to Africa south of the Sahara and two to Madagascar. The vernacular names are Flufftail (from the fluffy, decomposed tail), Pygmy Rail, and Pygmy Crane. As stated by Peters (1934, p. 194) the type species of the genus is *S. lineata*, which is a synonym for *S. affinis*. *Sarothrura ayresi* was originally placed in the genus *Coturnicops*, once considered to have representative species in the Nearctic, Neotropical, and eastern Palearctic regions as well. This arrangement was further reinforced by Peters (1934, p. 194). Vaurie (1965, p. 352), however, placed both the Palearctic and Nearctic species, *C. exquisita* (Swinhoe) and *C. noveboracensis* (Gmelin), in the genus *Porzana*, although de Schauensee (1966, pp. 80, 81) retained *Coturnicops* for the single Neotropical species, *C. notata* (Gould). But on morphological and zoogeographical grounds, the allocation of *ayresi* to *Sarothrura* seems to be more correct.

Verheyen (1957, pp. 24, 25) put the Rallidae into five subfamilies: the Rallinae, the Sarothrurinae, the Himantornithinae, the Porphyriinae, and the Fulicinae, placing *Coturnicops* in the Rallinae, in which *Porzana* is also grouped. No mention is made of *ayresi*, however. Such a subdivision seems quite logical, especially as it includes the Sarothrurinae which, as a group, seem to have no particularly close relatives,

TABLE 1
SYSTEMATIC LIST OF SPECIES AND SUBSPECIES IN THE
GENUS *Sarothrura*

Species	Subspecies
<i>S. pulchra</i>	<i>S. p. pulchra</i> <i>S. p. zenkeri</i> <i>S. p. batesi</i> <i>S. p. centralis</i>
<i>S. elegans</i>	<i>S. e. elegans</i> <i>S. e. reichenovi</i>
<i>S. rufa</i>	<i>S. r. rufa</i> <i>S. r. elizabethae</i> <i>S. r. bonapartii</i>
<i>S. lugens</i>	<i>S. l. lugens</i> <i>S. l. lynesii</i>
<i>S. boehmi</i>	—
<i>S. affinis</i>	<i>S. a. affinis</i> <i>S. a. antonii^a</i>
<i>S. insularis</i>	—
<i>S. ayresi</i>	—
<i>S. watersi</i>	—

^a Probably further divisible eventually.

although they may be an offshoot of the generically diverse Rallinae. In the latter subfamily there is a rather striking resemblance between both sexes of Forbes's Chestnut Rail, *Rallidula forbesi* (Sharpe), of New Guinea and the male of *S. pulchra*, but this might be due to the effect of superficial convergence.

Verheyen (1957, p. 24) recommended a detailed anatomical examination of the genus. This might be fruitful but is outside the scope of the present paper which is confined to a study of the external characters of each species.

In table 1 we list the species and subspecies that we recognize. The systematic arrangement is discussed on pp. 70–72.

DESCRIPTION

PLUMAGE: The upper sides of both sexes of each species, which vary more strikingly and significantly than do the undersides, are illustrated in figures 1 and 2, in color. In the case of those species (*pulchra*, *elegans*, and *rufa*) in which there is some subspecific variation in color on the upper side, specimens of the nominate subspecies have been used. The illustrations should convey a better idea of the characteristic pattern of each species than any written description. But it must be emphasized that there is considerable individual variation. An extreme

example of this is to be seen in the color plate in Mackworth-Praed and Grant (1937), which shows the females of *S. lugens* and *S. lynesii*. We regard these two as conspecific, differing only in size, but not in color, as might be inferred from this plate.

Sexual dimorphism is strongly marked, except in *S. ayresi*, in which it is relatively slight (*ayresi* has a further peculiarity; in both sexes the secondaries are mainly white). There is no appreciable difference in measurements between the sexes, but differences in color are striking. The male is black with a pattern of white streaks or spots and a chestnut head. The female lacks chestnut on the head, and is dark brown; each species has a characteristic white or buffy spotted pattern. The only exceptions are: the female of *pulchra* is chestnut on the head, and has a barred rather than spotted patterning; in *ayresi* the female closely resembles the male, whereas in *watersi* black is replaced by dark brown dappled with black in the male, the patterning being otherwise vestigial and confined to the female. In both sexes of *rufa*, *lugens*, and *boehmi* the tail is predominantly black, but in the other species it is partially or wholly chestnut.

MOLT: Stresemann and Stresemann (1966, pp. 152–153) found that *Sarothrura* is one of the rallid genera in which the primaries are molted alternately rather than simultaneously, basing their conclusion on material of *pulchra* and *insularis* in the American Museum of Natural History, New York, and the Zoologisches Museum, Berlin. Thus it would appear that in *Sarothrura* the power of flight is never lost. According to R. K. Brooke (personal commun.), a male of *rufa* from Morogoro, Tanzania, July 5, 1957, in the Zoologisches Museum Alexander Koenig, Bonn, has the two outermost primaries old, the third growing, the remainder fresh. This suggests that in *rufa*, too, the molt is alternate, not simultaneous. Stresemann and Stresemann (personal commun.) did not examine any of the *Sarothrura* material in the British Museum (Natural History). Benson, did, however, and his findings are shown in the Appendix to the present paper. These give indication of an alternate molt in *pulchra*, *elegans*, and *rufa*. Unfortunately, no specimen of *ayresi* showed any sign of molt. As Stresemann and Stresemann (personal commun.) have pointed out, molting information would be of particular interest in this species, originally placed in the genus

Coturnicops (see p. 7), for they suspected that in that genus the primaries are molted simultaneously. Irwin has examined the material in the National Museum of Rhodesia, Bulawayo. His findings, included in the Appendix, indicate no evidence of a simultaneous molt. Stress is laid on the difficulty in detecting worn primaries, which are much less obvious than they are in more actively flying groups.

SOFT PARTS: Descriptions of the soft parts of the African species have been published by various authors, notably Chapin (1939, pp. 16–24) and McLachlan and Liversidge (1957, pp. 108, 109). The iris seems to be invariably brown; the bill brown or gray (mainly blue, upper parts dusky, in *S. rufa*); and the feet brown or gray (dusky pink in *ayresi*, according to McLachlan and Liversidge). Not every collector records the colors of soft parts on the labels of his specimens. However, examination of the material of *rufa* in the British Museum (Natural History) suggests that the color of the bill may be blue tinged with gray, or sometimes just gray. Thus in a male from Bitye, Cameroun, it is recorded by G. L. Bates as “black above, bluish grey below,” and in one from Natal by J. Vincent as “upper mandible black, lower grey.” As to the feet of *ayresi*, T. Ayres did indeed record the tarsi and feet of the female syntype as “dusky pink.” On the other hand, S. R. Clarke recorded the legs of another South African female in London as “dark brown with a greenish tinge,” whereas an Ethiopian male had feet “flesh,” another “purple flesh.” As to the two Malagasy species, *S. insularis* and *watersi*, of 29 specimens of the former and seven of the latter in London, the only information is from one female of *insularis*, which had the upper mandible black, the lower slate, and the feet slate.

For the purposes of this paper, such variations of the soft parts as may exist are not of great significance. At the same time, we emphasize that their recording is very subjective and we will not refer to this matter again except to mention that the downy chicks of *rufa*, *lugens*, *boehmi*, and possibly *pulchra*, have been noted to have pale markings on the bill, which may serve to emphasize signal movements employed in obtaining food from adults (Boyd and Alley, 1948, p. 107).

Sarothrura pulchra has a very long tarsus (see table 2), almost as long as the middle toe. The contrast with its nearest relative, *elegans*, is

TABLE 2
AVERAGE MEASUREMENTS (IN MILLIMETERS) FOR
VARIOUS SPECIES AND SUBSPECIES OF *Sarothrura*^a

Species or Subspecies	Wing	Culmen	Tarsus	Middle Toe
<i>S. p. pulchra</i> and <i>centralis</i>	84	16	29	32
<i>S. p. zenkeri</i> and <i>batesi</i>	74	15	27	28
<i>S. e. elegans</i>	88	16	24	28
<i>S. e. reichenovi</i>	87	15	24	27
<i>S. r. rufa</i> and <i>elizabethae</i>	76	14	21	28
<i>S. r. bonapartii</i>	69	13	19	26
<i>S. l. lugens</i>	78	14	21	26
<i>S. l. lynesii</i>	72	13	18	24
<i>S. boehmi</i>	85	14	19	21
<i>S. a. affinis</i>	72	13	16	22
<i>S. a. antonii</i> (Rhodesia and Malawi)	82	13	18	24
<i>S. insularis</i>	72	13	19	28
<i>S. ayresi</i>	76	13	18	26
<i>S. watersi</i>	72	16	22	32

^aCompiled from the figures in tables 7, 10, 13, 16, 18, 22, 26, 28, and 30. Here the figures are approximations, not exact means, nonetheless of value for comparative purposes.

rather striking. The tarsus is conceivably an adaptation to the wetter terrain frequented by *pulchra*. The middle toe measurement for *boehmi* is much less than that in its nearest relatives, *rufa* and *lugens*. *Sarothrura boehmi* inhabits drier, harder ground than do *rufa* and *lugens*, and may, therefore, have less need for long toes to support its weight. This is discussed in detail in the section on systematics. *Sarothrura boehmi* is also the longest-winged of these three. There is evidence that at least in southern Africa it is migratory. On the other hand, *rufa* and *lugens* may be sedentary everywhere. The possible significance of the long culmen, tarsus, and middle toe of *watersi*, particularly in comparison with the other Malagasy species, *insularis* and its nearest apparent relative, *ayresi*, is not clear. The intra-specific variations are discussed later in the present paper.

EGGS: The eggs of *S. pulchra*, *elegans*, *rufa*, *boehmi*, *affinis* and *insularis* are white, as are presumably those of the other three species. This seems to be another well-marked peculiarity of the genus, compared with most other rallid genera. In these six species, the nest is well domed over to hide the conspicuous eggs, al-

though in *rufa*, doming is only slight. Breeding may be indefinite near the equator, where there is no clear-cut demarcation of seasons. But from southern Africa there is adequate evidence that egg-laying is predominantly within the period of the rains (November to April). On the other hand, the slender evidence for *S. insularis* of Malagasy, where the seasons are the same as in southern Africa, indicates that it breeds before the rains, although there is also a record of eggs of *elegans* from southern Mozambique from as early as September 6. There is evidence (see sections on Breeding in the Species Accounts) that, despite the strong sexual color dimorphism, in *pulchra*, *elegans*, *rufa*, *boehmi*, and *affinis* both sexes incubate the eggs. To date, there is no record of which sex incubates in the case of the other four species, although presumably both sexes do so.

CHICKS: The chicks of all the species are probably clothed in black downy filoplumes; black seems to be almost invariably the color in the Rallidae as a whole (Boyd and Alley, 1948, pp. 589–592). Only the immature stage of *S. watersi* is completely unknown. In the other species the color of the plumage is a uniform near black, except in *pulchra*, in which it is a dingy brown with some patterning. The patterned adult dress is evidently attained fairly rapidly. Thus Liversidge (1968) has given us an account of the development of a chick of *rufa*, quoted on pp. 45–46. According to that account, the first adult-like striped feathers start to appear at the age of only six weeks. Further evidence of this rapid development is the small number of immature specimens and chicks found in the collections (see table 3). It seems that the feet develop more rapidly than do the wings, suggesting that running is more important in early life than is flying, as, indeed, is to be expected (see measurements of certain immature specimens of *pulchra* in table 6, and of one each of *affinis* and *ayresi* on pp. 61 and 66–67).

HABITAT: *Sarothrura pulchra* and *S. elegans* inhabit forests and thickets, whereas the other species inhabit swamps or grasslands. *Sarothrura elegans* occurs in relatively dry habitats, but *pulchra* is normally found near water. *Sarothrura boehmi* and *ayresi* occupy temporarily shallowly inundated grasslands for breeding, and their ranges seem mutually exclusive; that of *ayresi* is fragmented (South Africa and Ethiopia). In at least one locality, for example, Ngitwa, in north-

TABLE 3
FREQUENCY OF SPECIMENS OF VARIOUS SPECIES OF
Sarothrura IN COLLECTIONS

Species	Males	Females	Immatures and Chicks	Total
<i>pulchra</i>	445	135	19	599
<i>elegans</i>	80	38	4	122
<i>rufa</i>	336	176	13	525
<i>lugens</i>	31	23	5	59
<i>boehmi</i>	35	15	7	57
<i>affinis</i>	27	18	2	47
<i>insularis</i>	73	33	1	107
<i>ayresi</i>	15	13	1	29
<i>watersi</i>	7	7	0	14
Totals	1049	458	52	1559

eastern Zambia (Benson, 1956, p. 597), *rufa*, *lugens*, and *boehmi* occur together, the former two in much lusher growth; elsewhere *rufa* is known even from papyrus swamp. Whether there is any difference in habitat between *rufa* and *lugens* is still uncertain. *Sarothrura affinis* inhabits relatively dry grasslands and, except in the extreme south of its range, is strictly montane. *Sarothrura insularis* of Malagasy is another dry grassland dweller. Little is known about the second Malagasy species, *watersi*, but it is said to prefer a wetter habitat than that of *insularis*.

Unfortunately, few collectors have recorded the stomach contents of their specimens. But small seeds, insect fragments, small snails, and grit, too, have been recorded.

MOVEMENTS: As with many other of the Rallidae, individuals of *Sarothrura* appear at lighted buildings at night. This does not necessarily indicate any regular movement, but perhaps rather the feeble powers of flight, resulting in an individual's being blown by wind away from its normal habitat and subsequently being attracted to a light. Nevertheless, there is fairly convincing evidence from dated specimens that at least in southern Africa the long-winged *boehmi* is migratory, only present during the rains. It may be significant that its habitat in this region is liable to become completely desiccated in the long dry season, even to be burnt over. There is also the possibility that *ayresi* in Ethiopia is migratory, but this requires further study. *Sarothrura elegans* is sometimes believed to be a migrant (see, for example, Moreau, 1966, p. 244), although we are not convinced that

there is any long-distance movement. It is of interest that *elegans* is known on the islands of Fernando Poo, Zanzibar, and Pemba. Excluding Malagasy, the only other species known on any island is *rufa*, which is also found on Zanzibar and Pemba.

VOICE AND BEHAVIOR: Unfortunately, voice is the only aspect of behavior which yields detailed information, as all the species are secretive. Normally all that is seen of a *Sarothrura* in life is one unexpectedly flushed, dropping down after flying a few yards never to rise again. Nevertheless, *rufa* and *boehmi* are well known in Malawi, at least by voice, and have the onomatopoeic name of *nduindui* (Benson, 1953, p. 108). Bocage (1877, p. 482) quoted Anchieta as calling them by the onomatopoeic name of *xitingue-tingue* for *Corethrura dimidiata* (= *S. rufa*) at Caconda, Angola. Benson has personal knowledge that until he left Malawi in 1952, *Sarothrura* spp. were frequently snared and eaten by children. In Zambia, Benson tasted two female *boehmi*, and rated their edibility as high. (Benson has tasted many species of birds in edibility tests for H. B. Cott.) *Sarothrura insularis* is evidently well known by voice in Malagasy, for Rand (1936, p. 360) gave several onomatopoeic names. No doubt there are many more in Africa.

The extremely secretive nature of the *Sarothrura* rails has in the past made identification of their calls very difficult. Consequently there are few first-hand accounts of their voices in the literature, and until recently there was published information on the voices of only four (*pulchra*, *elegans*, *rufa*, and *insularis*) of the nine species. In recent years Benson aided by his collector, Jali Makawa, was able to track down and identify the calls of *lugens* and *affinis*. For the calls of *ayresi* and *watersi*, which have not been seen by any of the authors, there is still no information available.

Lack of information and confusion about rail calls is not confined to Africa. Even in the United States, where the majority of the birds are well known, the repertoire of all the rail species has never been thoroughly documented, and there is still debate over the authorship of certain calls. In Africa almost nothing is known about the calls of *Porzana* spp. and even in the better known genera, such as *Crex*, *Gallinula*, and *Porphyrio*, the voices are imperfectly understood. In fact the voices of the Sarothrurinae are now

probably about as well known as those of any other rail group.

One of the most thorough documentations of *Sarothrura* calls is that of Pakenham (1943), a paper which deserves special mention here. Pakenham gave first-hand accounts of the calls of *elegans* and *rufa*. Other field work has been done by Benson, Chapin, Beatty, Astley Maberly, Heinrich and others, all of which will be referred to under the individual species.

The advent of the transistorized tape-recorder has made the identification of bird calls, particularly those of such secretive groups as the rails, a good deal easier. Keith met Benson in 1964, after having had two years' experience tape-recording birds in East Africa. At the time Benson had a paper in press (Benson and Holliday, 1964), in which he remarked that "it would be especially valuable if tape-recordings could be made of the very attractive calls of all the *Sarothrura* spp." We then agreed to go into the field together in Zambia and record as many *Sarothrura* voices as possible. With the help of Jali Makawa, Keith was able to record the voices of *pulchra*, *rufa*, *lugens*, *boehmi*, and *affinis*. Keith had already recorded *elegans* in Kenya, so six of the nine species of *Sarothrura* now have their voices on tape. Sonograms of these calls appear in figures 3-6. These sonograms were made on the Sona-graph housed in the Department of Herpetology at the American Museum of Natural History.

The method of recording and identifying *Sarothrura* voices used by Keith and Makawa was as follows: first Benson and Makawa (or Makawa alone) would lead Keith to the places where they had collected the various species or heard them calling. Makawa would then imitate the voice of the particular species known to be at a certain locality, and in nearly every place he visited he managed to elicit a reply from the rail (Astley Maberly, 1935b, was similarly able to get a response from *S. elegans* by imitating its song, also to entice it into view). Keith would record the voice of the rail, then play back the recording. The playback would produce a spirited response from the rail as it heard a presumed rival calling in its territory, which enabled Keith to get further recordings. He continued playing back and recording until he believed he had the full repertoire of the calling bird.

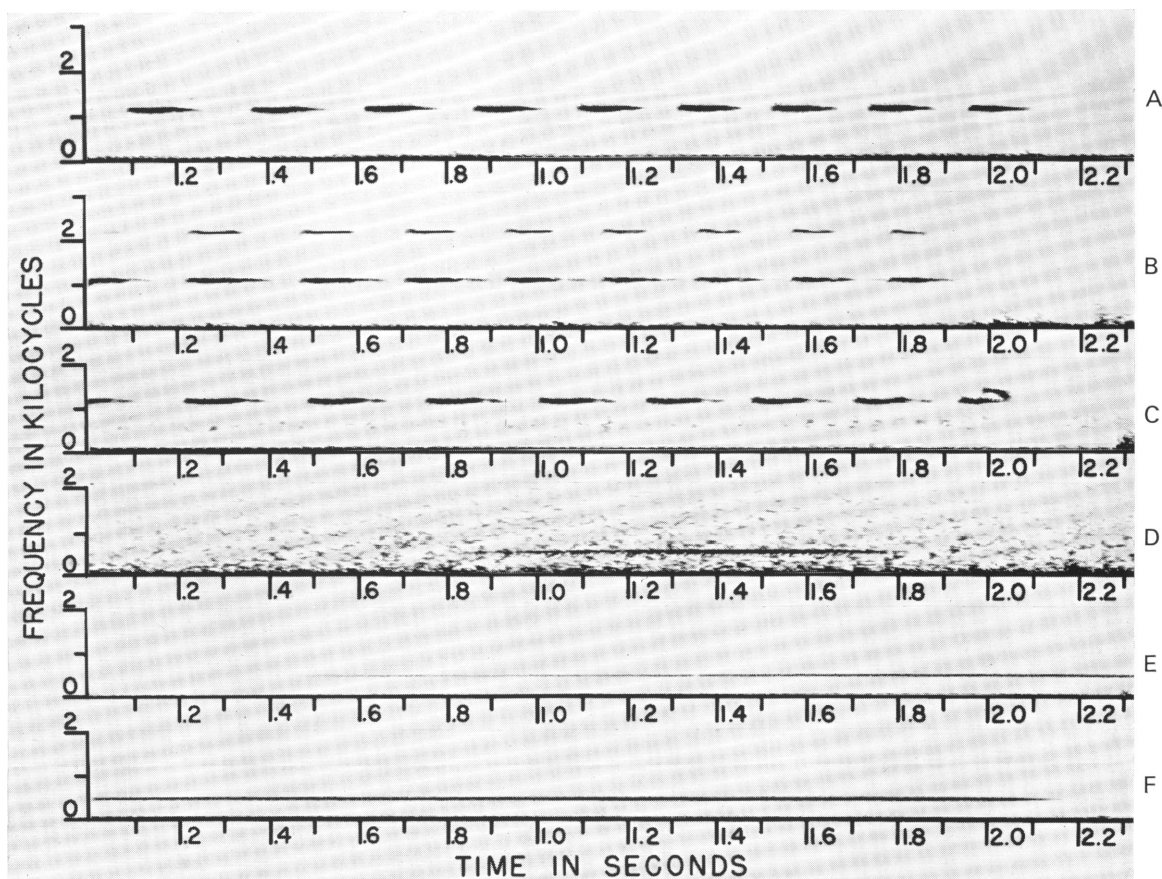


FIG. 3. Sonograms of songs of *Sarothrura* species. A, B, C. *pulchra*. D. *affinis*. E, F. *elegans*.

Identification of the calling birds had already been made by Benson and Makawa on previous trips on the basis of collected specimens flushed while calling, and Keith attempted to confirm identification by playing back the song and inducing the rail to come into view. He was able to confirm the songs of *pulchra* and *affinis* in this way, although it required a great deal of patience. The birds were shy and would venture into sight only briefly before sneaking behind vegetation. Both were enticed to within 8 feet of the observer, but were still hard to see, their presence being at times ascertained only by slight movements in the grass and leaves. The other species were similarly enticed to within 6 or 8 feet of the observer, but could not be seen even at this range because of the nature of their habitat. *Sarothrura lugens* lives in long, thick grass, *rufa* in long grass and cattails, and *boehmi* in shorter grass. In all cases there was no open

ground nearby into which the birds might have been persuaded to come. *Sarothrura affinis*, on the other hand, was recorded on the short grass of the Nyika Plateau in Zambia, and could be seen scurrying from one clump to another. *Sarothrura pulchra* was recorded in a strip of moist riparian forest at Salujinga, northern Zambia; it came nicely into view walking over the dead leaves on the forest floor. Zambian recordings were made in the following months: *pulchra* in November, 1964; *rufa* in November and December, 1964; *lugens* and *affinis* in December, 1964; *boehmi* in December, 1964 and January, 1965.

Identification of the other tape-recordings was made by Benson and Makawa on the basis of their own experience. Keith did not see the specimen of *elegans* he recorded in Kenya, but he has caught specimens in nets in the vicinity of similar calls, and the recording has been confirmed to be that of *elegans* by several people who

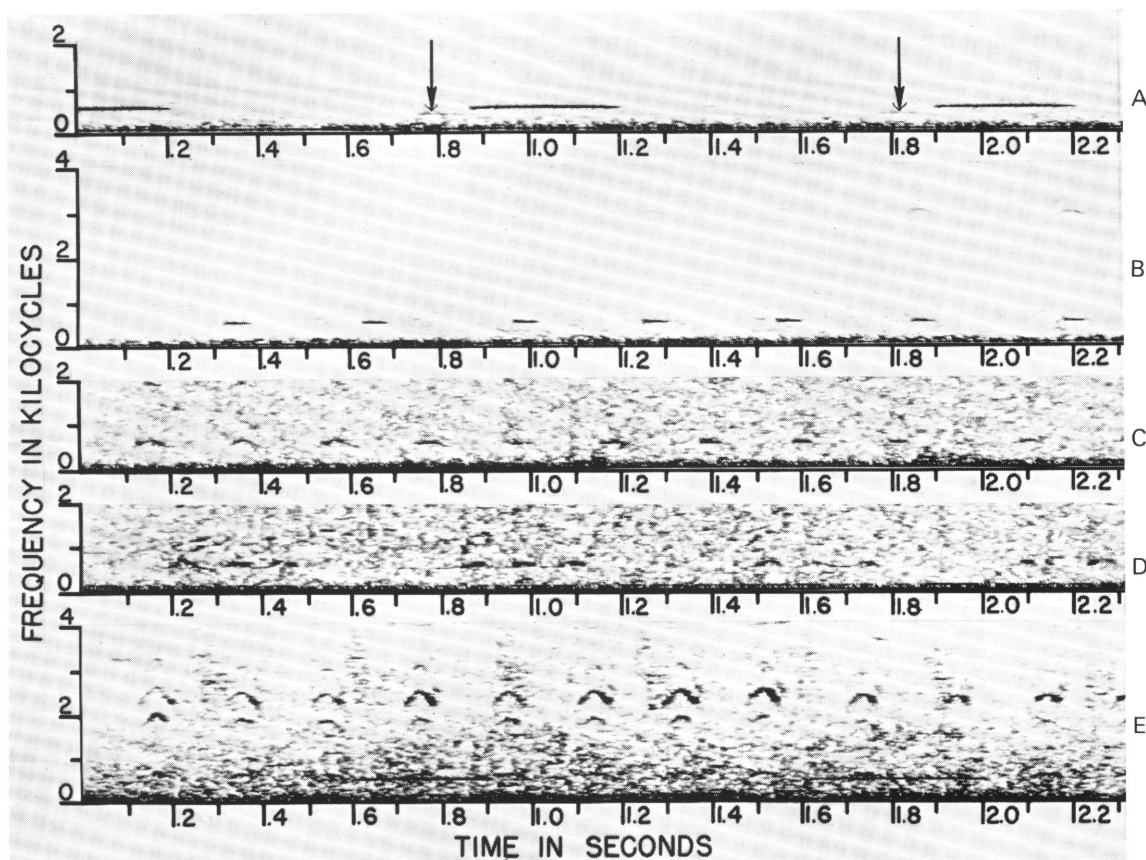


FIG. 4. Sonograms of songs of *Sarothrura boehmi*.

know the bird. It also conforms to all the written descriptions of the call.

We would like to suggest to future workers that they use this method of recording and playback of the song. Keith recently witnessed the effectiveness of this method when it was used on the Black Rail, *Laterallus jamaicensis* (Gmelin), by Joseph A. Hagar in Maryland, May, 1967. This species is a notorious skulker, almost impossible to flush, but by recording and playing back the song, Hagar was able to induce the bird to come out of a marsh and onto the road as it searched for the author of the song. Keith had earlier tried this method on another skulker, the Yellow Rail, *Coturnicops noveboracensis* (Gmelin), but without success (Keith, 1967). However, the habitat was very thick, and Hagar has told Keith that this method will work on yellow rails as well. For this system to be successful it is necessary to have some open area, such as a road or a patch of bare ground, onto which the

rail can be persuaded to come, otherwise the bird may come to within 6 feet of the observer and still remain invisible.

Once the call has been tied down to a particular species, there remains the further, even more difficult, problem of discovering which calls are made by the male and which, if any, by the female. There is some evidence that females join the males in calling. Pakenham (1943, p. 174) stated, "I have noticed on occasions when two individuals are together the voice of one is pitched in a higher key than the other's—a sexual difference?" He was here discussing the calls of *S. rufa*. Keith recorded two individuals of *lugens* calling simultaneously (fig. 5C) and judged the two birds to be not more than 6 feet apart. One or the other of these birds had been responding to playbacks of the recorded call for some time, and it seems reasonable to assume that these were two birds of a pair attempting to warn off an invader, rather than two rival

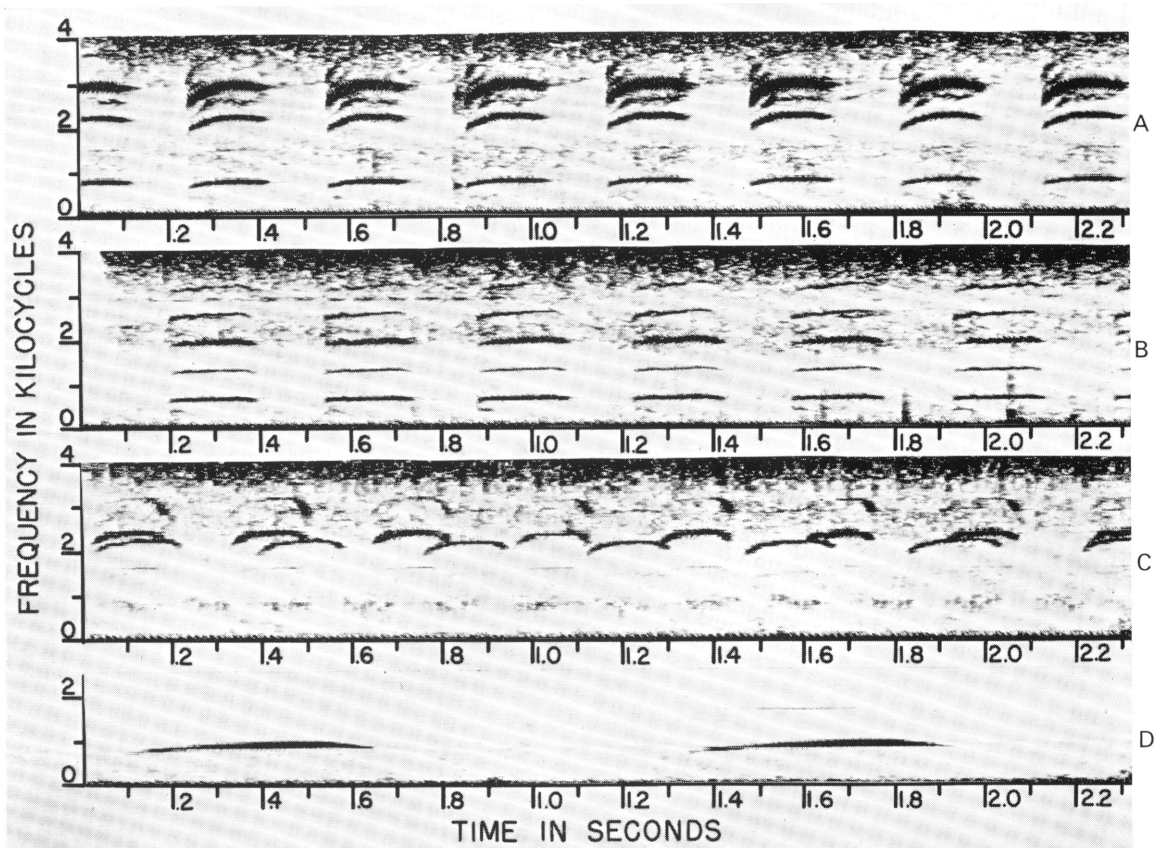


FIG. 5. Sonograms of songs of *Sarothrura* species. A, B, *C. lugens*. D. *rufa*.

males calling at each other across a territorial boundary. It will be seen from the sonogram that one of the voices is pitched slightly higher than the other, and this was quite audible in the field. It should further be noted that these birds were singing independently, one, in fact, singing slightly faster than the other, so that their notes did not coincide. This cannot, therefore, be properly described as a duet, which implies a formal, correlated vocalization, such as is given by another African Rail, *Limnocorax flavirostra* (Swainson).

Further evidence was supplied as recently as August, 1967, at the annual meeting of the American Ornithologists' Union in Toronto, Canada, where an interesting paper on captive rails in an experimental pen in Minnesota was given by Gerald Kaufmann. Kaufmann has kindly allowed his unpublished findings to be included here. He had two pairs of Virginia Rails, *Rallus limicola* Vieillot, in the pen, and

they soon staked out territories. The males called at each other across the territorial boundary, and were often joined by the females, so that four birds were sometimes calling together. The call of the female is identical to that of the male, except that it is on a slightly higher pitch.

Diamond and Terborgh (1968, p. 65) have shown that duetting takes place between the male and female of the Rufous-tailed Moorhen, *Amaurornis olivacea* (Meyen), in New Guinea. The two calls are identical and overlapping, but, unlike the cases above, the calls of male and female are on the same pitch. The duet between male and female is the commonest vocalization in this species.

These findings make it seem more likely that Pakenham and Keith did hear calling pairs of *rufa* and *lugens*. If this is so, assessment of rail populations based on numbers of calling birds becomes more difficult, especially as, at times,

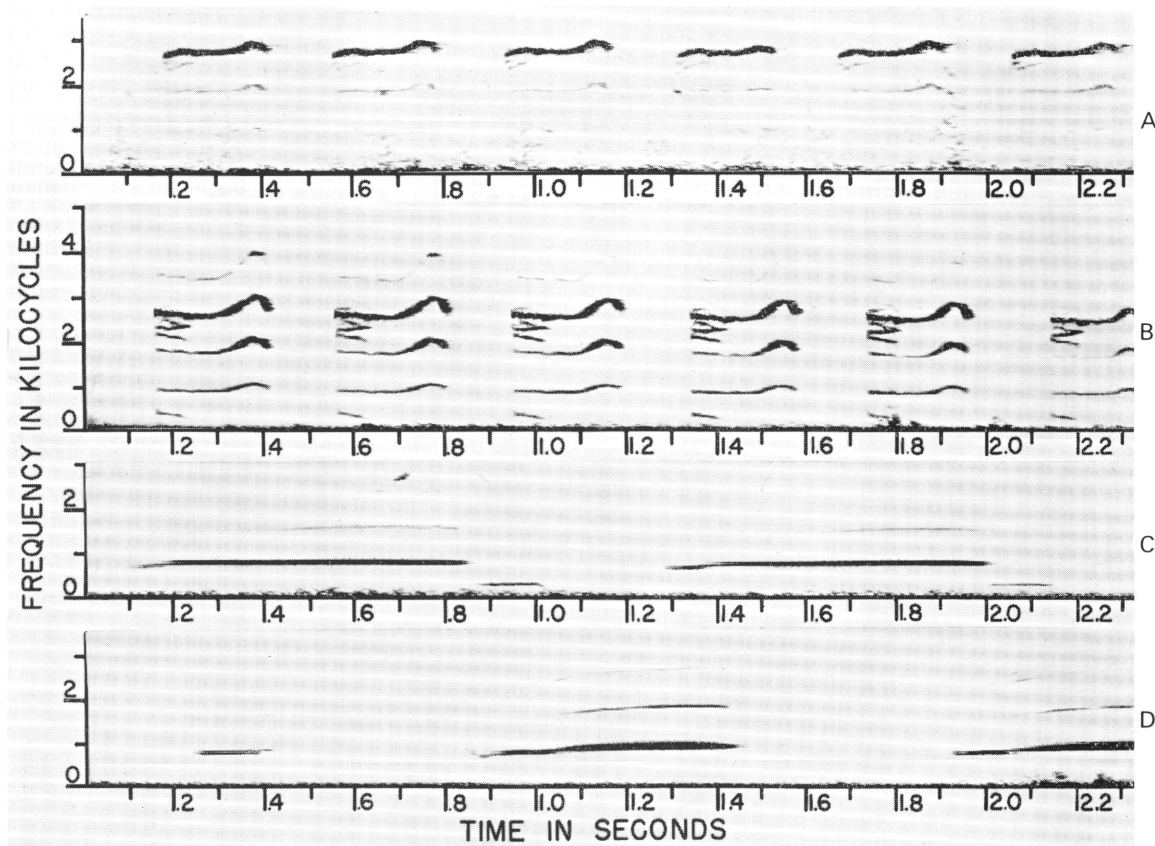


FIG. 6. Sonograms of songs of *Sarothrura rufa*.

males will doubtless call without females.

Not very much has been recorded in the literature about calls from other female rallids. Howard (1940) noted a few calls from female *Gallinula chloropus* (Linné), but these, from what can be ascertained from his accounts, did not seem to be territorial. Gullion (1952), on the other hand, studying the American Coot, *Fulica americana* Gmelin, heard a wide variety of calls in similar situations, and females joined in the territorial calls. Gullion did not make any comments on the pitch of male or female calls. Coots and gallinules, however, do not have anything that can really be described as a song comparable with the songs of the *Sarothrura* spp. and the smaller American rails.

We have attempted in most species to differentiate between "song" and "call(s)." This is somewhat arbitrary, as it is difficult to give a good definition of what constitutes a "song," as distinct from other vocalizations. In general, a

song may be considered to be a note, phrase, or phrases regularly, and often continuously, repeated in a definite sequence or pattern, whereas a call-note is a more random, casual utterance given at irregular intervals. In the case of the members of the genus *Sarothrura* with which we are familiar, this distinction is usually not hard to draw, as they all have distinctive notes which are uttered for long periods continuously, especially during the breeding season, and we think it reasonable to designate these as songs. All other notes, which in most cases are very different from songs, will be considered calls.

We have been amazed at the length of time these birds will keep singing continuously, often as much as 20 minutes or half an hour. Astley Maberly (1935a, p. 42) says of *Sarothrura elegans* in South Africa that, "they will remain motionless in one spot for hours at a time, calling at fairly regular intervals." Keith has similarly noted continuous singing of the territorial song

by *Laterallus jamaicensis* and *Coturnicops noveboracensis* in North America. These are both very small species, living in grassy marshes. The larger American rails are much less vocal.

As a general rule, rails, like most birds, sing in the early morning and late evening, but many sing at night, and others at any hour of the day. In North America, Keith (1967) found that *Coturnicops noveboracensis* sang much more frequently at night than during the day. *Laterallus jamaicensis* hardly ever, if at all, sings during the day, usually commencing about an hour after sunset. In general, North American rails prefer to sing or call at night, although some, such as *Porzana carolina* (Linné), are regular daytime callers.

It seems that singing by rails of the genus *Sarothrura* can be induced by imitation or playback of their song at any time of day, and daytime singing without these artificial stimuli has been noted for all species. Jali Makawa found that rainfall stimulates singing; the same was noted by Pakenham (1943) for *rufa*. *Sarothrura elegans* appears to prefer singing at night, according to most observers, and Keith's recording of *elegans* was in fact the only one made at night. However, Keith and others have also heard *elegans* singing during the day.

When grouping members of the genus according to voice, we find both similarities and differences. The tone and quality of the moaning song is similar in *rufa*, *lugens*, *boehmi*, and *affinis*, and it is possible that *insularis* belongs in this group, since a call (not song) described by Rand (1936, p. 360) sounds like a call made by *rufa* (see below). *Sarothrura elegans* has a long moaning song, too, but of a quite different quality, such that, if one knew only the songs of the above four and were then exposed to the song of *elegans*, one would not guess *elegans* to be a *Sarothrura*. *Sarothrura pulchra* has a completely different song from any of the others; it is faster and much higher pitched. When Keith first heard it he was convinced that he was listening to a small barbet (*Pogoniulus* sp.).

SUBSPECIATION

We exclude the two Malagasy species, *S. insularis* and *watersi*, in which no geographical variation has been detected. Comments on variation are derived from the statement of mean measurements in table 2.

Sarothrura pulchra: Four subspecies are recog-

nized. Variation in color is better marked in the female than in the male. The populations of extreme southeastern Nigeria, southern Cameroun, and Gabon (*S. p. zenkeri* and *batesi*) are markedly smaller in size than any other, possibly a reflection of Bergmann's Rule. Especially puzzling, however, is the sharp contrast with the population of northern Cameroun, as large sized as any, yet living little farther away from the equator and at no markedly higher altitude.

Sarothrura elegans: This wide-ranging species can be split into two subspecies. There is possibly a third subspecies in the northeast of the range, where material is almost non-existent. There is a single small specimen from Liberia.

Sarothrura rufa: There are three recognizable subspecies, based partly on not very well-defined variation in color, best marked in the female. As with *pulchra*, the populations of southeastern Nigeria, southern Cameroun, and Gabon are small in size (*S. r. bonapartii*), and there is also some tendency to smallness in Sierra Leone and eastern Tanzania. The species is unknown in northern Cameroun, but it possibly occurs there. If so, it would be interesting to ascertain whether there is a contrast in size with the southern Cameroun population, as in the case of *pulchra*.

Sarothrura boehmi: As is to be expected in this species, which is migratory at least in the southern part of its range, there is no evidence of any subspeciation.

Sarothrura lugens: *S. l. lynesii*, which has usually been regarded as a distinct species, is now regarded as conspecific, only differing in its over-all smaller measurements. Mackworth-Praed and Grant (1937) placed the African species in two groups, according to the length of the middle toe, *lugens* being long-toed, *lynesei* short-toed. Such a grouping can no longer be maintained. In Rhodesia the species is known by only a single female. It is possible that when further Rhodesian specimens become available it will be necessary to recognize a third subspecies. It is not clear why the more equatorial nominate *lugens* is larger than *lynesei*. This would appear to be a reversal of Bergmann's Rule. Indeed, the single specimen placed with *lynesei* from eastern Rhodesia at nearly 6000 feet must be from the coldest part of the range of the species. Yet it has a wing length of only 70 mm.

Sarothrura affinis: As is to be expected in this species, which except perhaps in the extreme south of its range is montane in distribution and therefore isolated, variation is well marked. We formally recognize only two subspecies, but probably it will eventually prove necessary to recognize at least two more. The figures in table 2 do not reveal the whole situation, detailed on pp.60–61. For example, smaller birds similar in size to the nominate subspecies, which is confined to South Africa, occur on Mt. Kenya and the Aberdare Mountains, but have had to be lumped for the time being with *antonii*. Larger birds also placed with *antonii* occur as near to these two localities as the Trans-Nzoia District. Variation has no doubt been accentuated by isolation, and Bergmann's Rule apparently does not apply.

Sarothrura ayresi: There are apparently two quite isolated populations in South Africa and the highlands of Ethiopia. They show no differences, but the South African material consists merely of three females.

WEIGHTS: A few weights are included in the species accounts for *S. pulchra*, *elegans*, *rufa*, and *affinis*. Such information is apparently completely non-existent for the other five species.

SPECIMEN REPRESENTATION

Use has been made of the data for each species to compare the relative frequency of specimens of the various species in collections, although it should be mentioned that *rufa* is represented by no fewer than 210 specimens from a single Congo locality, Butembo. The results are summarized in table 3.

In the immediately following comments, and in the absence of evidence to the contrary, it is assumed that the difficulties of collecting the various species are about equal (the easiest way to collect species is to snare them). It can be seen that much the largest representation of specimens is of *pulchra* and *rufa*. Although the area of Malagasy is relatively small, *insularis* is also well represented, contrasting strikingly with *watersi*, which may be a relict on its way to extinction. *Sarothrura ayresi*, with its two isolated populations, may be another relict. Possibly it has been ousted in the intervening area by *boehmi*. Another apparent relict is *affinis*, which has a broken, montane distribution under present climatic conditions. The forest or thicket-dwelling *pulchra* and *elegans* seem closely related. Yet the number of specimens of *elegans* is by far the smaller, despite its wider range. There

TABLE 4
MUSEUM OR INSTITUTION CONTAINING EXAMINED MATERIAL OF *Sarothrura*^a

City or Town	Name of Museum or Institution	Number of Specimens	Examined by	Remarks
Baton Rouge	Louisiana State University Museum	2	R. K. Brooke	—
Berlin	Zoologisches Museum	34	E. Stresemann S. Mauersberger	—
Bonn	Zoologisches Museum Alexander Koenig	9	H. E. Wolters R. K. Brooke	—
Brussels	Institut Royal des Sciences Naturelles	39	Benson and Irwin	—
Budapest	Hungarian National Museum	4	L. Horvath	All <i>ayresi</i> from Ethiopia; two from Hungarian Institute lent to Benson
Budapest	Hungarian Institute of Ornithology	2	L. Horvath A. Keve	
Bulawayo	National Museum of Rhodesia	79	Benson and Irwin	
Cambridge, England	University Museum of Zoology	10	Benson and Irwin	—
Cambridge, Massachusetts	Museum of Comparative Zoology, Harvard University	57	R. A. Paynter	—
Cape Town	South Africa Museum	5	J. M. Winterbottom	—
Chicago	Field Museum of Natural History	180	M. A. Traylor	1 <i>elegans</i> lent to Benson and Irwin
Copenhagen	Universitets Zoologiske Museum	6	F. Salomonsen	—
Dresden	Staatliches Museum für Tierkunde	4	S. Eck	—

TABLE 4 (Continued)

City or Town	Name of Museum or Institution	Number of Specimens	Examined by	Remarks
Durban	Durban Museum and Art Gallery	12	P. A. Clancey	—
East London	East London Museum	9	C. D. Quickelberge	—
Exeter	Royal Albert Museum and Art Gallery	1	C. A. Howes	1 <i>pulchra</i> lent to Benson and Irwin
Frankfurt	Natur-Museum und Forschungs-Institut Senckenberg	6	J. Steinbacher	—
King William's Town	Kaffrarian Museum	8	C. J. Skead	3 each of <i>elegans</i> and <i>affinis</i> lent to Benson and Irwin
Kitale, Kenya	Stoneham Museum	6	Benson	2 <i>affinis</i> lent to Benson
Liverpool	City of Liverpool Museums	1	R. Wagstaffe	1 <i>watersi</i> lent to Benson
Livingstone	National Museum of Zambia	4	Benson	—
London	British Museum (Natural History)	294	Benson and Irwin	—
Los Angeles	Los Angeles County Museum of Natural History	17	H. Friedmann	1 <i>elegans</i> lent to Benson and Irwin
Nairobi	National Museum of Kenya	30	Benson	—
New Haven	Peabody Museum of Natural History	18	Eleanor H. Stickney	—
New York	American Museum of Natural History	136	Keith	1 <i>elegans</i> and 1 <i>lugens</i> lent to Benson
Paris	Muséum National d'Histoire Naturelle	55	Benson and Irwin	—
Pietermaritzburg	Natal Museum	6	Benson	—
Pittsburgh	Carnegie Museum	30	K. C. Parkes	15 <i>pulchra</i> and 11 <i>rufa</i> lent to Benson and Irwin
Pretoria	Transvaal Museum	45	O. P. M. Prozesky R. K. Brooke	1 <i>rufa</i> lent to Benson and Irwin
Tervuren	Musée Royal de l'Afrique Centrale	539	Benson and Irwin	7 <i>pulchra</i> and 39 <i>lugens</i> lent to Benson and Irwin
Toronto	Royal Ontario Museum	1	R. C. Long	—
Vienna	Naturhistorisches Museum	5	K. M. Bauer	3 <i>rufa</i> , 2 <i>affinis</i> lent to Benson
Washington	United States National Museum	16	S. Dillon Ripley R. L. Zusi	1 <i>elegans</i> lent to Benson
Total		1670		

^a In addition, note has been taken of the type of *S. affinis antonii*, which was in the Hungarian National Museum, Budapest but which is no longer in existence; of the type of *S. modesta*, in the Musée d'Histoire Naturelle in Chaux-de-Fonds, Switzerland, considered a synonym of *S. l. lugens*; and of a specimen of *S. elegans* from Fernando Poo, in Madrid. All three specimens are discussed under the relevant species. It would also seem that there are two specimens of *rufa* in Lisbon (Bocage, 1877, p. 482).

is certainly some difference in habitat between the two. But it may be that there is some overlap marginally, and that *pulchra* is the more successful. No habitat-difference has been established between the marsh-dwelling *rufa* and *lugens*. *Lugens* is not so wide-ranging a species, but the difference by no means accounts for the fact that the number of specimens is little more than one-tenth that of *rufa*. Benson and Irwin (1966) pointed out that there are 35 specimens of *rufa*

from Malawi, but none of *lugens*. Yet there is every reason to suppose that it also occurs there. On the other hand, from Kasaji, in the southwestern Congo, there are 39 specimens of *lugens*, as against only 31 of *rufa*—all in Tervuren. It would seem that *lugens* is generally in unsuccessful competition with *rufa*, but survives well at least at Kasaji. *Sarothrura boehmi* is another wide-ranging species, but poorly represented in collections. Its habitats may be rather unstable.

Thus failure of the rains, and consequent failure of the required inundations of its breeding habitat, might in certain years be disastrous locally.

It can also be seen that the preponderance of males to females is considerable; the ratio in the case of *pulchra* is more than three to one. There is no reason to suppose that there is any actual disproportion in the numbers of the sexes. Snaring should accordingly result in the collection of the sexes equally, but we have no statistics on this point. The explanation may be

that the collector armed with a gun is more likely to have his attention drawn to males by reason of their striking songs. The paucity of immature specimens and chicks has already been discussed.

LOCATION OF SPECIMENS: Table 4 provides information on the present locus of specimens. The locus is indicated by the city or town in which is situated the museum or institution housing the specimens. Table 4 also gives data on the numbers of specimens, the name of the examiner, and appropriate remarks.

SPECIES ACCOUNTS

EACH SPECIES is treated under a standardized format of headings, several of which require some preliminary explanation.

SYNONYMY: Care has been taken to include every name proposed originally at either specific or subspecific level, even those not now recognized as valid.

DISTRIBUTION (AND MAP): Each distribution is accompanied by a map. These maps are based on simplified copies, made available by Mrs. B. P. Hall, and are derived from the vegetation map of Africa (Keay, 1959). Localities at which one or more specimens have been collected are shown as solid black circles. In a few cases records based not on any specimen, but on an otherwise reasonably certain identification, are shown by an open circle. There is a gazetteer of localities but only those localities specifically mentioned in the text of the paper as a whole are included. Thus a locality shown on one or more of the maps is only included in the gazetteer if it is also mentioned somewhere in the text.

It has been impossible to plot the locus of some specimens on a map in the absence of a precise definition. A century ago it was an all-too-common practice merely to label a specimen "South Africa", "West Africa," or "Madagascar." It has also been impossible to plot a number of specimens of *S. pulchra* from the Congo, now in Tervuren, because the name of the locality could not be traced.

BREEDING: All measurements of eggs are in millimeters, unless otherwise indicated.

SYSTEMATICS: Measurements in full, that is, of wing, culmen, tarsus and middle toe, have been taken by Benson or Irwin only. The only material personally examined by one of them for which this full complement of measurements was not taken was the very large series of *S. pulchra* and *rufa* in Tervuren and Brussels, time permitting the measuring of wings only. In some cases it will be found that the number of measurements does not tally. Thus in the case of three females of *S. pulchra* from southeastern Nigeria (table 7), only two culmen measurements are given because the culmen of one specimen was broken and could not be measured. Keith has measured the wing of every specimen in New York, and we are indebted to various other persons, whose names are included in

table 4, for wing measurements of *pulchra* and *rufa*.

Wing lengths are of the wing flattened; culmen lengths are from the base of the skull. The method of measurement of the tarsus and middle toe (with claw) needs special explanation, for the figures presented in some instances show considerable divergence from those in Mackworth-Praed and Grant (1937) or Chapin (1939), for instance. It must be emphasized that in the dried museum specimens tarsus and toe measurements are much more difficult to take accurately than those of wing and culmen. In particular there is the difficulty that a toe, in many cases, is bent and invariably brittle, so the same strict accuracy is not claimed for these two measurements as for the other two. A case in point may be the long tarsi of two males of *S. affinis* from the Kat River, South Africa, now housed in Brussels, compared with those of other South African specimens. These measurements have been taken in the manner illustrated in figure 7.

MATERIAL: Specimens are divided into those "personally examined" and "others." The former category includes all those examined by one or another of the present authors; the latter are those so kindly reported on by some other person, as detailed in table 4. We believe that to indicate the whereabouts of the specimens in existence which we have been able to trace will be of value to those who may follow us in a study of this genus. Doubtless there are some untraced, particularly mounted ones. Nevertheless, the coverage is reasonably complete. Some species are poorly represented in any collection. A statement of the number of specimens for each species has been provided in table 3. This table shows that material of *pulchra* and *rufa* greatly predominates. These two species are represented by a combined total of more than 1100 specimens out of fewer than 1600 for the genus. On the other hand, *ayresi* and *watersi* are each represented by fewer than 30 specimens. The exact grand total according to this statement is 1559, whereas according to table 4 it is as much as 1670. The explanation for the difference is that in the case of a few museums the information provided, referring mostly to *pulchra* and *rufa*, did not extend to separation of the sexes. Thus the information could only be em-

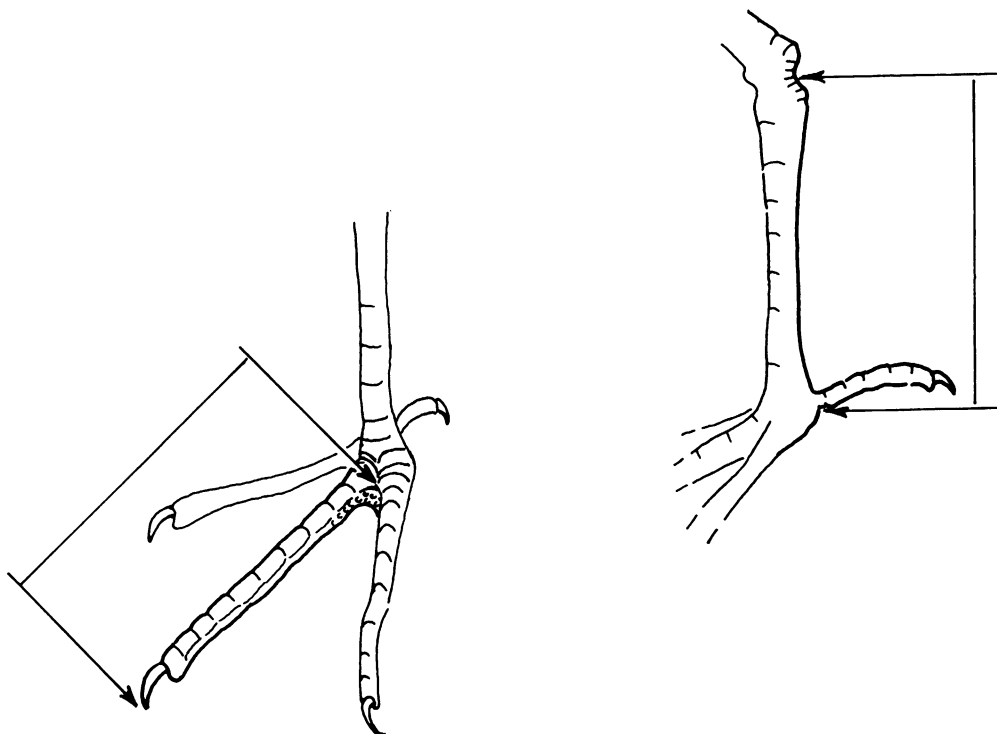


FIG. 7. Diagrams to illustrate method used in measuring tarsus and middle toe with claw, in the genus *Sarothrura*.

bodied in table 4, and not under the "Material" heading for each species, or in table 3.

Immature specimens are those still retaining at least a part of the typical immature dress, and chicks are those still mainly clothed in black, downy filoplumes.

Table 5 contains a statement of names assignable to the genus *Sarothrura*. A full supporting reference for each such name will be found in the relevant species account which follows in this section. The further information in table 5 in regard to location (or apparent non-existence now) of original type material should be a convenience, even though some information can be found in the species accounts.

Sarothrura pulchra

Crex pulchra J. E. GRAY, 1829, p. 410. (No locality but fixed as Sierra Leone by Bannerman, 1921, p. 114.)

SYNONYMY: *Rallus cinnamomeus* LESSON, 1840, p. 99. (Casamance, southern Senegal.)

Sarothrura pulchra tibiensis BANNERMAN, 1922, p. 43. (Ribao, northwestern Cameroun.)

Both these names appear to be synonymous with that of the nominate subspecies.

DISTRIBUTION: Extreme northwestern Zambia (Salujinga), northern Angola (north of *ca.* latitude 10° S.), Congo, except in the southeast, northwestern Tanzania (Bukoba), Uganda, western Kenya (Kaimosi and Kakamega), southern Sudan (Benengai), Central African Republic (Haut Kemo), ex-French Congo, Gabon, Cameroun, westward to Gambia and the Casamance River, southern Senegal.

The most northerly specimen examined from Nigeria is from Jagindi, on the Bauchi Plateau. But Fry (1965, p. 73) gave what is evidently a sight record from Samaru Lake, near Zaria, and mentioned that the remains of a *Sarothrura* sp. were found in a dead *Python sebae* even from as far north as Kano. Fry's records are discussed below.

HABITAT: This species and *elegans* are the only two in the genus which inhabit forest and thickets rather than swamps or grasslands, the essential difference between them being that *pulchra* normally occurs near water, *elegans* in

TABLE 5

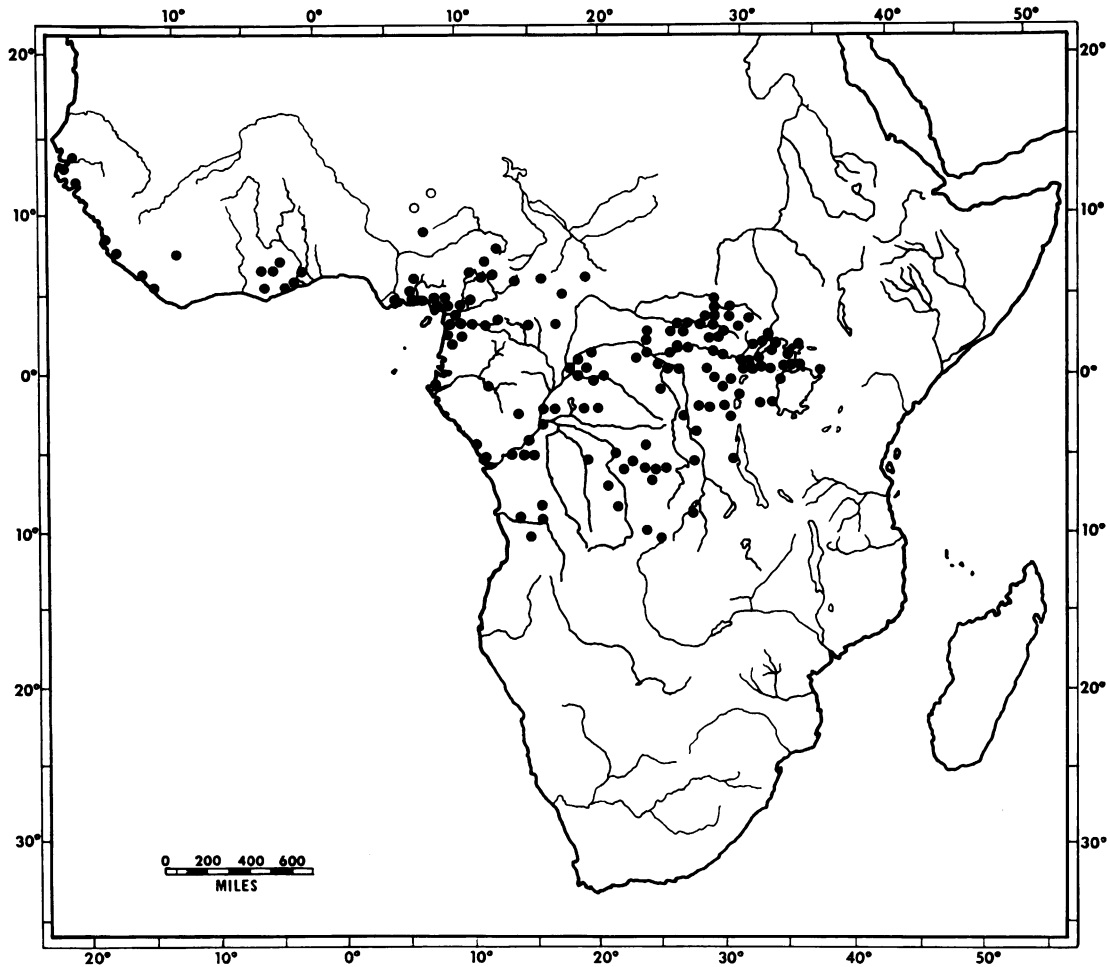
ALPHABETICAL LIST OF NAMES ASSIGNABLE TO THE GENUS *Sarothrura*, WITH NOTES ON TYPE MATERIAL

Name	Species to which Assignable	Location of Material Used in Original Description	Remarks
<i>affinis</i>	<i>affinis</i>	^a	—
<i>ansorgei</i> ^b	<i>rufa</i>	New York	Type and syntype
<i>antonii</i>	<i>affinis</i>	see pp. 60–61.	—
<i>ayresi</i> ^b	<i>ayresi</i>	London	Second syntype not traced
<i>batesi</i> ^b	<i>pulchra</i>	London	—
<i>boehmi</i>	<i>boehmi</i>	Berlin	See Chapin, 1939, p. 16
<i>bonapartii</i> ^b	<i>rufa</i>	Paris	—
<i>buryi</i> ^b	<i>elegans</i>	London	—
<i>centralis</i> ^b	<i>pulchra</i>	New York	—
<i>cinnamomea</i>	<i>pulchra</i>	^a	—
<i>danei</i> ^b	<i>boehmi</i>	London	—
<i>dimidiata</i>	<i>rufa</i>	^a	—
<i>elegans</i>	<i>elegans</i>	^a	—
<i>elizabethae</i> ^b	<i>rufa</i>	New York	—
<i>insularis</i> ^b	<i>insularis</i>	London	—
<i>jardinei</i>	<i>rufa</i>	^a	—
<i>jardini</i>	<i>affinis</i>	^a	—
<i>languens</i>	<i>elegans</i>	Cambridge, Massachusetts	—
<i>lineata</i> ^b	<i>affinis</i>	Cambridge, England	—
<i>loringi</i>	<i>elegans</i>	Washington	—
<i>lugens</i>	<i>lugens</i>	Berlin	See Mackworth-Praed and Grant, 1937, p. 626; Chapin, 1939, p. 17
<i>lynesi</i> ^b	<i>lugens</i>	London	—
<i>macmillani</i> ^b	<i>ayresi</i>	London	—
<i>modesta</i>	<i>lugens</i>	Chaux-de-Fonds	—
<i>pulchra</i> ^b	<i>pulchra</i>	London	—
<i>reichenovi</i>	<i>elegans</i>	Berlin	—
<i>rufa</i>	<i>rufa</i>	^a	—
<i>ruficollis</i> ^b	<i>rufa</i>	London	—
<i>somereni</i> ^b	<i>boehmi</i>	London	—
<i>tibatiensis</i> ^b	<i>pulchra</i>	London	—
<i>watersi</i> ^b	<i>watersi</i>	London; Cambridge, England	3 syntypes
<i>zenkeri</i>	<i>pulchra</i>	Berlin	Mislaid, not seen since 1950

^a Not traced; perhaps no longer in existence.^b Personally examined by one or another of the authors.

drier situations. Further details can be found under *elegans*, although Benson can bear this out from his admittedly limited experience of *pulchra*, which he found at Salujinga, northwestern Zambia, in a narrow strip of evergreen forest (not more than 100 yards wide) bordering a stream (see also Benson and Irwin, 1964, p. 107). On the other hand, elsewhere in Zambia he has found *elegans* in drier cover away from streams (see references under Habitat for that species). In neighboring Angola, too, according to Heinrich (Ripley and Heinrich, 1966, p. 2), *pulchra* prefers the neighborhood of small streams, although it is also found far from water.

Some references to the habitat of *pulchra* are quoted under *elegans* in comparing the habitat differences between the two species, but others may be given here. Holman (1947, p. 632) found *pulchra* common in swamp forests in Ghana. Bannerman (1931, p. 22) quoted Büttikofer who wrote that it occurs in Liberia in low swampy forests, likewise Hutson in Nigeria who said it occurs in streams in thicker *kurimis* where the sunlight rarely penetrates. Serle (1950 p. 353) collected specimens at Kumba, southeastern Nigeria, in forest near water. He collected (1957, p. 390) a long series at Enugu, southern Nigeria, where he found it abundant

FIG. 8. Distribution of *Sarothrura pulchra*.

Key: ●, collected specimen; ○, sight record.

and widespread, inhabiting forest or shrubby growth, occasionally thick herbage, always near water. Serle also found it very common in the swamp forests of the Niger delta, but absent from mangrove forest. The same author (1965, p. 67) also reported it as widespread and common in the forests of Victoria, Kumba, and Mamfe, and occurring up to at least 5500 feet in the Bamenda highlands. Chapin (1939, p. 25) stated that it inhabits the wooded banks of brooks and swamps, and in the northeastern Uelle he even found it in papyrus. The latter is recorded below as a habitat for *S. rufa*, but is perhaps not generally typical for either species. Cave and Macdonald (1950, p. 377) found one drinking at a pool in forest at Benengai, southern

Sudan, and Cave and Macdonald (1955, p. 121) gave the habitat as "swampy localities in depth of forest." From Ubangi-Shari (Central African Republic) Blancou (1938, p. 647) described it as gallery forest. Good (1952, p. 76) contrasted the habitat of *S. p. zenkeri* and *batesi* with that of *S. p. tibatiensis* in Cameroun. But probably the species is confined everywhere in that territory to dense cover. It occurs as far west as Gambia, as there is an immature specimen in London labeled "Gambia," collected by Rendall. It might be questioned whether there is any typical habitat in that territory. But Moreau (personal commun.), who is acquainted with Gambia, stated that there is apparently suitable fringing forest along the Gambia River itself.

Rallus cinnamomeus (see above) was described from Casamance, and presumably there is also suitable habitat along the river of that name, even slightly farther west than the Gambia River. Recently Archer (personal commun.) collected nine specimens (now in Los Angeles) in the Bugoma forest, western Uganda, of which four are recorded as being near forest streams, but three as about a quarter mile away from streams. Nevertheless it does seem that in general the species has an attachment to water, and it is specifically mentioned by several of the authors quoted above. The species seems to be absent from montane forest, although Serle (1965, p. 67, see above) reported its occurrence in the Bamenda highlands, and Chapin (1939, p. 25) found it in the eastern Congo up to 5300 feet. With regard to Fry's records from Nigeria (see above under Distribution) he (personal commun.) confirmed that the Zaria record is a sight one, but is sure that it is correct, as he had a good view of the bird. The habitat was low broken reeds, about a foot high, with many dead branches—the lakeside vegetation had been broken down and the shrubs felled. Consequently the habitat did not provide any shade, which is unusual for *pulchra*. He also wrote that the Kano specimen taken from a python consisted of a head and a few feathers. He is fairly confident, but not absolutely certain, that it too was a *pulchra*. Thus it appears possible that this species extends even into the relatively dry vegetation type 20 (Keay, 1959) in northern Nigeria. According to Elgood (personal commun.), there is some dense scrub in wet areas around Kano that could provide suitable habitat.

FOOD: From examination of the contents of seven stomachs, Chapin (1939, p. 25) found that the greater part of the food consisted of insects, but small snails were found in three, small frog-bones in two, and earthworms in one. No seeds were noted (nor are they mentioned in any of the records which follow).

Serle (1950, p. 353) recorded the stomach contents of a female from Kumba as snail shells, insects, and gravel. Of 32 stomachs examined by him (1957, p. 390) from Enugu, all but one held insects, all but nine grit, and two held snail shells. Of four specimens in Nairobi from Uganda for which the stomach contents are recorded, two held quartz fragments, another held fragments of snail shells and vegetable

matter, and another insects. Of the nine specimens recently collected by Archer in the Bugoma forest (see under Habitat), grit predominated in the stomach contents. There were also a few small whole snails and some insect remains. Benson and Irwin (1965b, p. 2) found that a male from Salujinga, Zambia, had been eating small black ants and beetles.

BREEDING: Chapin (1939, p. 25) found a nest at Faradje, northeastern Congo, on April 27. It was a small oval mound about 4 inches high by 9 inches long. It was covered with dead leaves, like those around it, and could be entered only through a horizontal slit kept closed by the weight of the roof until raised by the bird. The interior was made of dry plant stems and dry leaves. The female was snared at the nest with her two pure white eggs, measuring 30.3 by 21.9 mm. and 30.9 by 22.1 mm.

Chapin found a similar nest in the same locality on May 7. The incubating male was caught with the two eggs just about to hatch. From this evidence and that from dissections, Chapin concluded that the breeding season falls in the first half of the rains, with the qualification that near the equator there is probably no complete regularity. From Kamituga, eastern Congo, on November 5, Prigogine (1961, p. 253) recorded collecting a female at her nest with two white eggs, both measuring 30.0 by 21.5 mm.

Serle (1957, p. 390) collected two females at Enugu, southern Nigeria, on September 12, containing large yolked eggs, and two females, dated December 22, which had just finished laying. In southeastern Nigeria Serle (1965, p. 67) collected a female at Kumba on October 2 containing large yolked eggs, and an immature specimen at Fort Victoria on October 29 with wing length 61 mm. only (see also table 6). A female in Nairobi collected at Entebbe on April 18 held "soft eggs."

The measurements of some immature specimens are given in table 6. The first six of these specimens, including Serle's from Fort Victoria, seem virtually fully grown except for wing length, but each may have been hatched from an egg laid only about two months prior to the date of collecting. The period for the Kamituga specimen may not be more than three weeks, and the Imbele one appreciably less. The plumage of these six and of some other young birds, fully grown and not so easy to assess for age, is described under Systematics.

TABLE 6
MEASUREMENTS (IN MILLIMETERS) OF IMMATURE SPECIMENS OF *S. pulchra*

	Wing	Culmen	Tarsus	Middle Toe
♂, July 28, Entebbe (Zika forest), Uganda: in Nairobi	78	15.5	30	31.5
♀, May 11, Luluabourg, southwest Congo: in Bulawayo	77	16	30	30.5
♀, May 10, Entebbe (Zika forest), Uganda: in Nairobi	74	14	29	30
♀, Oct. 20, Bonthe, Sierra Leone: in London	64	14	30	29
♂, Oct. 29, Fort Victoria, southeast Nigeria: in London ^a	63	12.5	23	24.5
♂, April 15, Haut Kemo, Central African Rep.: in Paris	61	16	33	31.5
♂, Dec. 19, Kamituga, eastern Congo: in Tervuren	39	12	26	28
♂, Dec. 9, Imbele, ^b Congo: in Tervuren	25	7	14	7

^aThis is the specimen referred to on p. 24 of the text, as having a wing measuring 61 mm.

^bThis locality has not been traced, but is probably not far from the equator. For the guidance of a student who might wish to trace it, Herroelen collected it in 1952 (there is no more precise date). The museum registration number is 63,856.

Most of the foregoing information is from localities fairly near the equator, where, as already pointed out by Chapin (1939, p. 25), there may be no very definite season. However, in a locality such as Salujinga, northwestern Zambia, at the southern extremity of the range, breeding may be quite strictly seasonal, limited to the period of the rains (November to April) as with other *Sarothrura* spp. (Benson, Brooke, and Vernon, 1964, pp. 47–48). Unfortunately all that can be stated in support of this breeding period for *pulchra* is that Benson and Keith heard the song there in November, and Benson also in April, while Benson and Irwin (1965b, p. 2) recorded a male collected on November 18 with testes apparently starting to enlarge.

MOVEMENTS: Probably there is no movement anywhere. From near the southern extremity of the range, there are specimens from Salujinga for August, September, and November, and from Kasaji for June (one), September (one), November (four), and December (one). From certain other localities in the southwestern Congo (Luluabourg, Gandajika, Merode, Tshikapa, Kabinda, Katombi), specimens fall into months as follows: January, none; February, one; March, two; April, four; May, five; June, nine; July, 13; August, five; September, one; October, one; November, eight; December, seven. At Enugu, southern Nigeria, Serle (1957, p. 390) found *pulchra* to be common and sedentary. As is to be expected, the distribution of dated specimens by months from near the equator is throughout the year, as shown by the following data from Uganda and western Kenya: January, 13; February, 13; March, seven; April, nine; May, four; June, eight; July, eight;

August, seven; September, six; October, 11; November, seven; December, 14.

VOICE AND BEHAVIOR: The song of *pulchra* has been rendered in different ways by various authors. It is probably the best known of all the *Sarothrura* voices, and Chapin (1939, p. 25) commented that it is "probably the commonest species in collections because—I suspect—of its voice." He wrote that the bird has "a cheery call, not very loud, but repeated almost incessantly. The notes have something faintly bell-like—'goong-goong-goong-goong'." Holman, quoted in Bannerman (1931, p. 23) stated "The normal call is a succession of four or six clear mellow notes in monotone." Another rendering given by Bannerman (*loc. cit.*), "Hud-hud-hud," is less successful. Blancou (1938, p. 647) said that the local name for the bird in Ubangi-Shari (Central African Republic) based on its call, is "*Ouôn-ouôn*." In Angola, Heinrich (Ripley and Heinrich, 1966, p. 2) described the song as "a fairly low, slightly muffled whistling note, repeated about 6–7 times in a moderately fast sequence, sounding like 'u.u.u.u.u.u.'"

Heinrich (*loc. cit.*) wrote that this call is very similar to the call of the muscicapid, *Trochocercus nitens*. We cannot comment on this, because none of us is familiar with the song of *T. nitens*, but to Keith's ears, the song sounds very like that made by some small barbet such as *Pogoniulus bilineatus*, except that it has a rather more ringing and insistent quality. As can be seen from the sonograms, the song is much higher pitched than that of any other species, although the calls of some species reach these higher frequencies. There is a high overtone making the song sound high to the human ear;

this is only barely visible in Sonogram 3A, but is very apparent in Sonogram 3B. Occasionally the song ends in a falsetto note, as illustrated in Sonogram 3C. Interestingly enough, Keith has also heard *Pogoniulus bilineatus* make occasional falsetto notes during its typical four-note series, although it is usually the second or third notes which are falsetto, not the last.

In a continuous tape recording lasting 2 minutes, 23 seconds, made by Keith, a singing bird sang 31 times without pausing for more than the normal break between songs. This gives an average duration of song plus break of 4.6 seconds. The song lasts 2.75–3.0 seconds, just too long to be all fitted onto one sonogram. Breaks between songs last 1.5–2.0 seconds. On Keith's recordings there are normally 11 or 12 notes per song, occasionally 10; compare this with the shorter series mentioned by all authors quoted above. Possibly there are regional or individual differences.

Keith has not heard any utterance from *S. pulchra* other than the song, but various calls have been recorded. Chapin (1939, p. 25) recorded a shrill "kik-kik-kik . . ." which is "emitted rapidly, and more rail-like in quality [than the song]." This undoubtedly corresponds to the "tickticktickticktick" noted by Heinrich (Ripley and Heinrich, 1966, p. 2). Bannerman (1931, p. 23) quoted Holman as saying that "the birds will chatter enthusiastically among themselves. Another familiar call closely resembles laughter." Finally, Heinrich (*loc. cit.*) wrote that "the voice of the female is very different." He heard it once but failed to make notes. He did not state why he decided that particular call came from a female.

A number of observers have been fortunate enough to have seen *pulchra* at close quarters. Chapin (1939, p. 25) wrote, "If one sits quietly and patiently along a brook where the bird has been calling, it is fairly sure to reappear, walking along the bank or jumping from stone to stone." Heinrich (*loc. cit.*) described the bird as moving through the vegetation on the forest floor "with the adroitness of a mouse, not even a single stem trembling." Compare the mouselike movements described for *S. elegans* (p. 36). Good (1952, p. 76) saw a bird only 2 or 3 meters away "threading his way among the thick herbage, looking like a tiny chicken, but very shy, and ready to disappear at the slightest movement on my part."

Leslie Brown has allowed us to include the following observations on *S. pulchra* contained in a letter to Benson: "... a pair of *S. pulchra* walked right up to me on the edge of a drainage channel near a mangrove swamp on the Ikoyi Peninsula at Lagos, Nigeria. They came out of the bush to bathe in the ditch, moving with a very dainty step, the tail held high and jerked. Both washed themselves in the ditch. I remained there and though they took fright from time to time and bolted back into the bush I would soon see them skulking about on the edge working up courage to come out again and have another dip. They were continually making motions of the throat and head as if calling, but I could hear no sound, and thought they might have been producing a sound beyond the range of human hearing (my hearing is perfectly normal). . . What struck me as so extraordinary was that they should be so tame when I was in plain view only two or three yards from them."

Apparently the birds did not connect Brown with danger—perhaps he was standing very still—for their behavior indicates they were pretty wild. Keith had a similar experience in Bwamba Forest, Uganda, in July, 1963. He had just put up a line of mist nets in the forest, and was standing still by the nets observing birds in the nearby canopy, when he heard a faint rustling of leaves on the ground. Looking down he saw a male *S. pulchra* step gingerly out from the undergrowth and start to cross the open swath, about 3 feet wide, which had been cut for the nets. Keith stood very still about 8 feet away, and the bird did not seem to connect him with danger. The bird walked slowly up to the nets, which had not yet been fully anchored on the ground, ducked neatly underneath, and continued its slow and cautious progress across the swath and into the undergrowth on the other side. Keith did not see any of the quick, mouselike actions recorded by others, but this was probably because the bird remained undisturbed all the time it was in sight. The ground was dry, and it was at least 100 yards to the nearest stream or swampy area.

An interesting observation on some captive birds from the Cameroons (in an area now part of southeastern Nigeria) was made by Yealland (1952, p. 56). He wrote: "These delightful little birds soon became fairly tame; I used to put crumbled decayed palm fibre on the tray of their cage for the sake of their feet and immediately

TABLE 7
MEASUREMENTS IN FULL (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura pulchra*
(Averages are in parentheses.)

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
Portuguese Guinea to Ghana	1♂	80	18	29	31
	6♀	79-83 (81.2)	15.5-17 (16.1)	29-31 (29.9)	30-32 (31.1)
Southern Niger Basin, south of <i>ca.</i> 6.5° N., below 500 feet altitude	22♂	80-86 (83.2)	16-19 (17.1)	28-31 (29.9)	30-34 (32.2)
	12♀	82-90 (85.2)	16-18 (16.7)	27-30 (28.7)	30.5-33 (32.1)
Extreme southeastern Nigeria: Fort Victoria and Kumba north to Kupé	33♂	71-78 (74.2)	14-17 (15.1)	24-28 (26.2)	26-30 (27.9)
	3♀	75, 76, 82	15, 16,	25.5, 26, 27	27, 27.5, 28
Central Nigeria: Bauchi plateau at Jagindi	1♂	89	17.5	29	33
Northern Cameroun, <i>ca.</i> 4.5°-9° N.: Bafia north to Mbanti, Tibati, Meigangi, Galim, Genderu and Garua	8♂	82-92 (86.0)	17-20 (18.1)	29.5-32 (30.7)	31.36 (33.1)
	1♀	90	17.5	33	36
Southern Cameroun, south of <i>ca.</i> 4.5° N.: Mbanga east to Bitye and Yokadouma, south to Ebolowa and Efulan	8♂	70-83 (73.2)	15-16.5 (15.7)	25.5-28.5 (27.5)	27-28.5 (27.9)
	5♀	72-78 (75.4)	14.5-16 (15.0)	27-28 (27.6)	26.5-29 (27.5)
Coastal Cameroun: Edea	2♂	70, 79	15.5, 16	26.5, 27.5	27, 28.5
Central African Republic: Haut Kemo	2♂	77, 84	16.5, 17	30, 31	29, 32
	1♀	85	17	30	29
River Congo (including Cabinda) upstream from mouth to include (ex-Belgian) Congo north of equator	5♂	77-85 (82.4)	16-17 (16.6)	29.5-31 (30.3)	29-34 (31.2)
	2♀	83, 84	16, 18	28.5, 30.5	30.5, 32.5
Near Congo-Zambia border: Kasaji and Salujinga	7♂	80-87 (84.0)	16-19 (17.6)	28-32 (30.6)	30-32.5 (31.4)
	5♀	83-88 (85.4)	16.5-18 (17.5)	28.5-32 (30.1)	32-33 (32.6)
Northern Angola: Ndalla Tando	2♂	81, 82	16.5, 17	30, 30	29.5, 30.5
	1♀	82	15.5	29.5	32
Uganda	14♂	80-86 (82.8)	15-17 (16.1)	28-30.5 (29.5)	28-33 (31.0)
	8♀	82-87 (84.7)	15-17 (16.2)	28-31 (29.9)	30-32 (31.4)
Southern Sudan: Benengai	1♀	87	17	31	32

they carried some of it into a corner and made a little nest or platform with it. This performance went on every morning, and I wonder whether it is their habit to make roosting platforms in the wild state." We do not know of any other evidence for this sort of behavior in the genus.

SYSTEMATICS: Measurements on wing, culmen, tarsus, and middle toe are given in table 7. Wing lengths were also taken of 49 specimens from the Congo, in Tervuren, the exact localities for which could not be traced. The resultant figures are therefore not included in the table. Table 8 gives measurements of wing length only.

Wing lengths (in millimeters) in these two

series as a whole, regardless of sex (there is no material difference in the figures for males and females), are as follows: Those from Portuguese Guinea to Ghana give an over-all figure of 78-86, with rather larger birds in the Niger Basin (80-90), but smaller in extreme southeastern Nigeria (71, 78, one 82) and southern and coastal Cameroun (70-83). Northern Cameroun birds are strikingly larger (82-92) than those from southern Cameroun, and a single bird from Bauchi Plateau, central Nigeria, is also large (89). It is not possible to offer any explanation for this striking difference in so relatively small an area. It is true that, according to the vegeta-

TABLE 8
WING MEASUREMENTS (IN MILLIMETERS) OF
Sarothrura pulchra
(Averages are in parentheses)

Geographical Location	Material	Wing
Portuguese Guinea to Ghana ^a	9♂	78-85 (80.1)
	6♀	79-86 (81.8)
Niger Basin ^b	4♂	80, 81, 84, 84
	1♀	81
Northern Cameroun ^b	12♂	83-91 (86.2)
	1♀	—
Southern Cameroun ^b	31♂	72-81 (75.9)
	1♀	—
Gabon: Lastoursville	2♂	72-75
	1♀	—
Ex-French Congo: Djambala	6♂	81-87 (81.8)
Brazzaville and Pointe Noire	1♀	85
River Congo upstream ^b	95♂	76-87 (81.1)
	30♀	77-86 (81.7)
Southwestern Congo, south of lat. 4° S., between long. 20° and 25° E.	50♂	77-88 (81.9)
	15♀	78-86 (81.8)
Eastern Congo, between equator and 5° S., and 26° and 29° E.	14♂	76-85 (79.5)
	1♀	82
Northern Angola: Lunda Province and Duque de Braganza and Canzele	15♂	76-83 (78.9)
	1♀	79
Uganda	39♂	77-85 (80.8)
	22♀	77-87 (82.0)
Western Kenya: Kaimosi and Kakamega	13♂	80-86 (82.8)
	8♀	80-89 (84.7)

^aSpecimens from here include 3 males and 3 females collected by A. D. Forbes-Watson (personal commun.) at Mt. Nimba, Liberia, during 1967-1968; still at the Nimba Research Laboratory.

^bAs defined in table 7.

tion map of Africa (Keay, 1959), the southern Cameroun birds are from the equatorial forest zone, the northern from forest-savanna mosaic. But presumably in both zones, the birds are confined to dense cover near water, so that there can be no great contrast in temperature that might help explain the difference. Good (1952, p. 76) stated that *S. p. tibatiensis* (the subspecific name that he applied to the large northern birds) "is the form found in the savanna country, but there frequenting also wooded swamps." His second definition of the habitat was surely correct, but perhaps the first was not. In any case, if *tibatiensis* really does inhabit savanna, it might be expected to be a small, rather than large, form as it would be subject to

higher temperatures in this more open habitat than in dense cover. Nor is there any striking difference in general altitude between the southern and northern Cameroun localities, which might help explain the difference. All of the former are below 1000 meters. Of the latter, whereas Galim, Genderu, and Meiganga lie between the 1000- and 1500-meter contours, Bafia, Mbanti, and Tibati are only between 500 and 1000, and Garua is at less than 200 meters.

Two specimens from Gabon are small (72, 75), but six from former French Congo are larger (79-87), and three from the Central African Republic are intermediate (77, 84, 85). The very long series from the Congo River upstream including the Congo north of the equator is again intermediate (76-87). Another long series from the southwestern Congo is very similar (77-88), as is that from the eastern Congo (76-85). Material from still farther east and south, from the southern Sudan, Uganda, western Kenya, the Congo-Zambia border, and northern Angola, again shows no striking difference, although the Kenya and Congo-Zambia border figures are as high as 80-89 and 80-88 respectively, and the Angolan, on the other hand, are as low as 76-83.

As to color variation, there is very little in males, although specimens from extreme south-eastern Nigeria, Edea in coastal Cameroun, and Gabon, have the flanks and abdomen strongly tinged with chestnut, which is not evident in any other material. Also, the black tips of the white spotted feathers as a whole are replaced by buffy brown, tending to impinge on the spotting, and resulting in an altogether duller appearance. This latter character, but not the chestnut on the flanks and abdomen, is also evident in some 30 out of 150 males from scattered localities in the Congo, in Tervuren. They may not be fully adult, some of them being largely dingy brown below as in other obviously immature specimens. But there is no evidence that this applies to this material from farther west.

In females from Portuguese Guinea to the Niger Basin and northern Cameroun, the chestnut or buffy barring is relatively broad, on the upper side about half the width of the dark sepia bars, on the underside about equal to them. In southeastern Nigeria the general color becomes richer, and the black (instead of dark sepia) barring is much wider, the chestnut barring much narrower. The tail is also more

heavily barred with black. In southern Cameroun generally, the black markings are still more intense, but the chestnut barring is paler, more buffy, and even more narrow. Farther east, through the remainder of the range, the general color is rather less rich, but richer than females from the Niger Basin westward, and the black bars are still relatively broad, but chestnut ones are narrow.

Combining the variation in size (from wing lengths) and color, the following is a statement of the recognizable subspecies and their ranges:

Sarothrura pulchra pulchra: Range: Southern Senegal to the Niger Basin south of latitude 6° 30' N.; Jagindi, on the Bauchi Plateau, central Nigeria; and northern Cameroun east of longitude 11° E. and north of latitude 40° 30' N. Material from these latter three areas is larger than that from Ghana westward, northern Cameroun specimens being the largest of all. But there is so much overlap that recognition of *S. p. tibatiensis* cannot be justified. Bannerman (1931, p. 22) suggested that *S. p. cinnamomea* may have to be recognized for birds from Portuguese Guinea westward, because the females have a brighter chestnut head. But female material from this area is still very sparse, so that this still cannot be formally supported.

Sarothrura pulchra zenkeri NEUMANN (1908): The male has flanks and abdomen strongly tinged with chestnut; tips of white spotted feathers are buffy brown instead of black, tending to impinge on the white spots, resulting in a generally duller appearance. Females are altogether richer than in *S. p. pulchra*, with dark bars black rather than sepia, and chestnut bars more rufous in tone; chestnut bars on upper side are approximately one-third the width of the black bars, on the underside, about one-half; as compared with one-half and equal, respectively, in the nominate subspecies. The tail is more heavily barred with black, and the wing is smaller (71–82) as compared with 78–92 in the nominate. It has a restricted range in extreme southeastern Nigeria and coastal Cameroun, and apparently into Gabon, whence, however, only three males have been examined.

Sarothrura pulchra batesi Bannerman (1922): Despite the strictures of Mackworth-Praed and Grant (1937, p. 631) and Serle (1954, p. 52), this seems a valid subspecies. The male is similar to that of the nominate *pulchra*, the female like that of *zenkeri*, but the black barring is still more intense. The chestnut barring above is paler, more buffy in tone, and only about one-quarter the width of the intervening black areas. The chestnut of the head is somewhat paler. Another small form, with wing 70–83, it occurs in southern Cameroun south of ca. 4° 30' N., except in the coastal area. In size (and in color of the female) it contrasts strikingly with the northern Cameroun birds (wing 82–92).

Sarothrura pulchra centralis Neumann (1908): The male is like that of the nominate *pulchra* and *batesi*. The female is less richly colored than in *zenkeri* or *batesi*, but more so than in the nominate; the width of the barring is as much as it is in *zenkeri*. It averages larger than *zenkeri* or *batesi*, with wing 76–89, the difference most accentuated in western Kenya (80–89) and on the Congo-Zambia border (80–88). The range includes the ex-French Congo, the Central African Republic, the Congo (except the southeast), southern Sudan (Benengai), Uganda, western Kenya, northwestern Tanzania (Bukoba), northwestern Zambia (Salujinga) and northern Angola.

Eight immature specimens, not yet fully grown, have been detailed together with their measurements in table 6. Their plumage, including some comparisons with that of adults, may be described in the same order of decreasing size and age.

Males, Entebbe and Fort Victoria. Differ in having the abdomen dingy brown with darker brown barring instead of black, spotted with white. Chestnut of head duller. Remainder of upper side as in adults, but duller black, white spots on mantle with a rufous admixture, and wing coverts tipped with rufous. The Fort Victoria specimen retains some black down on the head.

Females, Luluabourg, Entebbe and Bonthe. Duller rufous on head than in adults, especially in the Bonthe specimen, and underside as a whole, duller.

Male, Haut Kemo. Crown dull chestnut, lores and sides of face blackish; nape, throat and chest dull buff. Mantle, scapulars, secondaries and wing coverts brownish black spotted with buff, not white, although on the bend of the wing there is some white spotting, and the secondary coverts are in the process of being replaced by adult-like white spotted feathers, still partially in sheath. The primaries and secondaries are also partly in sheath. Lower back mottled buff and brown with traces of black filoplumes, whereas the chestnut-buff tail is only partially developed, with some black filoplumes about 15 mm. long still present. Abdomen and flanks dingy brown with faint shadow-barring.

Male, Kamituga. Center of crown, nape, wings, and underside as a whole, dingy brown. Forehead and sides of head blackish; throat sooty brown with a contrasting black streak about 25 mm. long extending medially onto the center of the chest. Lower back and wing coverts mottled with blackish brown. Tail blackish, with some black filoplumes. Several buffish white spots present on secondary coverts.

Female, Imbele (locality not traced, see table 6). Still largely in initial down, consisting of black filoplumes, but in process of replacement on the wings and thighs by feathers still largely in sheath—dingy brown on the wings, pale buff on the thighs (where slightly more developed).

Other specimens still partially in immature plumage

have been examined, but the foregoing sample should suffice to illustrate the essential features. The last three above and the Fort Victoria specimen are the only ones available still retaining, to some extent, the juvenile down, consisting of black filoplumes similar to those in other species of which chicks have been examined. Two downy young in the American Museum of Natural History are blackish, with thighs and belly browner. The immature plumage differs markedly from that of the other species, so far as it is known, in that it is essentially a dingy brown with some pattern, whereas in these others it is an unpatterned near-black. Even the immature of *S. elegans*, considered the most nearly allied to *pulchra*, are a uniform dark sepia-brown. The extreme tip of the upper mandible is pale in the chicks in New York.

Weights are available for some material from Uganda, in Nairobi: five males, 39, 44, 45, 45, 45; two females 41, 43 grams. Archer has provided figures from specimens collected by him in Uganda, now in Los Angeles: four males, 46, 46, 49, 49; two males, three females (figures not separated by sexes), 44, 45, 46.5, 48, 49 grams. Forbes-Watson has sent us figures for five of the six specimens recently collected by him in Liberia, included with measurements of wing only in table 8. The weights are: three males, 47.9, 49, 50; two females 46, 47.9 grams. Also, a male and a female from extreme southeastern Nigeria of the small *Sarothrura pulchra zenkeri*, in Bonn, weighed 42 and 40 grams respectively.

MATERIAL: Most of the specimens whose measurements are given in full in table 7 are in London, with the following exceptions: some of those from Cameroun as a whole are in Pittsburgh; all from the Congo-Zambia border are in Tervuren and Bulawayo; most of those from Uganda are in Maunabo. Of those for which wings only were measured (table 8), by far the largest number are in Tervuren. They are almost entirely from the Congo and total some 100 males and 30 females. There are also 27 males and two females from national parks in the Congo now in Brussels. Other relatively extensive series are as follows: Chicago, 77 specimens, including 13 males from northern Cameroun, 22 males and five females from southern Cameroun; Cambridge, Massachusetts, 33 specimens, including five males from Kenya and Uganda; Paris, 16 specimens, including one male and three females from French Guinea, and two males from Gabon (Lastoursville); New York, 74 specimens, including 30 males and 15 females from the Congo, and 16 males and seven females from Kenya and Uganda (see table 9).

Sarothrura elegans

Gallinula elegans SMITH, 1839, pl. 22. (Durban, Natal.)

SYNONYMY: *Sarothrura buryi* OGILVIE-GRANT, 1908,

TABLE 9
SUMMARY OF EXAMINED SPECIMENS OF
Sarothrura pulchra

	Examined by Author(s)	Examined by Others	Totals
Male	322	123	445
Female	113	22	135
Immature	12	3	15
Chicks	4	—	4
Total	451	148	599

p. 93. (Dubar, Wagar Mts., Somalia.)

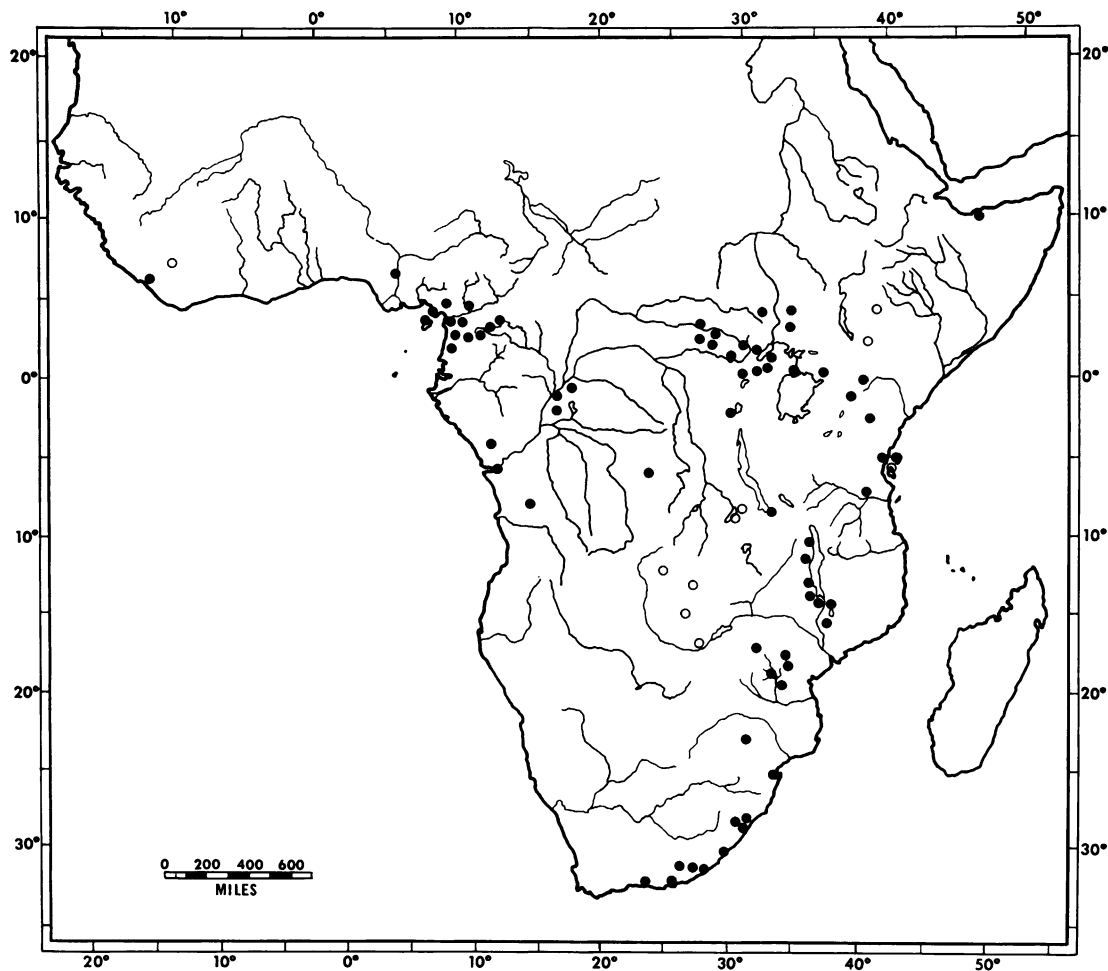
Sarothrura loringi MEARNs, 1915, p. 8. (Mt. Kenya.)

Sarothrura elegans languens FRIEDMANN, 1928, p. 68. (Bagilo, Uluguru Mts., Tanzania.)

All three of these names appear to be synonymous with that of the nominate subspecies.

DISTRIBUTION: Eastern Cape Province through Natal, eastern Transvaal, eastern Rhodesia, Zambia and Malawi to Kenya, Uganda and southern Sudan. Scattered records from northern Angola, Congo, Cameroun, and eastern Nigeria. One record each from northern Somalia (type of *S. buryi*) and Liberia. Also known from Pemba Island and Fernando Poo. Sound records from Zanzibar (Pakenham, 1945, p. 220), Mt. Marsabit, northern Kenya, October 29, 1962 (tape recording by Keith), and Mega, southern Ethiopia (Benson, 1947a, p. 49).

HABITAT: McLachlan and Liversidge (1957, p. 109) indicated that in South Africa *S. elegans* inhabits "forest and moist situations and old lands adjoining forest." Bray (1961, p. 259) gave a sound record from the Cape Province from cannas under the eaves of a building. At Pietermaritzburg, Natal, Cottrell (1949, p. 169) found a nest in dense cover by a deeply eroded stream which only ran freely in the rains. In the Transvaal, Astley Maberly (1935a, p. 39) found *S. elegans* inhabiting the densely wooded, well-watered foothills of the northern spurs of the Drakensberg Mountains near any thick bush close to water, although also several hundred yards from water. In Rhodesia, on Mt. Inyan-gani, Irwin (1955, p. 10) reported on a specimen collected in "thick wet forest." In mid-November, 1959, Irwin saw a pair only a few feet from him on the floor of *Piptadenia* forest in the Pungwe Valley, Rhodesia, at 2200 feet. Three others, all females, were flushed from the

FIG. 9. Distribution of *Sarothrura elegans*.

Key: ●, collected specimen; ○, sight record or sound recording.

tangled regrowth of cleared forest over a period of 10 days, so that the species must have been tolerably common in this locality. Benson (1953, p. 25) gave the habitat in Malawi as "rain-forest" and "dense scrub." In north-eastern Zambia he (1956, p. 598) heard it in dense thickets. For other Zambian sound records from a rather similar habitat, see Benson (1962, p. 634) and Benson and Irwin (1965a, p. 3). Pakenham (1943, p. 175) defined the habitat on Pemba Island as "bush-covered hillsides, so thickly grown with a heterogeneous conglomeration of trees, tall thickets, thorny creepers, weeds and whatnot as to be almost impenetrable"—in contrast with the habitat of *S. rufa*, which is swamps and wet meadows. In Tanzania, Moreau (Sclater and Moreau, 1933,

p. 425) collected one in herbage 3 feet high, about 1 mile from water. The type of *S. loringi* was collected in bamboo forest at 8500 feet on Mt. Kenya. Van Someren (1939, p. 33) gave the habitat from various localities in eastern Africa as "long grass away from water; swamp grass; river margin in grass; grass-land; grass near forest; on surface water . . ." Jackson and Sclater (1938, p. 301) stated that it "is found in the swampy parts of the Uganda forests," and defined the habitat of *S. Pulchra* in similar terms. But Tony Archer told us (personal commun.) that a male, which he collected in a mist-net at Mwela in the Bugoma Forest, Uganda, was in moist secondary forest undergrowth, about one-half mile from the nearest stream. Likewise, Forbes-Watson (personal

commun.), the collector of an immature female at Kakamega, Kenya (described below under Systematics) stated that this specimen was mist-netted in cut-over forest which was still a tangle of weeds and bushes with no trees. The site was on a ridge, 1000 yards from the nearest water. In southern Ethiopia, Benson (1947a, p. 49) heard the call in juniper woods. The only Somalia specimen was collected at the foot of the Wagar Mountains at 700 feet, around hot springs in desolate country (Archer and Godman, 1937, p. 334). Cave and Macdonald (1955, p. 21) and also Macdonald and Cave (1948, p. 242) stated that *S. elegans* frequents thick bush and grass in or near forest, usually where it is wet and swampy. Chapin (1939, p. 22) found that it lives on "high ground, away from water, seldom in virgin forest, and not in open grassy fields," preferring thickets on old cleared land. The experience of Bates (1927, p. 12) in Cameroun was rather similar. He found that *S. elegans* inhabits impenetrable tangles of vegetation on cultivated ground near villages. A rather similar definition was given by Good (1952, p. 77) from that territory. On the southeast side of Cameroun Mountain, southeastern Nigeria, Serle (1965, p. 67) heard it from sea level to 6000 feet, always where the high forest had been cleared. Beatty (*in* Rand, 1951, p. 579) stated that in Liberia *S. elegans* haunts dense thickets on high ground as frequently as it does the lush vegetation of marshlands. On Fernando Poo, Basilio (1963, p. 45) found that it frequents mainly old cultivation, and even found a nest in the center of a native village.

Some of the foregoing indications of the habitat, even though they might be correct for individual specimens, may be misleading. The habitat of *S. pulchra* is discussed under that species. It seems unlikely that the two species would occur together in the same habitat. The essential difference seems to be that *pulchra* is always near water, whereas *elegans* is often found away from water (see especially the accounts of Chapin [1939] and Bates [1927]; the latter directly compared the habitat of the two species). The lack of any difference in Uganda (Jackson and Sclater, 1938, p. 301) is open to question, whereas of the two types of habitat mentioned by Rand (1951, p. 579), quoting Beatty, the first would appear to be the true habitat, the second being that of *pulchra*. It is

also very doubtful if *elegans* is ever typically associated with grass, as might be inferred from van Someren (1939, p. 33). It would seem theoretically possible that, where *elegans* extends outside the range of *pulchra*, as in southeastern Africa, it might occupy relatively wet habitats as well as dry ones. But apart from a statement by Smith (1839), and referred to by Stark and Sclater (1906, p. 255), that it inhabits the margins of stagnant water, densely fringed with reeds or strong rushes, we do not know of any convincing evidence of any such association, and Smith's statement seems most misleading. Astley Maberly (1935b, p. 101) contrasted its forest habitat with that of *S. lineata* (= *affinis*) and *rufa*, which "appear to be more partial to swampy surroundings." Although Irwin (1955, p. 10) recorded it from "thick wet forest" in Rhodesia, actually *Macaranga* forest, he did not intend to convey any particular association with streams, as with *pulchra*, but merely association with wet evergreen forest. Benson corroborates that the same applies to the association of *elegans* with "rain-forest" in Malawi (Benson, 1953, p. 25).

FOOD: Sclater and Moreau (1933, p. 426) recorded the stomach contents of one specimen as tiny quartz pebbles and a little insect material. Chapin (1939, p. 23) examined six stomachs, finding insects most commonly, including termites and a small roach, presumably a cockroach. Small snails were noted in three, and tiny pebbles had also been swallowed, but seeds were noted only in one. Serle (1954, p. 52) recorded stomach contents of two specimens as snails, insects and grit. Those of an immature specimen of Los Angeles, described under Systematics, were insects only.

BREEDING: Chubb (1914, p. 35) has described a clutch of four eggs collected by A. D. Millar near Durban in November, 1910, as being pure white, without any markings, measuring 1.1–1.6 by 1.86–1.87 inches (27.5–29 by 47 mm.). The nest was in a tuft of grass on the ground, made of dry grasses and leaves, entirely covered, with a small entrance, resembling the nest of a rat. Had the bird not flown out of the nest it would have remained undiscovered, as it was entirely hidden in the tuft. Compared with further figures, the longer measurements of the eggs are certainly incorrect, and should presumably read 0.86–0.87 inch (22 mm.). *Sarothrura affinis* is unlikely to occur so low as

Durban, although *rufa* probably does. But there is no evidence that *rufa* ever roofs over its nest to the thorough extent to which this nest was roofed. There is also a clutch of five eggs in the Queen Victoria Museum, Salisbury, Rhodesia, taken by Millar on Salisbury Island, near Durban, March 11, 1919; and a C/4 fresh taken by P. Turner at Amanzimtoti, Natal, November 24, 1964. Both are claimed to be of *S. elegans*. In the case of the latter, the nest was in a thick clump of broad-leaved ferns, and the eggs measured 27.9–28.5 by 20.5–20.8 mm. Other evidence of breeding in Natal comes from a female in Pietermaritzburg, collected there by C. S. Holliday on February 12, 1953. It contained a soft egg about 14 mm. long. Also, Cottrell (1949, pp. 168–170) found a nest there on September 21, 1947, containing four white eggs, two of which measured 30 by 22 and 30.05 by 21 mm. The nest was a ball (i.e., evidently roofed) of grass, lined with rootlets. Cottrell had a good view of the male parent, and the record cannot be doubted. Further, Oatley and Pinnell (1968, p. 7) stated that two nests had been found at Winterskloof in October and December, and chicks were seen on several occasions, the last being October 11, 1967. They also mentioned that adults will attack the legs of humans if their chicks are approached. There is a male in London, collected at Durban in February, 1878, which has the label endorsed by one Gordge, "They breed in the month of February. Eggs large ovals, nearly as large as the bush dove's." To conclude this list of South African breeding records, all of which fall within the rains, there is one other for this period, Astley Maberly (1935b, p. 103) having seen a female with two tiny blackish chicks on December 12 in the northeastern Transvaal. Also, Bray (1961, p. 259) gave an undated record from the Cape Province. It is nevertheless of interest, because the nest is described as dome-shaped, and a bird leaving the nest was identified as a female.

Benson, Brooke, and Vernon (1964, pp. 47–48) gave no breeding record from Rhodesia, Zambia, or Malawi, although Brooke (1966, p. 435) gave one of a female trapped on eggs, September 6, 1913, in the Portuguese (Mozambique) section of the Vumba, close to the Rhodesian boundary. Compared with the data given by Benson and others (*loc. cit.*) for other species, this record is exceptionally early.

Chapin (1939, p. 23) caught a female on her nest containing three white eggs, one of which measured 26 by 20.2 mm., near Irumu, in the Ituri District, northeastern Congo, in late September, 1926. In contrast to observations from Natal, and disagreeing also with Bray (1961) this nest was not roofed. Nor is this mentioned by Bates (1927, p. 12) for two nests with eggs which he found at Bitye, Cameroun, in September and October, and at which a parent was caught. One clutch was of four eggs, the other of three; they are described as white, measuring in one set 26–27 by 20.5–21 mm., in the other 28 by 21–21.5 mm. Both clutches are in London. According to the record with the September one, which is a C/4, the bird (a male) was caught as it ran away from the nest in some grass behind a village. Apparently it was released, as it is not in the skin collection in London. The record for the October one (October 14, 1911) shows that the three eggs were almost ready to hatch. There is a male skin for this date, which is presumed to be one of the parents. Serle (1954, p. 52) recorded three chicks in black down from Kumba, southeastern Nigeria, June 5, 1951. On Fernando Poo, Basilio (1963, p. 46) found a nest with two white eggs measuring 26 by 19 mm. He did not give a date, although he heard the song in May, June, and July, which may be in the breeding season.

Van Someren (1939, p. 33) recorded males in breeding condition in Kenya in February, April, and May, but the two immature specimens collected at Kibale, Uganda, and Kakamega in December (see Systematics) may have been from eggs laid in September. Pakenham (1943, p. 176) thought that breeding might take place on Pemba Island in June–July, after the heavy rains, although direct evidence was lacking.

MOVEMENTS: The song appears to be seasonal, apparently mainly confined to the breeding season. Thus in the foothills of the northern Drakensburg, Astley Maberly (1935a, pp. 39–42) heard it only during the rains, and in the northeastern Transvaal Astley Maberly, (1961, p. 137) noted it as frequent from mid-September to the end of March, mostly in the rains. It would appear from the data in the preceding section that in South Africa this is the time of year when it breeds. Even near the equator, where there is much less contrast between the seasons, calling is heard only at certain times of the year (Chapin, 1939, p. 23). But it does not

follow that the birds have moved elsewhere during periods of silence. If there were any off-season movement, one of the most likely regions for this would be from South Africa, where the seasonal contrasts must be as great as anywhere in the range. Such specimens from the eastern Cape Province and Natal as are dated (there are only Astley Maberly's sound records from the Transvaal) fall into months as follows: January, one; February, six; March, one; April, four; May, three; June, two; July, seven; August, three; September, six; October, four; November, none; December, one. If we assume from the above that the breeding season is from September to March, there are a number of specimens from outside this period, including as many as seven for July, which suggests that there is no regular movement. Nevertheless, there may be some vagrancy, as suggested by Skead (1967, p. 63), who gave a record of one found in the long grass of a farm garden in the eastern Cape Province.

The following records also suggest the possibility of some movement. Bannerman (1935, p. 170) recorded catching a female in a house surrounded by 100 yards of cleared land at Ubijaja, Nigeria, April 2. Cave and Macdonald (1955, p. 121) mentioned collecting a specimen outside a house in savanna (such a habitat seems quite atypical) at Torit, in January. Both these specimens are in London; the latter is a male taken on January 27. There is also a female in Kitale from Kitgum, Uganda, October 31, 1923, the label of which is endorsed "killed in long grass . . . on skinning it was found to be very fat." The nature of the habitat and the fact that it was fat both suggest that it might have been a migrant. Furthermore, there is a record by Benson (1957, p. 88) of a female (now in Bulawayo) that killed itself against the lighted window of a house at the south end of Lake Tanganyika, where other undoubtedly migratory species have also been killed (it may have been this record which influenced Moreau, 1966, pp. 238, 244, to suggest that *elegans* might be a migrant). And there is a female in Bulawayo that was picked up in the streets of Salisbury on December 17. But in view of the evidence from South Africa, we are not convinced that there is necessarily any long-distance movement, as it would seem that *boehmi* has. The foregoing five records may merely represent quite local, individual movements. Also,

van Someren (1939, p. 33), in discussing the possibility of some regular movement, gave records from Kenya, Uganda, and Tanzania for February, April/July, and October. We have also examined two immature specimens from Kenya and Uganda collected in December and described below. These records show a fairly wide spread through the year.

VOICE AND BEHAVIOR: The voice of this bird has been the object of much superstition and wild speculation among local Africans. A good popular account pulling many of these beliefs together is that by Chapin (1948). In Uganda the bird was known for a time as "the banshee of Mabira" (i.e., Mabira Forest, a locality for it). In the Cherangani Hills in western Kenya, Keith was told by T. J. Barnley, on whose farm the bird occurs, that the local Africans believe the song of *elegans* to be the noise made by a chameleon in the agonies of giving birth. Chameleons are commonly supposed to be the authors of the noise. Another version, recounted in Chapin (*loc. cit.*) stated that the sound is that of a Chameleon (here personified) mourning for his mother, whom he has killed in an argument over some mushrooms.

Other suspected authors of the noise include a big skink, *Lygosoma fernandi*, a large land snail, *Achatina* sp., a puff adder, *Bitis lachesis*, "crowing crested cobras" (Benson, 1953, p. 25), a tree snake, and a climbing mammal.

Probably the first person to prove that the banshee-like wail came from *S. elegans* was Chapin, who, in 1913 surrounded one with a group of Africans in an old banana patch as it was calling, and flushed it. More intimate accounts are given by Astley Maberly (1935a and 1935b) and Pakenham (1943, pp. 176-177), both of whom sat for long hours near singing birds, endeavoring to see the singers. They saw the birds, but not actually in the act of singing. The only person who says he has actually watched a bird produce the noise is Harry Beatty, as quoted by Rand (1951, p. 579). Pakenham (1943, p. 177) said, "I never saw one in the act of hooting, but the only native I know who has done so described how the bird, from a position on the ground, puffed out its throat as it called."

According to Beatty, the bird he watched was "on a branch three feet above the ground, nestled amongst a cluster of leaves," and, "after a moment of relaxation the bird's body began to swell; then followed a sudden and perceptible

shudder and the whistled note began. It commences very low and softly, works up to a high pitch with vigor, and then, suddenly diminishing, it stops."

Chapin's description of the song (1939, p. 22) as "a low wailing, with almost the clarity of a tuning fork," is perhaps as good as any. The sonograms show that it starts softly and increases in intensity, ending fairly abruptly, just as noted by Beatty and others. Pakenham (1943, p. 176) wrote the song "hooooooooo," and Astley Maberly (1935a, p. 40) likened it to a miniature foghorn.

Keith's recordings, made on Mt. Marsabit, Kenya (sonograms 3E and 3F), show the length of each note to be pretty constant at 3.75 seconds. This compares with estimates by Pakenham (1943, pp. 176-177) of 2 to 3 seconds, and by Chapin of "three or four seconds." At any rate, this long single note is much longer than any known from other members of the genus and of a quite different quality.

On Keith's tapes, the intervals between notes ranged from 5.5 seconds to 7.5 seconds, and 16 intervals averaged 6.3 seconds. The bird thus sings at the rate of about six notes per minute, or one every 10 seconds. Chapin (1939, p. 22) noted that, "often it [the note] is repeated persistently, with intervals of silence lasting six or eight seconds, and in the stillness of night is audible at 300 yards." The last remark is a testimony to its intensity. Beatty noted, "the calls have been heard throughout the night; occasionally the pattern was continuous for many hours at eight seconds' duration, followed by a slight pause for breath, so to speak, and six seconds for inflating the air sacs." Pakenham (1943, pp. 176-177) heard one calling on Pemba "persistently from 7:30 P.M. till long after 10:00 P.M., at a frequency of about 7 to 8 times per minute, with great regularity." Keith noted continuous singing on Mt. Marsabit for several hours after sunset, and persistent singing was also noted by Astley Maberly (1935a, p. 40).

In the experience of Keith and others, the song seems to be consistently on one pitch, but Astley Maberly (1935a, p. 41) recorded an instance in which a bird gave the song note and then immediately repeated it "on a much higher key." Pakenham (1943, pp. 176-177) mentioned that the song may be given either "at full voice or very quietly." There is apparently some variation in pitch and intensity.

Astley Maberly (1935a, p. 41) mentioned the tones of the song dying away into a series of "strange, soft 'jug-jug-jug' notes," which could only be heard at close quarters. No such notes can be heard on any of Keith's recordings, which were made at extremely close range, and it is possible they are not part of the song but are "annoyance calls" similar to those recorded for *boehmi*, and probably due to the proximity of a human observer.

Astley Maberly (1935b, p. 102) is the only observer to record the song note frequently breaking into "a thin, high pitched double note, as 'Whoooooooooooo-eeeeeeeeeeeeee,'" which he again compares with a miniature foghorn. This sounds as if it is a variation on the song note, rather than a different call. The same author (*loc. cit.*) recorded a male and female, which he saw moving about at close quarters, maintaining "a running conversation of strange 'juggling' notes—'too-tookorook-tookorook-rook-ook-ook-ook-oooooooooooo.'" He noted that a series of notes like this often precedes the song note. The bird is also said by him to utter a monotonous succession of little crooning notes: "du-du-dooo-dooo-dooo," given while the bird is "moving casually about amongst the undergrowth." The latter notes are punctuated by subdued clucking.

Further evidence that *elegans* has a considerable repertoire is given by Pakenham (1943, pp. 176-177), who listed an astonishing variety of calls: a "quiet, short hum, merging into a monotonous, wasp-like whine," which can be modified into a "low growl, rising in volume and suffixed by a cat-like mew rising in tone and volume (sometimes with a slight decadent termination)." The growl has also been heard "in a series at 3-4 second intervals, without the mew." Also recorded are a "ktrrr, ktrrr, ktrrr," a "husky or gritty whine," and "a few soft, hen-like clucks."

A call attributed by Pakenham to *elegans*, although not with certainty, is "an eerie, tender wail as of feminine grief or pain, rising slightly in scale and falling away at the end." It is possible he may be describing the "Woooooooooooo-eeeeeeeeeeeeee" call of Astley Maberly. Chapin (1939, p. 23) recorded that a captive *elegans* would give a low growl.

It is generally agreed that *elegans* sings mainly at night, but daytime singing has been heard by Keith in Kakamega Forest, Kenya, and other places in East Africa, by Benson (1962, p. 634)

in Zambia, and by Basilio (1963, p. 46) on Fernando Poo. Possibly the volume of bird song during the day, especially in rain forests, tends to drown out the voice of *elegans*, and it may in fact sing commonly during the day like other members of the genus.

Several authors have noted that *elegans* calls from a bush or low tree, rather than on the ground (for example, Beatty, above). The bird recorded by Keith, judging from the angle at which the microphone was pointing, was about 6 or 8 feet up in a small forest tree, although careful searching with flashlights after the recording had been made failed to reveal the singer. The call is very ventriloqual, and a microphone centered in a parabolic reflector is a great aid in locating a ventriloqual singer, as it enables one to focus exactly onto the direction from which the sound is coming. Pakenham (1943, pp. 176–177) said the song is usually given “from a vantage point well concealed among the leaves, in a bush or tree at a height of anything from 4 to 10 feet from the ground,” but it can also be given from the ground. On Pemba, the bird usually called from 5 or 6 feet up in a *Psychotria* bush.

With regard to voice production, Pakenham (1943, pp. 176–177) mentioned that all three specimens of *elegans* obtained by him had a coating of sticky, gelatinous matter, 2–3 mm. thick over the whole inside surface of the skin of the neck from the base of the skull to the beginning of the breast and back. He commented that this “may well be related to voice production, lending resonance or tone to the hoot.” Chapin (1939, p. 23) said “it appears that the esophagus [of *elegans*] can be distended with air so as to increase the resonance,” and this is presumably what was referred to in the accounts given above by Beatty and Pakenham’s African informant, in which the bird seemed to puff itself out while (or just before) singing. Keith has noticed a similar “puffed out” appearance in the Black Rail *Laterallus jamaicensis* as it was singing.

Very few people have been able to observe the habits and behavior of any *Sarothrura*, so the observations of Astley Maberly (1935b, p. 103) are especially valuable. He watched for some time a female and two small chicks in a patch of “Kloof-jungle” in the Transvaal. Occasionally they would venture from the undergrowth, but only for a few moments at a time, and even then they would take advantage of any piece of

vegetation to hide behind. They would “move along in little, hurried steps, ceaselessly searching for insect prey, spiders, etc.” Such a tentative method of progression, hurried yet uneven, is characteristic of many rails. Astley Maberly said that “when alarmed they literally ‘dart’ like mice into the undergrowth, whence it is practically impossible to flush them. The movement is so rapid . . . that one merely sees a blackish streak.” The flight, he said, is clumsy and fluttering, and only resorted to in dire necessity. The combination of weak flight, noted in all species of *Sarothrura* when flushed, and the incredible speed with which they seem to be able to plunge through thick vegetation, helps to explain why the birds are so seldom seen. They can make better and quicker progress on land than in the air.

SYSTEMATICS: The figures in table 10 suggest little geographic variation, except that there is some tendency to a shorter bill in specimens in Cameroun westward. The small wing length of the single Liberian specimen is striking, although there are two equally small males from Uganda. Wing lengths of specimens from Fernando Poo suggests a tendency to smallness there, too, although the female is little smaller than average. As to color, females vary considerably, regardless of geography. Thus two from Durban, that are now in London, are relatively pale, but can be matched with the single specimen from Somalia. But another female in London, that is from Natal, is darker, and can be matched with specimens from Nigeria. In males it is possible to discern a more regular variation. Males from Uganda, the southern Sudan, the Congo, northern Angola, and Cameroun westward, have the spots both above and below larger and coarser, and they are generally darker above. For these birds the subspecific name *Sarothrura elegans reichenovi* (Sharpe, 1894, p. 121, Camerouns) can be used. No more precise locality than this is given, but the type must have been collected in present-day Cameroun or extreme eastern Nigeria. *Sarothrura e. elegans* may be considered to range from eastern Kenya and Tanzania (including Pemba Island) southward to the eastern Cape Province. With the existence of only one female from Somalia (and no specimen at all from Ethiopia), it is impossible to decide what subspecies occurs there. But a male from the Chyulu Hills, eastern Kenya, in Nairobi, agrees best with the nominate

TABLE 10
MEASUREMENTS (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura elegans*
(Averages are in parentheses)

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
South Africa	12♂	84-93 (88.8)	15.5-17.5 (16.4)	22-25 (23.7)	26-30 (27.9)
	3♀	88, 89, 91	15, 15, 17	23.5, 24, 24.5	28.5, 28.5, 30
	25♂	83-93 (88.5)	—	—	—
	9♀	85-91 (88.9)	—	—	—
Rhodesia/Zambia/Malawi/ Tanzania (mainland)	2♂	94, 94	16, 16	24.5, 25	29, 31
	3♀	90, 91, 92	15, 15, 15	23, 23.5, 25	29, 31, 31
Malawi	1♀	89	—	—	—
Rhodesia-Mozambique border ^a	1♀	93	—	—	—
Pemba Island	2♂	85, 86	15.5, —	23, 24	26, 27
Kenya/Uganda/southern Sudan	4♂	88, 88, 89, 93	15.5, 15.5, 16.5, —	23, 25, 25.5, 26	26, 26.5, 28, 28
	5♀	86-91 (89.4)	14-15 (14.5)	23.5-25 (24.4)	26.5-29 (27.7)
Kenya	1♀	88	—	—	—
Uganda	4♂	80, 80, 82, 84	—	—	—
	1♀	90	—	—	—
Somalia (type of <i>S. buryi</i>)	1♀	91	15	25	29
Congo	9♂	88-91 (89.8)	14.5-17 (15.8)	22-26.5 (24.5)	26-29 (27.4)
	2♀	87, 88	14.5, —	23, 23.5	24, 25
	6♂	83, 84, 84, 86, 86, 88	—	—	—
	1♂	85	15.5	23.5	25
Angola: Camabatela	1♂	85	15.5	23.5	25
Southern Cameroun/southern Nigeria	5♂	85-90 (87.0)	14.5-16 (15.3)	23-25 (23.7)	26-27 (26.7)
	4♀	85, 86, 86, 87	15, 15, 15.5, —	23, 23, 24, 25	25, 26.5, 27, 27
	2♂	87, 89	—	—	—
	2♀	84, 87	—	—	—
Liberia: Firestone Plantation	1♂	80	15	23.5	26.5
Fernando Poo	3♂ ^b	80, 82, 82	—	—	—
	1♀	87	—	—	—

^a From Brooke (1966a, p. 435).

^b Includes a specimen in Madrid (Basilio, 1963, p. 45).

sub-species, which may extend farther northward. It is not possible to recognize *S. e. buryi* for the populations of Somalia (and perhaps Ethiopia), because the single female is in no way distinctive. Provisionally it is regarded as a synonym of the nominate subspecies.

An apparently fully grown female (wing 90, culmen 14, tarsus 24.5 and middle toe 26.5 mm.) in Los Angeles, collected at Kibale, Uganda, December 8, 1966, is mainly in a uniform sepia-brown plumage (not so blackish as in such immature specimens as have been available for the other species, excluding *S. pulchra*, the

immature of which is very distinct). The color generally lacks the chestnut tone of adult females. A few adult feathers are on the chest, center of the abdomen, mantle and wing-coverts, and the remiges and rectrices are like those of adults. Another similar immature female exists in Washington. It also seems to be fully grown (wing 91, culmen 14, tarsus 25, and middle toe 28 mm.). It was collected at Kakamega, Kenya, December 14, 1965. There is an immature male in Nairobi, collected there on June 28, 1965. It may be a little older than the two females. The chestnut on the head is almost fully developed,

TABLE 11
SUMMARY OF EXAMINED SPECIMENS OF
Sarothrura elegans

	Examined by Author(s)	Examined by Others	Totals
Male	46	34	80
Female	18	20	38
Immature	3	—	3
Chicks	1	—	1
	==	==	==
Total	68	54	122

but the mantle is still a plain sepia-brown. Elsewhere on the upper side, both the buff spotting and the black ground color is duller than in adults. There are a few adult-like feathers appearing on the upper abdomen. But the abdomen as a whole is a dingy pale brown, the center whitish, barred with dull sepia.

The only chick in any collection seems to be one of the three recorded by Serle (1954, p. 52), referred to above under Breeding, and in London. Unlike chicks of *S. rufa*, *lugens*, and *boehmi*, it does not show any pale markings on the bill that might serve to emphasize signal movements employed by the young in obtaining food from adults (Boyd and Alley, 1948, p. 587).

A male from Mwela, Bugoma Forest, Uganda, now in Los Angeles, weighed 45 grams; a female from Kakamega, western Kenya, now in New York, weighed 49.5 grams. Of three specimens in Bonn, a male and a female from Fernando Poo weighed 44 and 50 grams respectively, but a male from Kupé, southeastern Nigeria, 32 grams only. Weights are available for two of the immature specimens, the male from Nairobi, 32 grams, the female from Kibale, 35 grams. Also, a female from near Amani, northeastern Tanzania, weighed 51 grams (Slater and Moreau, 1933, p. 426).

MATERIAL: Specimens are relatively numerous from some areas and scanty from others. It would be tedious, if not impractical, to detail the present location of each. Only those from the more poorly represented areas are mentioned. The two males from Pemba Island and the female from Somalia, are in London. The male from Liberia is in Chicago, the male from Angola is in New York. Of the material from Fernando Poo, one male is in New York, one in Madrid, and a male and a female in Bonn.

Sarothrura rufa

Rallus rufus VIEILLOT, 1819, p. 564. (Africa. Restricted by Grant and Mackworth-Praed, 1934, p. 69 to Cape Province.)

SYNONYMY: *Crex Jardinei* SMITH 1828a, p. 144. (South Africa.)

Crex ruficollis J. E. GRAY, 1831, p. 13. ("Cape of Good Hope?")

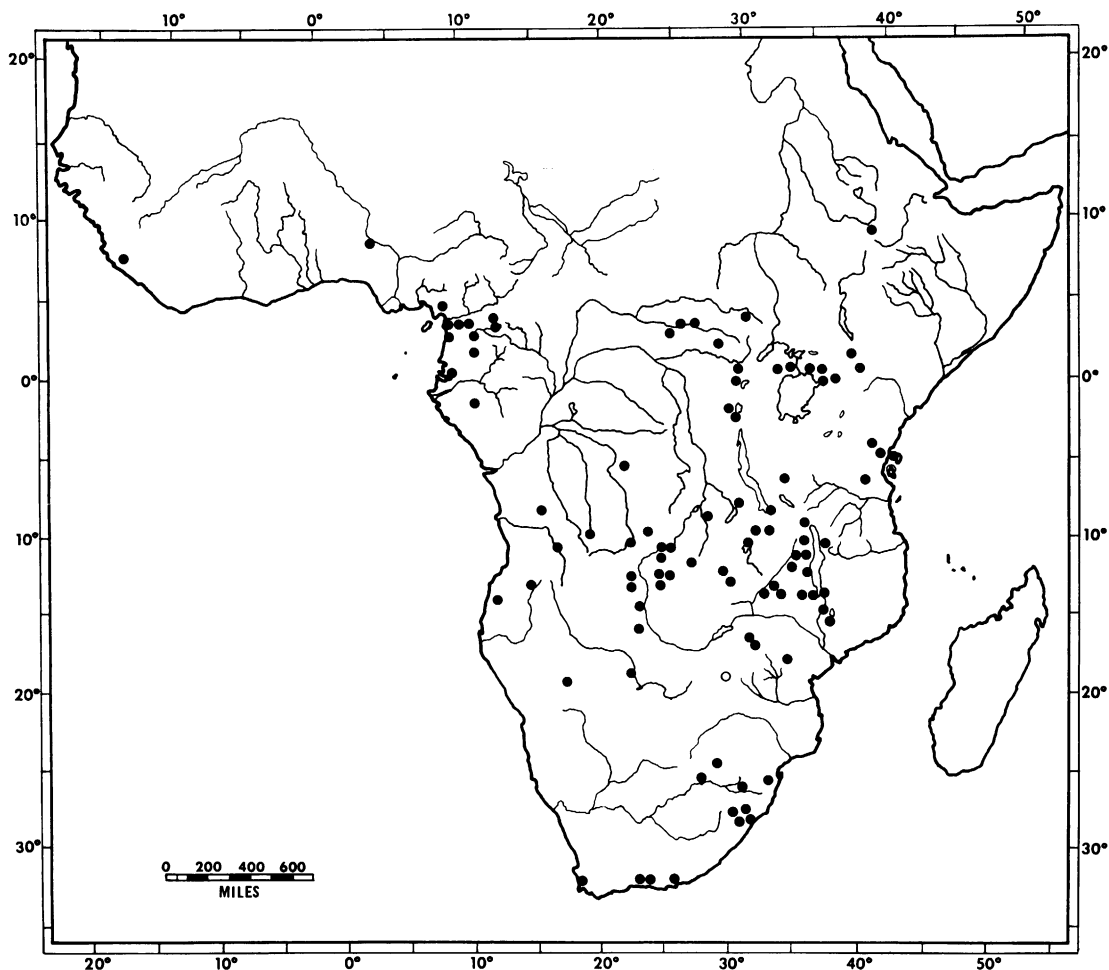
Porzana dimidiata TEMMINCK, 1831, p. 537. (No locality.)

Sarothrura rufa ansorgei VAN SOMEREN, 1919, p. 20. (Duque de Braganza, Angola.)

The last four names appear to be synonymous with that of the nominate subspecies, *S. r. rufa*. We agree with Macdonald and Grant (1953, p. 202) that *Crex jardineii* is correctly placed above. It should not be confused with *Gallinula jardinii* Smith, discussed under the synonymy of *S. affinis*. The type of *Crex ruficollis*, which is listed by Warren (1966, p. 252), is in London, and is considered to be a male of *Sarothrura rufa rufa*. *Porzana dimidiata* is well illustrated in Smith (1839, pl. 21). The specimen purporting to be a young bird on that plate would appear to be an adult female, the other specimen—an adult male. The status of *S. r. ansorgei* is discussed below under Systematics.

DISTRIBUTION: Widespread from southern Cape Province to about latitude 4° N., but unknown in South-West Africa except at Omanbonde (Gurney, 1872, p. 320) and in Botswana at Nokanen, it is apparently absent from the northwestern Congo, where there is probably little suitable habitat. It is known from Pemba Island, and by sound record from Zanzibar (Pakenham, 1945, p. 220), but there is no record from coastal Kenya (where it may nevertheless occur) or from Somalia, and there is only one record from Ethiopia, where perhaps it is more common than this suggests. It is also known from various localities in Gabon and Southern Cameroun, also Rokupr, Sierra Leone. From the intervening area the only evidence of its occurrence is a tail, wing, and foot of a male from Ilorin, western Nigeria, now in London, and Serle (1954, p. 52) collected specimens at Kumba, in extreme southeastern Nigeria.

HABITAT: This species is essentially an inhabitant of marshy, boggy areas. Thus Anderson as quoted by Gurney (1872, p. 320) recorded it as common at Omanbonde, northern South-West Africa, near "stagnant waters thickly fringed and studded with aquatic herb-

FIG. 10. Distribution of *Sarothrura rufa*.

Key: ●, collected specimen; ○, sight record or sound recording.

age," and Traylor (1965, p. 150) found it in southwestern Zambia and in northern Botswana at Nokanen in permanent swamp. McLachlan and Liversidge (1957, p. 108) stated that it inhabits growth in the middle of marshes, and Clancey (1964, p. 133) found it in reed beds and marshes. From Zambia, Benson (1956, p. 598) compared its habitat with that of *S. boehmi*, *rufa* inhabiting the lush centers of dambos (drainage lines through the prevalent *Brachystegia* woodland), *boehmi* the shorter-grassed edges, and *rufa* also inhabiting even papyrus swamp (Benson and White, 1957, p. 26). In the Mwinilunga District, White (1943, p. 128) found it unusually common in fernlike growth close to the banks of the Lunga River (that is, the West Lunga River, near Mwinilunga), the surrounding

country being black soil dambo, which became waterlogged and overgrown later in the rains. Pakenham (1943, p. 173) found it common in the north of Pemba Island, inhabiting swamps thickly filled with a tangle of tall succulent vegetation, the water stagnant or slowly flowing, and also small valleys with damp or boggy bottoms where there was lush grass. He contrasted its habitat with that of *S. elegans*, which inhabited dry ground. Moreau (Sclater and Moreau, 1932, p. 507) collected a male in breeding condition at Amani, in dense low grass (*Panicum*) around a marsh. Chapin (1939, p. 20) had a specimen collected for him at Faradje in a grassy marsh, and others near Pawa in quaking bogs. Curry-Lindahl (1961, p. 220) recorded a young bird from thick

aquatic riverine vegetation, "parfois parcourant les *Pistia stratiotes*." This would seem a typical habitat for *rufa*, but as no specimen was collected, the record cannot be accepted as conclusive. Conceivably the species was *S. lugens*. Good (1952, p. 74) stated that it lives in thick grass one-third to one-half meter high in drier situations, not near water or in swamps, but this seems more typical of *S. boehmi*, which in southern Africa at least frequents drier, shorter-grassed situations than does *rufa*. Even less likely is it that *rufa* ever frequents forests and forest streams, according to van Someren, as quoted by Jackson and Sclater (1938, p. 299). Its habitat may not differ from that of *S. lugens*, as both dwell in permanent swamps. R. J. Dowsett (personal commun.), who was in the Lake Chad area for most of 1968, stated that there are reed islands in the lake that might provide suitable habitat all year round for *S. rufa* (and possibly also for *lugens*). But he got no evidence of the occurrence of either.

Benson (1952, p. 82) recorded a specimen from the Nyika Plateau. It was collected by Jali Makawa, and unfortunately there is no record of the exact altitude. But there is no evidence that *rufa* ascends onto the high Nyika to occur alongside *S. affinis*. Benson and Holliday (1964, p. 131) specifically stated that it was not heard. There is a specimen in Nairobi from Molo, Kenya, at 8800 feet, but it is unknown any higher on Mt. Kenya and the Aberdare Mountains, whence *affinis* has been recorded.

FOOD: Chapin (1939, p. 20) found small seeds and insect remains in stomachs; Pakenham (1943, p. 174) found seeds, insect remains, and grit; Benson (1956, p. 597) found grass seeds, small ants and a snail, and (1959, p. 261) spiders, minute diptera, aquatic hemiptera, small black ants, seeds, and grit. Pakenham (1934) thought that the birds did not feed during the day, and only resumed feeding when the sun was low. Certainly calling can be heard at night as well as in the daytime (see below).

BREEDING: Broekhuysen, Lestrangle and Myburgh (1964, pp. 117–120) described a nest found at Faure, Cape Province, November 25, 1962. It was in a clump of the grass *Pennisetum macrourum*, in the middle of a cattle path, the cattle tracks passing on either side. It was a cup, evidently not roofed over, of exterior diameter 13 cm., interior, 9.5 cm.; depth of cup, 3 cm.; edge of cup, 21 cm. above the ground. The

lining consisted of dry narrow reedlike leaves. On November 25 it contained three eggs, and three days later five eggs, measuring 20.6 by 27.2, 21.4 by 27.2, 20.5 by 27.0, 20.9 by 27.0, 21.3 by 28.6 mm. On December 7 the male was seen leaving the site of the nest, and on December 8 it was actually on the nest. Broekhuysen and others (1964) concluded from their observations that the male incubated during the morning, that most of the afternoon the eggs were uncovered, and that in the late afternoon and at night the female incubated. On December 11 the nest was empty. This was the fourteenth day after the last egg was laid. There was no trace of the shells, and the previous day the eggs did not appear to be pipped. The authors thought that perhaps the eggs had successfully hatched.

According to Clancey (1964, p. 133), the nest is made entirely of leaves, and the structure is roofed over, a nest being found on the Usutu River on November 14. This may be derived from Pooley (1962, p. 45). But the record may not refer to a *Sarothrura* at all, since the eggs are described as greenish tinged, and we are unaware that any species lays anything but pure white eggs.

There are, however, two additional, possibly authentic South African records on the files of the Percy FitzPatrick Institute. On December 5, 1964, A. G. Maclean found a nest containing three eggs at Umvoti, Natal, which two days later had disappeared. The nest was at the base of long marsh grass in marshy ground and was very flimsy, with a slight dome. The eggs were pure white, measuring 20.3 by 26.6, 20.0 by 26.1, 20.0 by 25.8 mm. The only other species known from Natal are *S. affinis* and *elegans*, but the description of the habitat precludes any likelihood of either of these two being involved. There is also a record by G. Jackson of a clutch of three eggs from Greytown, Natal, at Yorks Dam, observed December 5–9, 1964, but which two days later was empty. The female was brooding on December 6, 8, and 9. The nest is described as a cup 40 mm. deep and 80 mm. wide. There is an immature male in London, from Potchefstroom, Transvaal, March 20. It is still mainly in black dress, with only a few white markings on the wing coverts, and a little red coming in on the head. It has a wing of only 67 mm. and is presumed to have been from an egg laid in January. A newly hatched chick brought to R. Liversidge at Coldstream, southern

Cape Province, on February 1 (see under Systematics) was undoubtedly from an egg laid in January. Layard (1867, p. 339), under *Corethrura dimidiata*, recorded an oviduct egg, but without date or locality.

The record by Broekhuysen and others (1964, pp. 117–120) seems referable to the end of the rains, being from the southwestern Cape Province where winter rains prevail. On the other hand, the Coldstream record would appear to be from within the summer rains area, and, referring as it does to egg laying in January, it can be taken to be a rainy season breeding record. The Natal and Transvaal records are also for the rains.

From Rhodesia, Zambia, and Malawi, Benson, Brooke, and Vernon (1964, p. 47) gave 15 records indicating breeding during December to March, that is, all during the rains. The seven records from the latter two territories are based on specimens so young that they could be aged or of females in breeding condition. Brooke (personal commun.) has brought Rhodesian information up to date, to include the rains of 1964–1965. In all, 11 clutches of eggs attributed to *rufa* have been found, the localities being Salisbury, Marandellas, and Buhera, and all were found between December 8 and March 7. The clutch size varies from three to five. The possibility of confusion in some of these records with *S. boehmi* cannot be discounted, although under that species some details are given for five records considered reasonably certain to be of *boehmi*. The remaining 48 records for the two species as a whole are perhaps most wisely left as attributable to either *rufa* or *boehmi*, with the note that they may also contain the odd record of *lugens*, known to occur at Inyanga. Brooke (1966, p. 435) did, however, give a definite record of *rufa* from the Vumba, near the Rhodesia-Mozambique border, of a female trapped on eggs on May 5. This is unusually late, but the rainy season probably starts earlier and finishes later in this locality than it does farther west.

Supplementary evidence of breeding during the rains in Zambia and Malawi, as seen from gonad activity of collected specimens, has been provided by Winterbottom (1939, p. 715) and Benson (1940, p. 389; 1942, p. 207; 1947b, p. 558; 1956, p. 597). Benson (1959, p. 261) also gave a record of gonad activity from Sakeji, in the Mwinilunga District, for as early as October

19. In this area the rains are more prolonged than in most other parts of Zambia, and rain in Mwinilunga is normal as early as October. An immature specimen collected on July 15 at Kasaji, southern Congo, in Tervuren, has a wing of only 58 mm., it is by no means fully grown. It was perhaps from an egg laid as late as mid-May. But as in Mwinilunga, to which Kasaji is adjacent, the rains are unduly prolonged. From Luluabourg, Chapin (1939, p. 19) mentioned a young bird collected on August 23, and suggested that eggs are laid in the early part of the dry season. Dry season breeding may well be possible in this area, but there would be less seasonal contrast there than in Rhodesia, Zambia, and Malawi, and as Chapin himself added, the breeding season may not be well defined in this locality. At Duque de Braganza, Angola, Heinrich (1958, p. 324) collected two males with much enlarged testes on May 27.

Pakenham (1943, p. 173) found that the breeding season on Pemba Island is in February and March, that is, at the end of the hot, dry months, with young abroad from mid-March to mid-April, at the opening of the heavy rains. This seems to be borne out by an immature specimen of his in London, with a wing of only 34 mm. collected on April 22, and almost certainly from an egg laid in March. Another immature specimen of his is dated March 10, but appears to be fully grown, and may even have been from a January egg. A male collected on March 4 had testes enlarged. The breeding season on Pemba may be more prolonged than Pakenham thought, in view of the specimen believed to be from a January egg, and the fact that farther south breeding is in the rains. Furthermore, there are three males in London from Amani, on the mainland less than 80 miles from Pemba, their labels showing that they were in breeding condition. They are dated March 2, April 22, and July 12. Probably in both Amani and Pemba, only about 5 degrees south of the equator, the breeding season is somewhat indefinite, as already suggested by Chapin (1939) for Luluabourg.

From Faradje, in the northeastern Congo, Chapin (1939, p. 20) recorded specimens ready to breed on July 12, and others in immature plumage from farther west on May 14. From Djaposten, Cameroun, he mentioned an egg and newly hatched chick, but without a date. There is a fully grown specimen, mainly still in

TABLE 12
COLLECTED SPECIMENS OF *Sarothrura rufa* ARRANGED BY MONTH AND LOCALITY

Month	Cape Province	Natal	Transvaal	Botswana	Rhodesia	Zambia-Malawi	Total
January	—	—	—	—	—	9	9
February	—	—	—	3	—	16	19
March	—	—	1	—	—	1	2
April	—	—	—	—	—	16	16
May	1	1	1	—	—	2	5
June	—	—	—	—	1	3	4
July	—	1	1	—	—	7	9
August	1	1	—	—	—	4	6
September	—	1	1	—	1	4	7
October	—	—	—	—	—	4	4
November	1	2	—	—	—	4	7
December	—	—	1	—	—	5	6

immature dress, in Pittsburgh, from Lolodorf, Cameroun, May 19. It may have been from an egg laid in March. According to Good (1952, p. 74), nests have been found in this territory in May and July. Serle (1954, p. 52) recorded a female collected at Kumba, southeastern Nigeria, on December 2, with two large yolking eggs in the ovary. There are two males in London from Rukupr, Sierra Leone, collected by R. R. Glanville. An adult dated July 26 had testes much enlarged. The other, dated July 20, is mainly in immature dress, with a wing of only 60 mm., and probably from an egg laid in May. The rains in Sierra Leone are rather strictly seasonal, from May to November, and these two records fall within that period.

MOVEMENTS: Astley Maberly (1961, p. 137) found an adult male in an exhausted state at his house in the northeastern Transvaal at 9:30 P.M. on August 7. There is also a record (Anon., 1952, p. 70) of a dead bird found at the base of a cliff near Rustenburg in the Transvaal, during August 31–September 1, brought to our notice by P. le S. Milstein. Pitman (1965, p. 34) quoted Neuby-Varty to the effect that in Rhodesia it appears in December to breed and disappears in March. We are unaware of any further suggestion that there might be any movement, and Benson and Irwin (1967a, p. 21) thought that in Zambia and Malawi there was no movement. From within 5 degrees either side of the equator it would seem particularly unlikely that there would be any. Farther north of this the data are so scanty that it is impossible to make any deduction. It is, however, possible to examine the situation in southern Africa where

there is as much seasonal contrast as anywhere within the range of the species. Some South African specimens are old ones, undated. Nevertheless the data now to be presented are far more comprehensive than those provided by Benson and Irwin (*loc. cit.*). The numbers of specimens by months for certain territories are shown in table 12.

The three Cape Province specimens are from Knysna and Port Elizabeth. Summer rains prevail both here and farther north. The data from Zambia and Malawi are much more comprehensive than those for any other territory. There is nothing in the data as a whole to suggest any regular movement. Evidence has been presented above showing that *S. rufa* is a rainy season breeder in southern Africa, the evidence from Rhodesia, Zambia, and Malawi being fairly comprehensive. Yet there are 22 specimens from these three territories for May to September, well within the dry season. The South African specimens for May to August are also within the dry season. The rains start earlier there than farther north, and the two specimens for September may have been collected near the beginning of the rains. In general, the habitat of *S. rufa* remains relatively stable throughout the year, in contrast to that of the migratory *boehmi*, so that any long-distance movement would not hold the same advantage as it may have for *boehmi*. The record by Astley Maberly (1961, p. 137) and the one (Anon., 1952, p. 70) from Rustenburg probably represent individual strays, perhaps blown out of their habitat after a storm. Regardless of regular movement, this kind of occurrence is frequent in the Rallidae as a whole.

As there are only two Rhodesian specimen records (table 12), it is worth adding that A. Walker (personal commun.) saw a bird at close quarters in a reed bed in permanent marshland, 10 miles north of Bulawayo, on October 18, 1967, and again on September 12, 1968. On the first occasion he called it up by playing back a tape recording of the voice of *rufa* made by Keith in Zambia.

VOICE AND BEHAVIOR: We are much indebted to Clem Haagner of Potchefstroom, Transvaal, for allowing his recordings of *S. rufa*, made at Plettenberg Bay, Cape Province, to be used in the present study.

The common call of this species seems to be much better known than the song, and is therefore best dealt with first. It is the only vocalization mentioned by Chapin (1939, p. 20), Good (1952, p. 74), and Benson (1956, p. 598); the only person to describe the song is Pakenham (1943, pp. 173–175).

The call is a series of loud, ascending notes uttered in quick succession (sound sonograms 6A and 6B), rendered by Chapin (1939, p. 20) as “t-wi, t-wi, t-wi. . .,” by Good (1952, p. 74) as “tchou-i, tchou-i, tchou-i. . .,” by Ripley and Heinrich (1966, p. 2) as “kéi-kéi-kéi. . .,” and by Pakenham (1943, p. 173) as “dúeh-dúeh-dúeh-dúeh. . ..” The length of the call appears to vary. Good (1952) said the call is repeated only five to seven times, and Chapin (1939) said it lasts but a few seconds, whereas Pakenham (1943) found that the call was uttered continuously for about 10 to 15 seconds. Haagner’s recordings (see above) have the more lengthy calling heard by Pakenham. Length of notes and intervals can be seen from sonograms 6C, D. There is a certain amount of variation in speed and intensity, perhaps occurring as the bird becomes more or less excited. Pakenham (1943) noted that “there is less pause between words in the middle of the utterance than at the commencement,” and a similar speeding up in the middle of the call has been noted for *S. lugens* (see discussion under that species). Benson’s (1956) description of “a thin, rather squeaky, rapid ‘dui,’ repeated some eight times, not nearly so strong as the ‘dueh’ call, and with no appreciable pauses,” is doubtless just a variation on this same call. It certainly does not describe the song.

Several authors have noted a sort of low grunt given in connection with this call, and this is

audible on Haagner’s recordings. The grunt is given simultaneously with the very beginning of the “dueh” note, and is not a separate note. This is probably the short note, lower than the lowest harmonic, depicted on sonogram 6B, and the similar, appearing short notes between the middle two harmonics may possibly be higher harmonics of the grunt.

These grunts become even more audible in connection with the song itself. Keith and Benson listened to a bird singing in the reeds in a dambo by the Kitwe-Lusaka road, Zambia, in November, 1964. The song started with a series of low grunts, and then, as the bird started to warm up, as it were, each grunt was followed by a clear note rising in intensity, “wooah.” Finally, the grunts were dispensed with, and a series of plain “wooah’s” commenced. This series stopped abruptly without trailing off into grunts or other notes. The “wooah” song note of this bird is shown in sonogram 5D. There was too much background noise for a successful sonogram to be made of the earlier grunts. On the two sonograms made from Haagner’s recordings of the “wooah” song, accompanying grunts can be seen. On sonogram 6C the short note on a lower pitch immediately following the song note is the grunt, the whole utterance sounding like “wooah-boo.” This is obviously the “haw-boo” of Pakenham (1943, p. 174). In sonogram 6D, the song was preceded by a series of grunting “boo’s,” and one of these stands alone at the beginning of the sonogram. In the next two notes, the “boo” can be seen being incorporated into the “wooah” at the beginning. All this tends to indicate, we believe, that the various grunting calls are not separate calls with a different meaning, but are rather a phenomenon related to actual voice production. The “g’were” song of *S. boehmi*, which incorporates a grunt, is another example of this.

Pakenham (1943) recorded quite a variety of admixtures of the “haw” (=“wooah”) and “boo” notes, each given both separately and in combination. Some of the “boo” notes heard by him were apparently louder than those on Keith’s and Haagner’s recordings, as they were audible at 60–80 yards, distance, in which event the “boo” could be heard but not the “haw.” In Keith’s experience it is the other way, the “boo” being audible only at close quarters.

The sonograms show the length of the song note is 0.6–0.8 second, the intervals varying

from 0.4–0.7 second. This about spans the normal range of note lengths and intervals. In all three sonograms traces of higher harmonics can be seen. These are perceptible to the human ear, and the song sounds higher than that of any other species except that of *pulchra*. Prolonged singing has not been noted for this species on the scale of *S. pulchra* and *S. elegans*, for example, but Keith noted several series of continuous “wooah”s lasting more than a minute, and, as might be expected, singing became more prolonged after the birds became excited by playback of their song.

Other vocalizations have been recorded for this species by Ripley and Heinrich (1966, p. 2) and Pakenham (1943, p. 174). The former list “a rather deep drumming sound, like ‘wuk-wuk-wuk-wuk-wuk-’”. It was often answered by another note, perhaps five tones higher, clearer and more lengthened ‘úk-úk-úk-úk-úk-úk-’.” This probably is the grunting “boo”; Pakenham (*loc. cit.*) noted that the “boo” can be given without the “haw.” The answering call on a higher pitch could well be a female answering a male (see remarks in the Introduction).

Pakenham (1943) listed a variety of utterances: “a gentle, petulant growling, beginning high and descending in scale, similar to a complaining whimper made by my pet mungoose (*Myonax sanguineus*); . . . alternated with this growling was a low, gusty wheezing, of the quality, but not the volume, of *Limnecorax flavirostra* (Swainson): this was not prolonged; . . . a soft and plaintive chirp something like the dull squeak of a crepe rubber sole on a polished wood floor—possibly a call to chicks? From females with chicks I have often heard the ‘duch’ call reiterated, the young answering with a monosyllabic ‘cheep’ repeated several times”; and “. . . a rather high-pitched, long-drawn hum which, just before ending, fell and rose again, closing on a slightly higher note than that on which it began; this was uttered extremely quietly, and seemed to indicate suspicion or warning.”

We have no comment to make on this catalogue of calls, except to admire the meticulous care which Pakenham gave to noting and describing them.

Both daytime and nighttime calling has been noted for this species (see especially Benson, 1956, p. 598); Pakenham (1943) said that drought has a silencing effect on calling, whereas

the promise or fall of rain tends to stimulate them. A similar phenomenon was noted by Jali Makawa for *lugens* (personal commun.). Pakenham also noted that calling seems to decrease after nesting has begun, and the same has been noted for the Black Rail (*Laterallus jamaicensis*) by Hagar (personal commun.).

Pakenham (1943) was occasionally able to observe the bird on Pemba. His impression was that the tail is depressed, not raised, while the bird is walking. He commented on the amazing speed with which a bird can run through grass, “occasionally turning and doubling on its tracks, and then forward again. Chicks could run with almost as great rapidity as adults. On two occasions a female tried to lead me away from her brood by running along in full view down open channels between grass-banks and stopping every few feet.” The statement in Stark and Sclater (1906, p. 256) that *rufa* “swims well and carries its tail erect” is believed to be most misleading. It probably never normally swims.

Liversidge (personal commun.) has described the actions of a chick brought in at Coldstream, Cape Province, South Africa on February 1, 1966. At the age of three weeks, in addition to taking on the characteristic appearance of a crake, the little bird developed the peculiar jump-run of crakes at the same age. This extraordinary rapid alarm movement, performed with remarkable speed, was not developed but suddenly started one day and was used ever afterward. The bird appears to spring up and twist as though to kick itself off the grass and shoot off with a rapid initial rush. Two days before it was killed a double call note was heard that was distinctly a deep note for such a young bird. Prior to this, only a very high-pitched note had been uttered. This note had to be heard from very close to the bird and was difficult to pinpoint.

SYSTEMATICS: No subspecies is recognized by Mackworth-Praed and Grant (1937, p. 629). On the other hand, Chapin (1939, pp. 18–19) recognized *Sarothrura rufa elizabethae* van Someren (locality, Kisumu and Kakamega, Kenya) and *S. r. bonapartii* (locality, Gabon) but not *S. r. ansorgei* van Someren. Of these, White (1965, p. 103) recognized only *bonapartii*.

A comparison of the measurements (tables 13 and 14) of specimens from South Africa with those from Gabon, southern Cameroun, and

TABLE 13
MEASUREMENTS IN FULL (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura rufa*
(Averages are in parentheses)

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
South Africa	4♂	75, 76, 76, 78	14, 14.5, 15, 15	20, 21, 22, 22	28, 28.5, 30, —
	4♀	75, 75, 77, 81	13.5, 14, 14, 15	21, 21, 22, —	28, 28.5, 29, —
Rhodesia	2♂	76, 77	14, 14.5	20.5, 21.5	28.5, 29.5
Zambia/Malawi	43♂	71–80 (75.9)	13–16 (14.4)	20–23 (21.8)	27–32 (29.8)
	19♀	74–81 (77.0)	12.5–15 (13.7)	19.5–22.5 (20.0)	26–30 (28.7)
Angola: Kalunda	1♂	78	14	22	29.5
Southern Congo: Elisabeth-ville	1♂	75	14	21	27.5
Northeastern Congo: Barisi, Blukwa, Butembo, Pawa	17♂	73–79 (75.6)	13–15 (14.0)	20–23 (21.5)	26.5–30 (28.4)
(all from Butembo except 3♂♂)	10♀	73–79 (76.4)	13–15 (13.8)	20–22 (20.8)	26–30 (28.2)
Southern Tanzania: Matengo Highlands	3♂	76, 77, 79	13, 13.5, 15	21, 21, 23	28, 29, 29
Northeastern Tanzania: Amani and Pemba Island	5♂	72–73 (72.4)	13–16 (14.5)	20–22 (21.5)	26.5–29 (28.2)
	1♀	71	14.5	19.5	26
Kenya: Nairobi and Nanyuki westward	4♂	74, 76, 77, 80	13.5, 14, 14, 14.5	19.5, 22, 22, —	25, 28, 30, —
	2♀	76, 79	14, 14.5	20, 23	27.5, 30
Uganda: Kyetume	1♀	79	14	21.5	28
Ethiopia: Gafersa	1♀	78	14	21.5	28
Gabon	4♂	67, 67, 68, 69	12.5, 13, 13, 13.5	18, 19, 19.5, 19.5	25, 25.5, 26.5, 29
	1♀	70	13	19	29
Southern Cameroun, south of ca. 4.5° N., and extreme southeastern Nigeria	14♂	67–73 (69.6)	12.5–14.5 (13.4)	19.5–21 (20.3)	25.5–29 (27.1)
	4♀	70, 72, 72, 73	12, 13.5, 13.5, 13.5	20, 20, 20.5, 21	26.5, 27, 27.5, 28
Sierra Leone	2♂	71, 74	14, 14.5	20.5, 21	26, 30

southeastern Nigeria in particular, suggests an over-all larger size in the former area, with no overlap at all in wing length—74–82 mm. as against 66–73 mm. On this basis it would be justifiable to apply the name *S. r. bonapartii* to the Gabon, Cameroun, and Nigerian birds, the scanty material from Sierra Leone probably also being best placed with this form. The wing of a male from Ilorin, western Nigeria (see under Distribution above) was not measurable. Birds tend to be smaller in eastern Tanzania (Uluguru Mountains, Amani, and Pemba Island) although the material from the Matengo Highlands gives no indication of this.

Considering the possibility of color differences, the separation of *bonapartii* on size is further supported to some extent by a tendency in the male for the white markings on the mantle to be in the form of streaks rather than

spots. No further geographical variation in males could be discerned. In females there is much individual variation. Nevertheless, the following broad divisions are recognizable: (1) Gabon, Cameroun, southeastern Nigeria: mantle usually streaked; (2) northeastern Congo, Uganda, extreme western Kenya (Kaimosi): mantle usually transversely barred, this also being apparent in the single female from Ethiopia; (3) central Kenya, Tanzania, southern Congo, and Angola southward: mantle usually spotted.

The material from these three regions may be placed respectively with *bonapartii*, *elizabethae*, and nominate *rufa*. But it must be stressed that this separation cannot be construed rigidly. As to the situation in Angola, there are apparently only seven males and five females in museums. Much more material is needed to arrive at any

TABLE 14
WING MEASUREMENTS (IN MILLIMETERS) OF *Sarothrura rufa*
(Averages are in parentheses)

Geographical Location	Material	Wing Length
South Africa	11 ♂	74-82 (78.1)
	5 ♀	75-79 (77.4)
Rhodesia/Mozambique border	1 ♀ ^a	78 (78)
Botswana: Nokanen	3 ♀	75, 76, 78 (76.3)
Zambia/Malawi	13 ♂	71-81 (76.5)
	5 ♂	72-78 (75.8)
Angola: Duque de Braganza, Chitau, Cavungu	6 ♂	73-78 (76.3)
	5 ♂	76-81 (78.0)
Southern Congo: Upemba National Park, Kasaji, Luluabourg	32 ♂	71-79 (75.7)
	17 ♀	74-79 (76.5)
Northeastern Congo: Bingi, Butembo, Kashusha, Kivu, Lubango, Pawa (of which 117 males and 69 females from Butembo)	127 ♂	70-81 (76.3)
	73 ♀	73-81 (77.2)
Eastern Tanzania: Uluguru Mountains	3 ♂	71, 73, 75 (73.0)
Kenya: Nairobi and Nanyuki westward	29 ♂	72-80 (75.3)
	12 ♀	72-81 (77.0)
Gabon	2 ♂	66, 67 (66.5)
	1 ♀	71 (71)
Southern Cameroun, south of ca. 4.5°	13 ♂	68-73 (69.5)
	11 ♀	66-73 (70.6)

^aFrom Brooke (1966a, p. 435).

conclusions as to geographical variation in a species such as *rufa*. We can only concur with Chapin (1939, p. 19) in regarding *S. r. ansorgei* as a synonym of nominate *rufa*, and note that Traylor (1963, p. 56) arrived at a similar conclusion.

No material from South-West Africa has been examined, but it may exist in Liverpool, where Canon H. B. Tristram's collection is now housed. For details see Tristram (1889, p. 28, under *Crex dimidiata*). But we have been unable to obtain any information about this particular specimen, which was collected by Andersson at Omanbonde.

We have examined 12 specimens still wholly or mainly in immature dress, and another three still showing some signs of its retention. This dress is dull matte black above, dull grayish black below, the chin, throat, and center of abdomen whitish. All three subspecies which we recognize are represented in this material.

A newly hatched chick in New York is clothed in black down and has pale tips on both mandibles. For a more detailed description of a 24-hour-old chick and its subsequent development we have to thank Liversidge (1968), from whom we quote: "The newly hatched chick had

long silky black filoplumes, black eyes, the legs were purplish black and the beak was white at the tip, black in the middle and deep pink at the base. This is to all intents the same coloration as a newly hatched Black Crake (*Limnocorax flavirostra*). Indeed, when the chick was brought in, the likelihood that it was a Black Crake seemed most probable.

"In three weeks the chick grew in size, the legs became less black. The bill coloration remained the same, but the black and pink portions grew so that only the extreme tip was white. At four weeks it was noticeable that the bill was elongated and the little chick was already assuming the characters of a rail in stance, walk and shape. The tail filoplumes were elongated, the wing had the tips of the quills bursting open to reveal black feathers. Its head at this stage was covered with dark quills. The chin was showing lighter color and there were indications of a light medium ventral line.

"At six weeks the first diagnostic feathers appeared in the form of white longitudinal striped feathers on the mantle. White had appeared on these feathers at five weeks, but the pattern became distinct at six weeks of age, indicating the chick to be a male Red-chested

TABLE 15

SUMMARY OF EXAMINED SPECIMENS OF *Sarothrura rufa*

	Examined by Author(s)	Examined by Others	Totals
Male	250	86	336
Female	131	45	176
Immature	12	0	12
Chicks	1	0	1
Total	394	131	525

Flufftail (*Sarothrura rufa*). At this stage the chin was a conspicuous white; there was a definite white medium stripe down to the vent with a narrow edge merging to black. For the rest the plumage was sooty black; the bill mostly black with pink nares and base. The first buff neck feathers appeared just under seven weeks of age."

Liversidge's observations were made at Coldstream, Cape Province, and he told us that the chick was brought to him on February 1, 1966. The initial bill color could have served to emphasize signal movements used in obtaining food from adults (Boyd and Alley, 1948, p. 589).

An adult male in Nairobi, from Molo, Kenya, February 9, 1965, weighed 30 grams, whereas Moreau (1944, p. 23) gave the weight of a male from Amani as 33 grams, and White (1948, p. 137) of one from Mwinilunga as 42 grams. From the measurements in tables 13 and 14, especially of wing, the light weight of the Amani specimen is to be expected, although the Nairobi one is surprisingly light.

MATERIAL: It is impracticable to give full details of where all the material examined personally, or reported on to us, is housed. Of the more extensive series by areas, that from Zambia and Malawi is almost entirely in Bulawayo, London, and Pretoria; and by far the greater part of that from the Congo is in Tervuren, of which no fewer than 210 specimens are from a single locality, Butembo: this is more than one-third of the total number of specimens known to us. Most of the Angolan material is in Chicago. Of the Tanzanian, that from the Matengo Highlands is in Vienna; from Amani and Pemba Island, in London; from the Uluguru Mountains, in Bonn, Cambridge, Massachusetts, and Copenhagen. Those from Gabon are in Chicago, London, New York, and

Paris, of which three males (including the type of *bonapartii*) and a female are in Paris. Ten of the Kenya specimens are in Cambridge, Massachusetts, and 26 in Chicago. There are 24 specimens from Cameroun in Chicago and another 11 in Pittsburgh. The scanty material from Sierra Leone and Ethiopia is in London, and that from Uganda in Tervuren.

Sarothrura lugens

Crex lugeus [sic] BOEHM, 1884, p. 176. (Ugalla, western Tanzania.)¹

SYNONYMY: *Sarothrura modesta* MONARD, 1949, p. 735. (Ngaounyanga, Cameroun.)

DISTRIBUTION: Known from scattered localities in eastern Rhodesia, northeastern Zambia, western Tanzania, central Angola, the Congo, and Cameroun. Rhodesian and Zambian records are placed under *S. lynesii* Grant and Mackworth-Praed (locality, Nsombo, northwest corner of Lake Bangweulu, northeastern Zambia), now considered conspecific with *lugens*, as discussed below. The species will doubtless eventually be discovered in various intervening localities, for example, in Malawi and northwestern Zambia. Benson (1959, p. 262) gave a sound record from Mkushi River, Zambia. Elgood (1964, p. 16) listed it provisionally from Nigeria, but (personal commun.) agreed that there is no authentic record west of the type locality of *S. modesta* in Cameroun.

HABITAT: In northeastern Zambia at Ngitwa, Benson (1956, p. 598) found it in dambos alongside *S. rufa* and *boehmi*. Although *rufa* and *lugens* prefer the lush centers, *boehmi* prefers the edges with shorter grass. Whether there is any ecological segregation between the former two must await further investigation, although like Benson (*loc. cit.*), Keith, when tape recording the voices of the birds at Ngitwa, was unable to determine any difference. Lynes (1934, p. 37, under *S. rufa*) recorded *lugens* from "tump grass" in the marshy fringe of Lake Bangweulu. According to the labels of the two females, now in London, they were in a dryish swamp, one being flushed from mat grass 2 feet high. He

¹Dr. Mauersberger informed us that the locality on the label of the type, which is not the original one, is Marupambala, January 16, 1883. We have failed to trace this locality. Boehm mentioned only Ugalla, but Marupambala is presumably close to it. Boehm does not give a date.

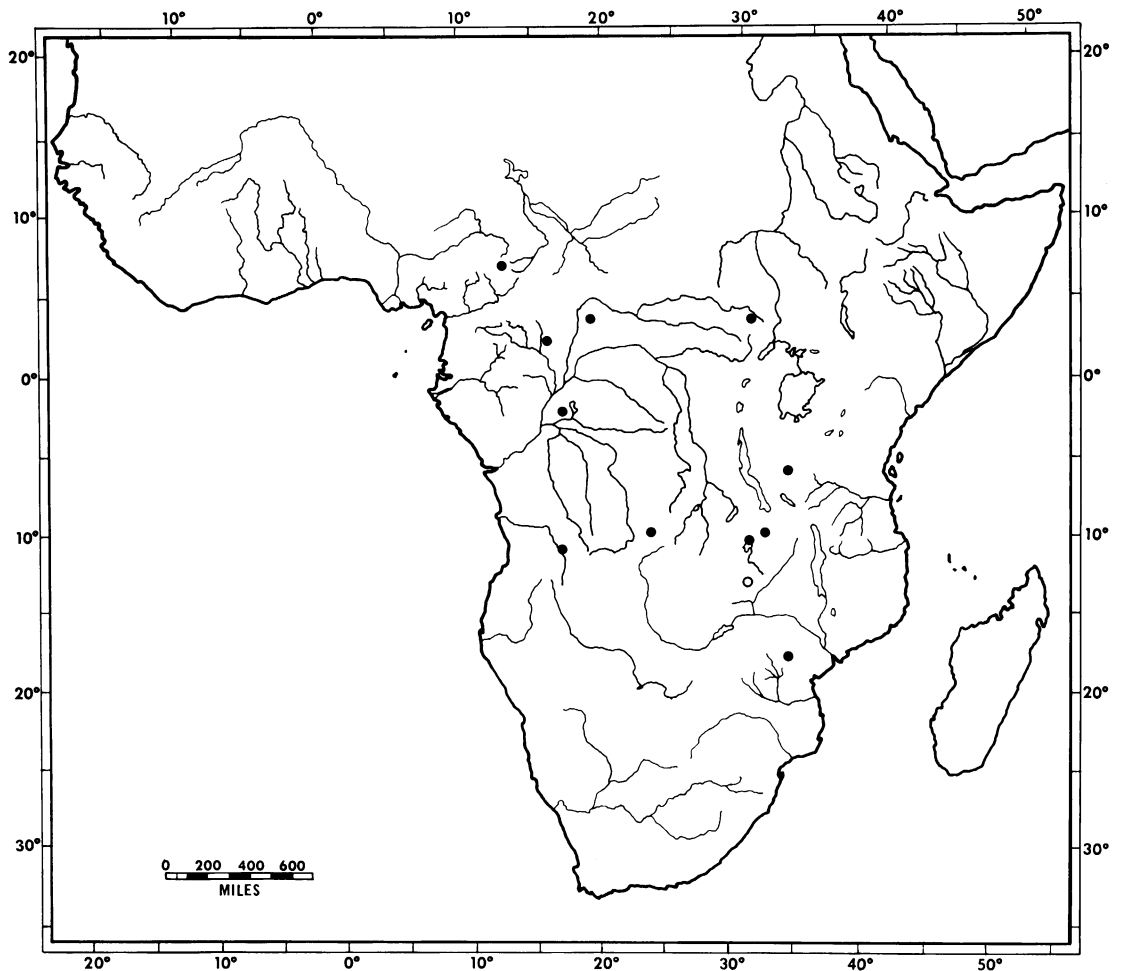


FIG. 11. Distribution of *Sarothrura lugens*.
 Key: ●, collected specimen; ○, sound recording.

collected them in November, just before the rains.

At Faradje, in the northeastern Congo, Chapin (1939, p. 18) found *lugens* in "densely packed vegetation, largely grasses and marantaceous plants . . . anywhere from waist to shoulder-high, where the mud was not so deep" as in papyrus swamp. This habitat seems to be similar to that in Zambia at Ngitwa.

Food: Chapin (1939, p. 18) recorded that the stomach of one of the specimens, which he collected at Faradje, contained finely divided insect remains and two hard seeds. Benson (1956, p. 597) found that the stomach contents of a chick were small black ants.

BREEDING: Lynes (1934, p. 37, under *S. rufa*)

stated that the two females which he and Vincent collected on November 18 and 25, on the edge of Lake Bangweulu were both about to lay eggs. But the notes on the labels of these specimens merely indicate that gonad activity had started. There is a definite record of breeding from Ngitwa, where on April 12 Benson (1956, p. 597) collected a female with two chicks only a few days old, indicating egg laying in March. But a male collected there on April 24 may have been from an egg laid considerably earlier, possibly even in December. It is discussed below, and it suffices here to state that although it is apparently fully grown it is still partially in immature dress. Two males from Kasaji, in the southwestern Congo, collected on

August 12 and 16, also retain remnants of a black immature dress, and conceivably were from eggs laid in March or April. Although it is obvious that further investigation is needed, it would appear that, at least in the southern part of its range, *lugens* is a rains (December–April) breeder. This agrees substantially with data for the genus as a whole from Rhodesia, Zambia, and Malawi (Benson, Brooke and Vernon, 1964, pp. 47–48). Nevertheless there are in Tervuren two tiny black chicks, collected at Kasaji on June 25 and August 3, apparently of a *Sarothrura* sp., suggesting that breeding in the genus can sometimes be prolonged well into the dry season. The second specimen indicates egg laying as late as July. There is also a third such chick from Kasaji, collected on February 22.

Monard (1951, p. 73) recorded that the type of his *S. modesta*, a female, collected on July 11 in Cameroun contained a fully formed egg and another unshelled.

MOVEMENTS: In Rhodesia and Zambia only 10 specimens (including two chicks) have been collected, all falling within the period November–April. It might be supposed from this scanty material that its status is that of a visitor during the rains. But this is not supported by the fine series of 39 specimens obtained by the Rev. S. Fisher at Kasaji (slightly farther south than Ngitwa, where seven Zambian specimens have been collected), which fall into months as follows: May, one; June, two; July, eight; August, 23; September, three; October, two. It is presumed that *S. lugens* is resident in the southern part of its range, and this is still more likely to be so in localities nearer to the equator, but material is even more scanty than from Rhodesia and Zambia.

VOICE AND BEHAVIOR: The voice has only very recently become known. The only published description of the song is that by Benson (1956, p. 598). The song note reminded him of that of *elegans*. "But is not so prolonged, lasting not more than 1 second, instead of 2–3 seconds, and is repeated at 1-second intervals some eight times. There is a gradual increase in intensity, followed by a decrease, so that the strongest note is the fifth. The two final notes are each sometimes followed by a still shorter note, suggesting exhaustion. They might be described as 'hoooboo.'"

The birds at Ngitwa, Zambia, were singing very little when Keith went there to record

them, and his only recordings of the song are so faint in relation to the loud insect background that they do not appear on a sonogram. Keith found length and timing of songs more or less as described by Benson, but to his ears the note is more guttural than that of *elegans*, less pure, and could not be mistaken for it.

During Keith's visit to Ngitwa, the birds, although they did not sing much, frequently indulged in vigorous calling. These calls are here described for the first time, and appear on the three sonograms for the species (5A–C). The calls were identified as those of *lugens* because they came from birds that had just been singing. Both *rufa* and *boehmi* are known to inhabit this same dambo, but a comparison of the sonograms of their calls with those of *lugens* will make the differences between the three species' calls apparent. This is an example of the usefulness of sonograms in making comparisons of calls; to the human ear there is a superficial resemblance among the three calls, but when they are reduced to sonograms it is easy to distinguish one from another.

The typical call of *lugens* consists of a long series of notes, rapid, loud, and far-carrying, which might be written, "koh-koh-koh--." They are repeated at the rate of about three per second, and the series lasts typically 30 to 45 seconds. These loud notes comprise the main, central section of the call; at the beginning there is a wind-up, starting with a few low notes, like shortened versions of the moaning song-note, turning into grunts, like the "guh" immediately preceding the song of *boehmi*, and finally becoming the loud "koh." Tempo and volume increase during this progression. Similarly, at the end, the "koh's" become slower, decrease in volume and pitch, and end in a sort of grunt.

As with the call of *boehmi*, a low grunt is incorporated into each note, only in this case the grunt does not precede the note but is given coincidentally, or perhaps just a fraction of a second earlier, so that it sounds, not like a different note, but rather like an undertone to the much higher-pitched "koh." Similar grunts are produced by *rufa* (see under that species for a general discussion of the problem).

Three sonograms of the call are shown. The wide bands of sound in the upper half of the sonograms are insects and other noises. In 5A the call is being given at full speed; in 5B it has started to slow down a bit, the notes are less

intense, a bit longer, and a bit more widely spaced.

In sonogram 3C two birds are calling at once. They were about 30 feet from Keith and about 6 feet apart, and are judged to be male and female of a pair (see Introduction).

The call notes of birds which had been recorded at close quarters and then had their calls played back to them tended to trail off into an irregular series of "annoyance" calls similar to those noted for *boehmi*.

SYSTEMATICS: First, it is necessary to discuss the status of *S. lynesii*, a taxon with a checkered systematic career. The two females on which it was based were originally assigned by Lynes (1934, p. 37) to an indeterminate subspecies of *S. rufa*. Grant and Mackworth-Praed, in their original description of *lynesei* (1934a), placed it as a subspecies of *S. lineata* (= *affinis*), but Mackworth-Praed and Grant (1937, p. 629) decided that, pending the receipt of males, it was advisable to regard it as a full species. Schouteden (1950, pp. 99–100) announced the discovery of the male of *lynesei* from Kasaji. Chapin (1954, p. 628) noted that in color this specimen bore considerable resemblance to the male of *S. lugens*, but that it had noticeably shorter feet. He (1939, p. 17) had identified an adult male from Chitau, Angola, with *lugens*, but in view of its relatively short feet now placed it with *lynesei*. Bannerman (1951, p. 157) examined the type of *S. modesta*, a female, and assigned it to *lugens*, of which *modesta* therefore became a synonym. He also remarked that the females of *lugens* and *lynesei* are alike, but that the middle toe with claw of *lynesei* is usually shorter. Benson (1956, p. 605) found that males, assumed to be *lynesei*, from Kasaji, did not differ in color from a male of *lugens* from Kunungu. Schouteden (1965, p. 23) recorded both *lugens* and *lynesei* from Kasaji, but without giving any details other than dates of specimens. In announcing the discovery of a female of *lynesei* in eastern Rhodesia, Benson and Irwin (1965, p. 2) suggested that *lugens* and *lynesei* might be conspecific, as White (1965, p. 104) had already done. White placed the southwestern Katanga, in which Kasaji is situated, as within the range of *lynesei*, not of *lugens*. Irwin and Benson (1966, p. 7) definitely regarded them as conspecific. Stresemann had compared for them in Berlin females of *lynesei* with the type of *lugens*, also a female, and found that the principal difference

was merely that *lugens* was larger (as is suggested by the longer wing length).

Further investigations support our belief that *lynesei* is no more than a subspecies of *lugens*. In this we have been particularly fortified by the availability of 27 males and 12 females from Kasaji, and one male each from Kunungu and Bokilio, Ubangi District, and a female from Bokalakala, in Tervuren, which have been compared directly with an immature male and three adult females of *lynesei* from northeastern Zambia, in London. These three females of *lynesei* were part of the material used by Benson and Irwin (1966) in establishing the occurrence of *lynesei* in eastern Rhodesia, at nearly 6000 feet at Inyanga. As they then pointed out, there is considerable individual variation in females, and this applies also to those in the Kasaji series. But it is impossible to discern any constant geographic difference in color or color pattern. The only male available from Zambia or Rhodesia is the one from Ngitwa already mentioned, not yet in fully adult dress, in London. The crown and sides of the head are still plain black, with some chestnut appearing on the nape. On the remainder of the upper side it still retains some plain black feathers, but for the most part it has already acquired an adult dress, almost indistinguishable from that of males from Kasaji. On the underside it is mainly brownish black, with the center of the abdomen and the chin and throat whitish. But some adult feathers have appeared on the chest and flanks, and the color and pattern in these areas again shows no difference from Kasaji males. It thus appears that in color *lugens* and *lynesei* are indistinguishable in both sexes.

Measurements of material in Tervuren and London are given in table 16, along with those for three females in Bulawayo (as in Benson and Irwin, 1966, p. 2) and another male, also there, from Kasaji.

It is evident from Bannerman (1951, p. 157) that the type of *S. modesta*, a female, has a wing length falling within the range 79–81, although Monard (1951, p. 73) made it as much as 85. Bannerman gave the length of the middle toe with claw as 29, and stated that in *lynesei* it never exceeds 26. When he wrote, the only specimens of *lynesei* that could have been available to him were the two females collected by Lynes in Bangweulu. Apart from the material whose measurements are given (table 16), and the type

TABLE 16
MEASUREMENTS (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura lugens*
(Averages are in parentheses)

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
Rhodesia	1♀	70	13.5	20.5	27
Northeastern Zambia	1♂ ^a	71	13	19	24
	6♀ ^b	70–74 (72.0)	12.5–14 (13.2)	17–19 (18.0)	23–25 (24.3)
Congo: Kasaji	27♂	75–82 (78.1)	13–15 (14.4)	19–22 (20.5)	24–28 (25.9)
	12♀	76–82 (78.5)	13–15 (14.0)	20–21.5 (20.8)	24.5–29 (26.3)
Congo: Kunungu (♂) ^c and Bokalakala (♀)	1♂	80	15	22.5	29
	1♀	82	15	22	27
Congo: Bokilio	1♂	78	13	20	— ^d
Congo: Faradje ^e	2♂	78, 81	—	—	—
	1♀	82	—	—	—
Tanzania: Ugalla ^f (type of <i>S. lugens</i>)	1♀	80	—	—	—

^a Immature, as described in text, but presumed to be fully grown.

^b Includes a specimen from Ngitwa in Tervuren.

^c These two localities have practically the same coordinates.

^d Toes bent, not measurable.

^e See Chapin (1939, p. 17); specimens are in New York.

^f See Irwin and Benson (1966, p. 7); specimen is in Berlin.

of *S. modesta*, the only other specimen of either subspecies of which we are aware is an adult male in alcohol, in New York, from Chitau, Angola, unfortunately without remiges, identified by Chapin (1939, p. 17) as *S. lugens*. Later he (1954, p. 628) identified it as *lynesei*, by reason of its relatively short feet, the metatarsus measuring 21, the middle toe (with claw), 26 mm. It has been measured again by Benson, who makes the length of the culmen, 14; tarsus, 18; middle toe, 24 mm. It is most unfortunate that the remiges are missing. Nevertheless these measurements agree better with those of the material from Zambia than with those of the Congo. So we prefer to place the Chitau specimen with *lynesei* rather than with *lugens*, thus agreeing with Chapin's revised identification. Attention should be drawn to the long tarsus and middle toe of the Rhodesian specimen, in this respect falling within the range of Congo rather than Zambian material. But clearly it is impossible to decide how constant this may be until further specimens have been collected in Rhodesia.

We conclude that *lynesei* is only distinguishable from *lugens* by its over-all smaller measurements, and that these two species replace each other geographically. According to present knowledge,

S. lugens lynesei is known only from eastern Rhodesia and northeastern Zambia. All of the material from Kasaji must be placed with *S. l. lugens*. Mackworth-Praed and Grant (1937, p. 627) divide the genus into two groups, a short-toed and a long-toed, *S. l. lynesei* falling into the former, *S. l. lugens* into the latter. But the difference in this particular case appears to be merely a reflection of the over-all difference in size. The male of *lynesei* was unknown in 1937. From a perusal of their paper, it is evident that the only females of the species that Mackworth-Praed and Grant had available were the two of *lynesei* from Nsombo and two of nominate *lugens*—the type, and the one from Faradje. Individual variation in color and pattern, to which we have already drawn attention, could be misleading.

It remains to state that the two chicks only a few days old reported by Benson (1956, p. 597) from Ngitwa, now in London, are clothed in long, silky black filoplumes, and cannot be distinguished from chicks therein of *S. boehmi*. They have the extreme tip of the bill and the base white, which may serve to emphasize signal movements employed by the young in obtaining food from adults (Boyd and Alley, 1948, p. 587).

MATERIAL: Details of all specimens and where

they are housed have already been given in the preceding section, the only exception being the type of *S. modesta*, in Chaux-de-Fonds.

Of the grand total of specimens examined (table 17), 39 are from Kasaji, and 42 are in

Tervuren. Included in the immature total are the two mainly adult males from Kasaji, mentioned under Breeding.

Sarothrura boehmi

Sarothrura boehmi REICHENOW, 1900, p. 290. (Likulwe, Haut Luapula, southeastern Congo.)

SYNONYMY: *Sarothrura somereni* BANNERMAN, 1919, p. 8. (Machakos, Kenya.)

Sarothrura boehmi danei BANNERMAN, 1920, p. 3. (At sea at latitude 10° N., longitude 15° W., off Guinea.)

DISTRIBUTION: Known from scattered localities from Rhodesia north to Kenya and Cameroun; also one record from off the coast of Guinea (type locality of *S. b. danei*, as above). The sound records on the map are from

TABLE 17
SUMMARY OF EXAMINED SPECIMENS OF *Sarothrura lugens*

	Examined by Author(s)	Examined by Others	Totals
Males	30	1	31
Females	22	1	23
Immature	3	0	3
Chicks	0	0	0
Total	57	2	59

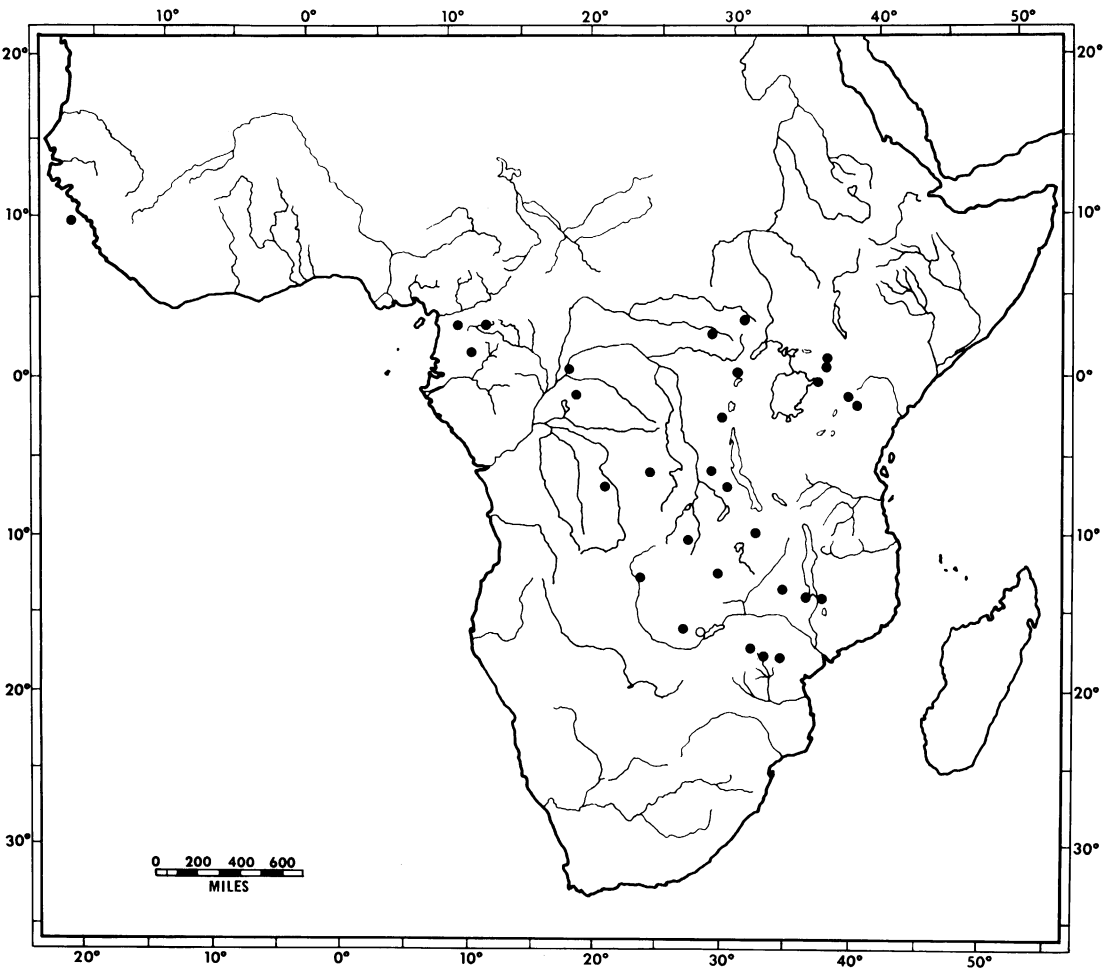


FIG. 12. Distribution of *Sarothrura boehmi*.
Key: ●, collected specimen; ○, sound recording.

Kawambwa and Choma, Zambia, made by Keith.

HABITAT: Inhabits relatively open growth—areas of short grass liable merely to temporary inundation during the rains. Thus 11 specimens (including three chicks) in Bulawayo, collected by Benson in Zambia, were trapped on the edges of dambos (drainage lines through the prevalent *Brachystegia* woodland), not in the lush centers, occupied mainly by *S. rufa*. This was also Keith's experience when tape recording the voice of this species in Zambia, whereas White (1945, p. 317) recorded breeding in a "wet shortgrass dambo" in the Balovale District. The specimen recorded by Benson (1944, p. 451) from Fort Johnston was from a temporary swamp which dries up after the conclusion of the rains, as he can reaffirm. Jackson (Jackson and Sclater, 1938, p. 298) collected a male "on the old rifle range at Nairobi," another on "the open grassy flat, but at that time a marsh," both in May, in "an exceptionally wet season." These two specimens are in New York. Van Someren (1939, p. 33) gave the habitat in Kenya as "temporary swamp" and "river margin." Good (1952, p. 77) gave the habitat in Cameroun as similar to that of *S. rufa*, which he stated lives in thick grass one-third to one-half meter in drier situations, not near water nor in swamps. But as elsewhere, there is probably a difference, and the habitat ascribed by him to *rufo* seems more typical of *boehmi*. Around Lake Chad, where Dowsett (personal commun.) spent most of 1968, there are grasslands liable to inundation during the rains, which fall between July and September. But the rainfall is no more than 8 inches a year, and many of such areas dry up even in these months. It is therefore very unlikely that *boehmi* occurs in this area.

The altitudinal range, at least in southern Africa, is considerable. There is a male in London from Fort Johnston, Malawi, at only 1650 feet, taken in breeding condition on February 8, and another in Bulawayo, from Inyanga, Rhodesia, at 6000 feet, February 15. There is a specimen in Tervuren from Luiko, in the eastern Congo, from as high as 1890 meters (ca. 6200 feet), and an immature specimen from Kitale, western Kenya, discussed below, could not have been from lower than 6000 feet.

Food: Chapin (1939, p. 16) collected an adult male at Faradje whose stomach contents consisted of small seeds exclusively. Benson (1956,

p. 597) gave the stomach contents of specimens collected at Fort Jameson as grass seeds and small insect remains.

BREEDING: Benson, Brooke and Vernon (1964, p. 48) gave 12 records from Rhodesia, Zambia and Malawi pointing to egg laying starting in January, eight in February, and two in March. They gave the clutch size as varying from two to five. Details, on which some of these records are based, are available in earlier publications.

In Rhodesia, Neuby Varty (1953, p. 52) found a number of nests and collected a parent. He described the nest as "saucer shaped, made of dried grass and about an inch thick, placed in a tuft from one to three inches above the wet ground, with the tops of the grass pulled over and interwoven to hide the nest." Eggs were creamy white, some with pinpoint spots of brown; 13 average 26.9 by 19 mm. Brooke (personal commun.) has brought Rhodesian information up to date, to include the rains of 1964–1965. In all, 33 clutches of eggs attributed to *S. boehmi* have been found, clutch size as follows: C/2, 2; C/3, 11; C/4, 13; C/5, 7. Twelve of these records point to egg laying starting in January, 16 in February, five in March. It is worth giving some abbreviated details of the more recent records, all from around Salisbury, to supplement Neuby Varty's information.

(1) January 25, 1962: C/5, Marimba River (C. Grabandt). Male parent filmed, the finder and Brooke satisfying themselves that identification was correct. Nest with grass of a tuft pulled over to make a covering bower.

(2) January 26, 1965: C/3, Avondale (G. Hopkinson). Eggs measure 27 by 19, 26.5 by 19, and 26.5 by 18.5 mm., color, creamy white. Nest a small pad with green grasses bent over to form a dome; deserted near where an *S. boehmi*, probably one of the parents, had been caught by a dog.

(3) January 28, 1965: C/4, Mt. Pleasant (K. E. Cackett). Eggs fresh, size 28 by 20, 28 by 19, 27 by 19, and 27 by 20 mm. Nest beneath a tuft of grass in short, dry grassland bordering a vleij; a large shallow cup of broad grass blades, grass of tuft pulled over to form a bower over the nest.

(4) January 30, 1965: C/4, Avondale (G. Hopkinson). Eggs creamy white with a few tiny freckles at larger end, size 26.5 by 18.75 (two), 26.5 by 18.5 mm. (two). Nest a pad with grass pulled over, but flooded out after heavy rain

(another such flooded out nest with C/4 found one week later).

(5) February 6, 1965: C/4, Avondale (G. Hopkinson). Nest in tuft of grass on ant hill; incubating bird hissed when disturbed.

Sarothrura rufa also occurs in the Salisbury area, and the possibility of confusion with it in some of these records has been considered. We do not know of any certain way of distinguishing the eggs of the two species, but the possibility of some difference needs further investigation. But it appears that in all of them the nest was well covered by the surrounding grass being bent over, as Neuby Varty found (obviously this is of particular advantage in the absence of a parent, because the eggs are white). *Rufa* does not appear to practice this to the same extent. Also, the site in records (3) and (5) seems much too dry for *rufa*, whereas in (1) the parent was identified as *boehmi*. With regard to (2), two other nests were found in the same locality the same day. They were not assigned to species. One contained four empty shells, the other three. The contents had apparently been eaten by a swamp rat, *Otomys* sp. It has been suggested to us that these rats may do considerable damage in this way, and that it is advantageous for the rails to breed early in the rains, before the rat population has recovered after reduction by burning of the grass in the previous dry season. A detailed investigation might prove rewarding.

In Zambia White (1945, p. 317) collected, in the Balovale District on January 21, a female with three much incubated eggs, and also took a clutch of four eggs on February 6. At Ngitwa, Benson (1956, p. 597) collected a female with three black chicks only a few days old on March 5, and (1959, p. 262) at Hot Springs, a female containing a fully developed egg on January 8. From Malawi, Mackworth-Praed and Grant (1938, p. 765; see also Benson, 1940, p. 389) recorded a male and a female collected at Mphunzi on February 15, with two very small black chicks, and a male there on March 4 with four eggs. These eggs, which are in London, measure 28.1 by 20.2, 27.5 by 20.0, 27.6 by 19.5, and 28.1 by 19.9 mm. A Rhodesian clutch in London, collected by Neuby Varty, measure 27.4 by 20.3, 26.3 by 19.8, and 28.0 by 20.3 mm.

From farther north, the only evidence of breeding traced is from Kenya. Reference is made above to two specimens collected by

Jackson in May. Both are stated to have been in breeding condition. As indicated under *S. affinis*, a breeding record from near Kitale is referable to that species, not *boehmi*. However, an immature specimen from near there, collected on September 15, was probably from an egg laid about two months previously. It is described below under Systematics. All the records from Rhodesia, Zambia, and Malawi fall within the rains, whereas Jackson's specimens were collected in an "exceptionally wet season." Van Someren (1939, p. 33) gave evidence of breeding in Kenya in May, in which month he collected a male with very large testes at Kisumu. This specimen has not been traced, but it was evidently collected during the long rains.

MOVEMENTS: Exclusive of chicks collected in February and March (see above), fully grown specimens are only available from Rhodesia, Malawi, and Zambia as follows: January, 10 specimens; February, 17 specimens; March, eight specimens. The earliest date is for a male now in New York (Balovale, January 6), the latest for an immature female now in Bulawayo (Ngitwa, March 25). In addition, Keith heard the call near Kawambwa as early as December 9, and near Kasama on December 13. These dates as a whole strongly suggest that the species is migratory in the southern part of its range. *Crex egregia* has already been shown to be only normally present in this region from about November to April, that is, during the rains (Benson, 1964, pp. 53-56; Benson and Irwin, 1965c, pp. 45-46), and the same applies to some extent to the Broad-tailed Warbler, *Schoenicola platyura* (Jerdon) (Brooke, 1966b, p. 215). The habitat of such species, similar to that of *Sarothrura boehmi*, is liable to be burnt over during the long dry season, from May to October. The relatively long wing length of *boehmi*, compared to that of most other *Sarothrura* spp., also suggests that it may be migratory, and Chapin (1939, p. 16) noted that the flight is strong and direct.

Sarothrura boehmi may be migratory also at Dundo, northeastern Angola, whence Ripley and Heinrich (1960, p. 3) gave a record for November 21. This would be in the early part of the rains, and the specimen in question may have been a recent arrival. The type of *S. boehmi*, from the southeastern Congo, was collected in December (Reichenow, 1900-1901, p. 290). It had previously been misidentified as *S. lugens*.

TABLE 18
MEASUREMENTS IN FULL (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura boehmi*
(Averages are in parentheses)

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
Rhodesia	3♂	84, 88, 88	13.5, 14.5, 14.5	18.5, 19, 19.5	20.5, 21, 21.5
	2♀	84, 87	13, 13.5	18, 18.5	20, 20.5
Zambia/Malawi	12♂	83-88 (84.6)	13-14.5 (13.8)	18.5-21.5 (19.6)	20-23 (21.2)
	8♀	83-88 (85.2)	13.5-14.5 (13.9)	19-20 (19.7)	20-22 (21.4)
Kenya: Nairobi (♂, July); Machakos (♀, August 20) (type of <i>S. b. somereni</i>)	1♂ 1♀	83 84	13 13	19 21.5	20.5 23
Congo: Baudouinville (May 15); Kasansa (February 5)	2♂	82, 83	14, 14	19, 19.5	19, 19
Congo: within 2° of the equator: Bokuma (December 6); Butembo (May); Coquilhatville (Nov- ember 20); Luiko (December 3)	3♂ 1♀	84, 84, 88 84	13.5, 14, 14.5 13.5	20, 20, 20.5 19	19.5, 20, 20.5 21
Gabon: Oyem (July) ^a	1♀	81	14	19	25
Cameroun: Bitye (November 29)	1♂	87	13	21	21
Off coast of Guinea (June 14; type of <i>S. b. danei</i>)	1♂	85	13.5	19.5	21

^a This specimen was identified by Benson (1967, p. 44).

Reference to Matschie (1887, p. 145) shows that exact date of collection was December 17. A specimen from Bakwanga, in the Kasai (Schouteden, 1964, p. 42) is dated February, but was not found in Tervuren, although one therein from Kasansa, in the Lomami District, is dated February 5. All three of these records also fall within the rains, but one from Baudouinville (May 15) is in the early dry season.

A determination as to whether there is also a migration north of the equator must await the acquisition of further specimens. At present the material available, whose dates are indicated in table 18, is scanty in comparison with that from south of the equator. It is worth emphasizing that the type of *S. b. danei* was collected at sea, on June 14, near the start of the rains. Possibly it was blown away from land while on migration.

VOICE AND BEHAVIOR: The song of *S. boehmi* has been incorrectly described in the literature several times. That attributed to this species by Rens who is quoted by Benson (1947b, p. 565), described as "ngu-ngu-nguwi-nguwi-nguwi---" is quite plainly the "düh" call of *rufa*, as suggested by Benson. Unfortunately, this error was compounded by Mackworth-Praed and Grant (1952, p. 294), who recorded this call

under *boehmi*. They further compounded their error by adding a description of their own, referring to this call as "a prolonged whistling 'tuning fork' call rising in pitch," a description that could not possibly apply to this call. Perhaps they assumed that since *elegans* has a "tuning fork" song, all members of the genus had a similar song.

The calls attributed to *boehmi* in Benson (1956, p. 598; 1959, p. 262) and Benson and White (1957, p. 158) are now believed to have come from *Crex egregia* (see remarks under *S. boehmi* in Benson and Irwin, 1967a, p. 21). The following descriptions of the calls of this species are therefore the first to be correctly reported.

The song of *boehmi* is illustrated in figure 4A. Each note lasts between 0.3 and 0.4 second, with intervals of 0.6 or 0.7 second between notes. To Keith's ears, the note sounds rather more like "er" than "oo," as in the word "were" (English pronunciation), or the French word "œuf." At a distance this is all one hears, but at close range a low grunt can be heard to precede each note. This is so low as to barely make an impression on the sound sonogram, but is just visible (indicated by arrows). We might then write the song as "guh-were" or just

"g'were." This grunt is probably connected with the mechanism of sound production rather than being a separate note of the song (see under *S. rufa*). Keith found these song notes could be repeated at a constant rate of about one per second, anything up to 25 times.

The voice of the singing male on sonogram 4A trailed off into the notes shown on the next sonogram (4B), a softer note, "cuk-cuk-cuk---." Although softer, it had a somewhat agitated quality to it, probably due to the fact that Keith had by then been playing back its song to the bird for some time. It might be designated as an "annoyance call," a reaction to an intruder. The notes were somewhat irregular, although they appear fairly evenly spaced on the section of tape illustrated.

The other three sonograms (4C-E) are of recordings made in a different locality with a high background of insects and wind, and the rail notes, though discernible, do not stand out so well. Sonogram 4C is a faster and more agitated version of 4B, with a slightly different quality to the note (the note slopes up in the middle instead of being straight, indicating a rise and fall in pitch). In the next sonogram (4D) the same bird turned these notes into triplets. In the last sonogram for *boehmi* (4E), two birds are vocalizing together. At the bottom of the scale, two long streaks indicating the song notes of the male are visible (compare with 4A). At the same time a second bird is giving an agitated version of the "cuk" note, with the higher harmonics much accentuated, making the note sound higher. This is undoubtedly the female of the pair whose territory Keith had invaded, and was a response to continued playback of the song. We see, then, that both male and female can make the "cuk" call. This may be compared with the calls made by *rufa* and *lugens* (probably also by both sexes). These recordings were all made during the day.

SYSTEMATICS: Mackworth-Praed and Grant (1937, p. 628) recognized *S. b. danei*, on the basis of a single male taken at sea off the coast of Guinea, as having chestnut more extensive, extending onto the chest. However, they (1938, p. 765) treated the species binomially, two males which had become available from Malawi being variable in the extent of chestnut. We concur in this latter opinion. The extent of chestnut on the underside seems variable regardless of geography. Normally it does not extend beyond the

lower neck. Thus this is generally borne out by the series of nine males from Rhodesia and Zambia in Bulawayo. But an exception is one from Marandellas, which has the chestnut as extensive onto the chest as in *S. rufa*, whereas one from Fort Jameson, Zambia, has it as extensive on one side of the chest, but lacking on the other side, that is, not extending beyond the lower neck. A similar type of irregularity was noted in seven males in Tervuren, one from Kasansa, in the Congo, having chestnut extending irregularly onto the chest. In some specimens (for example, the type of *danei*) a few black-and-white streaked feathers are apparent within the chestnut area, but not on the sides of the neck, nape or crown. In one specimen in Tervuren streaking is even continuous as far as the white of the throat. It would appear that this species is in process of either developing or losing the chestnut area on the underside.

Some females have a pale wash of chestnut on the chest. This is apparent in a specimen in London and one in Pretoria, from Mphunzi, Malawi, and in one in Bulawayo from Marandellas, Rhodesia. But others lack any such wash. Evidently this also is an example of individual, not geographic, variation. Two females in Bulawayo—from Marandellas, March 13, and Ngitwa, March 25—have some white markings on the upper side, characteristic of the adult female. But they are mainly in the immature plumage, dull matte black above, grayish black below, with the chin, throat, and center of abdomen whitish. White markings are still completely absent from the crown and nape. They appear to be fully grown (wing lengths, 84 and 85 mm.), and so their measurements are included in table 18. There is also an immature female in Kitale, collected in the vicinity of the East Surrey Coffee Estates there, on September 15. It is still mainly in a uniform blackish dress, although with some adult feathers appearing on the mantle, back, wing-coverts, and chest. Its measurements are, wing 76, culmen 12, and tarsus 19 mm., middle toe not measurable, and is evidently not quite fully grown. These figures are not included in table 18. The chicks already mentioned are clothed in long, black, silky filoplumes. All of them have the extreme tip of the bill pale, which may serve to emphasize signal movements by the young in obtaining food from the adults (Boyd and Alley, 1948, p. 597).

Like color, measurements show no geographic

TABLE 19
WING MEASUREMENTS (IN MILLIMETERS) OF
Sarothrura boehmi

Geographical Location	Material	Wing
Zambia/Malawi	6 ♂	80, 82, 83
		83, 84, 84
	4 ♀	84, 85, 88
		89
Angola: Dundo (November 21) ^a	1 ♂	88
Congo: Dikulwe (December 17)	1 ♂ ^b	80
Congo: Faradje (November 24)	1 ♂	81
Kenya: Nairobi (May 10, 13)	2 ♂ ^c	83, 86
Cameroun: Lolodorf (June 29)	1 ♂	83

^a See Ripley and Heinrich (1960, p. 3).

^b This is the type of *S. boehmi*.

^c The two specimens collected by Jackson; see also p. 53

variation, see tables 18 and 19. A comparison of the tarsus and toe measurements of *boehmi* with those of *lugens* and *rufa* is made in table 20. It will be seen that in *boehmi* the toe is little longer than the tarsus, but in the other two species it is considerably longer. It is suggested that *boehmi*, living as it does on relatively hard ground, does not have the same need for long supporting toes as do the other two species, living in an environment in which there is often no firm, supporting ground. Long toes might, in fact, be disadvantageous for a species that may have to run swiftly through relatively short dry grassland.

MATERIAL: Of the specimens whose measurements have been given in full (table 18), those from Rhodesia (five) and Zambia (10) are in Bulawayo, except for one Zambian specimen in Tervuren. Those from Malawi (10) are in London. The male from Kenya and all the Congo specimens are in Tervuren; the Gabon specimen is in Paris; all the remainder are in London.

TABLE 20
COMPARISON OF TARSUS AND MIDDLE TOE MEASUREMENTS (IN MILLIMETERS) OF *Sarothrura boehmi* WITH THOSE OF *S. lugens* AND *S. rufa*

Species	Locality	Tarsus	Middle Toe
<i>S. boehmi</i>	Rhodesia/Zambia/Malawi	18–21.5	20–23
<i>S. lugens</i>	Rhodesia	20.5	27
<i>S. lugens</i>	Zambia	17–19	23–25
<i>S. lugens</i>	Kasaji	19–22	24–29
<i>S. rufa</i>	Rhodesia/Zambia/Malawi	19.5–23	26–32

TABLE 21
SUMMARY OF EXAMINED SPECIMENS OF
Sarothrura boehmi

	Examined by Author(s)	Examined by Others	Totals
Males	28	7	35
Females	11	4	15
Immature	2	0	2
Chicks	5	0	5
	—	—	—
Total	46	11	57

Of those specimens for which wing lengths only are given (table 19), eight are from Malawi and are in Pretoria; two from Zambia, the one from Faradje and the two from Kenya are in New York; the one from Angola is at Yale; the type of *S. boehmi* is in Berlin; and the one specimen from Cameroun is in Chicago.

The three chicks from Ngitwa, Zambia, are in Bulawayo, and the two from Mphunzi, Malawi (see under Breeding) are in London.

We are unaware of any other specimens beyond one from Bakwanga (see under Movements), a male from Kisumu (van Someren, 1939, p. 33), and an immature specimen from Medje (Chapin, 1939, p. 16), but these cannot at present be traced. A summary of the material is given in table 21.

Sarothrura affinis

Crex affinis SMITH, 1828b, p. 144. (Cape Province.)

SYNONYMY: *Alethelia lineata* SWAINSON, 1838, p. 338. ("Inhabits South Africa?" Restricted by Grant and Mackworth-Praed, 1935, p. 58, to Knysna, eastern Cape Province.)

Gallinula jardinii SMITH, 1839, pl. 21. (Male, Cape Town.)

These names are considered synonyms of the nominate subspecies. Swainson's specific name was in general use until Macdonald and Grant (1953, pp. 198, 202) showed that *affinis* was applicable and had priority. Grant and Mackworth-Praed (1935, p. 58) stated that the type of *S. lineata*, reported to be in Cambridge (England) could not be found. It is, however, still there. It is a female, merely labeled, apparently in Swainson's handwriting "Australia?" although the published locality is as quoted above. It may be assumed to have come from South Africa, since in Swainson's day the range of the species north of the Limpopo was unexplored ornithologically.

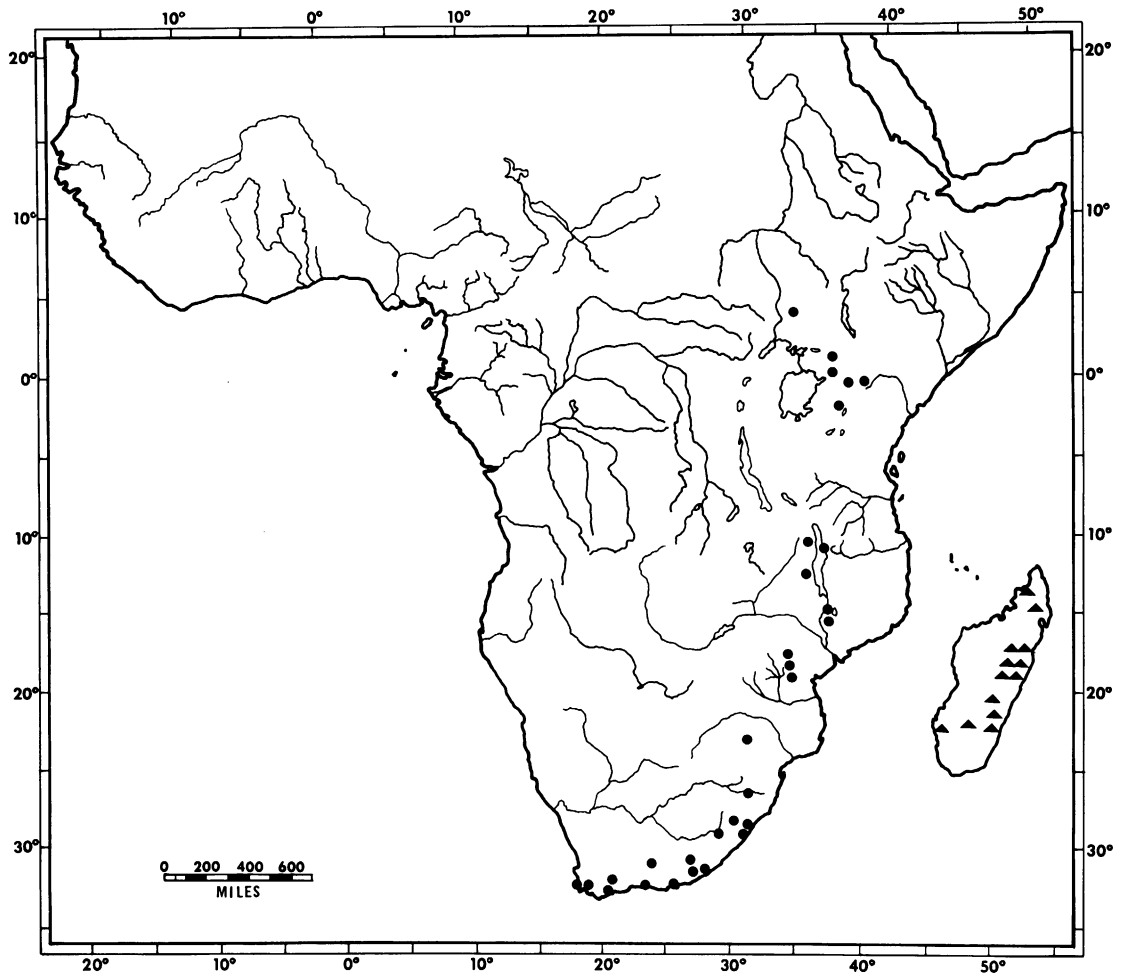


FIG. 13. Distribution of *Sarothrura affinis* and *S. insularis*.
 Key: ●, collected specimen of *S. affinis*; ▲, collected specimen of *S. insularis*.

Gallinula jardinii is not to be confused with *Crex jardineii* Smith, which is a synonym of *S. rufa*. It would appear that Smith, when describing *G. jardinii* had forgotten his description of 11 years earlier of *Crex affinis*. The illustration of the male accompanying this second description, as well as the description itself, clearly shows that it applies to one and the same species.

DISTRIBUTION: Southern Cape Province (Swelendam) to Natal and eastern Transvaal; highlands of eastern Rhodesia and Malawi; north-eastern Zambia (Nyika Plateau); Tanzania (Matengo Highlands and Ndassekera); highlands of Kenya (Mount Kenya, Aberdare Mountains and Trans-Nzoia District), and southeastern Sudan (Imatong Mountains). Except in the extreme south of its range, essentially

a montane species, and it has been collected on Mt. Kenya at over 12,000 feet. Sight records by Grant, quoted by Sclater (1912, p. 50), from Umfolozi and Beira, lowland coastal localities respectively in Zululand and Mozambique, may be based on confusion with some other species. Under existing climatic conditions its distribution is essentially discontinuous and relict. A parallel instance is that of the owl *Bubo capensis* Smith, discussed in detail by Benson and Irwin (1967b). *Sarothrura affinis* doubtless remains to be discovered in many further localities, especially in Tanzania.

HABITAT: For South Africa, McLachlan and Liversidge (1957, p. 109) gave the habitat as "rank vegetation and grass on the borders of forests," Clancey (1964, p. 134) as "long grass

and sedges in marshy spots in forested districts or upland," whereas Macdonald and Grant (1953, p. 198) quoted Smith that it is, "Found in damp situations, as well as about the banks of rivers and marshes in various parts of the Colony" (that is, the present Cape Province). In the Transvaal, where Grant (*in* Sclater, 1912, p. 50) collected specimens, he found it to inhabit "long grass and sedge in marshy places."

It is possible that among the foregoing statements there has been undue emphasis on a marshy environment, which suggests more the habitat of *S. rufa*. Those evidently from personal experience, by Smith and by Grant, are possibly generalized, and based to some extent on confusion with that species, which might also have been seen. By contrast, Skead (1967, p. 63) recorded a specimen of *affinis* taken in the eastern Cape Province "at night in long grass of the headland of ploughed lands," whereas in London there are two specimens collected by Vincent at Mooi River, which, according to their labels, were flushed during the mowing of a field of millet. Ranger (personal commun.) has provided some information from near King William's Town. On March 6, 1950, he caught a male (subsequently released) which was calling outside his house at night. It was in grass, neither short nor long, on a dry ridge, with no water or marsh for miles around. The same call was heard in long grass (*Cymbopogon* and *Miscanthidium* spp.) bordering forest in September. This also was a dry locality, "marshy places occurring as mere spots only when rain is heavy or prolonged." On February 12, 1958, a male was captured (it subsequently escaped) in a reaped dry field of lucerne and grass. On August 30, 1964, the call was heard in a valley near forest, in long vegetation, mostly grass. A male was killed by a mower blade in a lucerne field in December, 1965, and sent to Ranger (it was not retained as a specimen). These records are all from altitudes between 2000 and 2500 feet, and Ranger emphasized that he had no record from near water.

The evidence which follows, from more northern territories, like that of Ranger's in particular, is that *S. affinis* is not a marsh bird, and the definition of the habitat in South Africa by McLachlan and Liversidge (1957, p. 109) is considered the most accurate. In Rhodesia, in the Chimanimani Mountains, Masterson and Child (1959, p. 23) found it not uncommon in

"thick grass or bracken, sometimes on *Protea* covered hillsides," and found a nest on well-drained ground at 5300 feet. On the Zambian side of the Nyika Plateau, at 6300 to 7500 feet, Benson and Holliday (1964, p. 131) found it in much the same kind of habitat as did Masterson and Child, and this was Keith's experience when tape recording the voice in that area. From Malawi, Benson (1953, p. 26) recorded it from dry short grass above 5000 feet. Sassi and Zimmer (1941, p. 264) stated that in the Matengo Highlands, where it was collected at Ugano (altitude 1560 meters or *ca.* 5000 feet), it was found mainly in damp places near water, but that in the rains it occurs away from water. It is understandable that in the dry season, when dry grasslands away from water would be subject to burning, it would take refuge in damper places not so subject. Madarasz and Neumann (1911, p. 186) gave no indication of the habitat of the type specimen of *S. affinis antonii*, collected at Ndassekera, northwestern Tanzania, on January 17, although it was apparently from country at least 6600 feet. There is, however, an interesting account by the collector himself (Kittenberger, 1958, p. 29) of the obtaining of this specimen. It was trodden on by one of his carriers, in high grass, on the Edassakera Plateau [sic], on January 20, 1909. Around Kitale, in the Trans-Nzoia District of Kenya, which lies at over 6000 feet, Stoneham (1928, p. 170) recorded *S. boehmi* in long grass (savanna) country. This observation is really referable to *affinis* (see Mackworth-Praed and Grant, 1937, p. 626; Jackson and Sclater, 1938, p. 297). Meinertzhagen (1937, p. 741) found the habitat on Mt. Kenya and the Aberdare Mountains, between about 11,000 and 12,000 feet, to be open moorland bogs, also inhabited by snipe. Cave and Macdonald (1955, p. 120) collected specimens on a grassy hillside at 8000 feet in the Imatong Mountains.

To summarize, it may be that throughout its range *S. affinis* inhabits relatively dry grasslands. But in areas in which there is a prolonged dry season there may be some purely local movement (probably less than one mile) into wetter situations, not liable to be burnt. From personal experience of short grass montane areas in Malawi and Rhodesia, the necessity for this is understandable. No *Sarothrura* could be expected to live on recently burnt ground, with a lack of protective cover.

FOOD: Meinertzhagen (1937, p. 741) recorded that the stomach contents of Kenya specimens collected by him included "small insects and green food." Benson and Holliday (1964, p. 131) stated that stomach contents of one from the Nyika were "macerated insect fragments." There is a specimen from the Aberdare Mountains in Nairobi whose stomach contents are given as "seeds (two kinds), one beetle and quartz grit," and one from Mooi River, now in London, which contained the remains of tiny beetles. Clancey (1965, p. 134) stated that insects, termites, land mollusks and probably some vegetable matter are eaten. This is quite possibly correct, but the source of this information is not known.

BREEDING: Masterson and Child (1959, p. 23) found a nest containing five eggs in the Chimanimani Mountains at 5300 feet in February, interpreted by Benson, Brooke and Vernon (1964, p. 48) as egg laying in January. The nest "was a substantial basin of rootlets built into a tuft of grass, the top of which was woven into a loose canopy hiding the eggs." The eggs measured 23.8–25.5 by 19.5–20 mm. Their color is not described, although Masterson (personal commun.) stated that they were off-white in color and unmarked. They were so highly incubated that he was only able to blow one, which was addled or infertile. He noted that it is distinctly more rounded than eggs of *S. rufa* or *boehmi* which he has collected near Salisbury. The female was first flushed from the nest, and later the male collected at the nest, thus indicating that both sexes incubate. The exact date of collecting of the male, which is in Bulawayo, is February 2, 1958. Stark and Sclater (1906, p. 254) stated that an egg from a clutch of four collected in the Swellendam division is "oval, somewhat pointed at one end, smooth and somewhat shiny and pure white," measuring 1.03 by 0.71 inches (26 by 17.7 mm.). Unfortunately no date is given in either this or the original reference (Sharpe, 1884, p. 616). Chubb (1914, p. 35) described the eggs as pure white, but was in doubt as to whether they did not really belong to *S. elegans*. As explained under Habitat, the note by Stoneham (1928, p. 170) is really referable to *S. affinis*, not to *boehmi*. Stoneham collected a clutch of four eggs in the Trans-Nzoia District on May 5, the eggs being pure white, rounded at one end and pointed at the other. According to Mackworth-Praed and

Grant (1937, p. 626), a female was taken with them. There are the following clutches preserved in the Queen Victoria Museum, Salisbury, Rhodesia, supposedly of *affinis*: C/1, fresh, Mid Illovo, Natal, December, 1909 (H. W. Bell Marley); C/4, Balgowan, Natal, February 6 (J. A. Cottrell), measuring 26.7 by 20.4, 26.7 by 20, 26.3 by 20.1, and 26.2 by 19.4 mm.; C/1, Balgowan, date and collector unknown, measuring 25 by 18.4 mm.

The records above for which dates are given are referable to the rains. An immature male in Vienna, from Ugano, on the Matengo Highlands, March 3, has the wings incompletely developed, and was perhaps from an egg laid in January, that is, in the early part of the rains. This specimen is discussed under Systematics below. There is the following further evidence from gonad examinations: Benson and Holliday (1964, p. 131) recorded a male from the Nyika Plateau with greatly enlarged testes, January 7; Meinertzhagen (1937, p. 741), two females from Mt. Kenya in mid-February with ovaries much swollen; Cave and Macdonald (1955, p. 120), a pair in breeding condition in the Imatong Mountains in May. The Nyika and Imatong records are for the rains. But so far as the latter and the Mt. Kenya records (all from within 5 degrees of the equator) are concerned, there is liable to be some rain in almost any month, and the breeding season may be much more extensive than in South Africa, for example. In areas where there is a prolonged dry season, as far north as Malawi and southern Tanzania, it seems that breeding in such a season would be disadvantageous, with destruction of eggs or chicks by fire a major hazard.

MOVEMENTS: As indicated above, there is much less seasonal change near the equator, so that it is unlikely that there is any movement in such localities as Mt. Kenya or the Imatong Mountains. But the position needs more detailed examination for the southern part of the range, so far as is possible from the limited number of known specimens, not all of which are dated. However, the following are details by months of dated specimens: Eastern Cape Province:¹ March, two; April, one; June, one; July, one; August, two; September, one; November, one; Natal: March, two; June, one; Transvaal: May,

¹Additional sight or sound records from Ranger (see under Habitat) consist of one each for February, March, August, September, and December.

one; December, one; Rhodesia¹: January, two; February, one; Malawi-northeastern Zambia (Nyika Plateau)²: January, one; April, one; August, one; September, one; November, four; southern Tanzania (Matengo Highlands): March, one; May, one.

These records do not indicate any particular pattern. The admittedly rather slender evidence at present available is that *S. affinis* is a rainy season breeder. This is borne out for the genus as a whole in Rhodesia, Zambia, and Malawi by the relatively ample data (39 records) in Benson, Brooke and Vernon (1964, pp. 47-48). Thus it would seem that the dry season occurrences mentioned above—all those for May to October—are of non-breeding birds which had not moved except perhaps merely locally. Including sight and sound records, they total as many as 15, as against 22 for November to April. It is concluded that this species is non-migratory, with the proviso already mentioned under Habitat that it may move purely locally during the dry season owing to burning.

VOICE AND BEHAVIOR: The song was first described by Benson and Holliday (1964, p. 131), apparently too late to be included by Clancey (1964, p. 134), who stated that the voice has not been described. They heard it in the same locality, the Nyika Plateau in Zambia, where it was later recorded by Keith. They described the voice as "a typically *Sarothrura*-like call, 'huuuu,' rising in the scale, lasting about two seconds, followed by an interval of about one second, and normally only repeated twice or thrice though occasionally as many as thirty repetitions were heard."

Keith's recordings show somewhat different durations for songs and intervals than these estimates. Figure 3D shows the song to be of 1-second duration. On a single cut of tape on which there was continuous singing, there were 13 songs in 32 seconds, indicating one song every $2\frac{1}{2}$ seconds. The intervals between songs would thus be about $1\frac{1}{2}$ seconds.

The statement that the call (=song) was normally only repeated twice or thrice is inter-

esting because the genus as a whole tends to sing for long periods. Keith found more continuous singing by *affinis* on the Nyika.

The statement by Benson and Holliday that the song rises in the scale is not confirmed by the sonogram, which shows it to be all on one pitch. It will be seen, however, that the song starts softly and then intensifies during the latter half, and to the ear this does give the impression that it is going up the scale. This intensification of the song on the same pitch is a feature common to several species in the genus.

Keith heard birds only during the daytime, but Benson and Holliday recorded it as singing at night. A quite different call is recorded by Benson and Holliday, which Keith never heard, described as "a rattling, tinny note, lasting two or three seconds, impossible to describe at all adequately, presumed to emanate from the female." The assignation of this call to the female, although not unreasonable, is probably a bit premature, as various grunts, growls, and other noises have been heard from singing males of other species at close quarters.

Ranger has sent some personal observations of this species in South Africa to Benson, and has kindly allowed us to incorporate them here. He described the song as "a mournful 'O. ' repeated at intervals." The calling bird was so reluctant to fly that while stalking it Ranger walked right over it and then heard it calling behind him. It was so intent on calling, or so confident in its concealment in the ground vegetation, that it made no attempt to avoid capture, and Ranger (*in litt.*) picked it up by hand. He had similar experiences with birds on later occasions. He confirmed that the "flight was feeble, and only a short distance was covered," which agrees with what is described for other species.

SYSTEMATICS: Two subspecies are currently recognized. Thus White (1965, p. 105) restricted the nominate form to the Cape Province and Natal. Actually it extends to the Transvaal, whence there are specimens in London from Zuurbron and Woodbush. According to White, *S. affinis antonii* Madarasz and Neumann (Ndassekera, northwestern Tanzania) is larger, the male with more extensive chestnut on the underside, and extends from eastern Rhodesia northward (in suitable montane areas). This color difference holds good, that is, if males from the Imatong Mountains, the Matengo

¹Irwin flushed what was almost certainly an *S. affinis* from tufted montane grass on Mount Inyangani at 8000 feet, on October 22, 1966.

²There are also reliable sight records for June and December (Benson and Holliday, 1964, p. 132) and for November (Belcher, 1930, p. 67), while Benson flushed a *Sarothrura*, almost certainly *affinis*, in dry short grass at 6000 feet on Chimaliro Mountain, May 14, 1940.

Highlands, Malawi, and Rhodesia are compared with those from South Africa. In the former, chestnut extends onto the upper chest; in the latter it is confined to the sides of the throat, the center of which is whitish in both forms. There is however some instability in that a male from Mount Zomba, Malawi, has the chestnut still more extensive, occupying the whole of the chest, much as in *S. rufa*. Yet two specimens from Malosa, immediately adjacent to Zomba, show no sign of any such extensive development. But the situation is bedeviled by material from Mt. Kenya and the Aberdare Mountains. Of four such males, one is not fully adult, with chestnut not yet properly developed, and cannot be taken into consideration. Two of the remaining three—one from Mt. Kenya, one from the Aberdares—have the chestnut as restricted as in the South African material, whereas the other, also from Mt. Kenya, has chestnut on one side of the chest as extensive as in the Zomba specimen, but much less on the other. Of two males from the Trans-Nzoia District, Kenya, one has chestnut extending onto the upper chest, but in the other it is confined to the sides of the throat.

Another complication is that males from Kenya as a whole and one from the Sudan have the tail somewhat sooty, whereas those from Malawi and Rhodesia do not differ from South African males in having the tail purer chestnut. Also, the male from the Sudan and one from the Trans-Nzoia District resemble each other closely in showing a tendency for the streaking on the upper side, particularly on the lower back, to break up into spots. These markings are also chestnut rather than white in color. On the other hand, another male from the Trans-Nzoia District has the streaking well-defined, and colored white rather than chestnut. Such variation may occur individually throughout the range of the species and have no geographical significance. Thus a male from Rhodesia and a male from Malawi show the same tendencies, both in color and in pattern, as in that from the Sudan and in one from Trans-Nzoia, although in neither are they so accentuated. Of four males from South Africa critically examined from this aspect, all have well-defined streaking, but in one the streaks are buffy, in the other three, white.

Females show little variation in color, and a proper appreciation of the degree of subspeci-

ation can only be obtained with the collection of more males, particularly from the type locality of *S. a. antonii*. Unfortunately, the type of this subspecies, which was in the Hungarian National Museum, Budapest, is no longer in existence. It was destroyed during the uprising of 1956 (Keve and Samuel, 1960, p. 399), and L. Horvath, Curator of Birds, has confirmed this to us. It was examined by Mackworth-Praed and Grant (1937, p. 626), and there is a note in Grant's handwriting placed with three males from southern Malawi, in London, that they have been compared with the type of *antonii*, "to which they agree perfectly."

Measurements of specimens are given in tables 22 and 23. In addition, there are two males in Brussels, that bear the following particulars: "Rivière Kat., entré avant 1929, rec. Néant." Their measurements (in millimeters) are: wing, 73, 74; culmen, 12, 12.5; tarsus, 18, 19; middle toe, 21 (one not measurable). In The Times Survey Atlas of the World (1922), coordinates for the Kat River are given as latitude 32°55' S., longitude 26°43' E., that is, in the southeastern Cape Province. In color and measurements these two specimens resemble other South African males except for the long tarsus, which may have been inaccurately measured. Difficulties in obtaining strictly accurate figures for length of the tarsus and middle toe have already been mentioned on page 20.

From the nomenclatorial aspect, it is difficult at present to decide how best to treat the various populations. No final arrangement can be made until further material has been collected, particularly of males from Tanzania, including the type locality of *S. a. antonii*. The following is mainly tentative:

Sarothrura affinis affinis: In male, chestnut on underside confined to sides of throat. Small, wing 68–76 mm. Southern and eastern Cape Province, Natal and eastern Transvaal.

Sarothrura affinis antonii: In male, chestnut on underside more extensive, extending at least onto upper chest. Large, wing 76–85 mm. Highlands of eastern Rhodesia, Malawi, and north-eastern Zambia (Nyika Plateau); single specimens from southern Tanzania in the Matengo Highlands (wing only 76 mm.) and north-western Tanzania at Ndassekera (type of *antonii*, no longer in existence, wing given as 78 mm.).

Sarothrura affinis subsp. A: In male, chestnut

TABLE 22
MEASUREMENTS IN FULL (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura affinis*
(Averages are in parentheses)

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
South Africa	7♂	70-76 (72.9)	13-14 (13.5)	15.5-17.5 (16.5)	21-25 (22.6)
	6♀	68-76 (71.7)	12-13.5 (13.0)	15-16.5 (15.7)	20-22 (21.2)
Rhodesia: Inyanga and Chimanimani Mountains	2♂ 1♀	80, 80 82	12.5, 13 13.5	17.5, 18 18.5	24, 24 25
Malawi	4♂ 2♀	80, 81, 82, 85 83, 83	12.5, 12.5, 13, 13 13, 13	18, 18, 18.5, 19 18, 19.5	22.5, 23, 23.5, 25 24, 24.5
Tanzania: Ugano, Matengo Highlands	1♂	76	12	18	22
Kenya: Mt. Kenya and Aberdare Mountains	4♂ 4♀	72, 73, 74, 76 73, 75, 76, 76	12.5, 13, 13, 13.5 12, 13, 13, 14	15.5, 16, 16, 16.5 16, 16.5, 16.5, 16.5	22.5, 23, 23, 23 21, 21.5, 23, 23
Kenya: Trans-Nzoia District	2♂ 2♀	84, — 80, 81	13.5, 14 13, 13	18.5, 19.5 19.5, 20	22, 22.5 22, 22.5
Sudan: Imatong Mountains	1♂ 1♀	82 85	13.5 13	19 18	24.5 23

on underside perhaps usually less extensive than in *antonii*; tail not so pure chestnut as in either nominate *affinis* or *antonii*, more sooty in tone. In size nearest to nominate *affinis*, wing 72-76 mm. Highlands of Kenya east of Rift Valley (Mt. Kenya and Aberdare Mountains).

Sarothrura affinis subsp. B: Perhaps differing only from the last in being larger, wing 80-85 mm. Highlands of Kenya west of Rift Valley (Trans-Nzoia District), and southern Sudan (Imatong Mountains).

Of course, the association of the populations of Rhodesia and Malawi with *antonii* may be incorrect. When topotypes become available, it may prove more appropriate to associate subspecies A, or even B, with *antonii*. In the meantime, it would be unwise to formally describe

any new subspecies. It must again be emphasized that this is a montane species, in which an appreciable degree of subspeciation is to be expected.

There is still to be mentioned an immature male in Vienna from Ugano, March 3, identified by Sassi and Zimmer (1941, p. 264) as *S. rufa*. It is still in a mainly plain blackish dress, but has some adultlike feathers emerging on the mantle, back, and wing coverts, which shows clearly that it is an *affinis*, not a *rufa*. Furthermore, it has some dull chestnut (duller than in adults) appearing in the tail, and on the head. Its measurements are, culmen 11.5 mm., tarsus 19 mm., middle toe 23 mm. These measurements parallel those of an adult male from Ugano given above. Its wing is, however, much shorter and measures only 63 mm., and as suggested above, it was from an egg laid in January. One of the Kenya males whose measurements are given in table 22, from Mt. Kenya, February 11, has not yet fully acquired the chestnut on the head, and the sides of the abdomen are still mainly black.

An adult male in King William's Town, collected at Berlin near there on August 21, weighed 28.77 grams.

MATERIAL: Of the specimens whose measurements are given in full in table 22, all of those from South Africa are in London except for one male and two females in King William's

TABLE 23
WING MEASUREMENTS (IN MILLIMETERS) OF
Sarothrura affinis

Geographical Location	Material	Wing
South Africa	3♂	68, 70, 74
	1♀	72
Malawi/northeastern Zambia	1♂ ^a 1♀	81 76
Tanzania: Ndassekera	1♂ ^b	78

^a Male from Zambian side of Nyika Plateau, as in Benson and Holliday (1964, p. 131).

^b Type of *S. a. antonii*, from original description.

TABLE 24
SUMMARY OF EXAMINED SPECIMENS OF
Sarothrura affinis

	Examined by Author(s)	Examined by Others	Totals
Males	20	7	27
Females	16	2	18
Immature	2	0	2
Chicks	0	0	0
Total	38	9	47

Town, one male in Paris and one female in Cambridge, England (type of *S. lineata*). There are also the two males from "Rivière Kat" in Brussels. Those from Rhodesia are in Bulawayo; from Malawi and the Sudan, in London; from Mt. Kenya and the Aberdare Mountains, in London (Meinertzhagen Collection) except for one female in Nairobi; from the Trans-Nzoia District, in Kitale; from Tanzania, in Vienna.

Of the specimens whose wing lengths only are given (table 23), those from South Africa are in Pretoria, except for one male in East London. A male from northeastern Zambia (Nyika Plateau) is in Livingstone, a female from Malawi is in Cambridge, Massachusetts (as recorded by Peters and Loveridge, 1953, p. 97), and the male from Ndassekera is in Budapest. We are unaware of any other specimens except for four from South Africa in Berlin and one in Dresden. They are not included in table 24.

Sarothrura insularis

Corethrura insularis SHARPE, 1870, p. 400. (Nossi Vola, Malagasy.)

SYNONYMY: No synonym traced.

DISTRIBUTION: Only in Malagasy, where widespread, even known from Manombo, in the subdesert (see map in Rand, 1936, p. 215) and ranging from sea level to 1800 meters (*ca.* 5900 feet) (Rand, 1936, p. 360).

HABITAT: Although more than 100 specimens have been collected, the only positive information appears to be from Rand (1936, p. 360), who found that it frequented "the secondary brush, the grassland on the edge of the forest, and the little clearings in the forest."

BREEDING: Rand (1936, p. 360) had a nest with four eggs brought to him at Manombo on

October 6, another with two eggs, five days later. He wrote that (*loc. cit.*) "The nests were oven-shaped structures, surrounded by dense grass, said to have been on the ground in a grassy field near forest. They had rather thick walls except at the back, where the wall was rather thin. The materials on the outside were broad grass blades loosely put together, with a thick lining of fine grasses." The eggs were immaculate white, as in other *Sarothrura* spp., an average measurement being 26 by 20 mm.

Benson, Brooke and Vernon (1964, pp. 47-48) gave 39 egg-laying records for *Sarothrura* spp. in Rhodesia, Zambia, and Malawi, all of which fall within the period December to March, thus within the normal incidence of the rains, which are from November to April, as also applies in Malagasy (Rand, 1936, p. 205). Consequently, it is surprising that *S. insularis* can breed in early October. The Manombo records cannot be explained away on the ground that the rainfall there is exceptionally heavy and that there might be an appreciable amount of rain outside the normal season. On the contrary, Manombo is only just north of Tulear, in the driest part of Malagasy, with an annual rainfall less than 500 mm. (20 inches) (see map in Rand, 1936, p. 206). There is no reason whatever to question the authenticity of these breeding records. Furthermore, an immature specimen collected at Manombo on October 1, 1929, described below, may be only about two months old from an egg laid in late July in the middle of the dry season.

In London there are in all six eggs collected in the last century in Malagasy and attributed to *insularis*. Apparently they are from at least three separate clutches. Their range of measurements is 25.5-29.9 by 19.9-21.4 mm., and they are plain white, slightly glossed. Most unfortunately not one of these eggs is dated. The same applies to five eggs, collected in the last century, apparently from at least two separate clutches, in Dresden. According to Eck, the range of measurements is 26.5-28 by 20.5-22 mm.

FOOD: Nothing to record.

MOVEMENTS: Probably there are none. There is evidence that in southern Africa *boehmi* is only present in the rains as a breeding visitor. But as *insularis* is able to lay eggs in so arid a locality as Manombo before the start of the rains, it seems unlikely that it can have any movement.

VOICE AND BEHAVIOR: Recorded by Rand

TABLE 25

WING MEASUREMENTS (IN MILLIMETERS) OF *Sarothrura insularis* FROM SELECTED LOCALITIES

Geographical Location	Altitude	Material	Wing
Near Andapa	1800 meters (5900 feet)	10♂	68, 69, 69, 69 69, 70, 70, 70 71, 75
		4♀	68, 69, 70, 72
Tamatave	sea level	7♂	70, 71, 72, 72 72, 74, 74
		1♀	73

(1936, p. 360) as having a loud call, "So-bir-ey, biry, biry, bir, bir-----" which continued for some moments, gradually becoming fainter. Rand commented, "This call was one of the common sounds of the heath, bracken, and grass areas at Andapa, one day west." Calling birds could apparently be approached to within a few feet, but even so were almost impossible to flush. From Rand's brief description of the call, it sounds as if it might be something like the "dueh" call of *S. rufa*.

SYSTEMATICS: No geographical variation has been detected. It might be thought that the birds of the highlands would be larger than those of lowland coastal areas, but there is no suggestion of this from the wing lengths given in table 25. Considering the wing lengths as a whole (table 26) the largest figure (79 mm.) is of a male from Sianaka. This is 3 mm. longer than any other *S. insularis*. (Detailed figures from this locality are: eight males: 70, 70, 71, 71, 72, 74, 75, 79 mm.; two females: 69, 71 mm.) These figures do not suggest any undue tendency to large size there.

Although males are relatively uniform in

color, females show considerable variation. The streaking on the mantle and wing coverts varies from buff to a fairly rich chestnut. Independently of this, on the underside, some specimens have the chest distinctly spotted, others have this spotting developing into a series of longitudinal streaks, and in one the process is complete. These two types of variability in females appear to be individual, not geographical, and all of them have the abdomen and flanks distinctly barred.

A male in New York, collected at Manombo on October 1, 1929, is in partial immature dress. The general color is dark sooty brown, and this predominates on the crown, upper mantle, rump, sides of the breast, flanks, and under tail coverts. The chest and upper abdomen are sooty, spotted with white, the lower abdomen almost immaculate sooty. The tail is uniform rufous, and a few rufous feathers appear on the head and chest. The hind neck, lower mantle, and wing coverts have the typical adult striped pattern. This specimen may be fully grown, as its wing measures 74 mm., but it is probably not more than two months old.

MATERIAL: Most material is in London, Paris, and New York. Some specimens are merely labeled "Madagascar," or the locality is indeterminate. A summary of the material is given in table 27.

Sarothrura ayresi

Coturnicops ayresi GURNEY, 1877, p. 352. (Potchefstroom, Transvaal.)

SYNONYMY: *Ortygops macmillani* BANNERMAN, 1911, p. 38. (Charada, southwestern Ethiopia.)

DISTRIBUTION: Only certainly known from the Republic of South Africa and Ethiopia. We

TABLE 26

MEASUREMENTS (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura insularis*
(Averages are in parentheses)

Repository	Material	Wing	Culmen	Tarsus	Middle Toe
London, Paris, Cambridge (England)	42♂	67-79 (71.7)	12.5-14.5 (13.3)	17.5-21 (19.4)	25-31 (28.6)
	18♀	68-75 (71.3)	11.5-14 (13.0)	17.5-20 (18.9)	25-30 (27.2)
New York	17♂	68-76 (71.3)	—	—	—
	7♀	69-72 (70.7)	—	—	—

cannot at present accept a sight record by Brooke (1964, p. 279) from Chingola, Zambia. From South Africa there appear to be only three specimens in existence. Stark and Sclater

(1906, p. 258) quoted Millar that it occurs in vleis about Durban, but we do not know of any specimens or other evidence in support of its occurrence there. From Ethiopia it is known from several localities in the vicinity of Addis Ababa, and from Charada, Kaffa country. This last record is from 6000 feet. The South African records, considerably farther from the equator, are from between 3000 feet and 4000 feet, except for the southernmost, from King William's Town, which lies at less than 1600 feet.

HABITAT: The only definite information is from Guichard (1948, pp. 102-104) from Ethiopia. At Gafersa he found it in a 1-acre marsh, in which rushes and marsh orchids grew in ankle-deep water. At Sululta it was in close dry grass clumps partly submerged during the rains.

TABLE 27
SUMMARY OF EXAMINED SPECIMENS OF
Sarothrura insularis

	Examined by Author(s)	Examined by Others	Totals
Male	61	12	73
Female	26	7	33
Immature	1	0	1
Chicks	0	0	0
	<hr/>	<hr/>	<hr/>
Total	88	19	107

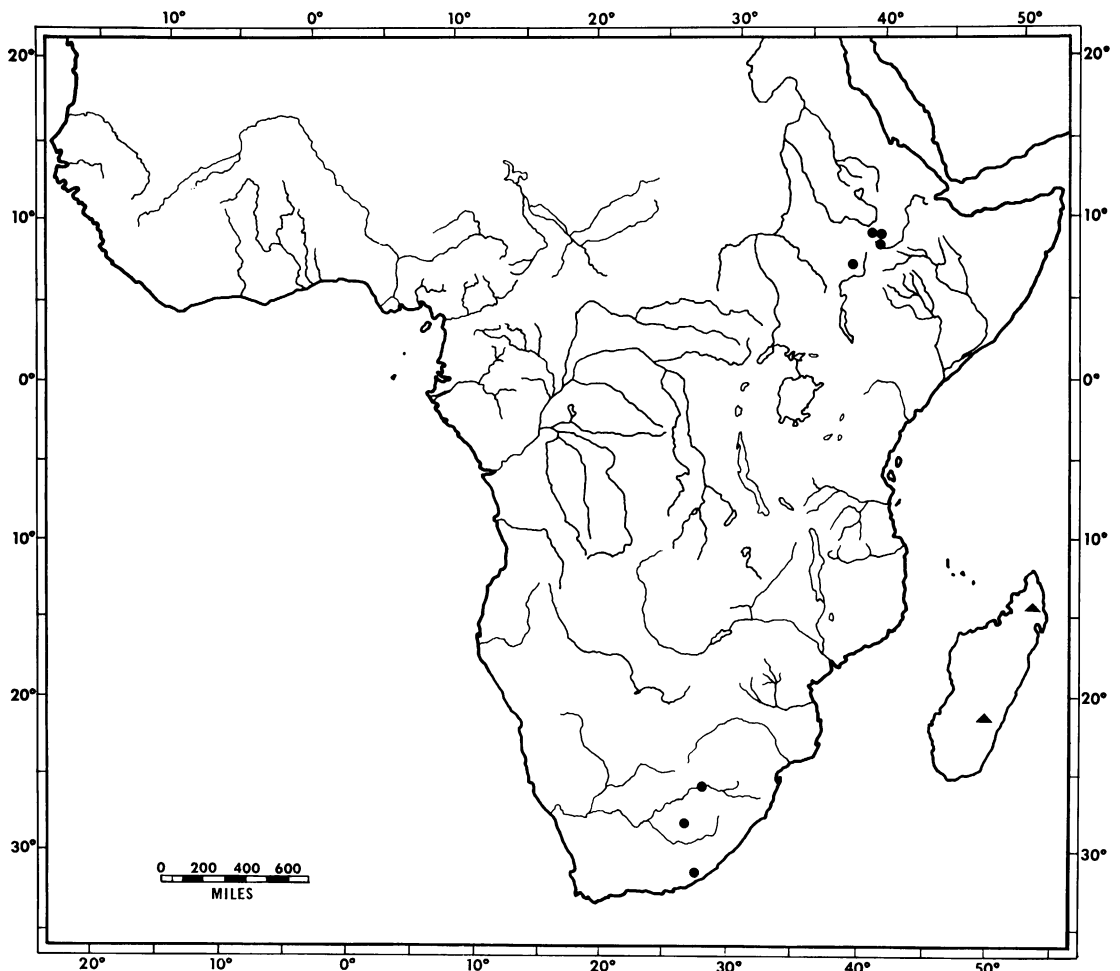


FIG. 14. Distribution of *Sarothrura ayresii* and *S. watersii*.
Key: ●, collected specimen of *S. ayresii*; ▲, collected specimen of *S. watersii*.

BREEDING: Guichard (1948, pp. 102–104) stated that all the males he collected had greatly enlarged testes, and this is confirmed from the labels of two from Gafersa dated July 11 and 15. The same author (1950, p. 165) mentioned a young bird unable to fly, caught near Sululta on September 22, now in London. Measurements of its culmen (13 mm.), middle toe (24.5 mm.), and tarsus (18 mm.) might suggest that it is practically fully grown. But this is not borne out by its wing length, which is only 40 mm. Guichard (1950, p. 165) suggested that breeding takes place in the Sululta marshes in August (in the rains), and this specimen seems to bear this out. Gajdacs and Keve (1968, p. 4) also stated that August is the breeding season in Ethiopia, and that a female collected on July 18 contained developing eggs.

FOOD: Ayres (1877, p. 352) stated that a specimen collected on October 4 had water insects in its stomach.

MOVEMENTS: Information from South Africa is so scanty that it is impossible to draw any conclusion. In Ethiopia, Guichard found that it arrives at Gafersa and the Sululta Plain in July. At Gafersa the habitat was nearly dry in April, when livestock grazed over it, whereas after the rains the Sululta Plain becomes "bone dry." Nevertheless, one of the Antotto specimens was collected in June. Guichard (1948, pp. 102–104) suggested that its movements are quite local, referring to the Charada specimen collected in May, in support of this. He may be correct. If there is any movement to as far south as the ornithologically well-known highlands of Kenya, for example, this would surely have been noticed long ago.

VOICE AND BEHAVIOR: Nothing to record.

SYSTEMATICS: The three South Africa females cannot be distinguished from Ethiopian females in either size or color. Grant and Mackworth-Praed (1941, p. 32) stated that one of the two original specimens collected—the two syntypes—can no longer be traced, being neither in the Norwich Museum nor in the home of the Gurneys. Benson visited the Norwich Museum in October, 1967, and assisted by J. Goldsmith made a further search but without success. Gurney (1877, p. 353) stated that both specimens are females, one being adult, the other immature, the latter being the one which he deposited in London. But there is no reason to suppose that it is immature. It is the right-hand

specimen in the plate accompanying Gurney's remarks. The left-hand specimen appears to be an adult male, and the plate shows no obvious difference from Ethiopian males. The plate also shows very well the sexual difference on the underside, the male having a strong rufous wash on the chest, lacking in the female (note that both specimens figured are shown as having the feathers of the mantle and wing coverts tipped and margined with olive, but in reality this is largely confined to males). It is evident that we will accept the finding of Grant and Mackworth-Praed (1941, p. 32) that Ethiopian and South African birds are indistinguishable.

The young bird whose measurements have already been given, is mainly brownish black above, although with some white and some rufous adultlike markings appearing on the nape and upper mantle. It is also mainly brownish black below, but white on the throat and center of the abdomen, and the feathers of the chest barred dusky and white. Although sexed as a male, the pattern of such white markings as are apparent above suggests that it is a female, the markings being in the form of spots rather than streaks.

MEASUREMENTS: See table 28 for measurements on available material.

It is remarkable that there is no definite record from between South Africa and Ethiopia. It is also surprising that no specimen has been collected in South Africa since 1901 (see below). Skead (1967, p. 63) mentioned only one other record from the eastern Cape Province, "said to have been recorded at East London." Courtenay-Latimer (1964, p. 25) stated that in the East London area it is, "Rare, distributed in scattered localities and recorded from East London." She (personal commun.) has two sight records, dated September 15, 1955, and October 5, 1956, from the Gonubi Bird Sanctuary, near East London. She was also brought a specimen by a Mrs. Pole for identification, unhurt and caught by a dog on September 17, 1956, at Cambridge, near East London. Unfortunately Mrs. Pole refused to part with it, and six months later it was released. In the absence of a preserved specimen, or even a photograph, we cannot accept any of these East London records.

From the degree of ornithological exploration in the area between South Africa and Ethiopia, it may be judged that there is a genuine gap in

TABLE 28
MEASUREMENTS (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura ayresi*
(Averages are in parentheses)

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
South Africa	3♀	76, 76, 78	12, 12.5, 12.5	18, 19, 19	25.5, 26, one incomplete
Ethiopia	13♂	73-79 (76.0)	12-13 (12.3)	17-19.5 (18.3)	25-27.5 (26.1)
	8♀	75-80 (77.0)	12-13.5 (12.6)	16-20 (18.5)	25-27.5 (25.9)

the distribution of *S. ayresi*, which is perhaps unable to compete with some other species, most probably *boehmi*, with which it is not known to overlap. But the two populations were presumably linked relatively recently, in view of the lack of any subspeciation. Economic development accompanied by destruction of habitat may have adversely affected it in South Africa.

MATERIAL: From the Republic of South Africa the following material was available: female, Potchefstroom, October 4, 1876 (T. Ayres, syntype of *Coturnicops ayresi*); female, King William's Town, August 1876 (E. O. Anstey); female, Bloemfontein, October 9, 1901 (S. R. Clarke). From Ethiopia, the following material was available: male, Charada, May 28, 1905 (P. C. Zaphiro, type of *Ortygops macmillani*); two females, three males, Gafersa, July 11-30, 1947 (K. M. Guichard); from Sululta: two males, August 10, 1947, male, September 15, 1948, immature female, September 22, 1948, female, September 10, 1948 (Guichard, Salim Abichacar); male, Akaki, July 27, 1939; male, Antotto, June 12, 1942; female, merely "1939."

The above specimens are in London, except for the two Antotto specimens, in Nairobi, and the following Ethiopian specimens in Tervuren: male, Gafersa, July 17, 1947 (Guichard); two males, Sululta, September 1, 1947; three females, Sululta, August 12-September 10, 1951.

In addition, there are two specimens in the Hungarian Institute of Ornithology, Budapest, which have been lent to Benson, as follows: male, Sululta, July 17, 1949; female, Sululta, July 18, 1948. According to A. Keve, the specimens recorded by Gajdacs and Keve (1968, p. 4) from Sululta (two dated July) are four in

TABLE 29
SUMMARY OF EXAMINED SPECIMENS OF
Sarothrura ayresi

	Examined by Author(s)	Examined by Others	Totals
Males	13	2	15
Females	11	2	13
Immature	1	0	1
Chicks	0	0	0
Total	25	4	29

number, and are in the Hungarian National Museum, Budapest.

The majority, at least, of the specimens for which no collector's name is appended were collected by M. Gajdacs, who resided in Addis Ababa from 1911 to 1965. A summary of the material is given in table 29.

Sarothrura watersi

Zapornia watersi BARTLETT, 1879, p. 772. (South-east Betsileo, Malagasy.)

SYNONYMY: No synonym traced.

DISTRIBUTION: Only definitely known from two localities in Malagasy.

HABITAT: The only information is from Rand (1936, p. 361) who recorded it from small swamps and neighboring grasslands near Andapa ("one day west of Andapa") at 1800 meters (5900 feet). Apparently there is some segregation from *S. insularis*, which Rand found preferred the drier bush and grass areas.

BREEDING: Rand recorded from near Andapa a male with testes enlarged on September 2, 1930, and a female ready to lay on September 5, 1930. Like those for *S. insularis*, these records

TABLE 30
MEASUREMENTS (IN MILLIMETERS) OF SPECIMENS OF *Sarothrura watersi*

Geographical Location	Material	Wing	Culmen	Tarsus	Middle Toe
Southeast Betsileo	2♂	73, — ^a	16, 16	22, 23	31, 31
	2♀	69, — ^a	15.5, 16	22, 23	32, 32
Near Andapa	3♂	69, 71, 72	16, 16, 16.5	21, 21, 23	31, 33, 33
	4♀ ^b	70, 71, 72, 74	16, 16.5, 16.5, 17.5	21.5, 22, 22, 22.5	32, 33, 33, 33
"Madagascar"	2♂	75, — ^a	15, 17	22, 22	29, 32

^aWing incomplete; cannot be measured.

^bIn addition, 1 female in New York, has wing length of 72 mm.

are seasonally very early. But it is evident from Rand (1936, p. 206) that the annual rainfall average around Andapa is exceptionally high—between 3000 and 3500 mm. (120 to 140 inches), and Rand (1936, p. 189) recorded that it rained nearly every day that he was camped there. So it may be that, as with *Sarothrura* spp. in Rhodesia, Zambia, and Malawi (see under *S. insularis*), *watersi* is a rainy season breeder.

FOOD: Nothing to record.

MOVEMENTS: There is no evidence of any movements, but obviously this little-known species requires further study.

VOICE: Nothing to record.

SYSTEMATICS: There is no evidence of any geographical variation in either color or size, although Betsileo and Andapa, the only definite localities, are separated by more than 500 miles.

MEASUREMENTS: See table 30 for measurements on available material.

Some females show no sign of any spotting on the upper side, but others show it to some extent, suggesting that formerly there was a more distinct type of pattern. The degree and depth of the barring in the tail is also variable in females, whereas in males the extent of black edging to the otherwise uniform rufous tail is no less so.

Salomonsen (1934, p. 388) has proposed a separate genus, *Lemurolimnas*, for *S. watersi*, on the basis of certain structural peculiarities, although we agree with Rand (1936, p. 361) that this does not seem necessary. Such peculiarities as there are may be the result of long isolation of *watersi* in Malagasy, although it may be relatively closely related to *ayresi*, as discussed in the section on phylogeny, see pp. 71–73. The summary of measurements for the individual species in *Sarothrura* (table 2) does not

suggest any unduly striking peculiarity. Nor do Salomonsen's own figures, apart from the increase of distance in *watersi* between the longest primary and shortest secondary, and of the length of the first primary in relation to the secondaries. It is also true that the nostrils are much longer than in *ayresi*, for example, and that the tail is of a relatively solid construction. But as regards the latter character, it would appear that in *pulchra*, *affinis*, and *insularis* the tail is little less solid. According to the findings in the section on phylogeny, this character thus appears in three out of our four groups, and therefore may not be significant. As to the plain color of the upper side, it would seem that markings have been lost in the course of isolation. Some females do show traces of spotting. Thus we feel that the systematics situation is best reflected by retaining *watersi* in *Sarothrura*.

MATERIAL: The following material was available: two males, one female, southeast Betsileo, December, 1875 (T. Waters, syntypes; one male, one female in London, one male in Cambridge, England); one female, southeast Betsileo, no date nor name of collector, in Cambridge,

TABLE 31
SUMMARY OF EXAMINED SPECIMENS OF
Sarothrura watersi

	Examined by Author(s)	Examined by Others	Totals
Male	7	0	7
Female	7	0	7
Immature	0	0	0
Chicks	0	0	0
	—	—	—
Total	14	0	14

England; three males, five females, near Andapa, August 23, September 7, 1930 (Miss. Zool. Franco-Anglo-Américaine à Madagascar, per A. L. Rand), shared between London, Paris,

and New York; two males, "Madagascar," no date nor name of collector, one is in London, the other in Liverpool. The material is summarized in table 31.

POSSIBLE PHYLOGENY

FOUR DIFFERENT LINES seem recognizable in the evolution of the genus *Sarothrura* (Sarothrurinae). Each such resultant group may be known by the oldest specific name within it, thus:

- The *pulchra* group: *pulchra* and *elegans*
- The *rufa* group: *rufa*, *lugens*, and *boehmi*
- The *affinis* group: *affinis* and *insularis*
- The *ayresi* group: *ayresi* and *watersi*

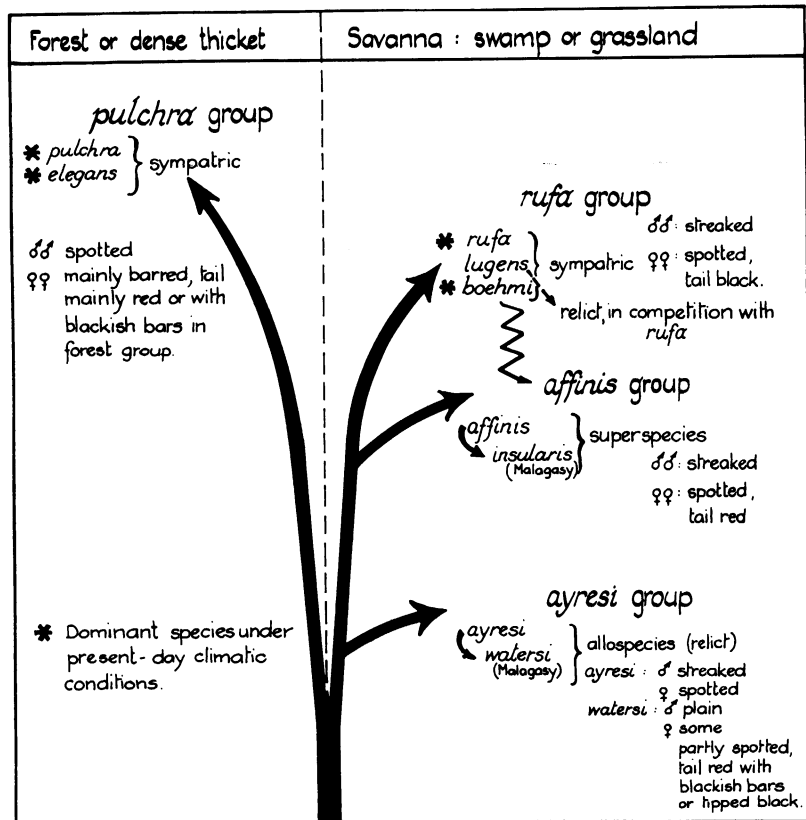
Although there exists a degree of overlap between these groups, certain characters stand out in each group. The *pulchra* and *rufa* groups form the two extremes, the component species in each of which are more closely related to each other than to any other.

In the *pulchra* group there is much chestnut in the tail, particularly in *pulchra* itself, in the male of which it is almost immaculate chestnut. The males of *pulchra* and *elegans* are spotted in body pattern, and the general resemblance between them is marked. In both species the abdomen and flank feathers have a subterminal white spot. In *pulchra* the spots are widely spaced, more rounded, and, in *elegans*, they tend to join up, to give more of a barred appearance. On the mantle these differences are somewhat further accentuated, reaching their extreme on the long secondary coverts, where in *elegans* each feather is almost "bisected" by barring, but in *pulchra* there are merely four or six, domino pattern, widely spaced dots. In the females, in contrast to the spotted pattern found in females of the *rufa* group, there is a more complex, conceivably more highly evolved, barred pattern. The female of *pulchra* is unique in having the male character of a red head and chest, and is also characterized by transverse barring above and below. Barring is also present in the female of *elegans* on the underside, particularly on the flanks, although on the upper side spotting predominates, rather similar to the pattern in the male.

In both sexes in the *rufa* group the tail is black, and, except in *rufa* itself, the males have the feathers of the mantle with a white streak on each web. In *rufa* the streaks are broken up into spots, although, even so, in the subspecies *bonapartii* there is a tendency to streaking rather than spotting. The females are generally spotted in appearance, each species with its subtly distinctive pattern.

The *ayresi* and *affinis* groups seem to stand between the *rufa* and *pulchra* groups. Thus in all four component species there is some red in the tail in both sexes, suggesting affinity with the *pulchra* group, yet the body pattern (almost obsolete in *watersi*) is more that of the *rufa* group. Considering first the *ayresi* group, as originally suggested to Benson in conversation with S. Dillon Ripley, *ayresi* and *watersi* seem fairly closely related, despite the absence in the latter of white on the secondaries and almost so of any pattern on the mantle and wing coverts, although some females do show a little vestigial spotting. The affinity between the two is perhaps best shown on the tail. In males, *ayresi* is barred with black, in *watersi* there are black tips. In females, there are some white markings on the tail of *watersi*, absent from *ayresi*—in contradistinction to the reduction of white in the plumage of *watersi* as a whole. *Sarothrura watersi* has an unusually long, fine bill; measurements show it to be much longer than in *ayresi*, or in the sympatric *insularis*. This is probably the result of prolonged isolation. In the male of *ayresi* the white streaking typical of the *rufa* group is present on the mantle, but there is some white spotting on the secondary coverts. Streaking is further reduced in the female, and replaced by spotting except just below the nape. But sexual dimorphism is less marked in *ayresi* than in any other species in the genus, and the only other important difference is the absence of a rufous wash on the chest in the female.

Sarothrura affinis and *insularis* seem so closely related as to form a superspecies, and, except for red in the tail, which suggests some affinity with the *pulchra* group, they could be placed in the *rufa* group. The male of *insularis* has the feathers of the mantle and wing coverts streaked on each web, *affinis* being basically similar except that those of the secondary coverts tend to break up into a spotted pattern. On the underside they are very similar. In *insularis*, chestnut or red always extends onto the chest. Although this is not so in South African specimens of *affinis*, chestnut is often as extensive in specimens from north of the Zambezi as in *insularis*. The similarity between the two species is no less evident in females. The pattern of the mantle feathers in *insularis* is, however, more complicated than in *affinis*. Each feather has a buff center surrounded

FIG. 15. Possible phylogeny of *Sarothrura*.

by black, and margined exteriorly with buff, except at the extreme tip, whereas in *affinis* there are merely two buffy bars, tending to break up into spots, one of these bars at the tip. On the underside, as in males, they are also very similar, *insularis* merely being much buffier.

We may now speculate on the origins of the various species, as illustrated in figure 9, in which the salient characters of each as outlined above are also shown. It is important to emphasize that the suggestions that follow are largely tentative, and are advanced with considerable diffidence. The first and basic premise, the most contentious of all, is that of the two groups the most differentiated from each other, *rufa* and *pulchra*, *pulchra* is the more recently evolved. It contains the only two forest- or thicket-dwelling species, the other seven in the group as a whole inhabiting swamp or grassland. In favor of the opposite it can be argued that in the past, under colder, more humid conditions, forest was more extensive. On the other hand, there were periods when the opposite was the case. Thus

Moreau (1966, p. 51) quoted evidence that the lowland forests of the Congo were formerly greatly reduced and isolated into fragments. Furthermore, there are only two species in the *pulchra* group that are fairly closely related to each other, as against seven in *rufa* and the other two groups. Admittedly two of these seven species may not come into the picture, isolated as they are as "dead ends" in Malagasy. Yet it follows that if the *pulchra* group were the oldest, one would expect it to be represented in Malagasy. But both *insularis* and *watersi* are grassland dwellers and most akin in pattern to the *rufa* group. A further reason that influences us to consider the *pulchra* group as the most advanced is the complex patterning of the females. Nevertheless, such evolutionary dichotomy leads to caution in any final decision in whether the forest and thicket, as against a more open savanna environment, have produced the most advanced or primitive species. Certainly the savanna grasslands inhabited by seven out of the nine species appear as a whole to have the

greater evolutionary potential, a remark which may not be confined to the genus *Sarothrura* alone. Indeed, if complexity of pattern is ignored the *rufa*, *affinis*, and *ayresi* groups and their allies may be considered in the end the more successful, if not the most advanced, among what are now two evolutionary streams.

It needs emphasizing that but for the red in the tail the *affinis* group (*affinis* and *insularis*) could be placed in the *rufa* group. Except in the south of its range, *affinis* is a montane species, with a broken distribution under present-day conditions. *Affinis* stock may be supposed to have colonized Malagasy in a colder, wetter, regime, when its range would have been more extensive. The resultant *insularis* seems a remarkably successful species able to exist even at sea level.

The *ayresi* group presents a more difficult problem. *Ayresi* itself is apparently relict in distribution, perhaps ousted through much of its former range by *boehmei* (in the *rufa* group).

The relationship of *ayresi* and *watersi* is not so close as that of *affinis* and *insularis*, and it seems certain that *watersi* has been established on Malagasy much longer than has *insularis*. Like *ayresi*, *watersi* would appear to be a relict on its way to early extinction.

It is pertinent, too, to remember that for the most part both the insular Malagasy species have their nearest relatives restricted to the eastern side of continental Africa from which colonization would have been easiest, although in an earlier period they may have been more widespread.

SUMMARY

1. THE SMALL RAILS comprising the genus *Sarothrura* form a well-marked group, for which a subfamily, the Sarothrurinae has been proposed. They are familiarly known as flufftails, from the fluffy decomposed tail. There are nine species, seven in Africa, two in Malagasy.

2. Except in *S. ayresi*, differences in color between the sexes are striking, although there is no difference in size. The male is predominantly black, each species with its characteristic pattern of white or buffy spots or streaks, and with a chestnut head. The female is predominantly black or brown, each species again with its characteristic pattern. Exceptions to the foregoing are that the female of *pulchra* has the male-like character of a chestnut head; whereas both sexes of *watersi* are brown, patterning is no more than vestigial, and confined to the female. In *rufa*, *lugens*, and *boehmi* the tail is black; in the other species there is a varying amount of chestnut. In some species at least, molt of the primaries is alternate so that the power of flight is never lost.

3. So far as they are known, the eggs are invariably white, and the nest is usually domed over to conceal them. In some species, at least, despite the color dimorphism, both sexes apparently incubate the eggs. The chicks are clothed in black down, and in some species they have pale markings on the bill, which may serve to emphasize signal movements employed in obtaining food from adults. Immature birds are uniform blackish, with the exception of *pulchra*, which has some patterning. The immature plumage is quickly replaced by a patterned adult dress, the change perhaps usually starting at an age of only about six weeks.

4. *Sarothrura pulchra* and *elegans* are forest and thicket dwellers. The others, including the Malagasy species, *insularis* and *watersi*, inhabit swamps or grasslands. *Sarothrura affinis* has a montane distribution, fragmented under existing climatic conditions. *Sarothrura ayresi* is probably confined to Ethiopia and to South Africa, although it has not been certainly recorded in the latter area since 1901. It may be represented ecologically in the intervening area by *boehmi*. No difference in habitat between *rufa* and *lugens* has been established. They appear to compete with each other, *rufa* being in most localities the more successful.

5. In southern Africa at least, breeding is predominantly in the rains. But the scanty data for *insularis* of Malagasy suggest that it breeds before the rains. There is strong evidence that *boehmi* is absent from southern Africa in the dry season, which lasts some seven months. In common with another rail, *Crex egregia*, its habitat is liable to be burnt out. No other *Sarothrura* is considered to have any regular, long-range movement.

6. Because of its secretiveness, very little, indeed, is known about *Sarothrura* behavior. But probably all the species have striking song calls during the breeding season. Those of the African species, except *ayresi*, have been tape recorded by Keith, and a special and pioneer feature of the present paper, so far as African ornithology is concerned, are sonograms of these calls.

7. Subspeciation is lacking in *boehmi*, *ayresi* (notwithstanding its fragmented distribution), *insularis*, and *watersi*. Color variation is rather slight, except in the female of *pulchra*. This species also shows a marked tendency to small size, mainly in southern Cameroun, and possibly a manifestation of Bergmann's Rule. There is, however, an inexplicable and striking contrast in size with northern Cameroun birds, and also in the color of the females. *Sarothrura rufa* also shows a tendency to small size in southern Cameroun and adjacent areas, but is unknown in northern Cameroun. *Sarothrura lynesii* is regarded as a subspecies of *lugens*. It only differs in being smaller—curiously in the colder part of the range of the species. Only two subspecies of *affinis* are formally recognized, but probably two more will eventually have to be. This involves the collecting of topotypical material of *S. affinis antonii*, the type of which was destroyed in the troubles in Hungary in 1956.

8. *Sarothrura pulchra* and *rufa* are much the best represented species in museum collections, *ayresi* and *watersi*, the worst. In general, this is also a reflection of the state of knowledge of these species in life. The only specimens from Ethiopia are 26 of *ayresi* and one of *rufa*; from Somalia, one of *elegans*. Males preponderate over females in collections in a ratio of more than two to one.

9. In the section on phylogeny the species are placed in four groups: (1) *pulchra* and *elegans*; (2) *rufa*, *lugens*, and *boehmi*; (3) *affinis* and *insularis*; (4) *ayresi* and *watersi*. The first two (the

pulchra and *rufa* groups) form the two extremes. The *pulchra* group is thought to be the most recently evolved and the most advanced. But for the red in the tail, as in the *pulchra* group, the *affinis* group could be merged with the *rufa* group. *Sarothrura affinis* and *insularis* form a superspecies. *Sarothrura affinis* stock may have

colonized Malagasy in a colder, wetter regime. The resultant *insularis* is a successful species, able to exist even at sea level. *Sarothrura ayesi* and *watersi* seem less closely related to each other than are *affinis* and *insularis*. The early extinction of *watersi* may be predicted, although *aysi* may still be holding its own in Ethiopia.

APPENDIX: MOLT¹

1. SPECIMENS OF *Sarothrura* in the British Museum (Natural History) showing molt of primaries.

Explanation: L, left wing; R, right wing; 1st, 2nd, etc., outermost primary, next to outermost primary, and so forth. An expression such as "10 mm. short" means that the feather in question is about 10 mm. shorter than the length when fully grown. Every specimen is considered adult.

Sarothrura pulchra

- No. 1928. 7. 20. 43. ♂, Jagindi, Nigeria, December 23, 1927. L, 4th, 20 mm. short.
 No. 73. 1. 23. 21. ♂, Wassaw, Ghana, exact site not traced, July, 1872. L and R, 3rd, 20 mm. short.
 No. 1951. 34. 40. ♂, Dikume Balue, southeastern Nigeria, December 21, 1950. R, 4th and 5th, 5 mm. short.
 No. 1955. 59. 1146. ♂, Ahoada, southern Niger Basin, October 22, 1952. L and R, 2nd and 3rd, only emerging from sheath.
 No. 1955. 59. 1144. ♂, Enugu, southern Niger Basin, October 2, 1952. R, 3rd, 17 mm. short.
 No. 1955. 59. 1175. ♀, Enugu, southern Niger Basin, August 6, 1954. L, 3rd, only emerging from sheath; R, 3rd, 10 mm. short.
 No. 1955. 59. 1170. ♀, Enugu, southern Niger Basin, September 12, 1953. L, 3rd and 4th, 10 mm. short; R, 3rd, 10 mm. short; 4th, 18 mm. short.

Sarothrura elegans

- No. 1938. 10. 19. 1. ♀, Kagelu, southern Sudan, October 3, 1937. L and R, 5th, 20 mm. short.

Sarothrura rufa

- No. 1946. 5. 185. ♂, Kota-kota, Malawi, February 24, 1944. L, 3rd, 10 mm. short.
 No. 1940. 6. 2. 1. ♂, Pemba Island, March 4, 1940. L, 5th, 10 mm. short; R, 5th, 5 mm. short. All other primaries slightly paler, perhaps older.
 No. 1934. 6. 18. 75. ♂, Amani, northeastern Tanzania, July 12, 1933. L and R, 1st and 2nd, only emerging from sheath. Remainder perhaps paler and older.
 No. 1910. 12. 24. 30. ♂, Kampala, Uganda, December 3, 1908. L, 2nd, 20 mm. short, 3rd, only

emerging from sheath; R, 1st, 10 mm. short; 2nd, 15 mm. short. L, 1st, rather pale, perhaps old.

Note that no primaries were at all strikingly worn and old, although there is some possibility of this in three of the *rufa* specimens, as mentioned.

2. Comment on material in National Museum of Rhodesia, Bulawayo. Except for one specimen of *rufa*, no actually growing primaries were found, but there are the following comments:

Sarothrura pulchra: Five from Salujunga, north-western Zambia, August–October, had primaries relatively fresh.

Sarothrura elegans: Five from Rhodesia and Zambia (February, one; April, one; October, one; December, two). No obvious wear.

Sarothrura rufa: 29 from Rhodesia and Zambia (January, six; February, three; April, two; June, one; July, three; August, three; September, four; October, three; November, two; December, two). January to April specimens seem to have the primaries relatively fresh. In those for June to August, wear is more obvious. In one for August 10, they are still worn, but another for August 11 appears to have recently molted, whereas another for August 12 has the outermost pair in sheath, the remainder having been already replaced. September to December specimens have the primaries relatively fresh.

Sarothrura lugens: One each from Ngitwa, Zambia, for January, February and March; one from Kasaji, southwestern Congo, August. Only the March bird appears worn, but without sign of molt.

Sarothrura boehmi: 12 from Rhodesia and Zambia (January, six; February, five; March, one). There is a variable degree of wear, but no evidence of actual replacement. Compared with the *rufa* material, wear is more obvious. *Sarothrura boehmi* is believed to be migratory (pp. 54–55). The primaries are therefore probably molted in the winter quarters.

In conclusion, the degree of wear is much less obvious than in more actively flying groups, the same applying to the British Museum material discussed under (1) above. Molt of the primaries probably takes place after breeding, when the birds may be less easily collected. The relatively large series of *rufa* bears this out, breeding in Rhodesia and Zambia being mainly during January to March (pp. 40–42).

¹ See also page 8.

GAZETTEER OF LOCALITIES

NOMENCLATURE OF TERRITORIES is essentially the same as in Fullard and Derby (1967, p. 115) although "Malagasy" now replaces "Madagascar." The ex-Belgian Congo is referred to as "Congo"; the ex-French Congo is referred to as such to distinguish it from the former.

Aberdare Mountains, Kenya. 0° 07' S., 36° 33' E. to 0° 58' S., 36° 39' E.
 Addis Ababa, Ethiopia. 9° 03' N., 38° 42' E.
 Ahoada, Nigeria. 5° 08' N., 6° 36' E.
 Akaki, Ethiopia. 8° 56' N., 38° 42' E.
 Albert, Lake. 1° 01' N. to 2° 20' N., 30° 21' E. to 31° 24' E.
 Amani, Tanzania. 5° 06' S., 38° 38' E.
 Amanzimtoti, Natal, South Africa. 30° 03' S., 30° 53' E.
 Andapa, Malagasy. 14° 39' S., 49° 40' E.
 Antotto, Ethiopia. 9° 12' N., 38° 40' E.
 Bafia, Cameroun. 4° 39' N., 11° 14' E.
 Bagilo, see Uluguru Mountains
 Bakwanga, Congo. 6° 10' S., 23° 29' E.
 Balgowan, Natal, South Africa. 29° 25' S., 30° 03' E.
 Balovale, Zambia. 13° 30' S., 23° 06' E.
 Balovale District, Zambia. 13° 00' S. to 14° 10' S., 22° 00' E. to 23° 40' E.
 Bamenda Highlands, Nigeria (now Cameroun). 5° 43' N. to 5° 58' N., 10° 09' E. to 10° 20' E.
 Bangweulu, Lake, Zambia. 10° 33' S. to 11° 28' S., 29° 32' E. to 30° 08' E.
 Barisi, Congo. 3° 09' N., 25° 11' E.
 Bauchi Plateau, Nigeria. ca. 9° N. to 11° N., 8° 15' E. to 10 E.
 Baudouinville, Congo. 7° 03' S., 29° 43' E.
 Beira, Mozambique. 19° 49' S., 34° 52' E.
 Benengai, Sudan. 4° 48' N., 27° 46' E.
 Betsileo, see Southeast Betsileo
 Bingi, Congo. 0° 24' S., 29° 02' E.
 Bipindi, Cameroun. 3° 06' N., 10° 30' E.
 Bitye, Cameroun. 3° 10' N., 12° 20' E.
 Bloemfontein, Orange Free State, South Africa. 29° 07' S., 26° 14' E.
 Blukwa, Congo. 1° 44' N., 30° 37' E.
 Bokalakala, Congo. 2° 05' S., 16° 24' E.
 Bokilio, Congo. 3° 48' N., 19° 04' E.
 Bokuma, Congo. 1° 08' S., 18° 49' E.
 Bonthe, Sierra Leone. 7° 32' N., 12° 30' W.
 Braganza, see Duque de Braganza
 Brazzaville, ex-French Congo. 4° 15' S., 15° 16' E.
 Bugoma Forest, Uganda. 0° 20' N., 30° 50' E.
 Buhera, Rhodesia. 19° 19' S., 31° 26' E.
 Bukoba, Tanzania. 1° 39' S., 30° 38' E.
 Bulawayo, Rhodesia. 20° 07' S., 28° 36' E.
 Butembo, Congo. 0° 08' N., 29° 17' E.
 Bwamba Forest, Uganda. 0° 50' N., 30° 03' E.
 Cabinda, Angola. 5° 34' S., 12° 12' E.
 Caconda, Angola. 13° 44' S., 15° 04' E.

Camabatela, Angola. 8° 19' S., 15° 27' E.
 Cameroon, see Mount Cameroon
 Canzele, Angola. 8° 17' S., 15° 11' E.
 Cape Town, South Africa. 33° 56' S., 18° 26' E.
 Casamance River, Senegal. 13° 12' N., 13° 55' W. to 12° 35' N., 16° 50' W.
 Cavungu (now Nana Candundo), Angola. 11° 31' S., 23° 01' E.
 Chad, Lake. 12° 30' N. to 14° 25' N., 13° 00' E. to 15° 45' E.
 Charada (Sherada), Ethiopia. 7° 18' N., 36° 25' E.
 Cherangani Hills, Kenya. 0° 55' N. to 1° 26' N., 35° 15' E. to 35° 34' E.
 Chimaliro Mountain, Malawi. 11° 08' S., 34° 06' E.
 Chimanimani Mountains, Rhodesia and Mozambique. 19° 40' S. to 20° 02' S., 32° 57' E. to 33° 10' E.
 Chingola, Zambia. 12° 31' S., 27° 53' E.
 Chitau, Angola. 11° 13' S., 17° 07' E.
 Choma, Zambia. 16° 50' S., 27° 00' E.
 Chyulu Hills, Kenya. 2° 26' S. to 2° 49' S., 37° 42' E. to 37° 58' E.
 Coldstream, Cape Province, South Africa. 33° 57' S., 23° 40' E.
 Coquilhatville, Congo. 0° 04' N., 18° 16' E.
 Dikume Balue, Nigeria (now Cameroun). 4° 55' N., 9° 15' E.
 Djambala, ex-French Congo. 2° 32' S., 14° 43' E.
 Djaposten, Cameroun. 3° 25' N., 13° 28' E.
 Drakensberg Mountains, South Africa. 27° 50' S., 29° 45' E. to 30° 15' S., 28° 20' E.
 Dubar, Somalia. 10° 20' N., 45° 06' E.
 Dundo, Angola. 7° 24' S., 20° 47' E.
 Duque de Braganza, Angola. 8° 58' S., 16° 06' E.
 Durban, Natal, South Africa. 29° 53' S., 31° 00' E.
 East London, Cape Province, South Africa. 33° 00' S., 27° 54' E.
 Ebolowa, Cameroun. 3° 00' N., 11° 10' E.
 Edea, Cameroun. 3° 45' N., 10° 08' E.
 Efulan, Cameroun. 2° 42' N., 10° 30' E.
 Elisabethville (now Lubumbashi), Congo. 11° 41' S., 27° 29' E.
 Elizabeth, see Port Elizabeth
 Entebbe, Uganda. 0° 05' N., 32° 29' E.
 Enugu, Nigeria. 6° 25' N., 7° 30' E.
 Faradje, Congo. 3° 45' N., 29° 42' E.
 Faure, Cape Province, South Africa. 34° 01' S., 18° 45' E.
 Fernando Poo Island, Gulf of Guinea. 3° 13' N. to 3° 48' N., 8° 24' E. to 8° 58' E.
 Firestone Plantation, Liberia. 6° 19' N., 10° 20' W.
 Fort Jameson (now Chipata), Zambia. 13° 40' S., 32° 42' E.
 Fort Johnston, Malawi. 14° 29' S., 35° 14' E.
 Fort Victoria, Nigeria (now Cameroun). 4° 00' N., 9° 12' E.
 Gafersa, Ethiopia. 9° 03' N., 38° 30' E.

- Galim, Cameroun. 7° 06' N., 12° 25' E.
 Gambia River. 11° 45' N., 11° 20' W. to 13° 29' N., 16° 34' W.
 Gandajika, Congo. 6° 44' S., 23° 57' E.
 Garua, Cameroun. 9° 17' N., 13° 22' E.
 Genderu, Cameroun. 7° 20' N., 12° 05' E.
 Greytown, Natal, South Africa. 29° 04' S., 30° 35' E.
 Haut Kemo, Central African Republic. 6° 17' N., 19° 27' E.
 Haut Luapula, Congo. 9° 05' S. to 13° 28' S., 24° 50' E. to 29° 50' E.
 Hot Springs, Zambia. 16° 45' S., 26° 08' E.
 Ilorin, Nigeria. 8° 30' N., 4° 32' E.
 Illovo, see Mid Illovo
 Imatong Mountains, Sudan. 3° 58' N., 33° 00' E., to 4° 12' N., 32° 42' E.
 Inyanga, Rhodesia. 18° 16' S., 32° 44' E.
 Inyangani, see Mount Inyangani
 Irumu, Congo. 1° 30' N., 29° 48' E.
 Ituri Forest, Congo. 0° 30' N. to 2° 40' N., 26° 50' E. to 30° 12' E.
 Jagindi, Nigeria. 9° 21' N., 8° 15' E.
 Jameson, see Fort Jameson
 Johnston, see Fort Johnston
 Kabinda, Congo. 6° 08' S., 24° 27' E.
 Kaffa country, Ethiopia. 6° 20' N. to 7° 15' N., 35° 45' E. to 36° 45' E.
 Kagelu, Sudan. 4° 05' N., 30° 41' E.
 Kaimosi, Kenya. 0° 08' N., 34° 47' E.
 Kakamega, Kenya. 0° 17' N., 34° 53' E.
 Kalunda, Angola. 11° 38' S., 20° 54' E.
 Kamituga, Congo. 3° 04' S., 28° 11' E.
 Kampala, Uganda. 0° 19' N., 32° 34' E.
 Kano, Nigeria. 12° 00' N., 8° 31' E.
 Kasaji, Congo. 10° 23' S., 23° 28' E.
 Kasama, Zambia. 10° 10' S., 31° 10' E.
 Kasansa, Congo. 6° 33' S., 23° 46' E.
 Kashusha, Congo. 2° 17' S., 28° 46' E.
 Katombe, Congo. 6° 29' S., 23° 58' E.
 Kawambwa, Zambia. 9° 45' S., 29° 10' E.
 Kemo, see Haut Kemo
 Kenya, see Mount Kenya
 Kibale, Uganda. 0° 50' N., 31° 06' E.
 King William's Town, Cape Province, South Africa. 32° 53' S., 27° 24' E.
 Kisumu, Kenya. 0° 06' S., 34° 45' E.
 Kitale, Kenya. 0° 58' N., 35° 02' E.
 Kitgum, Uganda. 3° 17' N., 32° 54' E.
 Kitwe, Zambia. 12° 48' S., 28° 14' E.
 Kivu, Lake. 1° 35' S. to 2° 30' S., 28° 50' E. to 29° 22' E.
 Knysna, Cape Province, South Africa. 34° 03' S., 23° 03' E.
 Kota-Kota, Malawi. 12° 55' S., 34° 15' E.
 Kumba, Nigeria (now Cameroun). 4° 40' N., 9° 25' E.
 Kunungu, Congo. 2° 06' S., 16° 26' E.
 Kupé, Nigeria (now Cameroun). 4° 45' N., 9° 40' E.
 Kyetume, Uganda. 0° 21' N., 32° 44' E.
 Lagos, Nigeria. 6° 27' N., 3° 28' E.
 Lastoursville, Gabon. 0° 50' S., 12° 03' E.
 Likulwe (Dikulwe) (River), Congo. 10° 56' S., 26° 24' E. to 9° 39' S., 27° 09' E.
 Lolodorf, Cameroun. 3° 10' N., 10° 42' E.
 Lomami District, Congo. 5° 00' S. to 8° 56' S., 23° 07' E. to 26° 24' E.
 Luapula, see Haut Luapula
 Lubango, Congo. 0° 19' S., 29° 12' E.
 Luiko, Congo. *ca.* 3° 30' S., 28° 30' E.
 Luluabourg, Congo. 5° 56' S., 22° 18' E.
 Lunda Prov., Angola. *ca.* 7° 30' S. to 11° 20' S., 18° 10' E. to 22° 00' E.
 Lunga River (West Lunga River), Zambia. 11° 13' S., 25° 20' E. to 13° 06' S., 24° 39' E.
 Lusaka, Zambia. 15° 26' S., 28° 20' E.
 Mabira Forest, Uganda. 0° 28' N., 32° 54' E.
 Machakos, Kenya. 1° 32' S., 27° 16' E.
 Malosa, see Mount Malosa
 Mamfe, Nigeria (now Cameroun). 5° 46' N., 9° 18' E.
 Manombo, Malagasy. 22° 56' S., 43° 29' E.
 Marandellas, Rhodesia. 18° 10' S., 31° 36' E.
 Marsabit, see Mount Marsabit
 Matengo Highlands, Tanzania. 10° 29' S., 34° 42' E. to 11° 35' S., 35° 18' E.
 Mbanga, Cameroun. 4° 32' N., 9° 31' E.
 Mbanti, Cameroun. 6° 30' N., 12° 08' E.
 Medje, Congo. 2° 26' N., 27° 17' E.
 Mega, Ethiopia. 4° 02' N., 38° 19' E.
 Meiganga, Cameroun. 6° 30' N., 14° 25' E.
 Merode, Congo. 6° 17' S., 23° 13' E.
 Mid Illovo, Natal, South Africa. 29° 58' S., 30° 31' E.
 Mkushi River, Zambia. At 13° 33' S., 29° 41' E.
 Molo, Kenya. 0° 15' S., 35° 44' E.
 Mooi River, Natal, South Africa. At 29° 13' S., 29° 59' E.
 Morogoro, Tanzania. 6° 47' S., 37° 44' E.
 Mount Cameroon, Nigeria (now Cameroun). 4° 12' N., 9° 08' E.
 Mount Inyangani, Rhodesia. 18° 18' S., 32° 51' E.
 Mount Kenya, Kenya. 0° 10' S., 37° 19' E.
 Mount Malosa, Malawi. 15° 18' S., 35° 18' E.
 Mount Marsabit, Kenya. 2° 16' N., 37° 57' E.
 Mount Nimba, Liberia. 7° 33' N., 8° 30' W.
 Mount Zomba, Malawi. 15° 22' S., 35° 22' E.
 Mphunzi, Malawi. 14° 18' S., 34° 05' E.
 Mwela, see Bugoma Forest
 Mwinilunga, Zambia. 11° 44' S., 24° 26' E.
 Nairobi, Kenya. 1° 17' S., 36° 48' E.
 Nanyuki, Kenya. 0° 02' N., 37° 06' E.
 Ndalla Tando, Angola. 9° 15' S., 14° 50' E.
 Ndassekera, Tanzania. 1° 58' S., 35° 43' E.
 Ngaounyanga, Cameroun. 8° 48' N., 13° 33' E.
 Ngitwa, Zambia. 10° 00' S., 30° 48' E.
 Niger River. 9° 08' N., 10° 43' W. to 4° 16' N., 6° 04' E.
 Nimba, see Mount Nimba
 Nokanen, Botswana. 19° 40' S., 22° 15' E.

- Nossi Vola, Malagasy. 17° 43' S., 48° 39' E.
 Nsombo, Zambia. 10° 48' S., 29° 55' E.
 Nyika Plateau, Zambia and Malawi. 10° 10' S. to 10° 54' S., 33° 35' E. to 34° 03' E.
 Omanbonde, South West Africa. 20° 12' S., 17° 50' E.
 Oyem, Gabon. 1° 35' N., 11° 33' E.
 Pawa, Congo. 2° 32' N., 27° 40' E.
 Pemba Island, Tanzania. 4° 52' S. to 5° 29' S., 39° 39' E. to 39° 52' E.
 Pietermaritzburg, Natal, South Africa. 29° 36' S., 30° 24' E.
 Pointe Noire, ex-French Congo. 4° 46' S., 11° 53' E.
 Port Elizabeth, Cape Province, South Africa. 33° 58' S., 25° 36' E.
 Potchefstroom, Transvaal, South Africa. 26° 43' S., 27° 06' E.
 Pungwe Valley, Rhodesia. At 18° 23' S., 33° 02' E.
 Ribao, Cameroun. 6° 32' N., 11° 30' E.
 Rokupr, Sierra Leone. 9° 01' N., 12° 57' W.
 Rustenburg, Transvaal, South Africa. 25° 40' S., 27° 15' E.
 Sakeji, Zambia. 11° 22' S., 24° 15' E.
 Salisbury, Rhodesia. 17° 43' S., 31° 05' E.
 Salujinga, Zambia. 10° 58' S., 24° 07' E.
 Sianaka, Malagasy. *ca.* 18° 00' S., 48° 40' E.
 Southeast Betsileo, Malagasy. *ca.* 22° 00' S., 47° 00' E.
 Sululta, Ethiopia. 9° 10' N., 38° 43' E.
 Swellendam, Cape Province, South Africa. 34° 01' S., 20° 26' E.
 Tamatave, Malagasy. 18° 09' S., 49° 25' E.
 Tanganyika, Lake. 3° 21' S. to 8° 49' S., 29° 04' E. to 31° 10' E.
 Tibati, Cameroun. 6° 25' N., 12° 33' E.
 Torit, Sudan. 4° 24' N., 32° 34' E.
 Trans-Nzoia District, Kenya. 0° 40' N. to 1° 18' N., 34° 35' E. to 35° 30' E.
 Tshikapa, Congo. 6° 26' S., 20° 49' E.
 Tulear, Malagasy. 23° 20' S., 43° 41' E.
 Ubangi District, Congo. 1° 34' N. to 5° 08' N., 18° 06' E. to 23° 30' E.
 Ubiaja, Nigeria. 6° 39' N., 6° 23' E.
 Uelle, Congo. 2° 00' N. to 5° 20' N., 22° 25' E. to 30° 57' E.
 Ugalla, Tanzania. *ca.* 6° 00' S., 31° 30' E.
 Ugano, Tanzania. 11° 06' S., 34° 55' E.
 Uluguru Mountains, Tanzania. 6° 50' S., 37° 45' E. to 7° 18' S., 37° 40' E.
 Umfolozi, Natal, South Africa. 28° 24' S., 32° 12' E.
 Umvoti, Natal, South Africa. 29° 09' S., 30° 37' E.
 Upemba National Park, Congo. 8° 09' S. to 9° 52' S., 25° 56' E. to 27° 16' E.
 Usutu River, Zululand. *ca.* 26° 50' S., 32° 18' E.
 Victoria, see Fort Victoria
 Vumba, Rhodesia-Mozambique border. 18° 48' S., 32° 54' E.
 Wagar Mountains, Somalia. 10° 00' N., 45° 20' E.
 West Lunga River, see Lunga River
 Winterskloof, Natal, South Africa. 29° 27' S., 30° 15' E.
 Woodbush, Transvaal, South Africa. 23° 50' S., 30° 00' E.
 Yokadouma, Cameroun. 3° 25' N., 15° 03' E.
 Zanzibar, Tanzania. *ca.* 6° 10' S., 39° 12' E.
 Zaria, Nigeria. 11° 03' N., 7° 40' E.
 Zomba, see Mount Zomba
 Zululand, South Africa. 26° 50' S. to 29° 15' S., 30° 33' E. to 32° 50' E.
 Zuurbron, Transvaal, South Africa. 27° 25' S., 30° 50' E.

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