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The land birds of Aldabra

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[Plates 30 and 31]

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1. Introduction

(*a*) *Geographical terms*

It is necessary first to define geographical terms used frequently in this paper:

Madagascar/Malagasy. Politically the country is known as the Malagasy Republic and Malagasy is used as an adjective. Geographically, however, the island is still called Madagascar. In this paper Malagasy is used throughout.

Malagasy region is used in the same sense as by Moreau (1964), and is the zoogeographical region consisting of Malagasy itself and its off-lying islands, i.e. most importantly the Comoro archipelago, the Aldabra archipelago, the Seychelles and the Mascarene Islands (Mauritius, Réunion and Rodriguez), but also such intervening islands as Gloriosa, Farquhar, Providence and the Amirantes.

The Aldabra archipelago consists of Assumption, Cosmoledo and Astove in addition to Aldabra itself.

(*b*) *Scope of investigations*

This paper contains an account of the investigations on land birds made during phases I to III of the Royal Society Aldabra Expedition, which lasted from 30 August 1967 to the end of March 1968, augmented by further information collected during phase IV, from April to July 1968, when officially there was no ornithologist on Aldabra. Additional information was obtained by Penny and Diamond between February and June 1969. The paper does not include any migrant shore birds of the families Charadriidae, Scolopacidae and Dromadidae, which are treated separately (Penny, this volume, p. 549). During phase I, from 28 August to 17 September 1967, Benson and Penny worked together on Aldabra. Penny remained for phase II, leaving on 21 December. Benson returned for phase III, arriving on 8 January and departing on

31 March. Much additional information collected by other members of the expedition has been utilized, and this is referred to on pp. 521–522.

Before the expedition previous knowledge of the birds of Aldabra had been summarized in two papers:

(*a*) By Benson (1967), dealing with the birds as a whole, including the sea birds, but with particular stress laid on the resident land species, their origins and trends of variation, from an examination of museum specimens. There is a historical introduction, in which ornithological activity up to 1965 is outlined.

(*b*) By Gaymer (1967), based on observations made by the Bristol Seychelles Expedition of 1964/5, which made two visits to Aldabra. Account is taken of observations made by earlier visitors.

Our main objectives, in respect of each species of land bird which breeds on Aldabra, were broadly (i) to assess its numbers, so far as it might prove practicable; (ii) to determine its ecological preferences; (iii) to determine the breeding season, where possible also collecting information on nesting sites, clutch sizes, incubation and nestling periods, etc.

Attention was also to be paid to any possible migrants (exclusive of the shore birds already mentioned), including those which might pass over Aldabra *en route* from Malagasy to Africa or vice versa, as well as any palaearctic migrants. The origins and affinities of the avifauna were already fairly well known from collections of specimens already made, so that there was no justification for any very extensive further collecting.

(*c*) *Arrangement of species*

In the heading for each species, the scientific name is given first, followed by the most usual English name (in some cases there are alternative names), and the local vernacular (Seychellois) name, though none in the latter category are known for any migrants. They are conveniently placed in three categories, those in the first two of which are listed in table 1:

(i) Seven in the order Ciconiiformes, according to the classification of Wetmore (1960, p. 25), consisting of five species of herons and egrets (family Ardeidae), a flamingo, *Phoenicopterus ruber*, and an ibis, *Threskiornis aethiopica*. With the exception of the Cattle Egret, *Bubulcus ibis*, these are not land birds in the same strict sense as those in category (*b*) or almost all those in (*c*). All of them breed on Aldabra, and the great majority are probably resident, except *Phoenicopterus ruber*, whose status is uncertain.

(ii) Fourteen species of resident land birds proper, ranging from a kestrel, *Falco newtoni*, to a fody, *Foudia eminentissima*. Of these, a barn owl, *Tyto alba*, is almost certainly extinct. A warbler, *Nesillas aldabranus*, was only discovered during the recent expedition. A crow, *Corvus albus*, may not be resident in the same strict sense as are the other species. None of them have been introduced by man, though the crow is commensal with man.

(iii) A relatively unimportant list of less than 20 migratory species, mostly only strays on Aldabra, though there is the interesting possibility that a few of them occur regularly. These species are not referred to again in the introduction.

Each species in these categories (i) and (ii) is considered under the following headings: *Status*; *Ecology and food*; *Behaviour and voice*; *Breeding*; *Systematics*; and *Miscellaneous* (where necessary). Inevitably there is some overlapping between these headings, though it is hoped that they will assist the reader in need of information on some particular point quickly. Extra sections are added where appropriate. Thus one entitled *Abnormal coloration of soft parts* is

included for some Ardeidae, in which temporary change in the colour of the bare skin on the head and of the legs has been observed. In some cases the heading is qualified. Thus under *Egretta garzetta*, which is dimorphic, the heading on systematics reads *Systematics (including notes on the colour-phases)*. In the case of *Dryolimnas cuvieri*, *Tyto alba* and *Nesillas aldabranus*, only brief general accounts are given, and the headings are not used. The reason for this is clear from the accounts themselves. Two other species, *Cypsiurus parvus* and *Cisticola cherina*, which might eventually colonize Aldabra, are also dealt with in this manner, but also placed in parentheses. Attention may also be drawn here to the necessity to guard against an artificial introduction of *Foudia madagascariensis*, which might adversely affect the status of the endemic subspecies of *F. eminentissima* (p. 500). Some general comments arising from the information in these routine headings now follow.

TABLE 1. THE SPECIES OF LAND BIRDS OF ALDABRA

(Exclusive of migrants; orders and families according to Wetmore 1960.)

order	family	species
	Category (*a*)	
Ciconiiformes	Ardeidae	*Ardea cinerea*
		Ardeola idae
		Bubulcus ibis
		Egretta garzetta
		Butorides striatus
	Threskiornithidae	*Threskiornis aethiopica*
	Phoenicopteridae	*Phoenicopterus ruber*†
	Category (*b*)—land birds proper	
Falconiformes	Falconidae	*Falco newtoni*
Gruiformes	Rallidae	*Dryolimnas cuvieri*
Columbiformes	Columbidae	*Alectroenas sganzini*
		Streptopelia picturata
Cuculiformes	Cuculidae	*Centropus toulou*
Strigiformes	Tytonidae	*Tyto alba*‡
Caprimulgiformes	Caprimulgidae	*Caprimulgus madagascariensis*
Passeriformes	Pycnonotidae	*Hypsipetes madagascariensis*
	Sylviidae	*Nesillas aldabranus*
	Dicruridae	*Dicrurus aldabranus*
	Corvidae	*Corvus albus*
	Nectariniidae	*Nectarinia sovimanga*
	Zosteropidae	*Zosterops maderaspatana*
	Ploceidae	*Foudia eminentissima*

† Status uncertain. ‡ Considered extinct.

(*d*) *Status*

Notes are included on abundance. In some cases an attempt is made to assess the numbers, though it is never more than an informed guess. Not even this is possible for the smaller passerine species. But in descending order their relative abundance is believed to be as follows: *Nectarinia sovimanga*, *Zosterops maderaspatana*, *Foudia eminentissima*, *Hypsipetes madagascariensis*, *Dicrurus aldabranus*, *Nesillas aldabranus*. Of these, the last named is by far the least numerous. It is only so far known from the western end of Middle Island, at Gionnet, but its range on Middle Island is probably more extensive. In any case, it appears to be a relic, perhaps from a former wetter régime, and there is no reason to suppose that its present status is due to disturbance by man.

Of the five Ardeidae, the most numerous is *Egretta garzetta*, followed by *Butorides striatus* and *Ardea cinerea* (in this order). *Ardeola idae* and *Bubulcus ibis* may be recent colonizers. For the former there is no definite record before 1967. Any increase in the number of goats might favour the latter, with which there appears to be some symbiosis. The numbers of *Threskiornis aethiopica* appear to be less than formerly. It is most plentiful in the southeast of the atoll, and now rare around Settlement. The total population may not exceed 200. Emphasis is laid on non-disturbance of breeding colonies, since the birds desert or trample on their eggs very easily. The status of *Phoenicopterus ruber* is uncertain. The numbers on the atoll vary. Aldabra may be a dead end for wanderers, though where these birds have come from is quite uncertain. There is no acceptable evidence that they breed on Aldabra.

The numbers of *Falco newtoni* are small. It may have colonized Aldabra since the advent of man, who may be directly (or indirectly) responsible for the provision of suitable breeding sites (buildings, coconut palms and old crow's nests). *Dryolimnas cuvieri* is thought to be extinct on West Island and South Island, due to the introduction of predators by man. *Alectroenas sganzini* is more numerous in the east than in the west of the atoll. This might be either due to the distribution of suitable food-plants or to human predation (it is extremely tame and almost certainly also highly edible). *Streptopelia picturata* shows a similar pattern of distribution. In this case the contrast can be more certainly attributed to the latter cause. *Centropus toulou* exists in fair numbers, and its present status gives no cause for concern, but nevertheless it has probably been extirpated on neighbouring Assumption.

The only species known to have colonized Aldabra (there is no reason to suppose that this was aided by man) and to have become extinct is *Tyto alba*. The reason for its disappearance is not known. *Caprimulgus madagascariensis* exists in fair numbers, but introduced cats may prey on it, and this needs watching. *Corvus albus* is a commensal of man, and is unlikely to have colonized Aldabra before his advent.

(*e*) *Ecology and food*

For the resident land birds proper—the category (ii) species—as far as practicable the ecological divisions shown on the map in Stoddart & Wright (1967, figure 4) or Stoddart (1968, figure 1) have been followed. On Aldabra there are no closely allied species-pairs, ecologically separated from one another in order to avoid interspecific competition. Possibly there is some competition among the Ardeidae. *Ardea cinerea*, *Egretta garzetta* and *Butorides striatus* all feed on the shore. But *Egretta garzetta* is easily the most plentiful, and competition is unlikely to be serious. *B. striatus* also feeds to some extent inland. *Ardeola idae* occurs inland often at pools, while *Bubulcus ibis* is usually inland away from water, its main food probably being insects. *Threskiornis aethiopica* feeds mostly at inland pools, where *Ardeola idae* also occurs. But the numbers of both are small, and in any case they seem to take quite different kinds of food. To some extent *Threskiornis aethiopica* does also feed on shores, where it might compete to some extent with the Whimbrel *Numenius phaeopus*, which feeds in a similar manner.

Among the small passerines there is possibly some competition between *Zosterops maderaspatana* and *Nectarinia sovimanga*, and it is perhaps significant that elsewhere in the Aldabra archipelago only the latter is known on Assumption, while on Cosmoledo and Astove it is the more common. Competition on these smaller atolls may be altogether more severe, and table 2 shows how much poorer they are in species. The only one which is not represented on Aldabra is *Cisticola cherina*. It may have only recently colonized Cosmoledo and Astove (from Malagasy), and it would not

be surprising if in due course it established itself on Aldabra, where the only warbler is the relic *Nesillas aldabranus*. The objection to this (Hartman 1958) is not understood. In considering the comparative richness in species of Aldabra, it must furthermore be remembered that the chief source of colonization is Malagasy, yet Aldabra is the most remote therefrom of the four atolls. But these other three could have been utilized as 'stepping stones' in the colonization of Aldabra. Mayr (1965) emphasizes that extinction is more rapid, the smaller the island. The origins of the Aldabra avifauna are considered further below.

TABLE 2. THE LAND BIRDS OF THE ALDABRA ARCHIPELAGO

	Aldabra	Assumption	Cosmoledo	Astove
Ardea cinerea	X	X	X	X
Ardeola idae	X	—	—	—
Bubulcus ibis	X	?	?	?
Egretta garzetta	X	(X)	X	X
Butorides striatus	X	X	X	X
Threskiornis aethiopica	X	—	—	—
Phoenicopterus ruber	?	—	—	—
Falco newtoni	X	—	—	—
Dryolimnas cuvieri	X	(X)	(X)	(X)
Alectroenas sganzini	X	—	—	—
Streptopelia picturata	X	(X)	(X)	(X)
Centropus toulou	X	(X)	—	—
Tyto alba	(X)	—	—	—
Caprimulgus madagascariensis	X	—	—	—
Hypsipetes madagascariensis	X	—	—	—
Nesillas aldabranus	X	—	—	—
Cisticola cherina	—	—	X	X
Dicrurus aldabranus	X	—	—	—
Corvus albus	X	X	?	?
Nectarinia sovimanga	X	X	X	X
Zosterops maderaspatana	X	—	X	X
Foudia eminentissima	X	—	—	—

X, definitely breeds, or may be reasonably presumed to do so.

(X), formerly recorded, and bred, or may be reasonably presumed to have done so; but definitely or probably no longer occurs at all.

?, may breed, but this cannot be assumed.

The Assumption records are from Stoddart, Benson & Peake (1970); Cosmoledo records from Benson (1970*a*); Astove records from Benson (1970*b*).

This table is more up to date than table 9 in Benson (1967).

Of the species of land birds proper, in category (ii), the majority occur in any of the habitats as mapped by Stoddart (1968), except sand dunes. Physiognomically mangroves are perhaps the most distinctive habitat, the nearest approach to evergreen forest, which is still well represented in parts of the Comoros and Malagasy. But no species is in any way confined to this habitat, though *Alectroenas sganzini* and *Dicrurus aldabranus* have a markedly strong association with it. It is suggested (p. 501) that mangroves might have been the habitat originally occupied on Aldabra by *Foudia eminentissima*, which in the Comoros and Malagasy is a forest species. A word is necessary about clumps of *Casuarina* trees. Presumably they are the result of a fairly recent colonization, perhaps unaided by man, though he might have aided in their local spread, after the initial colonization had been achieved. They are represented at Settlement, Main Channel, East Channel, Anse Cèdres, and a few other scattered localities on the northern side of Aldabra, though there are none on the southern coast. All these category (ii) species occur to some extent in this habitat, and *Nectarinia sovimanga* and *Foudia eminentissima* often nest

in *Casuarina* trees. The latter is also fond of their seeds. Coconut palms, probably introduced by man, and found in a few scattered localities, have provided at least one nesting site for *Falco newtoni*. In the Seychelles they are used for nesting by *Foudia madagascariensis* (p. 501), and could also be by the Palm-Swift *Cypsiurus parvus*, which occurs in the Comoros and Malagasy. A few qualifications must be made in regard to catholicity of habitat among these category (ii) species. *Falco newtoni* prefers open country, and is rare on Polymnie and Middle Island. *Caprimulgus madagascariensis* probably never occurs in mangroves. *Nesillas aldabranus* is only known from high champignon at the west end of Middle Island. *Corvus albus* is a commensal of man, scavenging in open secondary vegetation. But there is no species, such as the mynah *Acridotheres tristis*, abundant in the Comoros and the Seychelles, directly introduced by man.

(*f*) *Behaviour and voice*

No detailed ethological studies were possible, but many random observations are included. No generalizations are appropriate or necessary except in regard to tameness. The category (i) species did not appear to be any more tame than they are in other parts of their range, with the exception of *Threskiornis aethiopica*. This species is much more tame than it is in south central Africa, though not to the same degree as formerly, perhaps due to molestation by man. The following species in category (ii) are also unusually tame, more so than related forms elsewhere (comparisons are mostly from Benson's experience in south central Africa, in Zambia and Malawi):

Falco newtoni: allows approach to within 2 m.

Dryolimnas cuvieri: we have no experience of this species elsewhere, but on Aldabra it is very tame, picking at the clothes of a reclining observer.

Alectroenas sganzini: can almost be caught by hand. Despite persecution, it is also still very tame in the Comoros, as was some form (now extinct) on Farquhar and Providence. It has probably been much killed for food on Aldabra, but this has not altered the habit. Yet restlessness was shown in the presence of a kite *Milvus migrans* (pp. 460, 514).

Streptopelia picturata: allows approach to within 2 m. It has probably been killed extensively for food, but the habit persists, as with the last species, though it would no longer eat out of the hand.

Centropus toulou: is much more tame than any *Centropus* sp. in south central Africa, and can be approached to within 2 m.

Caprimulgus madagascariensis: in daytime can be approached to within 1 m.

Foudia eminentissima: very tame, especially at Settlement, where it can be almost caught by hand. This has not been noticed in the Comoros.

Some of the other passerines are also tame, but probably no more so than relatives elsewhere, *Hypsipetes madagascariensis*, *Corvus albus*, *Zosterops maderaspatana* and *Nectarinia sovimanga* being cases in point. In Africa, *Corvus albus* is confiding in markets, while *Pycnonotus barbatus* (the African ecological counterpart of the *Hypsipetes*), and other species of *Zosterops* and *Nectarinia* are often so in gardens and indeed elsewhere too. Tameness has no doubt been evolved because of the absence of predators. But *Dicrurus aldabranus* is not particularly tame, and one is led to wonder why this may be. It does not appear to have any enemy on Aldabra. It has developed into a well-marked species, so that there should have been no lack of time for the habit to have developed.

Notes are included on the voice of many of the species, mostly contributed by Penny. With advancing years, Benson was unable to hear at all some species, which formerly he could have.

Thus he could hear little of the repertoire of *Hypsipetes madagascariensis* and *Dicrurus aldabranus*, and could not hear *Zosterops maderaspatana*, *Nectarinia sovimanga* and *Foudia eminentissima* at all. The song-call of *Streptopelia picturata* on Aldabra and the Comoros appears to differ markedly, and that of *Caprimulgus madagascariensis* may differ in tone on Aldabra and Malagasy. It would be worth confirming these differences, particularly for the *Streptopelia*, by tape-recording if possible.

(*g*) *Breeding*

A fair number of data are available to throw light on breeding seasons, though to be sure much further information is needed, particularly for the period April/August, so far little covered. Comparisons are frequently made with data from Malagasy, the Comoros and south central Africa (Rhodesia, Zambia and Malawi). For the latter area very considerable numerical data exist for some species. The incidence of the rainy season for this general area lying between about 10 and 25° S of the equator is broadly similar. It might therefore be expected that the breeding seasons of the same or related species of birds would show the same trend, and for the most part this would appear to be the case. Attention may be drawn to a few points:

Ardea cinerea, *Egretta garzetta*, *Butorides striatus*: these three species may breed to some extent on Aldabra throughout the year, but at present there are no data to prove this.

Threskiornis aethiopica: the season on Aldabra may be restricted, egg-laying being perhaps confined to November/December. This contrasts with the African data, which indicate a much more extensive season.

Alectroenas sganzini: few data exist at present, and unfortunately comparable data for this genus from elsewhere in the Malagasy region are also scanty.

Streptopelia picturata, *Nectarinia sovimanga*: African data for other *Streptopelia* spp. suggest that these two species may breed to some extent throughout the year, but at present data are lacking from Aldabra to prove this.

Corvus albus: information is scanty, but there are two records of copulation in January and May, outside the known egg-laying season for Malagasy, the Comoros and south central Africa.

Many more data need to be collected on clutch size; for instance the only record of an occupied nest of *Centropus toulou* is of one found by Abbott in 1892. Moreau (1944, p. 313) found a difference between South African and equatorial data—usually larger in the former zone, though the difference was mostly of less than one egg in a clutch. A few tentative comparisons can be made here. Most of them indicate a similar tendency to a decrease towards the equator. The clutch sizes of *Bubulcus ibis*, *Egretta garzetta* and *Threskiornis aethiopica* are less on Aldabra than in South Africa. Only one nest of *Falco newtoni* has so far been found on Aldabra, containing three young. From Malagasy there are a few records, including one record of $C = 5$ and one of $C = 6$, but the clutch size of the related *F. araea* in the Seychelles is said to be only two. The contrast in this particular case, should it be borne out by further data, is striking. A few data for *Alectroenas sganzini* from Aldabra indicate a clutch size of one, and it is curious that that of *A. pulcherrima* in the Seychelles is two, though this should be verified. There are no data for the Malagasy and Comoro representatives of this genus. Probably only one complete clutch of *Hypsipetes madagascariensis* has been found on Aldabra, and this was a $C = 2$. A few records from Malagasy and Mayotte, in the Comoros, are of $C = 3$; but $C = 2$ on Anjouan, in the Comoros, and in the Seychelles (*H. crassirostris*). The one record for *Nesillas aldabranus* is of a $C = 3$. Benson & Penny (1968, p. 105) quote records of $C = 2$ and $C = 3$ for *N. typica* in Malagasy, and $C = 2$ in the Comoros. But $C = 1$ seems normal for the only warbler in the Seychelles,

Bebrornis sechellensis. For *Foudia eminentissima* $C = 3$ would appear normal on Aldabra and probably also in the Comoros, but for *F. sechellensis* $C = 2$. There is a recent paper on variation in clutch size by Cody (1966). He suggests that stable environments, the tropics, islands and coasts, will favour reduced clutches, whereas instability of conditions results in increased clutch size. The evidence so far from Aldabra is that it falls into the former category.

One enigma to which attention should be drawn is a group of 79 nests, 52 of which contained eggs, found in a breeding colony of Ardeidae on Ile aux Aigrettes. The species concerned was not certainly established, though it is suspected to have been *Butorides striatus*. If this is correct, it may be the first record of this species breeding colonially in Africa or the Malagasy region. It is also remarkable that no occupied nest of *Hypsipetes madagascariensis* was found in 1967/8, and that only two juveniles were recorded. The season may have been a poor one for the successful breeding of this species, perhaps ultimately connected with a below average rainfall.

(*h*) *Systematics* (*including origins and variation*)

A fair amount of detail has been added to that by Benson (1967), and there is also a considerable amount of information on moult. The most striking addition has been the discovery (by Penny) during the recent expedition of a warbler which has been named *Nesillas aldabranus*. On a broad view of the species concept it might be placed as a subspecies of *N. typica*, of Malagasy and the Comoros, but even so it is an extremely well marked one.

Table 3 contains a summary of the systematic status of every form dealt with, exclusive of the migrants in category (*c*). Broadly, they are arranged in a descending order of degree of endemism, ranging from the two species endemic to Aldabra, down to the wide ranging, undifferentiated, *Corvus albus*. Within each grouping a similar treatment has been employed. Thus, admitting that it is a matter of opinion and is subjective, in the second grouping *Foudia eminentissima aldabrana* is placed as the most distinctive of the subspecies endemic to Aldabra—the one nearest to attaining specific rank—with *Alectroenas sganzini minor* the least so.

The origins of the Aldabra avifauna were discussed by Benson (1967, pp. 103–104), and there is no need to do so again in any detail. It must be re-stressed that it is predominantly of Malagasy origin, and there is not a single case in which it can be asserted with certainty that the source is African. Benson did suggest that *Ardea cinerea* might be so, and placed Aldabra specimens with *A. c. cinerea* rather than the Malagasy *A. c. firasa*. But with further material available it seems best to regard them as intermediate. The case of *Butorides striatus* is however peculiar, since it appears to be of direct Asiatic origin, this applying also to *B. s. rhizophorae* of the Comoros and *B. s. javanicus* of the Mascarenes.

As to a possible route which might have been utilized in the colonization of Aldabra, obviously in no case can this be determined with absolute certainty. But taking *Caprimulgus madagascariensis* as an example, it is likely that colonization was via the other islands in the Aldabra archipelago rather than via the Comoros, where it is unknown. That it does not exist elsewhere in the archipelago may be presumed to be because the areas of land available are so small that they could not support a viable population. Conceivably *Foudia eminentissima* was evolved in the Comoros from original African stock, and there was a colonization of Aldabra from there rather than from Malagasy, where the species does also occur. However, there can be no certainty on this question. But we may be on surer ground in suggesting that *Alectroenas sganzini minor* is of Comoro origin. The total land area of the Comoros is much greater than that of Aldabra. Thus Grand Comoro alone is more than six times the size. It is therefore more likely

that this species was evolved in the Comoros, where the turnover of species would be less than on Aldabra (Mayr 1965), and furthermore the Comoros are of much greater age. It is of interest that, subsequent to the presumed colonization of Aldabra, this population may not have been altogether isolated, because some specimens show traces of red in the tail, suggesting some gene flow with the red-tailed *A. madagascariensis* of Malagasy, and some also completely lack pale fringes on the mantle and wing coverts, as is always so in *A. pulcherrima* of the Seychelles.

TABLE 3. SYSTEMATIC STATUS OF ALDABRA LAND BIRDS

(1) Monotypic species endemic to Aldabra
Dicrurus aldabranus Ridgway
Nesillas aldabranus Benson & Penny
(2) Subspecies endemic to Aldabra
Foudia eminentissima aldabrana Ridgway
Threskiornis aethiopica abbotti (Ridgway)
Dryolimnas cuvieri aldabranus (Günther)
Nectarinia sovimanga aldabrensis (Ridgway)
Zosterops maderaspatana aldabrensis Ridgway
Hypsipetes madagascariensis rostratus (Ridgway)
Caprimulgus madagascariensis aldabrensis Ridgway
Alectroenas sganzini minor Berlepsch
(3) Subspecies endemic to Aldabra and Assumption
Centropus toulou insularis Ridgway (*a*)
(4) Subspecies endemic to Aldabra archipelago and Gloriosa
Streptopelia picturata coppingeri (Sharpe) (*a*), (*b*)
(5) Subspecies endemic to Aldabra, Assumption and the Amirantes (*a*), (*c*)
Butorides striatus crawfordi Nicoll (*a*), (*c*)
(6) Subspecies probably endemic to Malagasy and the Aldabra archipelago
Egretta garzetta dimorpha Hartert (*a*)
(7) Monotypic species endemic to Malagasy and Aldabra
Falco newtoni (Gurney) (*a*)
Ardeola idae (Hartlaub)
(8) Monotypic species in most of Africa and part of Malagasy region
Corvus albus Müller

Ardea cinerea on Aldabra may be intermediate between *A. c. firasa* of Malagasy and *A. c. cinerea* of Africa and the palaearctic. A single specimen of *Bubulcus ibis* is similar in colour to those from Malagasy, the Comoros and Africa, but is small. The subspecies of *Phoenicopterus ruber* is the wide ranging *P. r. roseus*. That of *Tyto alba*, considered extinct, was *T. a. hypermetra*, of Malagasy and the Comoros, but this only averages a little larger than the African *T. a. affinis*.

(*a*) There is minor inter-island variation in measurements, but insufficient to justify any further formal subspecific recognition.

(*b*) Presumed to have formerly occurred on Cosmoledo and Astove (Benson, 1970*a*, *b*); definitely did so on Gloriosa (Nicoll 1906, p. 689) and Assumption (Stoddart *et al.* 1970). Thus only now survives on Aldabra.

(*c*) This may also be the subspecies on Cosmoledo and Astove.

Streptopelia picturata coppingeri might also be the result of a colonization from the Comoros. Both this subspecies and *comorensis* lack the grey head of nominate *picturata* of Malagasy. With reference to table 3, much the largest land area which is (or was) occupied by *coppingeri* is Aldabra, which is accordingly the most likely area in which it was evolved. It follows that the remainder of the archipelago, and Gloriosa, were colonized from Aldabra.

A word is necessary about means of colonization. It might be wondered how such poor fliers as *Dryolimnas cuvieri* and *Centropus toulou* could have colonized Aldabra. Millot (1952, p. 20) has suggested rafts of vegetation brought down rivers in spate as one means, and this might have applied to these two species. There was a demonstration of the possibilities, when in February 1968 several large clumps of bamboos appeared off the north coast of Aldabra, and were duly washed shore. On a lesser scale, R. C. Wood (in Benson & Benson 1947, p. 4) records that a

family of a rail *Limnocorax flavirostra* were blown on sudd 24 km across the southern end of Lake Nyasa.

It is not practicable to make any general attempt to trace the history of the Aldabra avifauna before its original establishment on Malagasy, though a few incidental suggestions are made. Thus *Centropus toulou* may not be the result of a colonization of Malagasy from Africa but rather from Asia. And the original *Nesillas* stock might have reached Malagasy from Africa, whereas *Bebrornis* of the Seychelles and Rodriguez could be of Asiatic origin.

Benson (1967, pp. 104–105) discussed trends of variation, but this is in need of considerable expansion and amendment. The comments which follow are a complete re-draft, best placed under distinct headings:

Pallor. Reduction of melanin, often resulting in pallor, suggesting that the climate of Aldabra is a fairly dry one, is evident in a number of forms. The immature dress of *Dicrurus aldabranus*—grey above, dingy white below, instead of the normal black with mere white fringes on the underside as in the immature stage of other *Dicrurus* spp.—is striking. The form of *Nesillas* most similar in colour to *N. aldabranus* is *N. typica lantzii*, of dry southwestern Malagasy. Both are distinctive in lacking any rufous tones above, and are the only two forms of the genus which are white below. The reduction of black in the feathering on the head and neck of immature *Threskiornis aethiopica abbotti* is noteworthy. *Foudia eminentissima* is paler above than in any representative of this species in Malagasy or the Comoros. Also, the underside is pale dull yellow rather than olive, and the red coloration in the male is more orange in tone. In the white colour of the abdomen, the male in breeding dress of *Nectarinia sovimanga* is most similar to that of the dry southwestern Malagasy subspecies, *N. s. apolis*. The female is duller than in nominate *sovimanga*, occupying the greater part of Malagasy, but very similar to *apolis* and the other two subspecies in the Aldabra archipelago (*abbotti* and *buchenorum*). The green coloration of the upperside of *Zosterops maderaspatana* is more yellowish in tone than in the more humid parts of Malagasy. *Caprimulgus madagascariensis* is paler on the crown and scapulars than in Malagasy, with more extensive white in the tail. The black on the abdomen in the non-breeding dress of *Centropus toulou* is much reduced. *Streptopelia picturata coppingeri*, of the Aldabra archipelago and Gloriosa, is paler than any other subspecies.

Size differences. There are a number of instances of a tendency to small size, perhaps a reflexion of a hot climate (Bergmann's rule). This is assumed from differences in wing length. Some masses are now available from Aldabra, but they cannot be used in illustration too, because the necessary data for comparison from other relevant areas are still lacking. On average, *Nectarinia sovimanga aldabrensis* is smaller than any other subspecies, as is *Zosterops maderaspatana aldabrensis* (for Aldabra archipelago measurements for this species, see Benson 1969). *Alectroenas sganzini minor* is smaller than the representatives of this genus in Malagasy, the Comoros and the Seychelles. *Streptopelia picturata* is smaller on Aldabra than in Malagasy and the Comoros, though Assumption and Gloriosa specimens are slightly larger than Aldabra ones (Benson 1967, p. 79). The original form of the Seychelles (*S. p. rostrata*) is smaller still. *Butorides striatus* is smaller than in the Comoros and the Mascarenes, with hardly any overlap in measurements. A single specimen of *Bubulcus ibis* is small, and there seems to be a tendency to smallness in this species in the more northern part of the Malagasy region as a whole.

Benson (1967, p. 104) mentioned *Caprimulgus madagascariensis* as being larger on Aldabra than in Malagasy, but this is not supported by revised figures, which merely show a slightly larger mean. *Centropus toulou* also shows a slightly larger mean. Neither of these differences may be

significant. Indeed there is no convincing instance of an increase in size, such as are known from what are presumed to be more ancient islands (a few instances are quoted by Benson 1967, p. 82). It is true that *Dicrurus aldabranus* averages a little larger than *D. f. forficatus* of Malagasy (Vaurie 1949, pp. 231–234), but conceivably some of the early colonists of Aldabra might have been from the Comoros as well as from Malagasy, and the colonists from these two areas were perhaps still so little differentiated from one another that they were able to hybridize. *D. fuscipennis* of Grand Comoro and *waldenii* of Mayotte are both quite considerably larger than either *aldabranus* or nominate *forficatus* (Vaurie 1949, augmented by Benson 1960*a*, pp. 85–86). It is also true that *Foudia eminentissima* is larger than in Malagasy. But so also are the Comoro forms, and it is not impossible that Aldabra was colonized from the Comoros (p. 508).

Increase in tail length. There is a proportionate increase in the length of the tail, as illustrated by the ratio of tail length to wing length, in *Centropus toulou*, *Nesillas aldabranus* and *Zosterops maderaspatana*. But no biological reason for this difference can be suggested.

Variation in bill size. Dicrurus aldabranus and *Nesillas aldabranus* are both relatively long-billed. Grant (1965, p. 364) has found a strong tendency for island birds to have a longer bill than their mainland counterparts, and suggests that this is because they have to deal with a greater range of food sizes. There are two records of *D. aldabranus* preying on geckos. The normal diet in the genus is insects. *Dryolimnas cuvieri* is also on average a little longer billed than in Malagasy. *Foudia eminentissima* on Aldabra has a relatively stout bill, though there is no evidence at present that this is related to abnormal food. In fact it feeds to a considerable extent on insects, for which stoutness of bill would not be necessary. *Egretta garzetta* is another species showing a tendency to a longer bill, though it may be wondered whether Grant's hypothesis might apply in the case of a shore-feeder such as this.

Special cases. The most notable one is that of the rail *Dryolimnas cuvieri*, which has become almost flightless. There is no reason to suppose that it is smaller than on Malagasy, and this case is not comparable to the size differences inferred from variations in wing length already discussed. Flightlessness of Rallidae on islands is a well-known phenomenon, and a perusal of Greenway (1967, pp. 214–253) indicates that at least eight insular forms which were flightless or nearly so have become extinct. In an insular environment there are unlikely to be any natural enemies, so that retention of powers of flight holds no advantage, and could be a positive disadvantage through a danger of being blown out to sea. This of course takes no consideration of enemies introduced by man. The tarsus and middle toe of *D. c. aldabranus* are relatively short in average length, perhaps because at least on the hard coral rock of Aldabra there is not the same need for support as in a swampy environment.

Hypsipetes madagascariensis has acquired some brownish wash on the upperside and on the thighs, but the reason for this is not understood. *Nectarinia sovimanga* is shorter billed than on Malagasy, as is also the case on Assumption, with this difference most accentuated on Cosmoledo and Astove. The small *Nectarinia* spp. in the Comoros also show this tendency. But whether this variation has any adaptive significance is rendered the more dubious by the case of the larger species in the Comoros, *N. notata*, which shows an increase, not a decrease in bill length compared to Malagasy.

We are not aware of any variation which has been particularly developed in the last 70 years or so, since the first general collection was made on Aldabra in 1892 by Abbott. It is advisable to make this statement, in view of the changes noted by Packard (1967) in populations of *Passer domesticus* in North America, in not more than 90 years. Another point which must be mentioned

is that, should it prove necessary to collect any further specimens, and there is no alternative to preservation in alcohol before skinning, it is important to record on the label the period of such preservation and the degree of concentration. While some colours are not much affected, the red chest-band in the adult male of *Nectarinia sovimanga*, and olives and yellows in the female and juvenile, certainly can be, as also may be greens and yellows in *Zosterops maderaspatana* (Benson 1970*a*, *b*).

(*i*) *Miscellaneous*

Included under this heading are notes on the derivation of vernacular names. These are used by the indentured labour employed on Aldabra and domiciled in the Seychelles, whence many of the names emanate (Loustau-Lalanne 1962, 1963). It would be interesting to know how *Bubulcus ibis* originally acquired its vernacular name of Madame Paton. There are also a few notes on edibility.

2. The species in systematic order

Any specimen referred to as being in London is in the British Museum (Natural History); in Paris, in the Muséum National d'Histoire Naturelle; in New York, in the American Museum of Natural History; in Washington, in the United States National Museum; in Yale, in the Peabody Museum of Natural History, Yale University; in Cambridge (England), in the University Museum of Zoology; in Bulawayo, in the National Museum of Rhodesia, Bulawayo. In the absence of any statement to the contrary, it may be assumed that the specimen in question is in London. All specimens collected on Aldabra during the recent expedition, including any nests and eggs, have been presented on behalf of the Royal Society to the British Museum (Natural History), while any stomach contents, whatever their nature, are in the Department of Entomology therein.

The nomenclature is in general the same as in Watson, Zusi & Storer (1963), which was followed by Benson (1967) and Gaymer (1967). Measurements of specimens are in millimetres unless otherwise indicated; likewise masses are in grammes. Averages of measurements are usually given in parentheses following the extremes. Species whose names appear in headings, but whose occurrence is hypothetical, are considered in parentheses. A sign '♂' indicates an unsexed specimen.

(*a*) *Species in the order Ciconiiformes*

***Ardea cinerea* Linnaeus** (Grey Heron), Florentin

Status. This species is of general distribution on Aldabra, and is much in evidence on coastal flats (as on the reef opposite Settlement) and the lagoon shore, at low tide. It appears to be resident, and the population must number several hundreds.

Ecology and food. Grey Herons were uncommon inland. We have only two records of individuals at inland pools, and of one away from water in dry open country. Normally they were observed fishing at small pools exposed at low tide, their prey being fish and eels, and once a crab. Voeltzkow (1897) found that it was much disliked by man, and unrelentingly hunted, because it preyed on young turtles when hatched. There is no recent observation on this, probably because there has been a decline in the number of turtles; see Stoddart & Wright (1967, p. 40), who give other references to predation on newly hatched Green Turtles, *Chelonia mydas*. In the Seychelles, Grey Herons are said to eat some eggs and young of terns (Ridley & Percy 1958, p. 17). Diamond found a large pellet containing the remains of a noddy (*Anous stolidus*) chick, and three of his rings which he had placed on such chicks, at a large colony of noddies.

The pellet was much too large for that of a Pied Crow, *Corvus albus*, which does however take some eggs (p. 486), and a Seychellois labourer claimed that Grey Herons do take these chicks.

Behaviour and voice. When feeding, it is strongly territorial, maintaining an apparently strict individual distance of some 20 m along the shore. It evidently inspires fear in other birds. Penny found that one passing over a pool would flush any waders (Charadriidae and Scolopacidae) feeding on the edges. The reaction of crows is mentioned on p. 486. Frigate birds, *Fregata* spp., drinking on the wing at inland pools in the southeast of the atoll, would disperse on the appearance of a Grey Heron flying low, though possibly merely because its size and slow flight would increase the risk of collision in their aerobatics. When on the ground, Penny found them intolerant of the presence of other Ardeidae within about 20 m. Frazier has a record of an immature bird near Settlement on 17 July chasing a white phase *Egretta garzetta*, in flight for over 20 m. The egret coughed up some food, which the heron ate. In some contrast to the attitude towards other Ardeidae, Penny found that longer legged waders, particularly the Crab-Plover *Dromas ardeola*, would sometimes be allowed to feed quite close. An immature bird was killed at Settlement on 18 June by a labourer, who told Frazier that they eat small domestic chicks. Another immature killed on 2 July was fighting with another Grey Heron, and was stunned. It was put out on the beach by Frazier, and was attacked by crows. It was recovered while the heart was still beating, and had a massive haemorrhage in the neck. For some information from two nestlings on Ile aux Aigrettes, see the next section.

Breeding. Abbott (in Ridgway 1895, p. 530) saw nests containing young in November, on islets in the lagoon. The following occupied nests were recorded during the recent expedition:

Ile Esprit, 29 August, two young (crew of H.M.S. *Vidal*).

Ile aux Aigrettes, 14 February, two young about half-grown, in mangroves (*Rhizophora mucronata*) (Diamond). This nest was not in the mixed colony first mentioned on p. 431 below.

Ile Mentor, 12 April, two young (Frazier). Frazier noted that both young made a loud growling sound (as do parents) and lunged forward in an ungainly, though menacing, manner. Both had pin feathers on the wings, back and head, the belly being naked. They had irides yellow, legs yellow-green.

The following old, abandoned, nests, attributed to *A. cinerea* by reason of their large size, were found: Iles Moustique, 30 November, two some $2\frac{1}{2}$ to 3 m up in a *Rhizophora mucronata*, with down feathers and 'whitewash', but no young seen; Coffee Camp, 22 December, three (one with a nest of *Egretta garzetta* in it), 30 to 100 cm up in *Pemphis* bushes; West Island, 9 January, one in mangroves, in vicinity of an occupied colony of about ten nests of *E. garzetta*; islet in East Channel, 11 January, two 30 cm up in *Pemphis* bushes; islet in West Channel, January, two as in last record.

Penny saw some six or eight birds together during 20/23 November at East Channel, with at least one apparent pair.

A young bird, with the top of the head grey, and lacking the black stripe along the sides characteristic of adults, was seen by Penny at West Channel on 18 September, and another such by Benson on the reef at Settlement on 3 and 4 February.

The following records made in 1969 are a further indication that the breeding season is extensive. Those of the colours of soft parts may be related to the period of egg-laying. The first record suggests an incubation period of not more than 3 weeks, thus rather less than in Britain (Witherby *et al.* 1944, p. 129).

Islet by La Gigi, 24 March, nest 2 m above water, on edge of islet, in an overhanging

Sideroxylon bush, one clean (probably fresh) egg. Both parents had legs and base of both mandibles bright pink. On 14 April there were two very small chicks, already dry, but probably not more than two days old.

Another islet by La Gigi, 24 March, nest 2 m above spring tide mark, in an overhanging *Pemphis* bush, four eggs. One red-legged adult in attendance. Another empty nest on the same islet had an adult with pink legs and bill beside it.

Islet off Polymnie, 5 April, empty nest on rock in cover, but open to the sky. An adult perched high in bushes nearby had bright red legs and lower mandible. On neighbouring islets, two more birds, both with bright red bills, though it was not possible to land and search for nests. On yet another islet, an empty, unattended nest, but apparently fresh.

Aside from the specimens mentioned below, we have no further records of young birds. Either the young are in general retiring, and do not normally come out onto the open shore to feed as do adults, or the breeding success rate was low in 1967/8. It is difficult to think of any possible predator on Aldabra, except perhaps sharks, nor was there any obvious shortage of possible food. Exactly how old these young birds were it is not possible to suggest. There are three similarly coloured specimens retained by Frazier, dated 1 and 18 June, and 2 July (the latter already mentioned); also four other such young birds already in London—one collected by Nicoll on Assumption on 12 March, and three from Aldabra, two of them dated October 1906, the other undated.

Rand (1936, p. 326) gives no Malagasy breeding record, nor does Benson (1960*a*, p. 32) for the Comoros, though Loustau-Lalanne (1963, p. 13) states that the season in the Seychelles is August and September. The Aldabra records suggest that in all these areas the season may be fairly extensive. Inland in south central Africa, Benson, Brooke & Vernon (1964, p. 35) record egg-laying for every month of the year. They give eight clutches as $C = 2$ (agreeing with the few Aldabra data), though eight more as $C = 3$–5.

Abnormal coloration of soft parts. Frazier saw an adult (black stripe along the sides of the head and black head-streamers noted) with pink legs, on an islet near the southeastern extremity of Middle Island, 11 May.* From Abdulali & Alexander (1952), Meiklejohn (1952), and Gush (1952), it could be inferred that this was a sign of breeding activity. And see also Lowe (1954, p. 73), though (p. 159) he suggests that colour changes of the featherless parts of this species may be due to two entirely different processes, either seasonal or purely temporary. This is discussed further under *Bubulcus ibis* (p. 435).

Systematics. Benson (1967, p. 67) thought that Aldabra was within the range of *A. c. cinerea* rather than *A. c. firasa*, of Malagasy, which has a longer bill and tarsus. The following are figures (millimetres) for the seven specimens now available, all immature, from the Aldabra archipelago (six from Aldabra, one from Assumption, a female):

	wing	culmen (from frontal feathering)	tarsus
2♂♂	430, 454	131, 136	160, 170
♀	416	127	166
4♀♀	410–458 (438.5)	121–136 (128.7)	140–180 (164.2)

Possibly some of these specimens are not fully grown. Even so, the two largest culmen lengths exceed the maximum given by Benson (1960*a*, p. 31) for African *A. c. cinerea*, and are almost up to the average for Malagasy *A. c. firasa*. On the other hand, the tarsus lengths are all below Benson's minimum for *firasa*. But it must be admitted that in dried specimens, with bent joints,

* For three further records, see top of page.

they are often impossible to take with strict accuracy, and this applies to some of the present ones. Nevertheless, using the culmen figures, it is perhaps best to regard Aldabra birds as intermediate with *firasa* rather than true nominate *cinerea* as Benson (1967, p. 67) does. But from his earlier figures, two specimens from the Comoros and one from the Amirantes must stand as nominate *cinerea*.

According to Frazier, two immature males which he collected had masses of 1.0 and 1.2 kg.

Miscellaneous. The name Florentin is also used in the Seychelles (Loustau-Lalanne 1963, p. 12).

***Ardeola idae* (Hartlaub)** (Malagasy Squacco Heron), Gasse.

Status. This is a breeding species, in small numbers, the total population probably not exceeding 100 individuals. It occurs principally at the eastern end of the atoll, where Penny found nine occupied nests on 17 November. It was first noticed by us on 1 September—a single individual in non-breeding dress on West Island. Thereafter single birds were seen spasmodically until on 4 November Penny recorded two wholly white birds (in breeding dress) and three in non-breeding dress at Flamingo Pool. Benson saw it occasionally around Takamaka in February. Frazier saw one in non-breeding dress on the sea coast opposite Takamaka on 15 March, and another such bird at Dune Jean-Louis on 24 March, 12 April, 25 June and 23 July—possibly always the same individual. Further observations are required during the period May/August to ascertain how numerous the birds are at this season. There is the possibility that the majority migrate to Africa, as from Malagasy (Benson 1967, p. 92).

The foregoing are the first records we know of from Aldabra, except for two birds which might have been this species seen by Voeltzkow (1897) in April or May 1895, described as herons of medium size, white with black teguments. It would seem that colonization has been very recent, perhaps within a few decades at the most. It is particularly significant that Abbott (in Ridgway 1895, pp. 526–539), who was on Aldabra for over 3 months, from September to December, does not record it. It is easy to understand how colonization might have been achieved, since *A. idae* is well known as an off-season visitor from its breeding quarters in Malagasy, the only area in which it is known to breed apart from Aldabra, to eastern Africa, between about the equator and 17° S: see for most recent information Irwin (1969) and Benson & Dowsett (1969). In non-breeding dress it would be extremely difficult to distinguish, except in the hand, from *A. ralloides*. The differences between the two are given below under *Systematics*. Conceivably a few of the individuals in non-breeding dress recorded were stray *ralloides*, which occurs casually in the Comoros (Benson 1960*a*, p. 34), and breeds alongside *idae* in at least one heronry in Malagasy (Malzy 1967*a*, p. 124).

Ecology and food. It was often flushed from inland pools, though was also found away from water, and Penny once saw one feeding with egrets *Egretta garzetta* on the lagoon shore, at Takamaka, 30 September. No field observations were made on its feeding behaviour or prey, but the stomach contents of a feathered juvenile collected on 18 January included the heads of ten skinks, *Ablepharus* sp. and of one gecko; four grasshoppers; and four beetles (including two 'blister beetles'), also the heads and elytra of some fifteen more. This supports our observation that it feeds largely inland.

Behaviour and voice. The only observation worth recording is that at the Ile aux Aigrettes breeding colony (see below) Penny heard a nasal, rather musical, rattled 'burrr', made on the approach of other species of Ardeidae, especially *Bubulcus ibis*, to a nest.

Breeding. Nine nests were found by Penny on dry ground on Ile aux Aigrettes, 17 November,

in a mixed colony with *Egretta garzetta* (the most numerous species), *Bubulcus ibis* and possibly *Butorides striatus*. The colony nearly covered the islet, about 25 m square. The *A. idae* nests were smaller than those of *E. garzetta*, of diameter about 20 cm, and 1.5 to 2.5 m above the ground, under the canopy of small bushes. They were made of small twigs, some bearing leaves, laid rather than woven into the fork of a bush, and unlined. All contained eggs, three $C = 2$ and six $C = 3$. Of a $C = 3$ collected, incubation was about 50 % from completion in two eggs, with the other still further advanced. They are pale blue with faint white mottling all over. They measured 42×33, 42×32 and 40×32 mm, and had a mass of 20, 21 and 22 g. Benson found some nestlings in this colony on 18 January, though in the absence of parents at nests could not be sure of the identity of any eggs. But one nestling sharing a nest with an unhatched egg appeared to be an *idae*, since it had buffy rather than white down on the crown as in other chicks attributed to *E. garzetta* or *Bubulcus ibis*. Two other birds considered to be *idae* were older, though of age probably not more than two weeks, and were already clambering about on branches away from their nests. Other older, feathered, birds, but still unable to fly, were also present, including the one collected (see under *Ecology and food.*) This has wing 128 mm, culmen (from frontal feathering) 41 mm, and mass 259 g. It had iris pale green; bill dull orange, extreme tip of upper mandible sepia; legs and feet pale green, soles dull yellowish. Bare skin on the head and wings was pale green, elsewhere fleshy. Fully fledged birds (in non-breeding dress), as well as wholly white ones (in breeding dress), were also present.

On 13 February Diamond found six empty nests on an islet east of Ile aux Cèdres. One of them contained the dried remains of a feathered *A. idae* chick, which was collected. It has wing 138 mm, culmen (from frontal feathering) 39 mm. There were 10 to 15 birds around, including two in the white breeding dress, with blue bills. The nests were all in the mangrove *Rhizophora mucronata*. Several immature *E. garzetta* were also present, but no *B. ibis*. The following day Diamond saw several *A. idae* flying away from an islet northwest of Ile aux Aigrettes, but he was unable to land there.

Systematics. The possibility of confusion between *A. idae* and *ralloides* has already been mentioned. *A. idae* in its white breeding dress should be unmistakable. But in non-breeding dress the two species would be very difficult to distinguish except in the hand. *A. idae* is slightly darker on the mantle and scapulars. But a much clearer distinction is that it is only the sides of each feather in these two regions which are sepia, the centre adjoining the shaft being buffy. The general effect is of a streaked appearance. In *ralloides* the mantle and scapulars are uniformly sepia, so that there is no streaked appearance (in breeding dress the mantle is uniform vinous brown, the scapulars golden brown). *A. idae* is rather the larger. Thus Chapin (1932, p. 426) gives a wing length of 210 to 262 mm for *idae*, as against 192 to 234 mm for *ralloides*.

No other specimen of age comparable to the two from Aldabra has been available. These two only differ from six fully grown ones of *idae* in non-breeding dress—five from Malagasy, one from eastern Africa—in being a little darker sepia on the mantle and scapulars, with the buffy coloration in these two areas, and also on the chest and nape, more rufous in tone. These differences are almost certainly attributable to the disparity in age, and it seems unlikely that there is a subspecies endemic to Aldabra. As already mentioned, it would appear that the atoll has only recently been colonized. Nor does it seem likely that any degree of endemism will soon be evolved, in view of probable gene flow between the Aldabra population and birds on passage between Malagasy and Africa. Stoddart, Benson & Peake (1970) report one which flew onto Assumption, from the direction of Aldabra, on 16 September.

Miscellaneous. We have given 'Gasse' as a vernacular name, used in the Seychelles for *Butorides striatus* and *Ixobrychus sinensis* (see Loustau-Lalanne 1963, p. 15).

***Bubulcus ibis* (Linnaeus)** (Cattle Egret), Madame Paton.

Status. Considered to be a breeding resident, the population possibly totalling several hundreds. It is frequently to be seen at Anse Mais, and along the south coast, inland, feeding on the shore itself being quite abnormal. On South and Middle Islands, and Polymnie, it is rare. It is only known to breed on Ile aux Aigrettes. It occurs in smaller numbers elsewhere in the Aldabra archipelago, though Stoddart, Benson & Peake (1970) record a flock of as many as 60 on Assumption, 15 September 1967.

Abbott (in Ridgway 1895, p. 531) saw only one bird. There is a specimen in breeding dress in New York, collected for Lord Rothschild in 1903 or 1904, discussed under *Systematics*. Otherwise no record earlier than 1964 has been traced, Gaymer (1967, p. 114) reporting a recent increase—'at least 100 birds now live on South Island, around Takamaka'. We have been told that the species was introduced into the Seychelles by a Captain Eric Calais in 1930, and Loustau-Lalanne (1963, p. 14) mentions a recent successful introduction onto Frigate island. Nevertheless, Abbott (in Ridgway 1895, p. 531) found it plentiful on Coetivy and the Amirantes over 75 years ago. Also, two of the specimens on which Salomonsen (1934, p. 221) described *B. i. seychellarum* were collected in 1882, and the third, which is in Paris, a little earlier (Oustalet 1878, p. 190). It is assumed that, the old specimen in breeding dress notwithstanding, there has been a recent expansion in numbers on Aldabra. There is no evidence that this has been aided by man directly. But it might be related to an increase in numbers elsewhere through human activity. Thus for Malagasy, Rand (1936, p. 331) suggests that the clearing of land and planting of rice fields has probably resulted in the bird becoming much more common. And Siegfried (1966, p. 164) notes a significant increase in South Africa, particularly during 1920–40, associated with a conversion of woodland into grassland, and development of water conservation and irrigation measures.

Ecology and food. At Anse Mais, the birds can frequently be seen foraging in the open grassy clearing there. Along the south coast they occur in small flocks, often in quite thick scrub. The largest number recorded in such a flock is about 18, behind Dune Jean-Louis on 22 April (Frazier). On 10 September, near Dune d'Messe, Benson saw eight feeding near two goats. This was in fairly thick scrub, so that it was impossible to see if they were actually following the goats, though Frazier twice got a record of one doing so at Anse Malabar on 19 July. In Africa an association with cattle and other domestic stock is well known, see, for example, Skead (1966, p. 113). As he points out, it is obvious that grasshoppers and other insects reveal themselves more readily when a beast is on the move, and conceal themselves more effectively when the birds are on the feed alone. In Zambia wild ungulates, such as elephants and buffalo, are also followed (Benson & White 1957, p. 4). Heatwole (1965, p. 83) shows that Cattle Egrets associated with cattle obtain more food than when they are alone. On Aldabra there is no evidence as yet that Cattle Egrets are more plentiful where there are goats than elsewhere. Goats are not in fact plentiful (Stoddart 1968, p. 481), but if they were to increase there might be a corresponding increase in the Cattle Egret population. To some extent they also feed around the Aldabra tortoise *Geochelone gigantea*. Rice (1956, p. 264) mentions some examples of other egrets which engage in an association with larger hoofed mammals.

Penny counted 35 birds in a mixed roosting colony with 48 Sacred Ibises *Threskiornis aethiopica*

at Takamaka Grove, 4 October. A count for the same period (the last hour before dusk) on 10 November resulted in three egrets and two ibises only, and by that date there was certainly an occupied breeding colony on Ile aux Aigrettes (see below). As elsewhere, the prey is probably mainly insects, especially grasshoppers. Droppings below this roost, probably from the egrets, consisted mostly of tibiae of a large grasshopper, together with beetle elytra, the abdominal segments of a wasp, and the remains of millipedes. Some droppings also contained crab chelae, possibly from *Cardisoma carnifex*, the very plentiful land crab of Aldabra. Skead (1966, pp. 116–118) gives a particularly detailed account of the general diet of the Cattle Egret in the eastern Cape Province. Rand (1936, p. 332) and Benson (1960*a*, p. 34) give some information for Malagasy and the Comoros respectively. In the Seychelles, on Desnoeufs and to some extent Bird Island, there is serious predation of terns' eggs (Ridley & Percy 1958, p. 45). If it is on the increase on Aldabra, as it may be, the situation in this respect needs watching.

Behaviour and voice. Some aspects of behaviour have been mentioned in the previous section, and there is nothing that can be added here. The degree of association with goats and tortoises requires further study.

Breeding. Birds in breeding dress, distinguished by the presence of reddish buff plumes on the crown, mantle and chest, were seen at the east end of the atoll from 10 November onwards, but not after 18 January. But as egg-laying had apparently started in early October (see below), some individuals may be expected to assume this dress as early as September. The only breeding locality we know of is in the mixed colony with other Ardeidae on Ile aux Aigrettes, already mentioned on p. 431. On 17 November Penny found a group of 18 nests of this species in one corner of the colony, with one or two others outside this group. Birds in breeding dress were seen displaying in another part of the colony as well, near nests with eggs, but only individuals of *Egretta garzetta* were seen incubating them. Eight out of the 18 nests contained chicks in various stages of development. One with primaries in pin was apparently about three weeks old, and from an egg laid in early October, judging by the breeding cycle figures in Skead (1966, p. 138). Two singles and two couples still confined to their nests were considered to be about 1 week old, and two chicks in another nest, downy and sessile, were still younger. When Benson visited the colony on 18 January, there were at least two adults still in breeding dress, and also several chicks and eggs attributable to this species.

On 17 November Penny also found eggs, the number in a nest varying from one to three. A $C = 1$ fresh collected measures 46 mm by 35 mm, mass 28 g. These measurements fall well within the range for 100 South African eggs, the range being 40.0 to 52.1 mm by 29.8 to 35.5 mm, the average 45.8 mm by 33.5 mm (McLachlan & Liversidge 1957, p. 24). Benson (1960*a*, p. 34) collected a $C = 3$ and a $C = 2$ in the Comoros, for which the range is 46.2 to 48.0 mm by 32.1 to 33.3 mm. In South Africa, according to McLachlan & Liversidge, the normal clutch size is three or four, rarely five, thus larger than so far north as Aldabra and the Comoros.

In the eastern Cape Province, according to Skead (1966, p. 111), there is a well-marked breeding season, and the birds are only in breeding dress from September to February. From south central Africa, where as a breeder it seems to be exceedingly uncommon, Benson *et al.* (1964, p. 36) were only able to give two egg-laying records which they considered authentic, and these are for November and December. For Malagasy, Rand (1936, p. 332) gives three records indicating egg-laying in November and December. On Anjouan, in the Comoros, Benson (1960*a*, p. 34) found a colony containing eggs and young in mid-October, and

Forbes-Watson (1970) also found an occupied colony there in that month. Probably on Aldabra, as well as in Malagasy and the Comoros, there is a well-marked season, as there certainly is in the eastern Cape Province, judging from Skead's exhaustive investigations. On the other hand, in the Seychelles, according to Loustau-Lalanne (1963, p. 14), the season is quite different, starting in April and lasting until October. On Farquhar atoll, Parker (1970) found almost fledged young on 3 October, which suggests egg-laying in August. Another point is that, while this species and *Ardeola idae* may be seasonal in their breeding, the other three species of Ardeidae which occur on Aldabra are perhaps not so.

Abnormal coloration of soft parts. Penny noted a few birds at the Ile aux Aigrettes breeding colony on 17 November with facial skin and legs suffused with red, but this was the only occasion on which this was noted. Benson (1960*a*, p. 33) noted a similar phenomenon in some birds at a breeding colony on Anjouan, in the Comoros. Forbes-Watson (1970) saw a few birds with bright red bills at a breeding colony on Anjouan, and has noted the same thing at breeding colonies in Africa and Malagasy. In the latter area Malzy (1967*a*, p. 135) states that in the breeding season the feet become yellow, then rose, and that the beak becomes a dark orange-yellow.

In the eastern Cape Province, Skead (1966, pp. 110–111) found that the bill, feet, bare skin around the eye, and the iris, become temporarily coral-red at the start of the breeding season, the redness persisting until egg-laying is complete, when it fades in both sexes to yellow, pale yellow or dull white. Riddell (1944, p. 506) records a rather similar change in spring in southern Spain. Although the eye remains chrome-yellow, the skin around the eye, the bare patch between the eye and the gape, and the bill, become orange, and in some birds the legs become deep orange. These rich hues begin to fade in July. From India, Prasad (1962, p. 114) has described and illustrated in detail a generally similar type of change in *B. i. coromandus*. The change in the colour of the bill (to crimson) takes place in June, involution of the male testes starts in July, and the normal non-breeding coloration is reassumed in August. He is unequivocal that the change is produced by the action of sex hormones. The changes are not identical in the two sexes. Thus the pre-orbital skin in the male is violet, in the female electric blue. Nevertheless, the end result is very similar, even though the male and female hormones differ chemically.

When he originally saw this change in the Comoros, Benson thought that it might be a purely temporary one, an expression of alarm or anger, rather than a manifestation of seasonal breeding activity. Benson & Benson (1948, p. 389) noted a temporary change in the colour of the bare skin around the eye of a raptorial *Gymnogenys typicus* (= *Polyboroides radiatus*). Even though the bird was at a nest, it seems correct to attribute the change to alarm or anger rather than breeding activity. Lowe (1954, p. 159) suggests the possibility of both seasonal and temporary changes in the colour of the soft parts of *Ardea cinerea*, and cites the Ostrich *Struthio camelus* as an example of the latter. Some change in this respect is also noted in the present report for *A. cinerea*, and for *Egretta garzetta* and *Butorides striatus* too. It would seem that in the instances cited for *Bubulcus ibis* it was probably always connected with breeding, though in the case of the other three species it is better to leave the question open. Another instance for *B. ibis* remains for mention. Vincent (1947, p. 491) records individuals in breeding dress at a roost in Natal, many kilometres from any nesting colony, with the bill and feet 'almost a venetian red'. Possibly any such individual had a mate incubating eggs in a nesting colony, to which it returned in the daytime.

Systematics. Benson has been lent the specimen in New York referred to above under *Status*. It was collected by F. R. Mortimer. It is unsexed and undated. There are other specimens of

Mortimer's collected on Aldabra in August and September 1903, October and December 1904, and possibly even other months. It is in breeding dress, and may even have had the bright coloration of the soft parts, since the bare skin around the eye is black, and the bill is not yellow but a dull buffy colour. In colour it agrees with *B. i. ibis*, and there is no question of it being the same as the Seychelles specimens discussed by Benson (1960*a*, p. 33). The plumes on the crown, chest and back are not golden cinnamon but a ginger-buff, though curiously there are some particoloured feathers in the wings and tail—white and more of a golden cinnamon than ginger-buff. This agrees with Penny's field observations on Aldabra. He records birds in breeding dress as having the plumes reddish buff ('ginger'). The wing length of this specimen is 234 mm, thus near the minimum for *B. i. ibis* (see figures in Benson 1960*a*, p. 33; Vaurie 1963, p. 164; Clancey 1968). Benson gives the wing length of eight Comoro specimens, which he placed with *B. i. ibis*, as 239 to 250 mm. Keith has given him the wing lengths of eight more therefrom in New York as 229, 235, 241, 242, 243, 243, 245, 249 mm. There is also one from the Comoros in Cambridge, with wing 248 mm. It does seem that in the northern part of the Malagasy region there is a tendency to smallness. Parker (1970) gives the wing length of a female from Farquhar atoll as 235 mm, and the three Seychelles specimens have wing 230, 234, 237 mm (Benson 1960*a*, p. 33).

Clancey (1959) proposed applying the name *B. i. ruficrista* to the African and Malagasy populations on the ground that their soft parts do not undergo any colour metamorphosis in association with breeding. This was not supported by Benson (1960*a*, p. 33), and it is clear from the special section dealing with this question above that there is such a change. However, Clancey (1968) has produced figures to show that South African are smaller than palaearctic birds, so that *ruficrista* is recognizable on this premise. Although we have used the name *B. i. ibis* rather than *ruficrista* above, we keep an open mind in regard to this question, which we have not had the time to investigate for ourselves.

Miscellaneous. There is a detailed account of roosting practice in South Africa by Skead (1966, pp. 119–122). Only the one roost has so far been found on Aldabra, at Takamaka Grove. They should be fairly easy to locate. Counts made at roosts in the non-breeding season should assist in determining the size of the total population.

The vernacular name Madame Paton is also used in the Seychelles (Loustau-Lalanne 1963, p. 14). The usual French name is Garde Boeuf, and the derivation of Madame Paton is not known.

***Egretta garzetta* (Linnaeus)** (Little Egret), Blanc-et-noir or Zaigrette

Status. This is the most plentiful of the species of Ardeidae on Aldabra. It is abundant and conspicuous on the shores of the lagoon, and in suitable places on the sea coast. It is impossible to assess the numbers at all accurately, but they may total several thousands. It is dimorphic (plumage white or dark bluish slate), and this is discussed under *Systematics* below. Unlike *Ardeola idae* and *Bubulcus ibis*, there is no reason to suppose that it has only recently colonized Aldabra, for Abbott (in Ridgway 1895, p. 530, as *Demigretta gularis*), Voeltzkow (1897, as *Ardea gularis*) and Nicoll (1906, p. 704, as *D. sacra*) all found it abundant.

Ecology and food. Little Egrets were only very rarely seen feeding at inland pools, but they were commonly noticed on all types of shore substrate except pure sand, on which very few birds of any kind feed. At low tide they were often plentiful on the reef opposite Settlement, and around West and East Channels. They frequently feed alongside *Ardea cinerea* and *Butorides*

striatus, but these two species are much less numerous, and there may be no interspecific competition, despite a probable similarity in the diet of all three. The size of prey is variable, Penny noting the smallest to be the little crabs of various species which abound in rock crevices, to once an eel at least 30 cm long, which the bird took several minutes to swallow. Small fish and eels are regularly taken. The stomach-contents of a dark phase bird at Takamaka on 19 November were: fish, one of length 55 mm, 16 of length 33 mm; crabs, five of one species, one of another, carapace widths 7 to 16 mm; and the head of a wasp *Bembex* sp. (Hymenoptera, Sphecidae). Rand (1936, p. 330) found that young at Namoraka, an inland locality in Malagasy, were being fed largely on earthworms and a few other fossorial 'grubs'.

Behaviour and voice. When foraging, Penny noted that the birds would usually stalk forward through small pools, often immersed to the tops of their legs, making darting movements at potential prey. If it was not secured the first time, stealth would be abandoned, and there would be a pursuit through the water, with wings flapping and the bill stabbing, often to no avail. Where the bottom was flatter, especially under overhanging limestone cliffs, the birds would stand still, on the watch for prey in a more characteristically heron-like manner. During advances through pools, the feet were often moved in small jerks or kicks through the water, possibly to stir lurking prey into movement, though alternatively it might be that movement of this kind may cause the prey to remain still until the bird is within range. In Malagasy, both Rand (1936, p. 328) and Milon (1959, p. 250) found that this species moves about in pursuit of prey, and neither mentions the motionless, typically heron-like, habit also noted by Penny.

Penny thought that feeding birds might be territorial to some extent. Several times he noticed that a bird approaching to within 1 m of another which was feeding would be driven away with wing flapping and stabbing movements of the bill. Again, on 19 January at Anse Cèdres, Frazier saw two dark phase birds jump into the air nearly 1 m and kick at each other, as if they were disputing fishing rights.

The birds would often feed in loose groups, the individuals in which would communicate with each other, especially on the approach of an observer, with a low rasping single 'eogh', repeated by other individuals nearby. This call was also heard by Penny at a nesting colony. At Bras Takamaka especially, he noted that feeding egrets were often disturbed by small sharks, usually a species with dark tips to the dorsal fin and tail. The sharks would cruise in water less than 30 cm deep, showing great curiosity when the observer waded nearby, and occasionally striking at his boots. They behaved in the same way to egrets, who either flew off for a few wing-beats before settling again, or would merely run a few steps, the disturbance thereby created usually driving the shark away. Possibly cruising sharks may occasionally capture an egret, but this was not observed, and no corpses were found.

On 8 December 1964, while on the Bristol Seychelles Expedition, Penny watched a group of about 100 egrets gathered at Passe Femme at low tide, closely packed compared with the normal dispersion when feeding, which none of them were doing. These birds were performing a courtship 'dance', one ducking beneath the neck of another, the plumes of the head and neck raised. There was no apparent segregation of the phases, dark and white birds being seen 'dancing' together. It was originally thought (Penny 1965, p. 410) that the male was always the active partner. But on 15 October 1967 Penny saw the same ritual performed by a pair, both white birds, and in this case it was the female which performed the active role in the 'dance', later submitting to the male, and following him when he flew off after copulation. A large assembly such as was seen in 1964 was not observed at close quarters in 1967–8, though on

2 October, at Bras Takamaka, and 4 December, at Passe Femme, there were congregations at a distance in which similar behaviour may have been taking place. The birds at Passe Femme may have been from a breeding colony on Iles Moustique visited on 30 November (see below), some nests in which were newly built and still without eggs.

In the streamway towards Dune Jean-Louis, on the southern edge of the lagoon, 6 March 1969, 44 birds (13 in the white phase, 31 in the dark phase) were standing in a tight group as the tide was rising. They would fly up and hover some 2–3 m up, or stand, or run with the wings spread, the remainder of the time feeding very actively. This behaviour may have been a means of getting fish to move so that they could be more easily seen and caught. The Black Heron, *Melanophoyx ardesiaca*, is well known to fish with its wings stretched out and forward (see, for example, McLachlan & Liversidge 1957, p. 28).

Breeding: Abbott (in Ridgway 1895, p. 531, as *Demigretta gularis*) records breeding in large numbers in December, in mangroves, two to four eggs being laid. There are the following records of occupied nests observed during the recent expedition:

Ile aux Aigrettes, 17 November (Penny). Mixed breeding colony with *Ardeola idae*, *Bubulcus ibis* and possibly *Butorides striatus*, originally referred to on p. 431 above. Nests in the small bushes which cover a large part of the islet, mostly at 1.5 m above the ground. Although there was cover up to 3 m, sites any higher than 1.5 m would not have been stable, as the branches were too thin. Nests distinguishable from those of the other species by their larger size, eggs also larger. Fifty-two nests were attributable to this species, their contents as follows: five $C = 1$, thirty $C = 2$, six $C = 3$, also 11 empty. Young birds not yet fully fledged were still present at this colony when visited by Benson on 18 January.

Iles Moustique, 30 November (Penny). Colony of this species only, in mangroves. Twenty-one nests in *Rhizophora mucronata*, four in *Ceriops tagal*, three in *Avicennia marina*. One in a *Rhizophora* was in the angle where the tree leaned against an *Avicennia*. Heights of nests above ground ranged from 1 to 4 m, average 2 m. Further details of the 28 nests in all are as follows:

still under construction	1
empty (some newly built)	11
eggs ($C = 1$)	4
eggs ($C = 2$)	8
egg (one) + young (one, *ca.* 7 days old)	1
young nearly fully grown (one near each nest)	3
total	28

See also entry below for 13 February.

Coffee Camp, 22 December (Penny). Colony of 19 nests of this species only, in *Pemphis* less than 2 m high, nests less than 1 m above ground. Two held two eggs; one with two eggs and a downy young; two with two downy young, one with one; one with one young half grown; remainder empty. There were also two well grown young walking about on the ground, and one young which flew away while the islet was being searched.

West Island, 9 January (Frazier and Macnae). In mangroves, a lone nest 1.75 m up, holding one egg, one downy chick; also a colony of eight nests on edge of mangroves, 1.5 to 4 m up, two of which each held two eggs, one a chick two to three weeks old, four empty, one contents unknown. Also a feathered young bird on a beach near these mangroves, very light and weak, being fed by an adult.

Four lone nests, as follows (Benson). 24 January, one near east end of Middle Island, in *Pemphis*, single young *ca.* three-quarters grown, out of nest; 25 January, same locality as last, on a fallen tree in mangroves, less than 1 m above water, two young *ca.* two-thirds grown, out of nest; 1 February, west end of Polymnie, on a fallen tree in mangrove at an inland pool, 1 m above water, two young *ca.* two-thirds grown, out of nest; 2 February, Main Channel (west side), 1 m above water, two eggs.

West Island, 8 February (Macnae). In mangroves, a lone nest, one young out of nest, *ca.* seven-eighths grown.

Iles Moustique, 13 February (Macnae). Colony in mangroves, probably same as inspected by Penny, 30 November; many young near nests, also one with two eggs.

These records indicate egg-laying from November to January or even February, and Penny first saw nesting material being carried on 17 October. But the season may be more extensive, for at Settlement on 15 September he saw an apparently fledged young bird, with the legs as well as the feet olive-green; see further below under *Coloration of soft parts*. It might have been from an egg laid in July. At Diego Suarez, according to Milon (1959, p. 259), laying occurs in late October. Elsewhere in Malagasy, Rand (1936, p. 329) records a male with testes enlarged as early as 26 July, and a nest with young as late as 4 March. Near Tananarive, Malzy (1967*a*, p. 133) gives the egg-laying season as from October to December, but (p. 134) he records some 100 birds in breeding dress, and eggs and young, in July. Benson *et al.* (1964, p. 35) indicate egg-laying in colonies in Northern Rhodesia (now Zambia) in May, June and July. Further investigation as to the season on Aldabra is needed. It would appear that there is a peak about November, but it would seem possible that egg-laying can occur occasionally in almost any month.

Penny several times saw birds carrying nesting material in the form of twigs and small branches from a variety of shrubs, often plucked green, bearing leaves. Like the Sacred Ibis, *Threskiornis aethiopica*, *E. garzetta* sometimes builds a new nest on an old one of its own, and several were noticed to be two or more 'storeys' high. One in the Coffee Camp colony was built in the bottom of an old nest of *Ardea cinerea*. It was easy to recognize an empty nest as about to be used, not only by its cleanness, but also by the presence of green leaves. The nest is a roughly circular platform of 30 to 40 cm diameter, shallowly depressed in the middle, the twigs very little interwoven. Milon (1959, p. 253) found that at Diego Suarez the nests were always more than 1 m apart, and this was true of the Iles Moustique colony, in mangroves. But in the dense mixed colony on Ile aux Aigrettes, on dry ground, two or three nests might be contiguous, the parents on guard beside them maintaining an uneasy truce. No nest robbing was noticed, but birds returning to their nests had difficulty in regaining them through a gauntlet of neighbours.

Although Abbott states that the clutch size can be as large as four, we have no evidence of it being more than three. Nor do Rand, Milon or Malzy indicate that it is ever more than three in Malagasy. But in South Africa McLachlan & Liversidge (1957, p. 23) gives it as two to four, while in the southern Palaearctic region Witherby *et al.* (1944, p. 140) give four as common, sometimes five, and one record of six. Two clutches of eggs were collected at the Ile aux Aigrettes colony on 17 November. A $C = 2$ fresh measured 46 mm by 35 mm and 46 mm by 35 mm, and had masses of 28 and 30 g. Figures for a $C = 3$ fresh are 49 by 37, 48 by 37, 49 by 36 mm, 32, 34 g (one not weighed). The eggs are the usual pale blue colour.

The young are nidifugous at an early stage, and were found scrambling about near their nests

when not more than about half of adult size. The parents probably locate them by the high-pitched squawks which they make. In the breeding data above there is a record for 9 January of one well away from a nest being fed on the ground, and Frazier had a similar experience at West Channel on 23 March.

Coloration of soft parts. In the adult, the normal colour of the bill is black, with facial skin yellow; the legs black, the feet greenish yellow. A dark phase apparent adult seen by Penny at the Ile aux Aigrettes breeding colony on 17 November had both the facial skin and the feet pink. Benson made a similar observation on a dark phase bird (not at a nest) on Ile Michel, 17 January. Comment is also made under a similar heading for *Bubulcus ibis*.

Apart from the foregoing, Penny saw two apparent adults in the Coffee Camp nesting colony in which the yellow was not confined to the feet. A white phase bird had yellow extending up the legs for about three-quarters of the length, and in a dark phase one for about half. In young birds it seems normal for the legs as well as the feet to be olive-green. A fledged bird showing such coloration, seen by Penny on 15 September, has already been mentioned, and on 21 March Benson saw two such in West Channel. In young birds, too, the bill is dark grey rather than black as in adults, paler at the base, the lower mandible mainly flesh coloured (or yellow in one of the two seen by Benson), the tip dark grey.

Systematics (including notes on the colour-phases). It is most convenient to start this section with a discussion of the colour-phases, including some other details about the plumage. It is concluded with a systematic discussion, in which some comparative details from Africa are also given.

It is well known that the populations of *Egretta garzetta* in the Malagasy region are represented by two phases, one in which the plumage is wholly white (as in figure 3, plate 30), the other in which it is predominantly a dark, bluish slate. These are referred to as the white and the dark phases respectively. Some birds in the dark phase are paler, less bluish, than others, and would appear to be immature. Berlioz (1934, 1949, 1959, 1961) has discussed these phases, and (1961) has pointed out that in the vast range of the species—it extends even to Australia—the dark phase is relatively restricted in distribution, whereas the white phase occurs throughout the range. Although the species occupies freshwater as well as sea-coastal habitats, the dark phase seems to occur only at all regularly inland in Malagasy. Even on coasts it is apparently only represented in the following areas: western tropical Africa, from the equator northwards, and islands in the Gulf of Guinea; Malagasy and Aldabra archipelago; eastern tropical Africa, from Tanzania northwards, along the Red Sea and Persian Gulf, to the western coast of India and Ceylon.

Demiegretta sacra provides an interesting contrast to *E. garzetta*. According to Berlioz (1961), it is exclusively sea-coastal, occurring in the eastern Indian Ocean and the western Pacific. In tropical areas there are both white and dark phases, but in extra-tropical areas only the latter is known.

To turn to the situation on Aldabra in particular, from earlier accounts Benson (1967, p. 69) suggested that the ratio of the white phase to the dark phase might be about 65:35 as Milon (1959, pp. 257–258) had found at Diego Suarez in extreme northern coastal Malagasy, and from Tulear to Cape St Marie, in the coastal southwest. Of 1758 birds counted by us during September/March inclusive, the overall ratio works out at 2.47:1. There is some suggestion that the ratio on the sea-coast proper (mostly the reef opposite Settlement) is different to that in the lagoon and in the channels. For the former the figure is 3.17:1 for 1089 birds counted, whereas for the latter it is 1.71:1 for 669 birds. The difference may not be statistically significant, as there were considerable variations in the proportions from one count to another. None the less the

overall difference is of interest. White phase birds are of course more conspicuous, but account was taken of this and the counts were carefully made.† In Malagasy the ratio evidently varies from locality to locality. It would be interesting to know whether the ratio of the white to the dark phase is higher inland than it is on the coast. In the interior of Africa the dark phase is virtually unknown, though Tree (1963, 1965) does give two records of 'grey' birds from Zambia. Apart from the figures quoted above from Milon, Rand (1936, p. 328) makes a few contrasts. In the southeast, where it was common, not a white bird was seen, though it is not clear whether this refers to the coast or inland. Berlioz (1934, p. 277) quotes Delacour (1932) that the white phase predominates in the dry southwest, and Berlioz (1961) repeats this. But Delacour (1932, p. 12) only mentions the predominance of the dark phase in the southeast, while Rand, with extensive field experience makes no mention of the situation in the southwest. However, as already quoted, Milon gives a ratio of 65 white to 35 dark in the coastal southwest, so that the white phase is obviously not entirely predominant even in that area. Near Tananarive, in the interior, Malzy (1967*a*, p. 134) saw only the white phase, yet Milon (1959, p. 257) gives a ratio of 70 white to 30 dark. It is not possible at present to suggest any reason for any variation in the proportions, and more information on the ratios is required. But conceivably on Aldabra some difference in feeding success is the explanation of the contrast recorded, though we did not find any difference between the two habitats, either in the feeding technique of the birds or in the colour of the background against which they would be seen by potential prey.

Apart from a clear distinction between the white and the dark phases, a relatively few 'pied' birds were noticed. Dark-phase birds always have the coverts of the bastard wing and chin white. But one in the Ile aux Aigrettes breeding colony on 17 November had in addition the head plumes white. Others had the white in the wings more extensive, or the whole head and sometimes the neck white. Another variant occasionally noted was 'gull coloured', the wings and mantle dark, the rest of the body plumage white, and in one the head as well. A few predominantly white birds, with restricted dark areas of plumage, were seen. Milon (1959, pp. 256–257) records some white feathers in the wings of three dark-phase young examined, in one case showing a symmetrical pattern. He also records two white-phase birds with dark barbs, one of them (a young bird) showing a degree of symmetry, as also shown in a photograph. One young bird handled by Penny had white primaries, but the feathers of the wing coverts and the secondaries, individually particoloured, giving a speckled appearance, white and dark grey on a grey-blue ground. The neck had a streaky appearance, black on grey, while the head was clear grey. There are two specimens in London from Aldabra showing particoloration of individual feathers.

It is evident that the two colour-phases are not simply segregated; nor are they in eastern Africa, see below. This species would repay further study from a genetical standpoint. That there can sometimes be a certain degree of symmetry in the occurrence of white in dark-phase birds, or vice versa, needs stressing. Above all, in the normal dark phase, there is always white on the chin and bastard wing coverts. Irwin & Benson (1969) give instances of white feathering in specimens of the adult male of an African cuckoo-shrike *Campephaga flava*, normally wholly blue-black in colour. One such specimen had a symmetrical white chin patch.

† In observations by Penny, on the southern side of the lagoon near Dune Jean-Louis in 1969, the preponderance of the two phases was reversed. Numbers of white and dark birds respectively were: 3 March, 10:32; 6 March, 13:31; 19 April, 13:25; 29 April, 19:38; 1 May, 6:19; 26 May, 9:20. These figures give a ratio of 1 white: 2.36 dark (= only 0.42:1).

One quite aberrant bird seen by Penny at the Coffee Camp breeding colony requires mention. It was in the dark phase, but the normal dark bluish slate replaced by very dark brown. The bastard wing coverts, instead of being pure white, were suffused with brown as well, giving a beige colour. The head plumes were of normal length, but the body plumes were shorter than is normal. The legs were normally coloured.

Recently hatched birds are entirely clothed in dirty white down, and we agree with Milon (1959, p. 256) that in the early days of their existence it is not possible to determine the phase. But as soon as the feathers start to appear, from handling young birds at nesting colonies, Penny found that this could be ascertained without difficulty.

Penny did not find it possible to identify for certain any pairs of parents at the crowded breeding colonies inspected, except that at Iles Moustique one white-phase bird was joined by another such. Nor is there any record of young of both phases associated with the same nest. Macnae thought that there were white-phase parents mated with dark-phase ones at the West Island colony, 9 January. At the lone nest observed by Benson on 25 January, the two young were both in the dark phase. When he first saw it, a white bird flew away, though when he returned later there was a dark bird in the vicinity. At the lone nest on Polymnie, 1 February, the two young were both white. A white adult was seen near the nest, and a dark one farther away, but it was noted at the time that it might not have been one of the parents. On 23 March Frazier saw a dark-phase bird crouch and make a noise while approaching a white bird, which eventually fed it. On p. 437 above Penny has recorded dark and white birds 'dancing' together. Clearly further investigation of the colour of feathered young and their parents is needed, and this could be more easily carried out using single nests rather than colonies. Milon (1959, p. 259) summarized his observations by stating that in all cases where it was possible to determine to which phase the two birds of a nesting pair belonged, both were of the same phase. In every observation but one, all the young in one nest belonged to the same phase, which was the same as that of the parents. In the exception, there was one light-phase and one dark-phase chick, the only known parent being dark.

Grant & Mackworth-Praed (1933, p. 193) named the Assumption and Aldabra birds *E. g. assumptionis*, differing from *E. g. dimorpha* of Malagasy in having a longer bill. Benson (1967, p. 68), using their measurements, did not think that *assumptionis* could be recognized, as the overlap was considerable. It is worth giving our own figures (millimetres).

	wing	culmen from base	tarsus
		Réunion	
♀(?)	280	97	110
		Malagasy	
9♂♂	291–306 (295.9)	102–107 (103.8)	110–124 (116.5)
2♂♂(?)	302, 303	103, 104	105, 111
10♀♀	263–292 (280.2)	93–100 (97.4)	98–117 (108.0)
2♀♀(?)	265, 275	92, 93	103, 107
		Cosmoledo	
2♀♀	277, 287	90, 92	98, 105
		Assumption	
2♂♂	280, 287	101, 106	107, 115
		Aldabra	
1♂	288	106	108
5♂♂(?)	281, 281, 290, 291, 295	102, 106, 108, 110, 113	104, 105, 109, 111, 112
1♀	269	103	110

	wing	culmen from base	tarsus
Coastal Tanzania: Pemba Island, Zanzibar, Dar-es-Salaam, Rufiji River			
1♂(?)	282	99	106
3♀♀	252, 252, 263	85, 87, 94	87, 88, 92
6♀♀(?)	253–266 (259.2)	86–98 (89.8)	86–103 (90.4)
Southeastern Africa: Malawi to Transvaal and Natal			
6♂♂	269–293 (280.7)	93–101 (95.2)	104–110 (107.2)
5♂♂(?)	280, 282, 285, 285, 288	88, 94, 94, 97, 101	103, 106, 111, 111, 112
4♀♀(?)	260, 261, 267, 269	84, 88, 94, one broken	94, 96, 97, 104

These figures are taken from the material in London, with the addition of two specimens in Cambridge, while one of the two from Cosmoledo is now in New York. One of the Cambridge specimens is labelled as having been collected at Réunion. It is undated and in the dark phase. It was given by M. Lantz, the Curator of the St Denis Museum, Réunion, to E. Newton in January 1869. Only one specimen was collected on Aldabra during the recent expedition, a male by Frazier. The other sexed specimens from Aldabra and Assumption were collected by Nicoll, the two from Cosmoledo by Benson and Parker (see Benson 1970*a*), those from Malagasy by Rand. These are all assumed to be correctly sexed. Every specimen which was not sexed by the collector has here been tentatively sexed according to its wing-length, with a note of interrogation appended. Both the dark phase and the white phase are represented in the Malagasy, Assumption and Aldabra specimens, while both those from Cosmoledo are in the dark phase. In the coastal Tanzanian series, from the first three localities there are four normal dark-phase specimens, except that one of them lacks any white on the bastard wing-coverts. Two specimens from Aldabra showing particoloration of individual feathers have already been mentioned, and there are three in this series also showing it—two from Dar-es-Salaam, one from the Rufiji. Incidentally, Pakenham (1943, p. 170) thought that on Zanzibar and Pemba 'the black usually outnumber the white'. The dark phase is not represented at all in the final series, though some specimens have a few particoloured slate and white feathers in the wings. This is evident in three from Potchefstroom, in the Transvaal, in one merely labelled 'Zambezi', also in one from 'Transvaal' and one from 'Natal'. This is not apparently due to staining, though none of 15 specimens in Bulawayo, from Rhodesia, Zambia, Botswana and Mozambique, show any slate (Stuart Irwin, personal communication).

The wing-lengths indicate that the Assumption and Aldabra birds average a little smaller than those from Malagasy, while their bills average longer. The two Cosmoledo birds have very short bills. There seem to be some variation which may be termed 'microsubspeciation', though the formal recognition of *assumptionis* cannot be justified. But the name *dimorpha* can conveniently be retained for the birds of the Malagasy region. The African birds (nominate *garzetta*) have shorter wing-lengths, and there is practically no overlap in this respect between the males from Africa and from Malagasy itself. Also, even considering the overall figures, regardless of sex, there is no overlap in the bill lengths of the African birds and those from Assumption and Aldabra. Probably these two atolls have been colonized from Malagasy, Astove and Cosmoledo, where the species also occurs, having been used as 'stepping stones' in the process. Notes on the restricted range of the species in the Malagasy region as a whole follow below under *Miscellaneous*.

Under *Ardea cinerea* (p. 430), the difficulty of strict accuracy in taking measurements of tarsus in dried specimens is stressed. Nevertheless, the tarsus figures above are thought to be of

some value for comparative purposes. They do not suggest any very marked variation, though the overall figures regardless of sex indicate that the African birds are the shortest legged. This is presumably a reflexion of their smaller size as indicated by the wing-lengths. The culmen figures are longer than Grant & Mackworth-Praed's, which it is assumed were taken from the feathering rather than from the base of the skull.*

Miscellaneous. In the Malagasy region, apart from Malagasy itself, this species has a restricted range, and apparently it only occurs regularly in the Aldabra archipelago. Small numbers are recorded from Cosmoledo and Astove (Benson 1970*a*, *b*) and it occurred in the past on Assumption, though Stoddart *et al.* (1970) did not find it. In the Comoros, Benson (1960*a*, p. 103) could not find any satisfactory evidence of its occurrence, though Forbes-Watson (1970) saw a white-phase bird on Moheli airfield. It is curious that it should not occur in that archipelago regularly, since there are reefs off all four islands which might be expected to provide suitable feeding. Nicoll (1906, pp. 686–692) does not record it from Gloriosa. Loustau-Lalanne (1963, p. 13) records it from Providence and Farquhar. But it is not listed by Watson *et al.* (1963, p. 186), nor did Stoddart & Poore (1970) see it on Farquhar. It may have existed formerly on Réunion (Milon 1951, p. 164), and an old specimen therefrom has already been mentioned. There has been some misunderstanding about the species of egrets which occur on Astove (Benson 1970*b*). Throughout the Aldabra archipelago, apart from *Bubulcus ibis*, the only one we know of is *Egretta garzetta*.

The vernacular name Blanc-et-noir is clearly an allusion to the two colour phases.

***Butorides striatus* (Linnaeus)** (Green-backed Heron), Manic or Gasse

Status. This is an easily overlooked, inconspicuous, species, even when feeding out in the open. The total population might well exceed 1000. It occurs regularly on open shores, but is also to be found inland, not necessarily near water, and also in mangroves.

Ecology and food. Individuals were seen searching for food in the shelter of mangroves, among the roots, and also frequently out in the open, as on the reef opposite Settlement at low tide. At high tide they can be found resting in trees near the coast—e.g. in *Casuarina* trees, as noted by Benson north of Settlement on 5 February. But it also feeds on dry ground. Thus on 23 March at Dune d'Messe Frazier saw an immature bird apparently stalking insects on grass at the camp there, and it did in fact jab at a locust. On 30 March at Settlement Benson saw one searching for food on a path through a coconut plantation. Cogan saw one at a purely temporary rain-pool at Takamaka, 27 February, after rain had fallen the previous day, and an adult with bright red legs was seen at Takamaka on 6 June 1969.

That the species can exploit either a shore or an inland habitat is supported by the evidence from the stomach contents of specimens collected. Four out of five have been examined, and are as follows: (*a*) remains of a fish; (*b*) parts of a fish and leg of a crustacean; (*c*) grasshoppers and a skink; (*d*) crab remains. Of these, (*c*) indicates inland feeding, the remainder shore (where indeed the three specimens in question were feeding), though in the case of (*c*) the specimen was collected on the edge of West Channel, within easy reach of the shore. That individuals of the species can exploit either habitat is indicated by a nestling (see under *Breeding* below), which regurgitated the tail of a fish and the heads of several insects. In the Seychelles, according to Loustau-Lalanne (1963, p. 15), the habitat of this species is the sea-coast, but this cannot be altogether so, because he gives the food as lizards and frogs as well as small fish (and incidentally

* For a systematic discussion centred on western tropical Africa, see Amadon (*Bull. Am. mus. nat. Hist.* **100**, 405, 1953.

on some islands Sooty Terns' eggs and young are said to be taken). Moreover, Gaymer, Blackman, Dawson, Penny & Penny (1969, p. 175) state that it often feeds inland. Benson (1960*a*, p. 35) indicates some inland feeding in the Comoros. Rountree, Guérin, Pelte & Vinson (1952, p. 170) give the habitat in Mauritius as 'invariably near water, fresh, brackish or salt'. Clearly it is also both a shore and an inland species in Malagasy (Rand 1936, p. 334).

Abbott (in Ridgway 1895, p. 531) records these herons as standing for hours on backs of turtles when on shore and catching the bluebottle flies which swarm on their backs and heads, and also as picking up scraps around the turtles slaughtering place. We have no such observation, but as already mentioned on p. 428, there has been a decline in the number of turtles since Abbott's time, and few are now slaughtered.

Behaviour and voice. Certainly at East Channel, where at Benson's request H. Stickley collected three specimens, feeding out in the open at low tide, he had difficulty in approaching them. On the other hand, in the Comoros Benson (1960*a*, p. 35) records it as easy to approach, attempting to avoid detection by remaining motionless in an almost horizontal position, with the neck outstretched, a habit also noticed on Aldabra. On Assumption, Nicoll (1906, p. 696; 1908, p. 111) specifically comments on its shyness and the difficulty which he had in obtaining one specimen. Possibly it somehow becomes aware when it is being hunted. The call (in flight) is a single shrill 'chuck', which sounded to Benson very like that of this species in Zambia or Malawi. Normally it is solitary, and never were more than two birds seen together.

At Anse Malabar, 19 July, Frazier observed two birds flying and calling, 1 to 2 m apart, 5 to 7 m up. They appeared to be interacting in some way, and Frazier suggests that this was possibly a courtship flight.

Breeding. Abbott (in Ridgway 1895, p. 531) records it as breeding in mangroves in November and December, laying two eggs. The following nests, occupied or under construction, were found during the recent expedition:

Bras Cinq Cases, 4 November (Penny): two pale blue eggs, in mangroves, 0.7 m up in an *Avicennia marina.*

Takamaka Grove, 10 November (Penny): one egg, 5 m up in a *Ficus* tree. Egg cold, but parent in attendance. It was collected, and was fresh, size 40 × 30 mm, mass 18 g, colour pale blue. Six old nests nearby.

Cinq Cases, 18 November (Penny): under construction, in a mangrove 15 cm above level of a small pool.

East Channel, 20 November (Penny): old nest being rebuilt by a pair, 1.5 m up in a *Bruguiera gymnorhiza* over intertidal mud.

Iles Moustique, 30 November (Penny): two eggs, in mangroves, 2 m up in a *Ceriops tagal.*

Passe Femme, 4 February (Diamond): one chick (mass 13 g), one egg starting to hatch (mass 15 g), in mangroves. Egg light blue, size 36.5 × 29 mm.

The nests were roughly circular platforms about 30 cm across, with a shallow depression in the middle, though in the one at Takamaka the depression was as much as 10 cm, and it was 35 cm across. They were made of fine twigs, not much interwoven, but laid into a fork. Unlike at least some birds feeding in the open, parents observed at these nests were not excessively shy.

At the mixed colony on Ile aux Aigrettes, 17 November, originally referred to on p. 431 above, Penny found a group of 79 nests, 52 of which contained eggs, closely similar to those recorded above, including the $C = 1$ collected. Clutch sizes were as follows: $C = 1$, five;

$C = 2$, thirteen; $C = 3$, thirty-one; $C = 4$, three. Three of these clutches were collected, as follows:

$C = 3$, all well incubated; size 38 × 31, 36 × 31, 39 × 32 mm; mass 16, 17, 18 g.

$C = 3$, two partly incubated; size 41 × 30, 41 × 30 mm; mass 17, 18 g. Third egg cracked and infertile.

$C = 4$, three well incubated, one infertile; size 42 × 31, 40 × 30, 41 × 31, 41 × 31 mm; mass 16, 18, 18, 18 g.

Cattle Egrets, *Bubulcus ibis*, were seen beside these nests but not on them, and the eggs are much smaller and lighter than in a $C = 1$ of that species collected, (see p. 434, where many further figures are quoted), or a $C = 2$ and $C = 3$ of Little Egrets *Egretta garzetta* (p. 439), and somewhat so than a $C = 3$ of Malagasy Squacco Herons, *Ardeola idae* (p. 432), which in any case were so few in number that they could not have been responsible for so many nests. But not a single Green-backed Heron was seen on the islet by Penny during the 6 h he spent there, nor by Benson when he had 2 h there on 18 January, and the identity of these eggs is uncertain. The three clutches collected, together with the $C = 1$ collected, known to be of *B. striatus*, are a close match with eggs of other subspecies of this heron in the British Museum collection. But although Lack (1968, pp. 110–112) indicates that the genus *Butorides* nests to some extent colonially in Asia and America, we are not aware that *B. striatus* does so anywhere in Africa or the Malagasy region. Moreover, the first six nests recorded above were solitary, though possibly the old ones at Takamaka Grove might represent a colony.

Of five specimens collected, a male dated 21 January had right testis 11 × 4, left 12 × 4 mm, and it would seem that it was in or near breeding condition. Also, a female dated 22 January had the oviduct still swollen, and evidently egg-laying had recently been completed.

The foregoing records indicate egg-laying from about early November to January. But if inland records from south central Africa are an indication, the season may be much more extensive. Benson *et al.* (1964, p. 36) give 52 egg-laying records, every month being represented except July. The highest figures are for October (11) and February (12). For Malagasy, Rand (1936, p. 335) gives records indicating egg-laying in September and November. A few data from the Comoros in Benson (1960*a*, p. 35) indicate laying in August and September, while Forbes-Watson (1970) found a nest with two eggs on Grand Comoro on 18 October. According to Loustau-Lalanne (1963, p. 15), breeding occurs throughout the year in the Seychelles.

Abnormal coloration of soft parts. This is discussed generally under *Bubulcus ibis* (p. 435). The normal colour of the soft parts, from the records for five collected specimens, is: upper mandible black, lower pale green, bare skin between upper mandible and eye pale green; feet and legs yellow, brownish in front; irides yellow. A colour-slide of an apparent adult (lacking the heavy streaking below of immature specimens) photographed by Penny in mangroves near East Channel on 20 November clearly shows pink, not pale green, legs and feet, and between the upper mandible and the eye. Both mandibles and the eye appear as dark, and it is impossible to make out the colour, though there is a suspicion of a rim of pink encircling the eye. An adult seen by Benson in the same general area and habitat on 11 January at least had the legs pink, while in one which he saw there in mangroves on 25 January he recorded the legs, feet and 'base of upper mandible' as bright pink. Possibly this difference from the normal coloration is indicative of breeding activity, but if so, the two specimens collected on 21 and 22 January, apparently close to breeding, might have been expected to show some pink colour, but did not. Nor did

Penny notice any abnormality in the parent which had a fresh egg at Takamaka Grove on 10 November. For a record of a red-legged bird, see p. 444.

We are not aware of any earlier published account of such an abnormality in this species. It is therefore worth adding that W. F. Bruce-Miller has told Benson of an individual of the subspecies *B. s. atricapillus* which he saw on an islet covered with thick scrub in the Kariba Lake, on the boundary between Rhodesia and Zambia, 2 April 1961. It had bill and legs of a general coral-red colour, and also a red rim around the eye. The bird flew around in close proximity, and would not leave the islet. It gave Bruce-Miller the impression that it had a nest. His information differs from that from Aldabra in that the whole bill was red instead of merely the skin between the upper mandible and the eye. The rim of red 'around the eye' apparent in the slide and in the Kariba bird may represent the iris.

Systematics. Benson (1967, pp. 67–68), and again Stoddart, Benson & Peake (1970) have discussed the subspecies. It is evident that *B. s. crawfordi* occurs not only on Aldabra and Assumption but even the Amirante Islands, though the single specimen from the latter is a little larger and heavier. It would also appear that *crawfordi* only differs from *rhizophorae*, of the Comoros, by its smaller size, wing 156 to 169 as against 170 to 180 mm. It should be emphasized that *crawfordi* and *rhizophorae*, and also *javanicus*, of the Mascarene Islands seem to be of Asiatic origin, but *degens*, of the Seychelles, and *rutenbergi*, of Malagasy, of African origin, as originally discussed by White (1951).

Miscellaneous. We use 'Green-backed Heron' rather than 'Little Green Heron' as in Watson *et al.* (1963) and Benson (1967, p. 67), since this species has no green coloration except on the upperside. The vernacular names are the same as in Loustau-Lalanne (1963, p. 15).

Mobbing of this heron by a bulbul, *Hypsipetes madagascariensis*, is recorded on p. 478. On 18 May at Settlement a kestrel, *Falco newtoni*, attacked an immature *B. striatus*. The kestrel was perched in a *Casuarina* tree, when the heron flew in from the direction of the sea. As it passed below the tree, the kestrel dived down, striking it two or three times with a loud chattering call. The heron, squawking but managing to keep airborne, flew on to the verandah of the rest house, thence into the main room and out on the far side. The kestrel resumed its perch in the same tree. It is unlikely that *F. newtoni* would ever take such large prey as *B. striatus*, and it has also been recorded (p. 485) as mobbing the still larger crow, *Corvus albus*.

***Threskiornis aethiopica* (Latham)** (Sacred Ibis), Ribis

Status. There is one record of the African *T. a. aethiopica*, see p. 513. *T. a. abbotti* is endemic to Aldabra. The total numbers probably do not exceed 200. For the most part it inhabits the southeastern end of the atoll. The numbers may have been larger in the past. Thus we were told by the manager at Settlement that between 1923 (when he first visited Aldabra) and 1954 it was frequent there, feeding on turtle offal. They were however molested, he said, some being killed for food, and no longer visit the area. Benson did in fact see an immature bird outside the manager's house on 25 March, but that is our only record from Settlement proper, though the odd individual was sometimes seen on the shores of West Island. It seems always to have been extremely rare, virtually absent, on Polymnie and Middle Island.

By the first decade of the present century, the numbers had already been reduced. Thus according to Fryer (1911, p. 417) it was no longer to be found on Picard (West) Island, and Nicoll (1908, p. 119) was told that the bird was seldom seen near Settlement. It seems that

subsequently, according to the manager's account, it became more frequent at Settlement, though there has since been a drop in the numbers.

Ecology and food. Although these birds are frequently seen on the shores of the lagoon and on the sea-coast, their preferred feeding ground is around pools in the platin, in the southeast of the atoll, where they forage on the edge of the water for snails and small crabs. One immature bird was seen by Penny taking small snails from underneath the lower overhanging edge of a pool in the platin, and washing them in the slightly brackish water of the pool before eating them. At Grand Cavalier another immature bird was seen by him digging for the small fiddler crab *Uca* sp. which is abundant there in soft mud. This bird had the head and neck covered in mud, and was seen several times with the head completely buried as it dug, and Rand (1936, p. 337) records *T. a. bernieri* as thrusting the bill into mud up to the eyes. On the edge of the lagoon near Dune Jean-Louis, in late April, both adults and immatures were seen several times feeding in soft mud by sweeping the bill from side to side in places where the mud had been covered by a layer of water. They were catching burrowing crabs, *Macrophthalmus parvimanus*, feeding on the surface of the mud. In the lagoon shallows they were seen taking small crabs, snails and polychaete worms. According to Honegger (1967) it is predatory on the turtle *Chelonia mydas*, and will eat a whole nest of eggs. We did not observe this. Gaymer (1967, p. 116) records it as searching leaf litter inland, perhaps eating lizards, large insects and vegetable matter. Abbott (in Ridgway 1895, p. 530) records it as living 'constantly about the camp, feeding upon scraps and turtle offal', and Fryer (1911, p. 417) found that it scavenged around his camp on Ile Michel. At Dune Jean-Louis it is often to be seen scavenging among refuse and rubbish. Frazier saw as many as 14 there on 19 March. The stomach contents of an injured immature specimen which he collected there (see p. 451) included a few seed-fragments and the following insects: Coleoptera: Curculionidae and Tenebrionidae; Dictyoptera: Blattoidea (*Pycnoscelus* sp.)

On shores the ibis may be in competition with such waders as the Whimbrel, *Numenius phaeopus*, which feeds in the same places and in a similar manner. But around pools in the platin, its preferred feeding ground, it probably has no serious competitor, and the numbers and variety of species of waders are small. The Cattle Egret, *Bubulcus ibis*, feeds around camps among turtle remains to some extent alongside the ibis, but probably takes insects only, and may not be a serious competitor.

Behaviour and voice. At Takamaka Grove, 4 October, Penny counted 48 ibises, together with 35 Cattle Egrets, in a mixed roosting colony. On 10 November there were only two ibises and three egrets, and by that date breeding preparations had certainly commenced, see below. It usually nests, as well as roosts, gregariously, though when feeding is often solitary.

Abbott (in Ridgway 1895, p. 530), Nicoll (1906, p. 702; 1908, pp. 120–122) and Fryer (1911, p. 417) all comment on its tameness. Nicoll was able to pick up birds by hand. We agree with Gaymer (1967, p. 116) that they are not so tame as formerly, though both adults and young, when feeding, will allow an approach to within a metre or two. But Penny did notice that they seemed to be more shy when in the company of other birds, either Little Egrets, *Egretta garzetta*, on the shore or Cattle Egrets, *Bubulcus ibis*, at the Takamaka roost. These others were much less tame, and disturbance of them would also cause any ibises to fly off. As is discussed in the next section, at the nest they are evidently extremely sensitive to disturbance, even although still very tame. Behaviour at the nest is described in a special section below.

No striking call was heard. Fryer (1911, p. 417) mentions a 'harsh wheeze'.

Breeding. Gaymer (1967, p. 116) records a colony of 21 nests at Takamaka, 17 of which contained two eggs, two had one egg, and one had three, on 21 November. The remaining nest had been laid in by the following day. Although during the recent expedition many adults were seen at nests, as detailed below, not a single one containing eggs was found, though at Cinq Cases on 4 January Grubb found one with three young, and another on 31 January with two young nearly fledged. The only other record traced of nests containing eggs is by Fryer (1911, p. 417), who found the maximum number in a nest to be two. He does not give a date, though he was on Aldabra from August to February (Stoddart 1967, p. 5). Nicoll (1906, pp. 698, 702), who was on Aldabra for 3 days in mid-March, found that the breeding season was past, and only saw full grown young. It may be that the breeding season is restricted, egg-laying perhaps being confined to the period November/December, i.e. in the early part of the rainy season. Rand (1936, p. 337) records two nests each with two young about one-third grown in Malagasy on 11 January, this agreeing with the apparent Aldabra season. But in Zambia, where the incidence of the seasons is generally similar, Brooke (personal communication) gives egg-laying records for January/May and July/September. As to clutch size, in South Africa, McLachlan & Liversidge (1957, p. 37) give it as two to four, occasionally five. The Aldabra records do not show it as ever exceeding three.

When Penny found a roosting colony at Takamaka Grove on 4 October, as already mentioned, he thought that the birds would lay eggs there again, as they had in 1964 (Penny 1965, p. 104; Gaymer 1967, p. 116). The condition of the nests in the colony in which they had laid in 1964 was such as to indicate that they might have bred there in 1966. But minimal disturbance may have been sufficient to discourage the birds. On 10 November there were only three birds present, and no evidence of any attempt at breeding in this locality was ever obtained in 1967/8.

On 12 November Grubb found a colony of 26 nests, with 61 birds present, at a pool near Cinq Cases. One of these birds was actually a young one still with a feathered head and neck. These birds seemed quite undisturbed by visits from Penny and Grubb the following day, but on 17 November there were only two present, and none was seen there subsequently. On 16 December a new but almost completely abandoned colony was found in a *Thespesia* swamp west of Takamaka. There was a total of 83 nests, but only two birds present. On 17 December at Cinq Cases, Grubb found birds again a few metres away from the colony of 12/17 November, 52 being present, many still carrying nesting material and building a new colony. Two days later, on 19 December, this colony had been abandoned, but nests were being built in another colony, some 100 m away. When this last colony was re-visited on 4 January, he did in fact find a single occupied nest, containing three young. No more nests were seen until 31 January, when Grubb found two in *Lumnitzera* bushes about 2 km away, one empty, the other with two nearly fledged young. Although these birds are so tame, it is evident that they desert their nests very easily. Gaymer (1967, p. 116) relates how, after 21 nests with eggs had been found on 21/22 November, the eggs all 'vanished' in the 5 following days. Fryer (1911, p. 418) found that on returning to a colony, as each bird does singly, it 'reaches its nest by partly flying and partly running over the flat top of the tree, the result being that most of the eggs in the path of a returning bird are either broken or rolled off the nest into the water below'. Out of 18 eggs counted when the birds were absent, only two remained whole after they had all returned.

Possibly there is only the one group of breeding birds, in the southeast corner of Aldabra, totalling about 150. We have no evidence of breeding in any other part of the atoll, though

scattered non-breeding individuals occur farther west on South Island, and on West Island, so that the total population may be about 200. Conceivably in their breeding these birds are highly sensitive to climatic conditions. Although there are no meteorological data to support it, we have the impression that the southeast is the wettest part of the atoll, and it might be that this is the only suitable breeding area. Alternatively, or in addition, the birds may be dependent on the inland shallow pools in the platin, confined to the southeast, for suitable food for nestlings. At all events, it needs emphasizing that the population is small, and breeding colonies should be left undisturbed, even though Fryer's observation might suggest that it is the birds themselves which are the cause of desertion (by trampling on the eggs) rather than external human influence. It would seem that one or two nests can still be used for successful breeding after a colony as a whole has been abandoned. It is also possible that the bulk of the population bred successfully in 1967/8 in a colony which perhaps fortunately was not found.

The nests are built on the tops of low bushes, over or near water (perhaps explaining why no broken eggs have been found, except by Fryer), and are of diameter about 45 cm. They are rough assemblages of coarse twigs, often plucked green and bearing leaves, especially in the upper layers, and lined with tufts of grass and fresh and dead leaves. The lower layers are often the remains of a previous nest. When a colony is complete, most nests touch neighbouring ones, the whole forming an untidy raft across the top of the supporting bush, and usually between 1 and 3 m above the ground. At the colony found at Cinq Cases on 17 December, the water-level rose as a result of rain later that month, until some of the nests were barely 30 cm above the surface of the pool underneath. Gaymer (1967, p. 116) describes the eggs as off-white in colour, stained, without lustre; Fryer (1911, p. 417) as chalky shelled, greyish white in colour. They seem to differ from South African eggs, which McLachlan & Liversidge (1957, p. 37) describe as chalky with red-brown spots.

Behaviour at the nest. The notes in this section are entirely from Penny. Copulation was seen on three occasions at the Cinq Cases colony on 13 November, on the nests, not on the ground. In all these coitions the male was recognized by his longer bill. After one copulation the female squatted as though sheltering under the breast of the male. Several unsuccessful attempts were also seen, in which a male arriving at the colony attempted to tread a bird on top of which he had landed, but apparently by mistake, and not his mate. No preliminary courtship was detected, even when a pair had been standing close together for some time before coition.

Fighting was only seen when large numbers of birds were gathered together, chiefly at the nesting colony but also occasionally at the roost at Takamaka Grove. A bird landing in a group would exchange blows with the bird nearest to it, which may have been started by a display with open bill at the intruder. Fights were seen on the ground beside nests as well as on the nests themselves. They usually took the form of fencing with the bill, the birds exchanging sideways strokes, rather gently. Sometimes more direct attacks would be made, with one bird pecking at the body of another. On one occasion only were two birds seen to fight like game-cocks, jumping and kicking at each other. Submission was indicated by ducking the head and turning away; but on the crowded nesting colony this was not always sufficient, and birds were seen fencing over their shoulders with others behind them before taking to flight to end the combat. Oddly, the invader usually seemed to win a tussle, and successful defence of a perch already occupied was rare. There seemed to be some kind of a peck order in operation, both at the colony and the roost. At the latter this seemed to be determined by age, for on arrival young birds would invariably pitch onto the ground, whereas most adults would go direct to the

FIGURES 1, 2. *Threskiornis aethiopica abbotti*; 1, adults (by A. W. Diamond); 2, immature (by M. J. Penny). FIGURE 3. *Egretta garzetta dimorpha* white phase (by P. Grubb). FIGURE 4. *Alectroenas sganzini minor* adult (by M. J. Penny).

(*Facing p.* 450)

FIGURE 6. *Dicrurus aldabranus* adult in *Casuarina* tree (by M. J. Penny).
FIGURE 8. *Nectarinia sovimanga aldabrensis*: nest attached to tent flysheet (by M. J. Penny).

FIGURE 5. *Caprimulgus madagascariensis aldabrensis* apparent male (see p. 474) (by M. J. Penny).
FIGURE 7. *Corvus albus* beach scavenging (by P. Grubb).

tree. The young birds would fly up to join the adults in the tree only just before darkness fell, when new arrivals had almost stopped. By that time they were presumably able to find perches from which they would not be likely to be dislodged.

Systematics. Subspeciation has been discussed by Benson (1967, pp. 69–70). *T. a. abbotti* is a distinct form, only known from Aldabra, and probably more closely related to *bernieri* of Malagasy than to nominate *aethiopica* of Africa. The sexes appear to be indistinguishable in plumage. The male has a longer bill, but in the field, unless a female is also present for comparison, this distinction is difficult. During his observations at Cinq Cases, Penny did also notice that the longer billed birds nearly always had an area of paler skin, freckled with black spots, at the base of the upper mandible. This might prove a useful guide to the sexing of adults in the field. It is not apparent in an adult male collected by Nicoll in 1906.

Immature birds are easily distinguished from adults by having the head and neck feathered, whereas in adults they are devoid of feathers and the bare skin is black; see figures 1 and 2, plate 30. They also have the eye brown instead of pale blue (china-blue). But the change of blue may precede the loss of the feathering. At Takamaka on 14 March Benson saw two birds with the head and neck still feathered, but the eye changing in colour. Paleness of the eye is also apparent in the immature bird in the plate. At what age the feathering on the head and neck is lost is uncertain. According to Bannerman (1930, p. 113), in nominate *aethiopica* it occurs after the second or third year, though this statement is not documented. In *abbotti* at least the age of change may be variable. The two nestlings recorded by Grubb on 31 January already had black heads. On the other hand, two young which he saw on 17 February away from the nest, but still being fed by adults, still had the feathering. So had many seen in September/October, not at nests, and from the breeding season as already defined above nearly one year old at least.

In the immature of *abbotti*, the feathering on the head and neck is predominantly white, with very little black, and this is one of the distinctive features of this subspecies. In one collected by Nicoll, black is confined to the apical, exposed portions of the feathers of the crown and nape, with the shafts of those on the sides of the neck slightly black. In a bird with a broken leg collected by Frazier at Dune Jean-Louis on 3 May—the only specimen of any age collected during the recent expedition—these black markings are a little more accentuated. It has wing 346, culmen from base 161, tarsus 83 mm, and from the measurements of other specimens in Benson (1967, p. 70) would appear to be a male. It had iris dark brown, and had a mass of 770 g.

At least during mid-October to February, adults have a bare patch of bright red skin on the under surface of the wing, as is also recorded by McLachlan & Liversidge (1957, p. 37) for nominate *aethiopica*. Two adults seen on 3 March had the skin on the under surface of the wing dull purplish brown, not red. Possibly there is a seasonal change in the colour of this skin.

Miscellaneous. Particular attention must be drawn to the desertion of breeding colonies, described under *Breeding*. All persons visiting Aldabra should be warned of the damage that might be caused by even the most circumspect approach to a colony. The matter should also be borne in mind in the event of it being decided to site a station in the southeast of the atoll.

***Phoenicopterus ruber* Linnaeus** (Greater Flamingo), Flamant

Status. Earlier reports of flamingos on Aldabra are summarized by Benson (1967, p. 96). The numbers reported vary, Abbott estimating them to be as much as between 500 and 1000. Most

observers agree that flocks are to be seen, usually in the south and southeast of the lagoon, though Voeltzkow (1897), in an account not previously available to Benson, saw birds only at a distance, but at the western end of the lagoon, apparently in April. Except for eight seen by Lowery near Cinq Cases in mid-July, there is no definite record for the period May/August, but this may be merely due to a paucity of observers at this season. Gaymer (1967, p. 116) thought that there might be a resident population of about 50 birds, but Nicoll (1906, p. 703) was told that the species did not breed on Aldabra. Perhaps he was correctly informed. Flamingos were observed in several localities during the recent expedition, the numbers varying from 1 to 50 individuals, but no acceptable evidence of breeding was obtained. All sightings are believed to be of the same general group, and it is not believed that more than 55 birds at the most were present.

All observations recently made are from the eastern end of the atoll, either at inland pools, i.e. Flamingo Pool, named from the regularity of the birds there, and Grand Bassin Takamaka, where an egg was found, or in the lagoon shallows, i.e. behind Ile aux Cèdres or at Bras Cinq Cases, including that part at the eastern end flooded only by spring tides. On one occasion Penny was watching 13 birds at Flamingo Pool at the same time as Diamond had 29 in view behind Ile aux Cèdres. The birds were feeding in both places. The highest number recorded at any one time was 55.

On 25 September a single fresh egg was found at Grand Bassin Takamaka, just after a single flamingo had flown away. The bird was recognizable as a regular member of flocks, having a distinctive kink in the neck. It usually trailed behind the flock in flight, and was seen by Benson and Grubb as late as 22 February. The egg is chalky in colour and texture, with a pale blue shell revealed by a few scratches at one end, suggestive of the attentions of a crab. It measures 55 × 77 mm, and is similar to other eggs of *P. ruber roseus*. There was no trace of a nest-mound, either there or at any pool visited thereafter. Ridley & Percy (1953, p. 112) found an egg in similar circumstances at Lake Elmenteita, Kenya, and they comment that this is not an uncommon event. According to Brown (1959, p. 51), too, eggs are often dropped away from nests. The finding of this egg on Aldabra is not accepted as evidence of breeding.

Vaurie (1965, p. 88) states that *P. ruber roseus* is sedentary, but disperses after the breeding season, and is also migratory. It breeds in southern Europe east to northwestern India, in northern Africa, and also in the Rift Valley of Kenya and in South Africa, though not apparently in Malagasy (Malzy 1967*b*). The source of the Aldabra birds is quite uncertain. Possibly they are of palaearctic rather than East African origin. There is probably less seasonal movement from the latter, equatorial, area, and an indefinite and variable breeding season. It would be of great interest to mark Aldabra birds and determine the average length of stay. It may be that they remain for a long time, having wandered thus far, and that Aldabra is a dead end for such birds as reach it.

Two birds in a group of 13 at Flamingo Pool on 8 November were in wing moult, with about one-third of the primaries missing, and gaps visible also in the secondaries as they flew overhead.

Ecology and food. We have no direct observations on the diet of flamingos on Aldabra. They were seen feeding at brackish pools and in the lagoon, in a few cm depth of water over mud. Flamingo Pool itself is unusual among the inland pools of the area in having clouded rather than clear water. The water of such places as Bras Cinq Cases, flooded only by spring tides, is cloudy too. Presumably the diet is as determined by Jenkin (1957, p. 463) for the species in Kenya, i.e. invertebrates in the size range 1 to 10 mm. Honegger (1967) is surely mistaken in

including flamingos among predators on the Green Turtle *Chelonia mydas*. It is unlikely that flamingos have any serious enemies on Aldabra, although if they did breed they would perhaps suffer from the attention of rats and crabs, which could take eggs and young birds. On one occasion a party of flamingos was put up when a group of frigate birds *Fregata* sp. began drinking from the surface of the pool where they had been feeding; but this is unlikely to be a serious limitation on their activities.

Behaviour and voice. There is nothing particular to report.

Breeding. An egg has been described above, but it is not accepted as evidence of breeding.

Systematics. From six specimens, there is no evidence that the Aldabra birds are separable from the wide-ranging *P. ruber roseus* (see Benson 1967, p. 96).

(*b*) *Species of land birds proper*

***Falco newtoni* (Gurney)** (Malagasy Kestrel), Katiti

Status. Abbott (in Ridgway 1895, p. 533) did not find it very common. Gaymer (1967, p. 116) suggests that the total population cannot exceed 100 birds. It may well be appreciably less. Although there are many sightings from around Cinq Cases, Takamaka, Dune Jean-Louis, Dune d'Messe, and from West Island generally, they may well refer to a very few individuals repeatedly noticed. From Anse Mais there is a breeding record, see below. Penny also saw a pair there on 12 October and a single bird on 4 December. The only records from Polymnie and Middle Island are: one near west end of Polymnie, 3 September (E. A. Seaman); one flying across Passe Gionnet, 14 October (Diamond), and one feeding there, 2 March (Cogan). In particular, it has never been seen near East Channel, where Diamond spent most of his time during September 1967 to March 1968. Nor is there any record from any island in the lagoon, including the two largest ones, Iles Esprit and Michel, which were visited a number of times. It may have colonized Aldabra after man did; see under *Miscellaneous*.

Ecology and food. It prefers the more open vegetation, and visibility of prey in thick scrub might be difficult. But why it should be so sparse on Polymnie and Middle Island is not altogether clear. Its evident absence from around East Channel is despite the existence of some fairly open country within $1\frac{1}{2}$ km to the westward.

According to Gaymer (1967, p. 116), unlike the bird in Malagasy, it avoids human habitations. But we frequently saw it around Settlement. The only specimen collected, see under *Systematics*, was roosting in the eaves of the prison, and was said to have done so for the previous three months. Even at the time of Nicoll's visit, in 1906, it was 'fairly common in the casuarina trees' around Settlement (Nicoll 1908, p. 117).

Rand (1936, p. 379) states that in Malagasy the food consists largely of insects, especially grasshoppers, though he does mention that in stomach contents he also found the remains of a bird, a lizard, and of rodents and frogs. Those of the specimen collected at Settlement were: *Rattus rattus*, broken bones and fur; Orthoptera, Acrididae; some other unidentifiable fragmentary insect remains.

At Settlement on 20 March Walker was about to catch an 80 mm long mantis, clinging to the wall of a building, but was forestalled by a kestrel, which grabbed the insect and flew up into a *Casuarina* tree to eat it. At Gionnet on 2 March Cogan saw one alight on the ground and catch and eat a short-horned grasshopper. One observed by Frazier on 16 February at Dune Jean-Louis made a flight around from a favourite perching place at the top of the bole of a dead

tree, returning to the perch carrying something in its right foot. Perched again, it took 'dainty' bites at it, a black worm-like object, probably the intestine, being discarded with a shaking of the head. As the prey was greenish yellow, it may have been a grasshopper, apparently caught in flight. The observation was made at a distance of only 4 m. Frazier also saw what was apparently a lizard being eaten on this perch the same day. According to Gaymer (1967, p. 116), lizards are taken, and were brought to the young birds mentioned in the breeding record below. While Lowery was extracting white-eyes from a mist net on West Island, 27 June, a kestrel was caught in the net, suggesting that small birds may also be taken on Aldabra.

Behaviour and voice. As already indicated, it likes to perch at the top of the bole of a dead tree, in a commanding position, and is extremely tame. One which was perched at the top of an 8 m high dead coconut palm at Settlement on 2 September allowed Benson to approach to the base of the palm, so that his head was only about 6 m from it. Frazier's observations above were made even closer. It hunts by quartering low over ground or by hovering. One was seen by Benson and Grubb to hover repeatedly at Dune Jean-Louis on the evening of 2 September, once performing for as long as 90 s. It is usually to be seen singly, and never were more than two individuals seen in proximity to each other. Mobbing of Pied Crows is recorded under *Breeding* below, and has been noted at various times of the year. Thus Frazier saw one dive at a crow at Dune d'Messe on 16 July. Two days earlier, at Anse Mais, Hughes saw one mob a fruit bat *Pteropus aldabrensis*.

The call, made by both sexes, is a chattering 'tititiiti' (Penny); hence the vernacular name of 'katiti'.

Breeding. The only Aldabra record is the one quoted by Gaymer (1967, p. 117), of three large young in the crown of a coconut palm at Anse Mais on 18 November (1964). Penny (1965, p. 409) records that the parents drove would-be marauding Pied Crows away with 'reckless courage'. Food was brought about once an hour. The coloured photograph accompanying his paper shows the young as being still largely clothed in white down. A few Malagasy breeding records are mentioned by Benson (1967, p. 72), including one of a clutch of five eggs, another of six. On the other hand, in the Seychelles, the clutch-size of *F. araea*, closely allied to *newtoni*, is only one or two (Loustau-Lalanne 1962, p. 20). The possibility that the number of young reared per brood on Aldabra is less than in Malagasy needs further investigation. Probably in both areas breeding is confined to the hot pre-rains season, as for smaller raptorials in south central Africa (Benson 1963*b*, p. 627; Benson *et al.* 1964, pp. 43–45). In southern Africa, breeding in palms is recorded for *F. chiquera* and *dickinsoni* (see McLachlan & Liversidge 1957, p. 63–64), dead stumps in the case of the latter. According to Gaymer *et al.* (1969, p. 165), *F. araea* normally utilizes buildings, and *newtoni* may well do so at Settlement on Aldabra.

Systematics. Table 5 in Benson (1967, p. 72) is in need of some correction, due to printer's errors. The figures in the right-hand column are of unsexed specimens. The final sentence in the 'Notes' should read: 'The smallest is unsexed, the other two sexed as females, but perhaps incorrectly.

An adult female, the mantle devoid of markings except for a few black spots, was collected at Settlement on 16 March at 20h00, while an immature female collected by Hartman at Anse Mais on 16 December 1957 has been borrowed from Yale. The latter has the mantle and wing-coverts heavily barred with black, and the only grey apparent on the upperside is a little on the tail. Keith has provided wing lengths of five Aldabra specimens in New York. Twenty-seven specimens of *F. n. newtoni* in Paris have been examined (these were not considered by

Benson 1967, pp. 70–72), and the three specimens of *F. n. aldabranus* collected by Cherbonnier have been re-examined. Revised wing lengths are accordingly as follows:

	F. n. newtoni	
33♂♂ 171–196 (189.8)	23♀♀ 181–210 (197.0)	47oo 176–211 (191.8)
	F. n. aldabranus	
7♂♂ 170, 170, 172, 172, 175, 180, 183	7♀♀ 174, 177, 181, 184, 186, 188, 197	4oo 170, 174, 176, 177

The unsexed specimen from Anjouan, in the Comoros, is now placed with *F. n. newtoni* rather than *aldabranus*. It has chestnut below, but there is no other suggestion of the existence of this phase in *aldabranus*, either in any specimen or from the many field-observations at close range which are now available. Accordingly, the suggestion by Benson (1967, p. 71) that the Anjouan specimen might have been a stray from Malagasy rather than Aldabra is upheld. The only other difference between nominate *newtoni* and *aldabranus* is that the latter averages smaller, as shown by wing lengths. There is much overlap, and in accordance with modern taxonomic practice formal recognition of *aldabranus* can no longer be justified. Irwin & Benson (1966, p. 6) draw attention to a similar tendency to smallness in more northern populations of *F. tinnunculus rupicolus* in southern Africa. Except that the female averages larger, there appears to be no definite difference between the sexes in either Malagasy or Aldabra, contrary to the suggestion of Gaymer (1967, p. 116).

Benson (1967, p. 71) casts doubt on Nicoll's recording of the iris as yellow. The specimen from Settlement had it dark brown, and many field observations invariably indicated this colour. This specimen had a mass of 92 g, probably the only mass so far recorded for this species.

Miscellaneous. One might wonder how the species could have survived on Aldabra in the absence of palms (only coconut palms occur, introduced by man), or possibly human dwellings, in which to breed. But on South Island, except at Anse Mais, coconut palms are virtually lacking, nor are there any human dwellings (other than temporary shacks), and other sites must be utilized for breeding. Old crows' nests might be utilized, as recorded for *F. tinnunculus* in southern Africa (McLachlan & Liversidge 1957, p. 65). But it is unlikely that there were any crows on Aldabra before the advent of man. The virtual lack of differentiation in *F. newtoni* on Aldabra is in keeping with it being a recent colonizer, quite possibly subsequent to any human influence.

As already indicated, the vernacular name is an onomatope. The same name is used for *F. araea* in the Seychelles (Loustau-Lalanne 1962, p. 20).

***Dryolimnas cuvieri* (Pucheran)** (White-throated Rail), Chóumicho or Ralle

The present status and biology of this species on Aldabra have been fully dealt with by Penny & Diamond (1971). It will suffice here to merely draw attention to the following adaptational peculiarities of *D. c. aldabranus*, from Benson (1967, p. 73):

(*a*) The wing is so short that it is virtually flightless. This might be because it has no natural enemies. It could also be of advantage in lessening the likelihood of it being blown out to sea.

(*b*) The tarsus and middle toe average a little shorter than in nominate *cuvieri*, of Malagasy. Possibly it needs less support for its weight on hard coral rock than in a swampy environment, as in Malagasy.

(*c*) On average the bill is slightly longer than in nominate *cuvieri*, possibly because it has to deal with an unusually large range of food-sizes (Grant 1965, p. 364).

Although it appears now to be extinct on West Island and South Island, probably due to the introduction of predators by man, Vesey-FitzGerald (1940, p. 487) found it on Ile Michel, and Benson saw one there on 17 January. Three days later he saw three on Ile aux Cèdres, including a not fully grown young bird.

The vernacular name Chóumicho is used more frequently than Ralle. It is almost certainly an onomatope.

***Alectroenas sganzini* (Bonaparte)** (Comoro Blue Pigeon), Pigeon Hollandais

Status. This species is much more plentiful in the east than the west of Aldabra. Grubb found it common at Cinq Cases; Benson, Penny and others at Takamaka; and Benson, Penny and Diamond at East Channel. But farther west, while it may be nowhere entirely absent, it is much less common. At Dune Jean-Louis, where Frazier spent 92 days between 18 January and 26 July, he concluded that there were few. Benson and Penny spent most of 9 and 10 September there, and merely saw four. Dune d'Messe was little visited. Nevertheless, several observers spent most of 8 September there, and saw only one. Anse Mais was visited on 2 September, 12 October, and 7 February. The resultant totals were respectively one, nil, six. There are scattered records from West Island, but it is certainly not plentiful. Benson spent most of 1 and 2 February on the two sides of Main Channel, but saw one bird only. Farther east on Polymnie, at Anse Cèdre Polymnie, 30 January, he saw at least 10. At the west end of Middle Island it is not common. During 5 days (27 January to 2 February) at Gionnet, Benson saw only one lot of three, and none when he was there again for a day on 2 March. Such meagre recordings from western Aldabra may be contrasted with the situation around East Channel, Takamaka and Cinq Cases, where 20 or more birds may be seen commonly at the same time. Also, Wright counted 40 in one tree, near Anse Cèdres, South Island, 6 September. The situation on islands in the lagoon seems similar. On 2 December Penny noted it on Ile Esprit and Gros Ilot, though Benson saw none on the former, where he spent the whole of 13 February. But on 2 October Diamond saw over 20 in mangroves on the east of Ile Michel. On 17 January Benson saw at least three pairs there.

It is extremely tame (and almost certainly highly edible, as further discussed below), and so it might be thought that the disparity is due to human predation based on Settlement. However, according to Abbott (in Ridgway 1895, p. 532), even in 1892 it was not very common, and most likely his finding was based mainly on experience in western Aldabra. Nicoll (1906, p. 700) found it uncommon near Settlement, while Fryer (1911, p. 418) noted that it occurred in the less frequented parts and was common at Takamaka. Vesey-FitzGerald (1940, p. 487) makes the bare statement that it is 'Common on Aldabra', and contrary to our experience Hartman (1958) that it is 'fairly common on Picard Island'. It would seem that there was the same disparity 60 years ago as there is today. Possibly there had already been some human predation. On the other hand, the difference might be due to the distribution of trees providing a supply of edible fruits, and this is discussed below.

Ecology and food. In the Comoros it is associated with evergreen forest (Benson 1960*a*, p. 52), as is *A. madagascariensis* in Malagasy (Rand 1936, p. 373) and *A. pulcherrima* in the Seychelles (Loustau-Lalanne 1962, p. 15). On Aldabra it seems especially plentiful in mangroves, which physiogonomically are perhaps the nearest approach to evergreen forest there. Most of the

nests recorded below were in this habitat. But it probably does not find any food in mangroves, which may be used merely for roosting and breeding, and it certainly moves around. Small flocks were often seen overhead, including morning passages across East Channel from Middle to South Island, the reverse in the evening. At Takamaka, Penny noticed regular flights southward in the morning, northward in the evening, when apparently returning to the mangroves fringing the lagoon.

There is no record of it being seen on the ground, though a tiny stone was found in the stomach contents of each of two specimens. The food probably consists entirely of fleshy fruits. From his experience mainly at Cinq Cases, Grubb has listed for us the following plants, which may provide the only suitable food:

(*a*) *Actually noticed as utilized*

Solanum aldabrense: abundant among *Pandanus tectorius* trees behind the coastal scrub, regularly fed on. (Fosberg has also seen the fruits being eaten.)

Terminalia boivinii: another common tree, and fed on.

Scutia myrtina: not very common, but utilized.

Ficus spp.: more common towards the coast, but also occurring inland. (At Takamaka, Benson frequently saw blue pigeons in a small *Ficus*, eating the fruits, once counting 19 birds at one time in this tree. Seeds of *F. nautarum* were identified in the stomach contents of one specimen.)

Phyllanthus casticum: a relatively rare tree at Cinq Cases. But on Middle Island, both in December and in March, the small, round berries, about 3 mm across, were being eaten.

Scaevola taccada: very rare near Cinq Cases, but abundant on Middle Island and on the coast between Dune d'Messe and Dune Jean-Louis. In the latter area in September the white berries about 1 cm across, were being eaten. (Seeds were identified in the stomach contents of three specimens collected at Takamaka).

Maillardia sp.: does not occur at Cinq Cases, and is confined to Takamaka, where its fruits were seen being eaten.

Premna obtusifolia: has clusters of black berries about 3 mm across, which are eaten.

(*b*) *Possibly utilized*

Ochna ciliata: very common on platin. Has succulent fruits, which may well be eaten, as they quickly disappear from the trees. The fruiting season ended in November.

Flacourtia spp.: common, with succulent, edible berries. These berries were often seen drying on the trees, and although there was no evidence that they were fed on, this can be expected. (Fosberg did actually identify the berries in the crops of three specimens collected at Takamaka.)

Sideroxylon inerme: common everywhere, and has a soft berry. It was only coming into fruit in March. (Fosberg has seen these berries being taken, and also identified them in the crop of a specimen collected at Takamaka.)

Polysphaeria multiflora: produces a berry, but was not in fruit while Grubb was at Cinq Cases.

Allophylus alnifolia: has clusters of red berries.

Clerodendrum glabrum: produces a succulent fruit, but is scarce.

Grubb suggests that there are few other plants in the Aldabra flora which could be utilized,

only perhaps the following, which do not occur at Cinq Cases: some of the Rubiaceae; the Aloe *Lomatophyllum borbonicum*, which has big berries; and *Guettarda speciosa*, with large fruits over 2 cm across.

It has already been suggested above that blue pigeons are more plentiful in western than eastern Aldabra because there is a greater abundance of suitable edible fruits and berries. This is worth further investigation, as an alternative to the cause being human predation.

Behaviour and voice. Gaymer (1967, p. 118) records the male as hopping through the canopy of a tree after a female, cooing, bowing and raising the plumes of the head and neck, this being regularly noticed in November and December. Loustau-Lalanne (1962, p. 15) gives a more complex description for *A. pulcherrima*. We have no comparable records of our own. But a different kind of display was seen by Penny at Takamaka on 7 November. In this a bird climbs to a fair height flying normally, and then dives at a steep angle with the wings held rigidly downwards and slightly forwards. Before actually alighting on a tree it may fly up again, and repeat the performance. This type of display was also seen by Benson at Gionnet on 30 January. Vesey-FitzGerald (1940, p. 485) gives a rather similar description for *A. pulcherrima*.

Its extreme tameness has already been mentioned, and is referred to again on p. 460. We agree with Abbott (in Ridgway, 1895, p. 532) that it can almost be caught by hand. It is surprising that Voeltzkow (1897) and Nicoll (1906, p. 701) should have found it shy, this also being mentioned in Bourne (1966). It often perches out on a bare branch, in the open (see figure 4, plate 30) sometimes in congregations of some half a dozen birds, and more especially in the heat of the day. On such occasions it is especially conspicuous and no less confiding than at other times. The same habit is noted by Benson (1960*a*, p. 52) in the Comoros, and by Rand (1936, p. 373) for *A. madagascariensis*. It also congregates to feed, and at Cinq Cases and Takamaka Grubb and Penny noted flocks of up to 15 in flight. It not infrequently makes the crossing of East Channel, but in much smaller numbers than *Streptopelia picturata*; for some further detail, see p. 462.

Benson did not find that the call on Aldabra differs in any way from that in the Comoros. Abbott (in Ridgway 1895, p. 532) describes the cooing as hoarse and deep, with which we agree. It can perhaps be best rendered as 'haw', repeated four or five times.

Breeding. The following occupied nests, a parent seen at each were found:

Near East Channel

(all in mangroves, heights above water estimated as at highest tide-levels)

14 January (Diamond): 1 m above water; one egg, size 35.5 × 24.5 mm, mass 10.5 g. Already an egg 10 days previously. When the nest was re-visited on 23 January, it was empty and deserted.

22 January (Benson): in a *Rhizophora*, 1 m above level of coral; one egg, still present and being incubated on 26 January.

25 January (Benson): three nests, each with one egg, two in a *Rhizophora*, respectively 1 and 7 m above water, one in a *Bruguiera*, 2 m above water.

14 February (Diamond): in a *Rhizophora*, 4 m above water, one chick, partially in greenish grey down; chick still in nest on 20 February, but not there 2 days later.

In addition, a female collected on 27 January contained a broken, shelled egg.

Takamaka

15 February (Benson): in mangroves (*Bruguiera*), 1 m above water; one egg, still present and being incubated on 26 February.

17 February (Benson): in a *Terminalia boivinii* tree, 3 m up; one egg. This nest was ⅔ km away from the lagoon.

All these nests were well hidden among leaves, and were flimsy platforms of twigs. Despite the conspicuous colouring of this species and the fact that all eggs were being closely incubated, the nests were not easy to find. All eggs were pure white, that for 14 January being noted as smooth in texture with a slight gloss.

These records point to a clutch-size of one, yet in the Seychelles, according to Loustau-Lalanne (1962, p. 16), *A. pulcherrima* lays two eggs, though Vesey-FitzGerald (1940, p. 485), examined a nest containing one new-laid egg. Delacour (1929) found that in captivity on three occasions only one egg was laid by a *pulcherrima*. No information on the clutch size of *A. sganzini* in the Comoros or of *A. madagascariensis* has been traced. Delacour (1929) believed that in captivity the incubation period for *A. pulcherrima* was about 28 days, and found that a young bird several days old on 25 August left the nest on 12 September. We do not know of any further information in either of these respects for the genus.

How extensive the breeding season on Aldabra may be requires further investigation. The three juveniles collected in January and February (see under *Systematics*) might have been from eggs laid in December. A number of juveniles were seen at East Channel from 25 January onwards, but except for an isolated case of an individual seen by Penny on 30 October (possibly from a September egg) not any earlier, and Diamond is sure that if they had been at all numerous before 25 January he would have noticed them. One was also seen by Benson at Gionnet on 31 January, likewise at the south end of West Island on 28 March, and there were a number around Takamaka in the second half of February. Rand (1936, p. 373) records *A. madagascariensis* as breeding from July to March, suggesting a fairly extensive season. On the other hand, the 136 egg-laying records for fruit-eating pigeons of the genus *Treron* in south central Africa (Benson, Brooke & Vernon 1964, p. 55) indicate a rather well-defined season, and *Alectroenas* spp., also fruit-eaters, may be particular too.

Systematics. Wing lengths, followed by masses in g in parentheses, for specimens collected by us, are:

Adults	♂♂	158 (134), 165 (158)	Juveniles	♂	152 (130)
	♀	157 (171)		♀♀	139 (94), 150 (97)

An adult female collected by Hartman, borrowed from Yale, has wing 155 mm. These wing lengths bear out the small size of Aldabra birds (*A. s. minor*) compared with those from the Comoros (nominate *sganzini*), see Benson (1967, p. 75), though the largest figure above does indicate a slight overlap. *A. madagascariensis* of Malagasy may average even a little larger than nominate *sganzini*, since five specimens of this species in Cambridge have wing 170, 171, 175, 182, 187 mm.

Adult males of *minor* are a trifle brighter silvery grey on the neck and breast than adult females. Benson (1960*a*, p. 51) has drawn attention to a similar difference in nominate *sganzini*, and see also Goodwin (1967, p. 381). It is difficult to appreciate in old or soiled skins. The colours of the soft parts of the adults collected by us did not differ materially from those recorded by Gaymer in Benson (1967, p. 75). All four of these adults show very slight traces of red in the tail, a

tendency which seems rather more accentuated in *minor* than in the nominate subspecies. Another slight difference, not mentioned by Benson (1967, p. 75), is that whereas adults of nominate *sganzini* (30 specimens examined) always have the bluish black feathers of the mantle and wing-coverts with rather well-marked silvery fringes, in those of *minor* (11 specimens) on average the fringing is less well developed, and in four of them is virtually absent. The difference does not seem accountable for by wear of plumage, and it is noteworthy that fringing seems always to be absent in *A. pulcherrima*, though always well marked in *A. madagascariensis*. There thus appears to be some direct 'influence' of *pulcherrima* in *A. s. minor*.

Nicoll (1906, p. 707) remarks that 'really adult males' of *A. pulcherrima* 'have some of the grey feathers, those nearest to the blue abdomen, tipped with carmine, but to such a slight degree that it requires a search to find them'. It can be confirmed that some adults of *pulcherrima*, regardless of sex, show this tipping. It can also be found in some specimens of *sganzini*, both from the Comoros and from Aldabra, but is even less conspicuous than in *pulcherrima*. Goodwin (1967) considers *Alectroenas* most nearly related to the genera *Ptilinopus* and *Ducula*, and has shown us male specimens of *P. superbus* and *perousii*, in which such markings are much more distinctly developed.

The juvenile male listed above, which was collected at Takamaka on 15 February, is moulting into adult dress, as are two specimens collected by Nicoll on 15 March, and one in Paris collected by Cherbonnier on 11 May. The juvenile females, although they were fully fledged, are strikingly small and light. The smaller of them was collected on 26 January near East Channel, the larger on 19 February at Takamaka. They closely resemble in colour of plumage a juvenile collected by Benson on Grand Comoro, 10 August 1958, and which presumably furnished the description by Goodwin (1967, p. 381). These three Aldabra juveniles all had the soft parts duller than in adults: iris dark brown, with an outer rim of pale brown or pale dull olive; bare skin around eye dull dingy purple (in one 'pale dull olive'); bill dull olive, tip pale; feet brown (in one 'slate'). Goodwin writes of narrow pale yellowish fringes to many feathers in the juvenile. Such markings are quite inconspicuous, but much better developed in a juvenile of *A. pulcherrima* in London, collected by Nicoll on Mahé on 7 April 1906, and which must have provided the figure on plate 3 in Goodwin (1967). Another juvenile of *pulcherrima*, in Paris, from Praslin, also has the fringes well developed, though they are dull buffy rather than quite a bright yellow as in the Mahé bird. The juvenile of this species is also described by Gaymer *et al.* (1969, p. 159).

Miscellaneous. Both Abbott (in Ridgway 1895, p. 532) and Voeltzkow (1897) collected specimens in very fat condition, though we have no particular note of this, and do not understand its significance.

We did not taste any specimen, but it may safely be assumed to be very edible, as recorded by Benson (1960*a*, p. 52) for the Comoros. It was this and extreme tameness which led to the extinction of an *Alectroenas* on Farquhar and Providence (Stoddart & Benson 1970). The same authors also refer to concern for the future of *A. sganzini* in the Comoros, and see Penny (1968, p. 272) re the status of *A. pulcherrima* in the Seychelles. The situation also needs watching on Aldabra, and, as is almost certainly so with *Streptopelia picturata*, human predation may be the explanation of why it is so much less common in the east than in the west of the atoll. But for man, its extreme tameness and conspicuousness (still further accentuated by the habit of perching on a bare branch) might be no handicap, though it is interesting that Grubb noted restlestness in the presence of a black kite *Milvus migrans* (see p. 514).

The vernacular name Pigeon Hollandais is the same as for *A. pulcherrima*. It was originally given to *A. nitidissima* of Mauritius (extinct for over a century), the triple coloration of the plumage being reminiscent of the national flag of Holland (Hachisuka 1953, p. 178).

***Streptopelia picturata* (Temminck)** (Malagasy Turtledove), Tourterelle des Iles

Status. Like *Alectroenas sganzini*, this species seems to be much more plentiful in eastern than in western Aldabra. There may have been some change since Abbott's time. He (in Ridgway 1895, p. 532) notes, 'Very common, especially on Ile Picard, and extremely tame. Coming by hundreds around the house, even coming in doors and eating out of one's hand.' Voeltzkow (1897) writes that hundreds of turtledoves enliven the yard of Settlement, finding ample nutrition from the waste of the maize mills. Yet Nicoll (1906, p. 701) only saw 'very few'. Admittedly he only spent 3 days on Aldabra, but he would certainly have visited Settlement. Actually, he (1908, p. 117) contradicts this somewhat, stating that it was 'fairly numerous'. Nevertheless, the numbers at Settlement may well have already been on the wane, and Dupont (1907, p. 23, under *Turtur saturatus*) states that on Aldabra it is 'being used as an article of food and there is some chance of this being destroyed entirely'. Despite this, Fryer (1911, p. 418) was able to record it as 'not uncommon near the settlement'. Unfortunately there is no further positive information from Settlement until recently. Thus Vesey-FitzGerald (1940, p. 486) simply states that it is 'common on Aldabra', Hartman (1958) that it is common on West and South Islands, without qualification. Gaymer (1967, p. 118) indicates its presence at Settlement, mentioning that 'some rice and other scraps' are eaten there. During the recent expedition the largest number ever seen there was about 50, by Penny during 20 to 26 November, though on 12 December there were none. Benson counted 25 in one tamarind tree on 4 September, and a dozen on 8 to 9 January. But during more than 3 weeks in all at Settlement in February and March, on some days he saw none at all. At West Channel he got a total of 16 crossing from South Island to West Island during 1 h before sunset on 1 September, but counts made at the same time in February and March resulted in only one or two birds, or even none at all. These meagre figures may be compared with those below from East Channel. On West Island as a whole it is certainly no longer plentiful. The only record from Polymnie is of three seen overhead at the western end, by Benson and Wright on 3 September. At the west end of Middle Island it is also uncommon, and Benson saw merely one bird between 27 January and 2 February, while camped at Gionnet. In the west of South Island the situation seems no different. At Anse Mais on 2 September Benson merely saw one overhead, and on 7 February none. At Dune d'Messe on 8 September, when several observers were there, the result was merely two overhead. Frazier notes 'few really seen' at Dune Jean-Louis, where he spent 92 days between 18 January and 26 July.

By contrast with the above, Grubb found it common at Cinq Cases; Benson, Penny and others likewise at Takamaka and East Channel. The birds cross East Channel from Middle Island to South Island in the morning, returning in the evening. The following counts are from Benson's diary:

15 September: 68 between 07h35 and 07h40, crossings still plentiful until 08h45. Diamond saw large numbers crossing in opposite direction within 1 h of sunset on two previous evenings.

12 January: 732 between 16h25 and 17h00.

15 January: 3168 between 15h21 and 18h21.

23 January: 27 between 19h20 (sunset) and 19h40, when too dark to count.

26 January: 1320 between 17h52 and 18h52.

The figures for 23 and 26 January indicate that an even larger total could have been obtained on the 15th if counting had been continued after 18h21. Incidentally, blue pigeons make similar crossings, but in much smaller numbers. Thus in the 3 h on 15 January, 29 were counted. They fly higher than the turtledoves, at about 7 m instead of only 1 m above the water, and their wing-beats are slower. The turtledoves may be in loose flocks of up to 20 individuals, some six often being grouped more closely.

The figures and other records above do indeed indicate that the species is far more plentiful today in eastern than in western Aldabra. In the lagoon, too, while Benson saw none on Ile Esprit, visited on 13 February, yet on Ile Michel, on 17 January, he found it plentiful, as had Peake the previous September. Penny recorded it on Gros Ilot, 2 December. On Ile Michel, 2 October, he saw at least 13.

We are led to believe from the accounts of Abbott and Voeltzkow that it was very common on West Island. The most likely explanation of the change is human predation, as indeed recorded by Dupont. As is discussed further below, the birds are extremely tame. The situation on Assumption forms a parallel, except that unfortunately it has gone still further, and the population appears to have been completely extirpated (Stoddart *et al.* 1970). The same may apply to Cosmoledo and to Astove, for Dupont (1907) lists it from both, but Benson (1970*a*, *b*) could find no evidence of its occurrence on either. Abbott (in Ridgway 1895, p. 525) collected it on Gloriosa, though Nicoll (1906, p. 689) could not find it there, and one wonders if it has not long been extinct.

Ecology and food. In Malagasy, Rand (1936, p. 375) found that *S. picturata* avoided the open savanna in the Occidental. In the Comoros, Benson (1960*a*, p. 48) contrasts its habitat with that of *S. capicola*, which replaces *picturata* in more open country. On Aldabra, while it is to be seen feeding in the open at Settlement, or anywhere under *Casuarina* trees, on the whole it prefers thick cover. Thus at Takamaka, while Penny found it conspicuous early in the day, flying about and walking over the platin, after about 09h00 it tended to skulk in cover and was hard to see. As detailed below, it even breeds to some extent in mangroves.

As stated by Gaymer (1967, p. 118), it spends much time on the ground in small groups, searching for seeds. He found that those of *Casuarina* are eaten where possible, and at Settlement some rice and other scraps. From seven specimens whose stomach contents were preserved, seeds were identified as follows: in five: *Scaevola taccada*; in three: *Flacourtia indica*, *Triainolepis fryeri*; in two: *Apodytes dimidiata*; in one: *Casuarina equisetifolia*, *Scutia myrtina*, *Solanum aldabrense*.

The crop contents of a specimen collected at East Channel were identified in the field as two *Casuarina* fruits and many young fruits and leaves of a *Euphorbia*; likewise of one collected at Takamaka as fruits of *Apodytes dimidiata*, *Flacourtia indica* and *Ochna ciliata*. Another specimen was collected at Takamaka while eating buds of *Allophylus alnifolia* 4 m above the ground, but feeding is normally on the ground. Benson (1960*a*, p. 48) records some insects among stomach contents of Comoro specimens. Some legs of an unidentified insect were found in those of a specimen from East Channel, and in one from Takamaka a fly (Diptera, Muscidae), also a small snail.

Movements of considerable numbers across East Channel have already been referred to. These are probably to and from feeding grounds. But Gaymer (1967, p. 118) mentions that small freshwater pools are visited regularly in the morning and evening, usually by small flocks. At

Takamaka in February the odd bird was seen drinking at such a pool, but there is no further record from anywhere of drinking together in numbers.

Behaviour and voice. In courtship display as observed by Penny among three males and three females on Ile Michel, 2 October, the male (with vinous coloration on the upperside not so confined to the crown as in the female, but extending onto the mantle) follows the female around, dragging the tail and sometimes also the wings. The head is raised at intervals accompanied by bubbling 'cooing' and an intensification of the dragging. When the female eludes the male, the gap is closed by the male making fluttering hopping runs until he is close enough (within 1 m) to resume displaying. 'Fighting' was observed three times, between two males. The aggressor manoeuvres until the apparent intruder, who has perhaps approached too closely, presents a flank, when the aggressor advances with head low and beak horizontal. The intruder avoids the 'charge', retreating, at first a little distance; later a longer one, in confusion, pursued.

At Takamaka, 17 February, a female was being followed by a male, raising his head and puffing out the feathers, and then bowing. She seemed to take no notice except to utter from time to time what sounded to Benson like a low 'faa' ('a' as in 'bad').

The most usual and conspicuous call, taken to be the song-call, seemed to Benson quite different from that which he (1960*a*, p. 48) described for the Comoros. It sounded like 'coo-c-r-r-r-r', or 'coo, coo-r-r-r-r', repeated three or four times. It was not very loud, but sometimes gradually increased in power and intensity.

Abbott (in Ridgway 1895, p. 532) found it extremely tame, even eating out of one's hand. It is still so, and can easily be approached to within 2 m, though it would not now eat out of the hand. It is Benson's experience that no *Streptopelia* sp. in Africa is ever as tame as this, except perhaps *S. senegalensis* in gardens in Cape Town, where it is in close contact with man, but unmolested by him. Unfortunately, as already related, there appears to have been no lack of molestation on western Aldabra and on Assumption, to mention but two localities. Despite this, birds at Settlement seemed just as approachable as at Takamaka, for example.

Breeding. Abbott (in Ridgway 1895, p. 532) records that several nests were found in mangroves, though no further details are given. Nicoll (1906, p. 701) gives no evidence of breeding, though on Assumption around 12 March he (1906, p. 694) found a nest containing a newly hatched chick.

The following nests were recorded by Penny:

Near East Channel

21 October: 3 m up in a *Casuarina*, made of *Casuarina* needles laid in circles; a shallow bowl of 30 cm external diameter, 15 cm internal. Two eggs, female incubating. When re-inspected on 30 October, the nest had been abandoned.

21 October: 3 m up, site and materials as for last nest. Three eggs, female incubating. When re-inspected on 30 October, this nest was empty, one broken shell being found on the ground. D. Goodwin (personal communication) suggests that one of the eggs had been accidentally laid in the nest by another female.

22 October: 4 m up, site and materials as for last two. Two eggs, sex of incubating bird uncertain.

24 October: 2 m up, in dense cover. No eggs, female seen at nest, male nearby. Nest in junction between a *Scaevola* branch and that of some other shrub; made of twigs probably collected on the ground below.

28 October: 1.5 m up, site and materials as for first three nests. Two eggs, female incubating.

Gionnet

10 December: 2.5 m up, in mangroves (*Rhizophora*), made of coarse pieces of grass and fine twigs; two chicks, mostly in down, with primaries half-grown; female on nest.

Polymnie

5 April (1969): on an islet ⅓ km south of Polymnie, 1 m up in thick cover, below the canopy; two eggs.

In addition, in mid-December Diamond observed a nest near East Channel which was built in about four days. It was in a *Rhizophora*, some 2 m above water at highest tide-level, and was made of *Casuarina* needles. It was deserted before an egg was laid. An empty, abandoned nest was pointed out to Benson by a Seychellois named Wildu on 27 February. It was on the edge of mangroves, in a *Ceriops*, as much as 7 m up. Wildu, who had only been on Aldabra 3 months, was none the less confident that this was a *Streptopelia*, not an *Alectroenas*, nest. He claimed to know the nests of both well in the Seychelles, and said that that of *Alectroenas* is smaller and more of a cup. Although Loustau-Lalanne (1962, pp. 15–17) does not mention any difference, it would be worth testing this further.

Two juvenile specimens collected on 26 January and 19 February, discussed further under *Systematics*, might have been from eggs laid about five and four weeks earlier respectively. Two similar birds were seen near East Channel on 25 January, one of them still with some yellow hair-like down on the mantle. A male collected at Takamaka on 15 February had testes much enlarged, measuring 20 × 12, 23 × 10 mm, and a female collected there the same day contained a yolking oocyte of diameter 15 mm.

The foregoing records indicate egg-laying during the period October to February, thus much the same as in the Seychelles (Loustau-Lalanne 1962, pp. 16–17). But the season may be much more extensive. Benson (1960*a*, p. 48) gives some evidence of breeding in the Comoros as early as August, while in Malagasy Rand (1936, p. 375) found that the season probably extends at least from July to October. For south central Africa, Benson *et al.* (1964, p. 54) give comprehensive data for some other *Streptopelia* spp. showing that they can breed virtually throughout the year.

The clutch size on Aldabra is apparently normally two, and this seems to apply almost invariably in the genus as a whole (Goodwin 1967).

Systematics. Benson (1967, p. 75–79) used the subspecific name *S. p. coppingeri* for the populations of Gloriosa, Assumption and Aldabra, which according to his figures only differ from one another in minor differences in size. Wing lengths of recently collected Aldabra specimens are:

5♂♂ 157+ (in moult), 166, 167, 169, 170
6♀♀ 155, 157, 158, 160, 160, 163

Figures for other specimens mist-netted by Diamond and Hutson at East Channel between 11 and 19 January, and released, are:

7♂♂ 167, 168, 170, 170, 171, 173, 173
5♀♀ 158, 161, 162, 164, 165

These two series of figures fall within the range for Aldabra as in Benson (1967, p. 79), except that in those for the released birds the two largest males agree better with the slightly larger

Assumption birds. But if they had been retained as specimens and remeasured some months after death, a reduction of 2 or 3 mm after drying out could have been expected.

There are the following recordings of mass:

11♂♂	160–210 (183.8)
7♀♀	150–185 (165.4)

Also, a specimen caught by Frazier on 22 May, wing 162 mm (probably a female), had a mass of 155 g.

In addition, of three birds caught at Settlement on 2 December, in very worn dress, and brought to Penny, two males had masses of 147, 152 g, a female 102 g. These birds are very light, and they were in poor condition. For some earlier masses, see Gaymer (in Benson 1967, p. 77).

Two fledged juveniles were collected, an unsexed bird near East Channel on 26 January, and a male at Takamaka on 19 February. The male in particular appears not to be fully grown, its wing length being 146 mm, and it had a mass of only 130 g. The other has wing 154 mm, and a mass of 162 g. Both entirely lack any of the vinous colour of adults, and are plain dark brown, most of the feathers of the upperside edged with chestnut, of the breast with rufous-buff. At the time of collecting, the male had a little yellowish down still adhering on the head. Both are generally duller in colour than two juveniles in London of *S. p. picturata* and one of *S. p. comorensis*, and also differ from these three in having the abdomen greyish rather than whitish. Their soft parts were: bill dull black, purplish at base; iris dark brown; legs and feet dull purple in front, pale grey behind. Those of adults (either sex) were: bill purple, tip pale bluish grey; iris dull yellow, outer rim orange; legs and feet reddish purple, soles pale grey.

Eleven adults collected in January and February all have the primaries in moult; and some have the tail in moult too. The twelve specimens mist-netted by Diamond and Hutson in January also all had the primaries in moult.

As discussed by Benson (1967, pp. 76–77), the two syntypes of *S. p. aldabrana* are believed to have come from the Amirante Islands, not from Aldabra. But it is not now thought that the International Commission for Zoological Nomenclature could entertain the suppression of this name and the use instead of the junior synonym, *S. p. saturata*, misleading though the name *aldabrana* obviously is for the Amirante birds. There are similar anomalies in African ornithology, such as the names *Colius indicus*, *Telophorus zeylonus* and *Uraeginthus bengalus*.

Miscellaneous. We did not taste any specimen, though the palatability of this species may be expected to be high. Cott (1946, p. 460) quotes some favourable reports on the palatability of some other *Streptopelia* spp.

***Centropus toulou* (Müller)** (Malagasy Coucal), Toulou

Status: This species is widespread and not uncommon. Owing to the denseness of the thickets which it normally frequents it can easily be overlooked, if the observer is not in its immediate vicinity and it is not calling. There are records from the following localities: West Island—around Settlement, mangroves on eastern side, Anse Var, Main Channel, West Channel; Polymnie—Main Channel, Anse Cèdre Polymnie; Middle Island—Gionnet, Opark, Anse Malabar, several localities within 3 km of East Channel; South Island—Cinq Cases, Takamaka, Dune Jean-Louis, Dune d'Messe, Anse Mais. The only record from any island in the lagoon is from Ile aux Cèdres, where Benson heard a pair. There is no record from

the two largest islands, Michel and Esprit, on each of which Benson spent most of a day. Possibly neither is large enough to maintain a pair of coucals. But Ile aux Cèdres is so close to South Island that a territory might be divided between the two areas. The total number of coucals on Aldabra as a whole may amount to several hundreds.

Ecology and food. It is usually found in dense champignon thickets, relatively rarely coming out into the open. There are a few records from mangroves. Benson saw a pair cross a channel a few metres wide flanked on each side by dense mangroves, near East Channel on 23 January, while Macnae saw one in mangroves on West Island, 8 February, and likewise Diamond one at Opark, 20 March. In Malagasy, according to Rand (1936, p. 399), it is found 'in the ground-cover in the forest, occasionally in the trees, commonly in the brushlands and the dense reeds and grass of the smaller marshes'. On Aldabra there are no marshes for it to frequent. In Africa the supposedly conspecific *C. grillii* (but see p. 471) is rather strictly a marsh dweller, replaced on drier ground by such species as *C. senegalensis* or *superciliosus* (see, for example, White 1965, pp. 188–190). Indeed, van Someren (1947, p. 247) likens the habitat of *toulou* in Malagasy to that of *superciliosus*, and the same applies on Aldabra.

The stomach contents of three collected specimens (contents listed in order of predominance, according to the numbers of individual specimens in each group) are:

Immature ♀, East Channel, 21 January; Coleoptera, Scarabidae: Cetoniinae; Coleoptera, Curculionidae; Coleoptera, Cantharidae; Mantoidea.

Adult ♂, Anse Var, 5 February; Orthoptera, Acrididae; Hemiptera, Homoptera, Cicadidae; Coleoptera, Curculionidae; Coleoptera, Scarabidae: Cetoniinae; other Coleoptera; Hymenoptera; also a gecko, either *Phelsuma* or *Hemidactylus*.

Adult ♀, Gionnet, 2 March: Lepidoptera larvae; Orthoptera, Acrididae; Hemiptera, Homoptera, Cicadidae; Coleoptera, Curculionidae; Coleoptera, Cassidae; other Coleoptera.

A bird observed by Penny at East Channel fed on the ground on what appeared to be a grasshopper. According to Abbott (in Ridgway 1895, p. 533) it is 'very fond of lizards, and, it is said, also of rats'. Gaymer (1967, p. 119) states that bird eggs are also eaten, and perhaps young birds too. Some circumstantial evidence is given on p. 468 below in support of this. According to Rand (1936, p. 399), in Malagasy the food consists mostly of large insects and spiders. But Benson (1945, p. 92) gives an instance of *C. superciliosus* eating a small bird (*Pogoniulus pusillus*) in Kenya, while according to Chapin (1939, p. 211) mice, nestlings and eggs are eaten by *C. monachus*. The taking of rats and birds by the large *C. cupreicaudus* in Zambia may be fairly regular (see the data in Benson & Irwin 1967, p. 37).

Behaviour and voice. It is extremely tame on Aldabra, quite usually allowing the observer to approach to within 2 m. The immature female recorded above, which was apparently not still under parental care, allowed itself to be caught in a hand-net. Nicoll (1906, p. 694) notes its tameness on Assumption, where according to Stoddart *et al.* (1970) it may now be extinct. Rand (1936, p. 399) makes no mention of tameness in Malagasy, and it is not Benson's experience that any species in southern Africa is nearly so tame as is *C. toulou* on Aldabra. While it is often seen perched in bushes, it can also run with ease on the ground, Fryer (1911, p. 418) also emphasizing that it is very terrestrial.

The usual call is a 'water-bottle' type of call, and in southern Africa typical also of such species as *C. superciliosus* and *senegalensis*. This epithet is derived from McLachlan & Liversidge (1957, p. 190), who liken the call of *superciliosus* to that of water running out of a bottle. One of the performers, apparently the male (slightly smaller than the female), calls in lower pitch than the

other—a falling series of staccato 'hoo's', spanning six or seven tones, 12 to 20 in number. The lower pitched call usually, though not always, starts the duet, and continues after the higher pitched one has finished.

Duetting is recorded by Chapin (1939, p. 208) for *C. senegalensis*, and by Young (1942) for *bengalensis*. In Malagasy van Someren (1947, p. 247) records a pair of *C. toulou* duetting, and Rand (1936, p. 399) sometimes heard a second bird joining in, in a slightly different key. On Aldabra the call of *C. t. insularis* can be heard not infrequently on its own, not in duet, apparently most usually from a male failing to evoke any response. It is made with the neck craned forward, and the feathers of the nape ruffled, as if the bird were 'coughing'. Birds in dense cover will often 'water-bottle' when disturbed at very close quarters, though not before. In September this call was heard very infrequently, but much more often during November to March, when breeding may have been expected. It is certainly far-carrying, but we doubt if it can be heard 'at least a mile away' (Fryer 1911, p. 418).

Various other calls were recorded. At Gionnet on 10 December Penny noted an abbreviated version of the 'water-bottle' call—a series of four or five 'co's, resumed again at irregular intervals. What was apparently an alarm call was a chattering 'kek,. . . ', delivered at the same speed as the normal call, falling in intensity but not in pitch. He has also heard a hiss—'chsss'. At Anse Mais on 12 October he noted a bird in breeding dress as making another type of apparent alarm call, at a range of 2 m from him. This was a loud chattering version of the normal call, and reminiscent of a very slow alarm call of a Blackbird *Turdus merula* in England.

Benson made the following notes. On Middle Island, near East Channel, 16 January, *ca.* 10h15, an apparent male called 'cook, cook, cook, cook, cook, cook, cook, cook', the first 'cook' very faint. This was quite different from the 'water-bottle' call. It was made from a perch in a thicket about 2 m above the ground. Some 2 min later the bird disappeared, running away over the ground. At 10h25, a slightly larger bird (apparent female) was perched across a branch, the stance very upright, the tail occasionally raised to the horizontal, apparently for balancing. At 10h43 it made the 'water-bottle' call. One minute later it disappeared, but returned at 10h46 for 2 min to the same perch, when it rested horizontally along the branch, which supported its tail. Both these birds were in full breeding dress. Two other quite distinctive calls were heard at East Channel, the sex or age of the authors being uncertain—(*a*) 12 January, 'pop-pop-pop-pop-pop-pop'; (*b*) 24 January, 'cho-cho-cho-cho-cho-cho'. At Main Channel, 2 February, a fledged immature bird frequently made a chattering 'chuka-k-k-k-k', not at all far-carrying. An adult in breeding dress was seen once nearby, but it was not seen to feed the young bird, though neither was the latter seen to feed on its own. The same call was heard from a fledged young bird at Anse Var on 5 February. Another such bird, seen on the ecotone between a dense thicket and open ground under *Casuarina* trees at Settlement on 6 February, frequently made a very low 'i-k-k-k', not immediately repeated, inaudible at more than 2 m. Once an adult in breeding dress (from size probably a male) approached within a few metres of it, and made a low 'coo-cook-cook', then burst into the 'water-bottle' (low-pitched and male-like). This 'i-k-k-k' call is not confined to young birds, because the following day, at Anse Mais, it was heard from a bird in breeding dress (apparently a male). At Gionnet on 2 March 'ik-ik-ik-ik' immediately preceded a normal (low-pitched) 'water-bottle' call, by a bird in breeding dress, from the top of a 4 m high *Pemphis* bush. When 'water-bottling', not only was the head held slightly forwards and downwards, but it could also be seen to be very slightly vibrated forwards and backwards. This bird is believed to have been the mate

of a female collected earlier the same day. What appeared to be an adult moulting out of breeding dress, at Anse Var on 19 March, started off a 'water-bottle', which degenerated into an 'ik-ik-ik-ik'. This concludes an account of the various calls heard. It is evident that the repertory is considerable. Rand (1936, p. 399) describes several calls, and presumably there is the same variety in Malagasy as on Aldabra. Rand's 'tooting' is undoubtedly the same as our 'water-bottle'. His 'rattling' may be the same as Benson's 'chuka-k-k-k-k', and his and Penny's 'hissing' likewise. Rand several times heard 'tooting' at night, and probably this applies on Aldabra too, though we have no note of it.

At Takamaka, 17 November, Penny saw a coucal apparently searching for insects on the ground by the side of a path through dense champignon. According to normal experience, it was very tame, allowing an approach to within 2 m. For the first 15 min while it was observed, until it disappeared for good into the thick cover, a male sunbird was perched above it wherever it went, uttering a single hoarse 'tweet'. During this period the coucal once moved away from the path into thicker cover, when the sunbird broke into song. But when it returned to the path, the sunbird resumed its apparent alarm call, breaking into song again when the coucal disappeared for good. Despite a search, no nest of the sunbird was found. But there may well have been one, and this observation tends to support Gaymer's statement above that bird eggs, and maybe young, are taken. And see also p. 478 for a record of bulbuls mobbing a coucal.

Breeding. No occupied nest was found, though Abbott (in Ridgway 1895, p. 534) records breeding in December, the oval nest, with entrance at one end, being loosely made of strips of bark, grass and coconut leaves, placed in a bush 5 to 8 ft (1.5 to 2.5 m) above the ground, the number of eggs being three or four, white in colour. Diamond found the remains of an old nest, which had probably not been utilized for at least 6 months, on the edge of dense champignon, at the top of a 2 m high bush, near Settlement on 5 September. The outside was made of relatively coarse material, leaves of *Cyperus ligularis* and *Lomatophyllum borbonicum*, and the inside of finer material, including stems and tendrils of *Passiflora suberosa*. Near where he observed a pair on Middle Island, 16 January (see under *Behaviour and voice* above), Benson found an empty nest, about 2 m above the ground. It was a flimsily constructed dome, with entrance at the side, some 30 cm in length and 15 cm in height, made of coarse stems on the outside and finer material inside. Nicoll (1906, p. 694) found a nest with two eggs on Assumption in mid-March, while on Malagasy Rand (1936, p. 400) records gonad-activity during October to March, and a nest with two fresh eggs at Tulear on 2 February. We wonder if the clutch size is ever as large as four on Aldabra, as stated by Abbott. For notes on a seasonal change of dress, and for records of fledged young birds, see the next section.

Both Nicoll and Rand state that they saw only the male at the nest, while Chapin (1939, p. 214) thought it probable that among African coucals the males do most or all of the incubation. This should be tested on Aldabra.

Systematics, moult. The following are some particulars of material which was not available to Benson (1967, p. 78):

	wing/mm	tail/mm	culmen from base/mm	mass/g
♂, Anse Var, 5 Feb.	149	244	28	121
♂, West Island, 14 Dec.	150	232	29	—
♂, West Island, 24 May	156	202†	29	105
♀, Gionnet, 2 March	165	250	31	116
imm. ♀, East Channel, 21 Jan.	158	243†	29	131

† Incomplete, tail in moult.

The December specimen was collected by Hartman, and borrowed from Yale, the remainder during the recent expedition. According to Benson (1967, p. 78), the breeding dress, in which the head, mantle and chest are black, is worn from about October to March, by both sexes. In the remainder of the year the black feathers are replaced by brown ones with pale buffy shaft-streaks. Also, the bill changes from black to brown. The first two males above are in breeding dress. The third is in the non-breeding dress. The Gionnet female is slightly larger than the males, in accordance with Benson's earlier figures. It is peculiar in that although it appears to be adult it is mainly in a non-breeding dress. The brown feathers with buffy shaft-streaks are very worn. They have been partially replaced by some fresher, black feathers on the mantle and a few on the chest. It would appear that the moult had been arrested. Also, although the iris was red (it was brown in the immature specimen), the bill was not black but dull sepia (upper mandible), greyish white (lower mandible). What was almost certainly the same individual was originally seen at Gionnet on 27 and 28 January, when excellent views were obtained of it, and its dress seemed to be in about the same stage as on 2 March. In January it was with a slightly smaller bird in full breeding dress, presumably its mate. The presumed male 'water-bottled' several times, but the female never answered. A description of calling by the former on 2 March has already been given. No evidence was obtained that this pair had bred. No nest or young bird was seen, and the gonads of the female were small.

Watson *et al.* (1963, p. 78) thought that the female wears this brown dress at all seasons. But it would appear that the female collected at Gionnet is abnormal, and in any case it does have some black feathering. A female collected by Nicoll on 14 March is in full breeding dress. Neither do field observations support the notion that it is only in the male that the black is normally fully developed in the breeding season. Thus there is an apparent 'black' pair, observed near East Channel on 16 January (see under *Behaviour and voice* above). Also, Frazier saw two birds with 'black heads' near Dune Jean-Louis, 22 January, and Grubb a young bird with 'black parents' at Cinq Cases, 30 January. In any case, apart from the female collected at Gionnet, there is no convincing observation of a female in non-breeding dress during the period October to March. A bird seen by Penny on 10 December at Anse Porche, less than a quarter of a mile from Gionnet, could from his description have been the same individual. In late August and early September only birds in non-breeding dress were seen, and the earliest definite date for one in full breeding dress is 12 October (Penny, Anse Mais). The earliest date suggesting resumption of the non-breeding dress is 11 March, when Grubb saw two 'streaked' birds at Anse Malabar. At Settlement, 22 March, Benson saw a bird in breeding dress except for some buffy streaking on the mantle, while the bill was horn-coloured rather than black. And on 11 April Frazier saw there an 'adult, black body, brown wings, head mixed black and brown'. These two birds were apparently moulting into non-breeding dress. In New York there are no fewer than 20 specimens from Aldabra, collected for Lord Rothschild. Of these, according to Keith, 13 are in the non-breeding dress ('streaked'). They were all collected between 18 April and 3 September. Five of them, two males, three females, which we have been lent, collected between 23 July and 28 August, have no black feathers at all, and the general colour of the bill is brownish horn, not black. Of the remainder, sexed according to the measurements which Keith has provided, two males and three females collected between 25 December and 3 January are all 'black', while two males collected on 3 January are 'moulting'.

The immature female (gonads personally examined by Benson) from East Channel is in the same dress as another such collected by Nicoll on 14 March, described by Benson (1967, p. 78).

Both have the crown and nape black, with a buffy spot near the tip of each feather. The throat and chest are barred dark brown and buffy, and the chestnut of the remiges and their coverts is heavily barred with dark brown. The rectrices are barred with buffy. The East Channel specimen had bill dull brownish horn; iris brown, outer rim very pale; legs and feet slate, soles pale grey. Both specimens have considerably shorter wings than in adult females. Yet the East Channel bird was heavier than that from Gionnet, whose light mass might however be related to its failure to moult into a full breeding dress. The only other mass available is for an adult male with a mass of 120 g (in Benson 1967, p. 81). Similarly coloured immature birds were seen 4 km west of East Channel, 19 January, and at Main Channel, 2 February (call described above). A bird which Benson saw at Settlement on 27 March, but unfortunately only for a few seconds, might have been an immature moulting into an adult-like striped non-breeding dress. The tail was barred with pale chestnut, but the head was streaked. There are six immature specimens from Malagasy in a similarly coloured spotted dress, in London, as follows: two undated, 19 January, February, 18 March, 9 May. The last three have some streaked feathers, as in adults in the non-breeding dress, appearing. Probably the spotted immature dress is not worn for more than some 4 months.

Benson (1967, p. 81) found that the Aldabra form, *C. t. insularis*, was only distinguishable from nominate *toulou*, of Malagasy, by its average longer wing and more markedly longer tail, with *assumptionis* intermediate. It may be helpful to summarize measurements of wing and tail, exclusive of those of specimens in the immature dress, using the data in Benson (1967), those given above, and also the material in New York.

	wing	tail	$\frac{100 \times \text{tail}}{\text{wing}}$
	C. t. toulou		
18♂♂	140–160 (149.1)	198–227 (216.2)	145.0
15♀♀	158–176 (166.5)	224–256 (240.7)	144.6
	C. t. assumptionis		
4♂♂	149, 150, 154, 155	219, 222, 226, 237	148.6
	C. t. insularis		
18♂♂	149–159 (153.6)	223–256 (239.4)	155.9
9♀♀	165–181 (173.3)	250–292 (268.0)	154.6

Assumptionis should be placed as a synonym of *insularis*, although on average the tail is slightly shorter. *Insularis* can be maintained if only because of its relatively long tail, even though the measurements show a slight overlap with nominate *toulou*. In wing-length it averages very slightly larger. But in addition Benson (1967, p. 78) drew attention to a specimen of *insularis* dated October 1906 ('1960' is a misprint), in non-breeding dress, as differing from specimens of nominate *toulou* in this dress, which have the whole abdomen black (as in the breeding dress), by having black restricted to the thighs and under tail-coverts, the feathers of the remainder of this area being buffy white, with some eight narrow bars of dusky on each. However, a specimen collected by Cherbonnier in May agreed better with nominate *toulou*. Nevertheless, the specimen in non-breeding dress collected on West Island on 24 May, and the five others in this dress borrowed from New York, all show this type of coloration quite clearly. For the most part they even have the thighs and under tail-coverts buffy barred with dusky, instead of black as in nominate *toulou*. Possibly the Cherbonnier specimen had failed to moult on the abdomen, and this colour distinction is considered valid. Twenty specimens of nominate *toulou* in the

non-breeding dress have been available. The Assumption population has probably been extirpated (Stoddart *et al.* 1970). Three of the four specimens therefrom are certainly in breeding dress, and it is assumed that the fourth, in Washington, is also in this dress, because it was collected by Abbott on the same day as one which is in Cambridge (G. E. Watson, personal communication). Thus it is unlikely that the non-breeding dress of the Assumption population will become known, though it is assumed not to have differed from that of *insularis*.

Powers of flight in the genus *Centropus* seem poor, as they are in the Rallidae, which have colonized so many islands, and are represented on Aldabra. It is interesting that Sokotra has been colonized by this genus (Moreau 1966, p. 356), as have been Aldabra and Assumption.

Parkes (1957) preferred not to unite the African *C. grillii* and the Asiatic *bengalensis* with *toulou* for the time being, and points out that *grillii* resembles *bengalensis* far more closely that it does *toulou*. He also mentions that the immature plumage of *toulou* shows certain resemblances to that of the Asiatic *sinensis* group. We cannot at present take this matter any further, but we do not believe that *toulou* should be considered conspecific with *grillii* and *bengalensis*, though these latter two could well be so. The immature plumage of *toulou* is particularly distinct. As Parkes points out, it is more like that of *sinensis*.

Miscellaneous. The male collected at Anse Var had 'one testis 10 × 6 mm, the other not found'. Apparently it was the right testis which was measured, the left was rudimentary, as noted by Rand (1936, p. 400) in Malagasy, while Chapin (1939, p. 214) also comments on asymmetry of the testes in the genus *Centropus*.

The breast of the Gionnet specimen was tasted. It was tender and pale brown in colour. Although quite edible, its palatability was not rated as relatively high. The same applied in a specimen of *C. senegalensis* tested by Benson and others for Dr H. B. Cott in Zambia in 1957. There is a quotation in Cott (1946, p. 497) that *C. superciliosus* is conspicuous and distasteful.

Nematode parasites were collected from the gut of the East Channel and Gionnet specimens. They have been examined by Dr W. Grant Inglis, of the British Museum (Natural History), and according to whom they belong definitely to the family Seuratidae, and probably to a rare genus *Seuratinema*, only previously reported from Australia. But the specimens are all females, and a full identification is not possible without males.

The vernacular name Toulou is also used in southeastern Malagasy (Rand 1936, p. 400), and is no doubt an onomatope, derived from the 'water-bottle' call.

For records of mobbing of this species by other birds on Aldabra, see pp. 468 and 478. On 26 February 1969, north of Settlement, one was being mobbed by at least 20 sunbirds *Nectarinia sovimanga* making loud alarm calls.

***Tyto alba* (Scopoli)** (Barn Owl)

We agree with Gaymer (1967, p. 114) that this species must be assumed to be extinct on Aldabra. There is still no record since the one for 1906 mentioned by Benson (1967, p. 81). If it had been there in 1967/8, evidence of this would surely have been forthcoming. Abbott (in Ridgway 1895, p. 533) frequently heard it at night, and occasionally saw it in the daytime. It is odd that it should have succeeded in establishing itself naturally, which there is no reason to think was not the case, but should have subsequently become extinct. It is impossible to imagine any possible competitor, and rats, which might be expected to have been an important part of its prey, are presumably no less common than 60 years ago. According to Dr R. L. Zusi

(personal communication), there is no original record of what the four specimens collected by Abbott were feeding on. Nor, according to Keith, is there any record with a specimen in New York collected for Lord Rothschild in 1906. (Conceivably its disappearance was due to competition with the kestrel, *Falco newtoni*, considered a recent colonizer (p. 455). Pearson (1966) gives an instance of apparent competition between two raptorials (both diurnal) on Christmas Island.)

Like Malagasy and Comoro specimens, those from Aldabra have average longer wing-lengths than African ones (Benson 1963*a*). But as this is the only difference, *T. a. hypermetra*, described from Malagasy, is not worth keeping separate from the African *T. a. affinis*.

***Cypsiurus parvus* (Lichtenstein)** (Palm Swift)

Abbott (in Ridgway 1895, p. 535) mentions seeing a swift, thought to be of the genus *Collocalia*, several times. Palm Swifts are a possible alternative. *Cypsiurus parvus* occurs in Malagasy, but so far there is no evidence that it has colonized any part of the Aldabra archipelago, though it occurs throughout the Comoros. Potential breeding sites exist on coconut palms on Aldabra and Astove.]

***Caprimulgus madagascariensis* Sganzin** (Malagasy Nightjar), Somay

Status. Like all Caprimulgidae, this species is easily overlooked, particularly if it is not calling. It would appear to be in fact not uncommon, and the population of Aldabra may number several hundreds. There are records (mostly on voice) from the following localities: West Island—Settlement and Bassin Cabri; Polymnie—Palm Beach; Middle Island—Gionnet, Anse Malabar and west side of East Channel; South Island—east side of East Channel, Frigate Pool, Takamaka, Dune Jean-Louis, Dune d'Messe. There is also a record from an island of area only about 400 m^2 in the Passe Gionnet (Diamond). Abbott (in Ridgway 1895, p. 534) reported it as 'very common', but does not explain how he arrived at this conclusion. Reference to cats as possible predators is made on p. 475.

Ecology and food. It seems to prefer more open ground to hunt in, and Abbott found it breeding 'on the open sand hills, on bare ground'. Frazier heard calling at Settlement, from the *Casuarina* woods, under which the ground is fairly open. At Dune Jean-Louis he saw it hawking at dusk over dunes. Unfortunately no information was obtained on the food taken, and there is only the statement by Abbott, no doubt referring to Settlement, that 'numbers come around the houses in the evening, being particularly attracted by the swarms of beetles about the bone heaps where the turtles are slaughtered'. No particular association with the slaughtering of turtles was noticed during the recent expedition, but the numbers of turtles now killed are very much less than in Abbott's time. In Malagasy Rand (1936, p. 412) found that much of the food consists of large insects.

Behaviour and voice. As with other *Caprimulgus* spp., it was found asleep on the ground in the daytime. The number of such records is however very few, and it must often avoid detection by its cryptic colouring. Perhaps also it prefers the protection of thickets to sleep in. Except for one photograph of a bird taken by Penny at Gionnet, which had been disturbed, there is no record of tree-perching, though in Malagasy Rand (1936, p. 412) found it on dead limbs in the early evening. Wright flushed one near Anse Polymnie on 3 September around midday. It flew away for a metre or two. and then allowed him to approach to within 1 m. This is at least as close as could be achieved with any species in southern Africa. Penny flushed one at Takamaka at 09h15. After alighting it allowed him to approach to 1 m. Another bird which he saw there

2 months later allowed itself to be photographed at only a slightly greater distance. It spread its tail (as in figure 5, plate 31), and also opened its beak to show its dark red mouth. Penny also saw this type of threat-display at Gionnet; see under *Breeding* below.

What may be regarded as the song-call sounded like 'tok-tk-tk-tk-tk-tk' or 'tyok-ok-k-k-k-k', with emphasis on the 'tok' or 'tyok'. In rhythm this call is very similar to that which Benson heard near Tananarive, Malagasy (Benson & Pitman 1962), and noted by Rand (1936, p. 411) as 'prolonged into a wooden rattle'. But on Aldabra it seemed to Benson to be deeper in tone. It is probably always made from the ground. At Takamaka Penny heard this call throughout the night of 27/28 September. The moon had been full about 10 days previously, when calling is probably no less assiduous. Penny also noted that at East Channel in mid-November, while the normal call was often heard, early on some evenings a 'tyo', repeated several times, reminiscent of a whipcrack, was also to be heard. Later in the season, perhaps after breeding is over, the song-call is heard less frequently or not at all. Thus while Grubb often heard it at Takamaka in October, he never heard it in the 3 months following at Cinq Cases, where the birds must surely occur. During January to March Benson recorded it on three occasions—at Takamaka once at 21h00 on 16 February just as the moon was rising, and on the night of 25/26 February, around sunset and sunrise, on both these occasions several times. The only other February records are of one heard at dawn by Macnae at Settlement on the 5th, of one likewise by Cogan at Takamaka on the 25th, and of one continuously between 20h00 and 21h00 on 28 February behind the prison at Settlement. But at East Channel during 11/19 March Diamond heard calling regularly, and again at Gionnet on 20 March. In the latter locality it was once preceded by a faint, quavering 'huuu'. Also, what must be most exceptional, Diamond heard the song-call from an islet in the Passe Gionnet two hours before sunset, on 28 January. It was repeated four times. At Gionnet, when in the daytime he was photographing a pair which had an egg (see below), Penny once heard a muffled 'chok' from one bird. Abbott (in Ridgway 1895, p. 534) describes three calls. The 'chuk-tu-tu-tu-tu' must be the song-call described above. His 'ku-wuh, ku-wuh' does not appear to have been recorded during the recent expedition. It may correspond to the 'loud and liquid "wa-pit"' heard by Rand (1936, p. 411) in Malagasy, sometimes given on the wing. Abbott's 'winnowing', rarely heard, may be the same as Diamond's 'huuu'.

Breeding. At Gionnet, on 11 December, Penny collected a single fresh egg, sheltered under a bush by a path through thick scrub, on bare gravel. It was in a scrape, from which the carpet of dried leaves had been removed, so that it was resting on the gravel. There were two other similar scrapes, neither containing an egg, under the same bush. Two birds were present, one lighter than the other. The lighter bird had buff rather than white spots on the primaries, and may have been a female (see under *Systematics* below). After the birds had originally been disturbed, the darker one (probably the male) was flushed from the egg. It made the same threat-display as previously observed at Takamaka. Abbott (in Ridgway 1895, p. 534) records a 'nest containing two young' in September. Benson *et al.* (1964, p. 64) give 308 egg-laying records for Caprimulgidae in south central Africa, from August to January, but with only one for August and two each for the last 2 months, indicating that egg-laying is mainly in the hot weather preceding the rains. Probably the season on Aldabra is essentially the same, and the December record is unusually late. Both Newton (1863, p. 340) and Rand (1936, p. 412) record eggs in September in Malagasy.

The Aldabra egg agrees well in colour with five Malagasy eggs in Cambridge, and many

others in London, to which the description by Rand is applicable. Measurements kindly provided by C. J. O. Harrison are as follows:

Aldabra: 27.3 × 20.3 mm

Malagasy: $C = 1$, 26.4 × 19.9; $C = 2$, 26.7 × 19.4, 25.0 × 18.4; $C = 2$, 28.3 × 18.0, 26.2 × 18.7; $C = 2$, 27.6 × 19.4, 27.4 × 19.2. Eleven other eggs (not in clutches, none of them dated), 25.0 to 27.8 (26.4) × 18.7 to 20.2 (19.5).

In addition, Rand gives a measurement of 26.2 × 19.0.

The Aldabra egg is exceeded in length by several of the Malagasy eggs, but is broader than any. When *in situ*, it was highly cryptic in colour, and probably very edible. Unfortunately no egg of any species of the Caprimulgidae figured among the egg edibility experiments carried out by Cott (1954).

Systematics. The only specimen collected and retained (by Frazier) during the recent expedition was caught by a domesticated cat at Settlement, 19 June. However, the specimen in Cambridge mentioned by Benson (1967, p. 81) has again been available, and six collected for Lord Rothschild have been borrowed from New York. Benson found that in nominate *madagascariensis* the male is rather darker above than the female; the white tips on the outer two pairs of rectrices more extensive, extending back for about 30 mm as against 20 mm; and the spots on the outer four primaries white rather than rufous buff. Sexing the eight specimens of *aldabrensis* on the extent of white in the tail, five are clearly males (white extending back on the two outer pairs of rectrices for 36 to 45 mm), three are females (extending back for 23 to 28 mm only). Four of these five are overall darker than the remainder. Three of the five have the spots on the primaries wholly white, but in the other two both white and buff are present The three considered to be females have these spots wholly buff. It seems that the most constant and reliable difference in the plumage of the two sexes is in the extent of white in the tail. The bird in figure 5, plate 31 would appear to be a male.

The following are measurements of wing length (those for nominate *madagascariensis* from Benson (1967, p. 82); for *aldabrensis* from the above specimens excepting the one in Cambridge):

madagascariensis

27♂♂	147–163 (154.9)	28♀♀	147–160 (153.6)

aldabrensis

5♂♂	153, 155, 157, 159, 162 (157.2)	2♀♀	153, 159 (156.0)

Contrary to Benson (1967, p. 82) these figures do not indicate that *aldabrensis* is very appreciably larger than nominate *madagascariensis*. It has been found that the specimen in Cambridge has had the wing 'stripped' in skinning (see Clancey 1967, p. 481), so that an accurate measurement is not in fact possible. It is the female which Benson gave as having a wing length of 171 mm. It is an Abbott specimen, as are all the other four whose measurements Benson gave. These figures must be disregarded as being misleadingly large. A few further ones can however be provided to augment those tabulated above. Measurements of two specimens caught by Lowery in a mist-net at Anse Malabar on the evening of 14 July, and released, were 160, 163 mm. One netted there by Frazier on 20 July measured 159 mm, mass 43.5 g. This could not have been either of the two netted by Lowery, since he had marked them with yellow dye. Apparently the smaller of these two was recaptured by Frazier on 21 July. Its wing was measured as 159 mm, and it had a mass of 44 g.

Although it is now evident that any size-difference between *aldabrensis* and nominate *madagascariensis* is but slight, *aldabrensis* is nevertheless recognizable on colour. The crown and scapulars

are paler in *aldabrensis*, this being an overall difference regardless of sex. Also, comparing the two subspecies by sexes, in *aldabrensis* the white tips to the two outer pairs of rectrices are more extensive. Measurements for this have been given above. These differences seem to reflect the relatively dry climate in which *aldabrensis* lives. Benson (1967, p. 82) also mentions a lack of buffy spots on the foreneck in *aldabrensis*, but in several of the specimens collected for Lord Rothschild they are well developed.

Penny records the irides of the two birds which had an egg as bright reddish brown in sunlight.

Miscellaneous. This species may have no natural enemy on Aldabra, though the barn owl (now considered extinct) might have been. The kestrel would have difficulty in finding a nightjar lying up in the daytime, particularly if it were in a thicket, and in any case a nightjar seems rather large prey for it. But introduced cats could well be predators, and there is already one authenticated record of this in respect of a domesticated cat at Settlement. And see Stoddart (1968, p. 481) for records of cats which have become feral on South Island. A sleeping bird would be highly vulnerable, and in view of the report by Cott (1946, p. 472) on the edibility of some other Caprimulgidae probably extremely palatable. Introduced rats might take eggs.

The vernacular name 'somay' is a corruption of 'sommeil', the French for 'sleep', and its aptness is obvious. On the labels of specimens collected for Lord Rothschild it is shown as 'somaille' or 'somais'.

***Hypsipetes madagascariensis* (Müller)** (Malagasy Bulbul), Merle

Status. This species occurs throughout Aldabra, and is one of the most numerous land birds. There appears to be no area where it is more especially plentiful (or the reverse). It occurs on the larger islands in the lagoon. Benson counted eight on Ile Michel on 17 January (where it was also seen by Frazier on 21 July), five on Ile aux Cèdres on 19 January, and two on Ile Esprit on 13 February.

Ecology and food. It may be entirely absent from more open growth on dunes, but otherwise occurs in all the major habitats, with the qualification that it is perhaps not general in mangroves. Nevertheless, Macnae reported it as plentiful in this habitat on the east side of West Island, 8 February, and the following day, in the course of a traverse there of less than 400 m, Benson counted four single birds and four pairs. He also saw a pair in mangroves at Takamaka on 26 February, and one in mangroves on Ile Michel on 17 January. Macnae saw it in mangroves on South Island opposite Iles Moustique. But it seems to be rare or even absent from the narrow belts of this habitat at the eastern end of Middle Island. Diamond, who spent much time there, has no record at all.

As in the Comoros (Benson 1960*a*, p. 68), according to Gaymer (1967, p. 119), both berries and other fruits, and large insects, are eaten. In the stomach contents of our specimens, apart from insects, seeds have been identified of *Apodytes dimidiata*, *Passiflora suberosa*, *Scaevola taccada*, *Scutia myrtina*, *Solanum aldabrense*, *Terminalia boivinii* and *Flacourtia* spp. Grubb also saw feeding on *Phyllanthus casticum* as well as *Scutia myrtina*. At Settlement, in September, Benson saw feeding at flowers of *Erythrina*, *Lantana* and *Agave*, and a concentration of eight feeding on the berries of *Passiflora suberosa*. At Anse Var on 5 February he saw one eating a green mantis. At Takamaka, in September, Penny saw one eating a large black-and-red spider, and on 10 November a small grasshopper, to catch which it hopped about on the ground, following the insect until it was caught. At Gionnet, 10 December, he saw a bulbul flying over the camp

carrying a cicada, still stridulating. The bird perched, and after some difficulty managed to eat the insect. At Dune Jean-Louis, Frazier saw a bulbul performing aerial manoeuvres, including the chasing of a cicada, though it was not caught. Insect remains were found in the stomach contents of four specimens, and included:

In three: Coleoptera, Curculionidae.

In one each: Hymenoptera (ants, including *Camponotus* sp.); Coleoptera, Carabidae; Neuroptera, Myrmelionidae; Hemiptera, Heteroptera; Lepidoptera (larva).

In one, Arachnida (Araneida) were also represented.

Behaviour and voice. It is usually to be seen in two's or three's, though at Takamaka in September and again in November Penny noted assemblages of up to 20 individuals noisily chasing each other about, around sunrise and again at sunset. He noted a variable set of social calls, all based on loud, clear 'cheep' or 'chip' sounds. The most common consists of two notes, the second lower by about four tones. Sometimes there are three or four notes, the third and fourth still lower in pitch. Another variant is the 'chicken call', a rapid series of notes ending in a louder and higher single note. When a large group of birds forms, as at sunrise or sunset, there is a continual hubbub of chattering.

Penny describes the alarm-call as a single, harsh 'yeeah', repeated indefinitely at intervals. Benson recorded it as a grating 'keeeoo' not at all loud. It seemed no very different to a 'whining "meu"' heard in Malagasy and the Comoros (Benson 1960*a*, p. 67). Penny also records a call often heard late in the evening, consisting of two notes on a rising inflexion, very loud and ringing. Morris (1963, p. 69) records 'a wide repertoire of calls, some melodious but many harshly cackling'. Gaymer (1967, p. 119) found the song to be a 'harsh, quite complex whistle', though he adds that many other sounds are made.

The birds are easily approached to within a metre or two, but Benson found them no more tame than in the Comoros, or indeed than *Pycnonotus barbatus* in Africa, of which he (1960*a*, p. 67) was so much reminded. For some notes on aggressiveness to other birds, see p. 478.

Breeding. Abbott collected two clutches of eggs and nests, on 22 and 31 December, and described by Bendire (1894). Probably the eggs are identical with those in Malagasy and the Comoros. No occupied nest has apparently been found on Aldabra subsequently. Gaymer (1967, p. 119) saw nesting material being carried on 27 November. On the recent expedition Benson found three old, empty nests near East Channel between 12 and 27 January. They were all about 2 m above the ground, and similar to Bendire's description. One of them was in a *Pemphis* bush. He saw another old nest at Settlement, nearly 3 m up in a *Casuarina* overgrown with the climber *Passiflora suberosa*. But the only definite evidence of breeding was from two fledged juveniles, probably both from eggs laid in December. At Settlement on 18 January Macnae saw one being fed by an adult, from which it was distinguishable by the dull colour of the bill and by the very short tail. Another was collected at Anse Var on 5 February, and is described under *Systematics*. A male collected at Ile aux Cèdres on 19 January still had the testes measuring as much as 13 × 10, 10 × 6 mm. But breeding may have already been over. None of 11 other adults collected between this date and 26 March showed any marked gonad-activity, and most of them are in moult. The latest seasonal evidence of breeding in Malagasy is of young recently out of the nest, 3 to 10 January (Rand 1936, p. 456). Both there, and in the Comoros (Benson 1960*a*, p. 68), egg-laying evidently starts in September, and this presumably also applies on Aldabra.

It is remarkable that only these two juveniles were noticed. Before collecting the Anse Var bird, Benson had no difficulty in distinguishing it from adults. It may be that 1967/8 was a poor year for the rearing of bulbuls on Aldabra, connected with a paucity of suitable food due to a shortage of rain. No rainfall figures had ever been kept until a rain gauge was started on 17 October 1967. Between that date and the end of the month the fall was a mere 1.03 in (*ca.* 25 mm), and the figures for November, December and January were respectively only 3.82, 2.93 and 0.23 in (total of *ca.* 175 mm). Local belief confirmed that the rainfall was exceptionally low.

One of Abbott's nests contained two eggs the other one only (possibly an incomplete clutch). Further information is needed on the clutch size. In Malagasy, Rand (1936, p. 456) records two clutches of $C = 3$. In the Comoros, Benson (1960*a*, p. 68) records several clutches of $C = 3$ from Mayotte, but four from Anjouan, three of them certainly complete clutches, were all $C = 2$. In the Seychelles, according to Loustau-Lalanne (1962, p. 1), $C = 2$ is normal for *H. crassirostris*.

Systematics. Measurements of recently collected material, including also a specimen collected by Hartman, borrowed from Yale, are as follows:

	wing	tail	culmen from base
7♂♂	105–111 (108.4)	93–102 (96.6)	23–25 (23.9)
6♀♀	102–107 (104.8)	87–98 (91.8)	22–24 (23.1)
1 juv. ♂	103	88	21

Five of the males had masses of 46, 47, 48, 50 and 51 g, four of the females 41, 42, 43 and 48 g, the juvenile male 43 g. Eight other specimens mist-netted by Diamond or Hutson, in January/February, and released, had a mass of 38 to 45 (41.7) g. Their wing lengths were 98 to 113 (107.6) mm. Likewise, three caught by Lowery and Frazier in late May had a mass of 41, 45, 55 g, and had wings of 112, 112, 115 mm.

These figures show no substantial difference from those provided by Benson (1967, p. 83). The only point is that males may average a little larger and heavier than females. In the earlier figures there was no separation of sexes. There may have been some mis-sexing. Thus two of Voeltzkow's specimens, sexed as females, both had a wing-length of as much as 112 mm.

Benson was able to recognize the Aldabra form, *H. m. rostratus*, on account of the brownish wash on the upperside and thighs. Unlike *H. m. parvirostris*, of the Comoros, it is easily distinguishable (when in fresh dress) from *H. m. madagascariensis*, which always lacks this brownish tone. *Parvirostris* is perhaps a little less rich grey than *madagascariensis*, without any marked bluish tone on the mantle, but it is not a well marked form. It is important to emphasize that, in making comparisons, it is essential to use material which is in reasonably fresh dress. Three specimens of *rostratus* collected by Nicoll in mid-March are so worn as to be useless for this purpose. Seven of the recent specimens, collected in January and February, are little better. But five collected between 22 and 26 March have the moult into fresh dress well advanced, and show the characters of *rostratus* clearly. A specimen in Cambridge collected by Abbott on 3 October, and one in Yale by Hartman on 14 December, do also show these characters, but much less clearly, since their dress is becoming worn. Material from Malagasy and the Comoros collected in January and February, like that from Aldabra for these months, is also very worn. It would seem that in all three areas there is the one, annual, moult, taking place in the first 3 months of the year. Four Aldabra specimens dated 19 January have just started to moult, but are mainly still in very worn dress. A single Gloriosa specimen, dated 10 March, is in fresh dress on the mantle,

but shows none of the brownish tone of *rostratus*. It is probably best placed with nominate *madagascariensis*.

The juvenile, collected at Anse Var on 5 February, has rusty margins to the rectrices, and to the remiges and their coverts. This dress can only be worn for a very short time. Of over 60 Malagasy specimens, only three in this dress were found—two from Tsimanampetsoa dated 15 and 19 February, and one from Ampotaka dated 27 March. Of some 30 Comoro specimens there is an undated one from Anjouan in Cambridge in this dress. The Aldabra juvenile shows the characters of *rostratus* even more clearly than do any adults, in that it has the grey of the upperside as a whole quite strongly washed with brown. The Malagasy and Comoro juveniles show no sign of this at all, being an unwashed grey above. Skull ossification had not started in the Aldabra bird. Compared to adults, the orange coloration of the bill was very dull, the gape was markedly yellow, and the irides were pale greyish brown rather than red-brown. The palate was flesh, as in adults.

Benson (1967, p. 83) thought that Aldabra might have been colonized from the Comoros rather than via Astove, Cosmoledo and Assumption, where the species is unknown. These latter three islands are so small in area that they may not be able to support a population of bulbuls. But they might have been used as 'stepping stones' in the colonization of Aldabra. In any case, it is impossible to be in the least sure whether the nearest ancestor of *rostratus* is nominate *madagascariensis* or *parvirostris*. It is equally distinct from both.

Miscellaneous. On 15 December at Takamaka, Grubb saw a bulbul attack a Green-backed Heron *Butorides striatus*. The heron took off, and the bulbul chased it and struck it. The following day two bulbuls were seen to drive a coucal into cover by mobbing it and striking it. No reason for the attack on the heron can be suggested, though in the case of the coucal it might have been that the bulbuls had a nest in the vicinity. According to Gaymer (1967, p. 119), coucals will eat bird eggs, and perhaps young birds too.

The vernacular name Merle is the same as for *H. crassirostris* in the Seychelles (Loustau-Lalanne 1962, p. 1).

Nesillas aldabranus Benson & Penny (Aldabra Tsikirity)

A description and full report on this species has been given by Benson & Penny (1968), and it is only here necessary to include a brief general account. *N. aldabranus* was discovered by Penny in December 1967. It is a derivative of *N. typica*, of Malagasy and the Comoros, and of which it might be regarded by some as no more than a very well-marked subspecies. *N. typica* shows considerable geographic colour variation, probably related to climate. In this respect *aldabranus* most closely resembles the dingily coloured *N. t. lantzii* of dry southwestern Malagasy, *aldabranus* itself living in what is evidently a fairly dry climate too. Both forms lack any rufous tones above, and are white (rather than yellowish, buffy or dusky) below. *Aldabranus* is however a much darker brown above. As might be expected from the findings of Grant (1965), the bill of *aldabranus* is long in comparison with the Malagasy forms of *N. typica*, though little or no longer than in the more strictly insular (Comoro) forms. The tail is exceptionally long.

So far *N. aldabranus* is only known from Gionnet, at the western end of Middle Island. It has not been found on Polymnie, or on West or South Islands. How extensive its range is on Middle Island is still for determination, though it appears to be absent from the eastern end. To the east of Gionnet, the vegetation is extremely thick, at present virtually impenetrable because there is no proper path. There appears to be nothing peculiar about its habitat, which is a dense tall

scrub about 5 m high (high champignon), dominated by *Pandanus* sp., *Pemphis acidula*, *Sideroxylon inerme*, *Dracaena reflexa* and *Mystroxylon aethiopicum*. The original specimen is a female, collected with three eggs on 14 December. A second specimen, a male, was collected a few metres away by Benson on 29 January.

Benson & Penny (1968) made reference to *Bebrornis sechellensis*, of the Seychelles, and *B. rodericanus*, of Rodriguez, and suggested that it was perhaps best to keep this genus and *Nesillas* separate. It was Benson (1960*a*, p. 80) who originally suggested that they be merged, and this has also been supported by Bourne (1968, p. 343) and by Gaymer *et al.* (1969, p. 160). But the possibility cannot be discounted that *Bebrornis* is of Asiatic origin, *Nesillas* of ultimate African origin. If this is so, then it is a question of two colonizations independent of one another, from quite different directions, and it would seem misleading to merge the two genera. The parrot genus *Psittacula* is predominantly of Asiatic distribution, but has penetrated northern tropical Africa and also the periphery of the Malagasy region, i.e. the Seychelles, Rodriguez and Mauritius (it now only survives on Mauritius). Another instance of this is the swiftlet *Collocalia*, represented in the Seychelles, and on Mauritius and Réunion. *Bebrornis*, only known from the Seychelles and Rodriguez, may be a further example, though its possible ancestor is now obscure. The ancestor of *Nesillas* is also obscure, though Stuart Irwin (personal communication) has suggested that it may be related to the African genus *Bradypterus*. In any case, on geographical grounds, it is more likely to be of African than Asiatic origin. At the same time the latter possibility cannot be excluded, and the Asiatic bulbul genus *Hypsipetes* has colonized the whole of the Malagasy region.

It is Benson's present opinion that the affinities of the genera *Bebrornis* and *Nesillas*, which have long been isolated, are impossible to determine with any certainty. All that can be asserted with any confidence is that they belong to the family Sylviidae. However, M. A. Traylor (personal communication), who is preparing a check list of the African and Malagasy Sylviidae for the *Check-list of birds of the world* (in continuation of the work of J. L. Peters) has suggested that *Bebrornis* and *Nesillas* might both be derived from *Acrocephalus*, which is a successful colonizer of remote islands. He points out that it is represented in the Hawaiian Islands. Attention may also be drawn to the various forms of the genus *Conopoderus*, which seems clearly related to *Acrocephalus*, on islands in the southern Pacific, such as the Marquesas, the Tuamotus, and the Society Islands.

A word is necessary about the English name. Watson *et al.* (1963, p. 211) give both Brush Warbler and Tsikirity. Neither is very satisfactory, but we cannot think of an improvement. There are in fact many good warbler genera for which the former name would be no less suitable. The alternative name is probably derived from some Malagasy vernacular, though Rand (1936, p. 442) does not mention it in this context. We know of no vernacular name on Aldabra, and it is unlikely that one exists.

***Cisticolo cherina* (Smith)** (Malagasy Grass-Warbler)

This species is plentiful on Cosmoledo and Astove, which it may have recently colonized (Benson 1970*a*, *b*), as may also be Aldabra and Assumption in due course. Hartman (1958) apparently thought that it was an artificial introduction on Cosmoledo and Astove, but this does not seem in the least likely. Nor is his objection to its possible colonization of Aldabra and Assumption understood. The matter may be left to take its natural course. In any case, the artificial introduction of an insectivorous species such as this would be most difficult. Should there be a colonization of Aldabra, it would be most interesting to record the process of this.]

***Dicrurus aldabranus* (Ridgway)** (Aldabra Drongo), Moulin Ban or Moulenba

Status. Although generally distributed on the four major islands of the atoll, this is not a very numerous species. The total population probably does not exceed more than a few hundred individuals. It is decidedly less plentiful than the bulbul, sunbird, white-eye or fody. The only records from any island in the lagoon are from Ile Esprit, whence there is a breeding record (and where Hartman 1958 also saw it), and Gros Ilot. But the bird which Penny saw on the latter, whose area is small might have been a visitor from nearby South Island.

In the account which follows, black birds are referred to as adults, those which are grey above, dingy white below, as immature. The differences between these two general types of coloration are discussed in more detail under *Systematics*.

Ecology and food. It shows a marked preference for mangroves. Near the east end of Middle Island, Diamond saw it regularly in this habitat. It has also been recorded from mangroves at Bras Cinq Cases, Takamaka, Opark, Dune d'Messe, on the east side of West Island, and southwest of Iles Moustique (on South Island). There are two breeding records from mangroves, on Ile Esprit and at Gionnet. Possibly no individual lives permanently in this habitat. Thus drongos are to be seen spasmodically at Settlement. They might have been visitors from the mangroves on the east side of West Island. Others seen on dry ground near the east end of Middle Island might also have had their main stronghold in mangroves. On the other hand, it seems unlikely that individuals seen at Point Hodoul, Anse Cèdres or the west end of Polymnie, for example, could be dependent on this habitat. Those recorded outside mangroves were usually in fairly thick bush.

Rand (1936, p. 459) found that the food of *D. forficatus* in Malagasy was chiefly large insects. In the Comoro species, Benson (1960*a*, pp. 85–87) found that insects predominated, though in the case of *D. fuscipennis* and *forficatus* he does also record some fruit remains in a specimen of each, and in one of *waldenii* parts of a myriapod. Spiders were also noted for *forficatus* and *waldenii*.

Of six stomach contents of *D. aldabranus*, two each held the remains of one gecko. Otherwise there was nothing but insects:

In five specimens: Coleoptera, Curculionidae; Hymenoptera (ants, including some winged).

In four specimens: Hemiptera, Homoptera: Cicadiidae.

In two specimens: Coleoptera, Carabidae: *Opatrinus attenuatus*; Coleoptera, Scarabidae: Cetoniinae; Hymenoptera, Sphecidae: *Sphex torridus*.

In one specimen: Hemiptera, Heteroptera; Orthoptera, Acridoidea: *Aiolopus thalassinus*; Orthoptera (?grasshopper); Orthoptera (?Tettigonidae); other Coleoptera.

Penny saw an adult at Takamaka take a large grasshopper from the ground, and beat it against a small branch before eating it, though most insect prey is probably taken on the wing (and see Morris 1963, p. 70). The geckos in two of the stomach contents are interesting. There is also a slight suspicion of an adult drongo feeding on an immature one, see under *Behaviour and voice*. No less remarkable is the recording of some fruit remains in the stomach contents of two species in the Comoros. Probably they were picked up on the ground. Like Rand in Malagasy, Chapin (1954, pp. 3–12) and McLachlan & Liversidge (1957, pp. 274–275) record insects only for *Dicrurus* spp. in Africa, except that Chapin does also record a spider and a millipede for *D. atripennis*. But Vernon (1967, p. 290) records a *D. adsimilis* killing and eating a canary *Serinus mozambicus* at Pietermaritzburg, Natal, and this strengthens the suspicion in regard to an

adult *D. aldabranus* feeding on an immature bird. In a restricted insular environment a greater range of food sizes may in general be taken. This could be correlated with the unusually long bill of *D. aldabranus*, and is discussed further below under *Systematics*.

Behaviour and voice. In Africa, *D. adsimilis* is well known for its aggressiveness, see, for example, McLachlan & Liversidge (1957, p. 274), who record it as swooping at hawks, small carnivora, etc. In Malagasy, Rand (1936, p. 459) noted *D. forficatus* as occasionally chasing small hawks; Abbott (in Ridgway 1895, p. 538) *D. aldabranus* as 'noisy, and quarrelsome, pursuing frigate birds, crows and other large birds that approach their nests'. Fryer (1911, p. 419) noted its aggressiveness to frigate birds and crows. As related below under *Breeding*, it is certainly very aggressive when at its nest. Even when not breeding, it may sometimes be so. Penny saw one which apparently had no nest, chasing a *Falco newtoni* at Settlement, 4 December. Likewise at Takamaka on 17 February Fosberg several times saw one of these kestrels being mobbed by a pair of drongos. As long as the kestrel was perched it received no attention, but when it flew off it was chased. On 23 October Penny saw an adult drongo fiercely chasing another drongo, apparently immature, administering severe pecks. Later, the adult was seen feeding on the ground, though the prey could not be distinguished.

Often it is solitary, or two are seen together, though at Takamaka, 28 September, Penny saw as many as six together—five adults, one immature bird. This was too early in the year for the latter to have been recently fledged. It was probably nearly a year old.

Normally the voice was apparently so high-pitched as to be outside Benson's range of hearing. But two adults which he observed at Takamaka on 16 February made noises which sounded like 'cork' and 'quirrer', and other harsh chuckling sounds typical of the genus. The calls now to be described are all from Penny's notes. There appears to be no formal song-call. There is a 'chasing call', given when driving off an intruder from the nesting area. This consists of three musical whistles, quick and staccato, followed by two nasal harsh notes. The whole call, which may be rendered as 'titipoo faugh faugh' or 'ti-ti-you, caw, caw', may be given rapidly and continuously for several minutes at a time, during a chase in which a Pied Crow or other intruder is driven away. Another drongo may be attracted, and join in the chase. At the crux of the whole performance, when the intruder is actually being 'dive bombed', there is a single harsh 'chirrr' at the moment of impact or near impact. After the intruder has departed, the successful occupant of the territory will sometimes rest on a branch and give a variant of the foregoing call —'faugh weep', repeated several times.

At Takamaka, 4 October, a pair which were nest-building exchanged soft whistling, muttering calls, either at the nest or away from it, and possibly indicative of courtship. An apparent social call sounded like 'oink-eugh', nasal and wheezy, or 'eenk-yawk', and other similar sounds. In flight, a repeated high-pitched 'eugh-eugh-eugh' was heard.

Diamond recorded that in mangroves at East Channel in January immature birds would make a thin, almost whispering, twitter, with a distinctive rhythm, to adults. At Gionnet later the same month he also three times heard a short, scolding chatter, reminiscent of the alarm-call of *Nesillas aldabranus* (see Benson & Penny 1968, p. 105). This might have been mimicry, recorded for some African *Dicrurus* spp.; see, for example, Chapin (1954, pp. 6, 9), and McLachlan & Liversidge (1957, p. 274).

Unlike some other birds on Aldabra, *D. aldabranus* has not been noticed to be particularly tame.

Breeding. Abbott (in Ridgway 1895, p. 538) states that three or four eggs are laid, though

according to Bendire (1894, p. 40) he collected a $C = 2$ and a $C = 3$ on 18 November, and another $C = 3$ on 4 December. Bendire makes no mention of a $C = 4$. Gaymer (1967, p. 120) records a nest with one young at the end of November, but it was later abandoned. Another nest found on 2 December contained three young, while of family parties seen in November and December none contained more than two young, and most only had one. Gaymer records nests in *Casuarina* and *Ficus* trees as well as in mangroves. Benson found two old nests in *Sideroxylon* trees, 3 m up, at Takamaka in February. Some further observations on nests are available from Penny.

A nest was found near the east end of Middle Island on 28 October, about 2 m above the level of a tidal pool at highest tide-levels. It contained three pyriform eggs, very pale flesh coloured, with dark red spots in a zone around the larger, blunter end. The nest, which was in due course preserved, is a neat, solidly built cup, made of roots and *Casuarina* leaves, bound on the outside with spider's web, and lined with *Eragrostis* grass stems. Dimensions are (in mm): external diameter 130, internal 80; external depth 50, internal 20. On 19 November it contained a single chick, covered in grey down, the primaries about one-quarter grown. The mouth was large and yellow in colour. Both parents were present, 'dive bombing' Penny as he was photographing the nest, and uttering the harsh nasal 'chirrr' call already described as they passed overhead. His hat was twice struck by one of the birds. At midday on 22 November, when the nest was again visited, the chick was floating on the surface of the pool, dead. During the period of occupation of the nest, birds of several other species were successfully chased away, including Pied Crows (especially), bulbuls, fodies, and also boobies, *Sula sula*, and terns, *Thalasseus bergii*.

At Takamaka Grove, 4 October, a nest was under construction in a fig tree overhanging the pool there. On 9 November it had been abandoned, and another was being built, 7 m above the ground in the same tree, towards the tip of a curving branch. By 17 November the bottom of the nest was complete, and both parents were building in turn. Any other bird approaching the nest, including bulbuls and fodies, was driven off fiercely. The eventual fate of this nest is not known.

Another nest was found in mangroves on Ile Esprit, 2 December. Its presence was given away by the behaviour of the parents, which attacked Penny when he was within a distance of 10 m from it. It was 12 m from the water's edge, 5 m up in a *Rhizophora*. It was made mostly with grass, and rather flimsily constructed (possibly because of the sheltered nature of the site), so that it was possible to see through it from below. It contained two naked chicks. A nest containing two eggs was seen in mangroves at Gionnet on 10 December. It was in a *Bruguiera*, 3 m above the water. The parents were seen chasing off a Pied Crow.

Although Abbott indicates that the clutch size can be as much as four, this must be very unusual. For *D. adsimilis* in south central Africa, Benson *et al.* (1964, p. 88) give only 10 records of a $C = 4$. Out of a total of 278 clutches there were however 183 records of $C = 3$, 84 of $C = 2$. Rand (1936, p. 460) records two clutches of $C = 3$ for *D. forficatus* in Malagasy, Benson (1960*a*, p. 86) four of $C = 3$ for *D. waldenii* on Mayotte, in the Comoros. It may be that it is unusual for even as many as three young to be reared. Thus the nest found by Penny on 28 October containing three eggs held only a single young on 19 November, while most family parties observed by Gaymer contained only one young. Possibly Pied Crows succeed in taking some eggs, though it is doubtful if any of the other species noted as being attacked near nests could cause any such damage. Probably no eggs are normally laid later than the end of November.

For south central Africa Benson *et al.* (1964, p. 88) give 364 egg-laying records for *D. adsimilis*, of which 357 fall within the period September/November, with only five for December and one each for February and July.

Systematics. Apart from *Nesillas aldabranus*, *Dicrurus aldabranus* is the only bird on Aldabra which may fairly be considered as having attained the status of a full species. It is sufficiently well differentiated for its origins and affinities to be somewhat obscure. But like the remainder of the Aldabra land birds, it is probably of Malagasy origin, and derived from *D. forficatus* stock, from which it differs mainly in the reduction of the length of the frontal feathers. But its most distinctive feature is the immature dress, in which it is grey above and dingy white below.

The systematics of *D. aldabranus* have been discussed by Vaurie (1949, p. 231). Measurements may be given of two specimens borrowed from Yale, collected by Hartman, of recently collected material, and of three old specimens in London, none of which were available to Vaurie:

sex	date	wing	outermost rectrices	innermost rectrices	depth of fork	culmen from base	mass/g
			adults (in black dress)				
♂	12.ii.68	133	139	99	40	27	51
♂	22.ii.68	133	134	81+	—	29	—
o	—	133	135	104	31	29	—
o	14.xii.57	132	141	104	37	27	—
♀	31.i.68	128	132	98	34	26	46
			immature (grey above, dingy white below)				
♂	23.ii.68	125	118	74+	—	27	—†
♂	14.xii.57	125	123	103	20	27	—
o	12.iii.68	129	—	—	—	26.5	45
o	12.ii.68	126	121	100	21	25	40
o	24.i.68	120	113	—	—	26	44.5†
♀	xi.06	120	115	98	17	25	—
♀	14.iii.06	120	111	95	16	27.5	—

† Partially in adult dress.

It can be seen that adults tend to be longer winged than immature specimens, and also that the depth of the fork of the tail (difference between the length of the outermost and innermost rectrices) is greater. One is illustrated, figure 6, plate 31. Two of the adults (dated 12.ii.68 and 31.i.68) had the iris red, two of the immatures (12.iii.68 and 12.ii.68) had it brown, while a specimen partially in adult dress (24.i.68) had it red. None of the immature specimens is in obviously fresh dress, except for the one collected on 12.iii.68, which might have been from an egg laid the previous November. It would appear from *Breeding* above that the season is circumscribed, egg-laying being confined to October and November. In late August and early September a number of birds in immature dress were seen, and it would seem that they were around ten months old. Of the immature specimens detailed above, apart from the one dated 12.iii.68, all would appear to be about one year old, for the most part slightly more. No evidence was obtained of breeding in the immature dress.

The remiges and rectrices of adults, as they become worn, tend to become brown rather than black in colour, and this can be seen quite easily in birds in life in the field.

The average of the culmen lengths is 27.7 mm, of the wing lengths 127.0 mm. The ratio bill/wing works out at 21.8. Vaurie (1949, p. 333) gives a ratio of 21.66 for males and 22.20 for females of *aldabranus*, the highest for any of the many forms for which he determined it excepting

fuscipennis of Grand Comoro (22.32 for both sexes). For nominate *forficatus* of Malagasy he gives a figure of 19.64 for males and 20.30 for females. For the Comoro forms he gives 21.40 for *D. f. potior* of Anjouan (both sexes), though Benson (1960*a*, p. 84) made it only 20.1, about the same as Vaurie's figures for the nominate form. For *fuscipennis* Benson's figure is 20.6, as against Vaurie's 22.32. For *waldenii* of Mayotte Vaurie had no figure, but Benson gives 21.8.

Benson has re-calculated the ratio for the following forms, from material presently in London and Cambridge.

number of specimens	wing	culmen from base	$\frac{100 \times \text{bill}}{\text{wing}}$
	D. fuscipennis		
5	138–152 (143.8)	29–31 (30.0)	20.8
	D. f. forficatus		
†20	122–136 (125.8)	22–26 (24.4)	19.4
	D. f. potior		
10	134–144 (139.8)	27–29 (27.9)	19.9
	D. waldenii		
3	142–144 (143.0)	31–32 (31.3)	21.9

† Sample only.

It is clear that *waldenii* as well as *aldabranus* has a high ratio, and *fuscipennis* fairly so too. But the difference between nominate *forficatus* and *potior*, certainly conspecific, the latter probably a fairly recent colonizer of Anjouan, is not very striking. Grant (1965, p. 364) found that in North America and Mexico there is a strong tendency for island birds to have a longer bill than their mainland counterparts, because they have to deal with a greater range of food-sizes. The taking of geckos by *aldabranus* may help explain its large bill.

Miscellaneous. The origin of the vernacular names is uncertain. Moulin is French for a windmill. The bird has possibly got its name from its aerobatics, including swooping at other birds and indeed even at man, perhaps like a windmill. The usual French name for a drongo is the same as in English.

The breast of the immature specimen collected on 12 March was tasted. The flesh was dark brown in colour. The flavour was strong, and it was found to be not at all unpalatable. This is surprising, because Cott (1946, pp. 482, 496) found drongos, which are so conspicuous, to be distasteful, and Benson and others, who tasted *D. adsimilis* for Cott in Zambia in 1957, rated its palatability as relatively low.

Corvus albus (Müller) (Pied Crow), Corbeau

Status. Benson (1967, p. 98) regarded it as of uncertain status, there being no breeding record from Aldabra. It does however breed, as recorded below. Abbott (in Ridgway 1895, p. 537) found it to be not common. This was also the experience of Voeltzkow (1897) and Nicoll (1906, p. 700). Bourne (1966) records 'hundreds', while Gaymer (1967, p. 114) thought that the 'total numbers cannot exceed a few hundreds'. Frazier has noted that the total might be between 50 and 75, and not more than 100, obviously supported by man's activities. Independently Benson thought there might not be more than 50. It seems safe to say that the true figure does not exceed 100. The number may have increased since Abbott's visit in 1892, with some extension of human activity. As discussed on p. 488, colonization of Aldabra has probably followed man's occupation of the atoll.

There seemed always to be fair numbers on West Island, around Settlement. Thus 21 were counted there on 7 September; 25 on 25 January; 28 on 19 February; 32 on 3 March; 33 on 29 March; *ca.* 40 on 10 April. Possibly the average there is about 40, certainly with much fewer numbers elsewhere. Small numbers have been observed in many other localities, usually where there was some human activity, however transitory—e.g. at Anse Mais, Dune d'Messe, Dune Jean-Louis, Takamaka, Cinq Cases, Anse Cèdres, East Channel (both sides), Anse Malabar, Gionnet. The numbers in such localities certainly fluctuate. Thus at Jean-Louis, where Frazier spent 92 days between 18 January and 26 July, counts were made on 33 days, as follows: eight of two birds; four of three; two of four; two of five; four of six; five of seven; two of eight; two of nine; one each of 11, 13, 14 and 32. On 9 September Benson and Penny saw two birds there, four the following day. These figures serve to show the transitory nature of the population at a particular site, and this will be discussed further below. At Takamaka Penny noted some 'build-up' in numbers. On 22 September he counted three birds, 4 days later five, on 4 October six in the morning, nine in the afternoon, and 10 the following day. There is no further observation of ever more than eight birds. Diamond records that around his camp on the west side of East Channel there were between six and eight in November. The overall picture would seem to be of a nucleus around Settlement, with much smaller numbers elsewhere, augmented temporarily, possibly from Settlement. Thus the exceptional count of 32 made by Frazier at Dune Jean-Louis (on 19 March) consisted of two birds possibly resident there, augmented by a further 30 which came in from the west after two turtles had been landed and slaughtered. Of 18 birds at Dune Jean-Louis on 2 April 1969, five were recognized by their combinations of coloured rings as having been banded by Frazier at Settlement in 1968.

A 'build-up' in numbers at Dune Jean-Louis between 14 and 29 April was noticed, as follows: 14th, two; 15th and 16th, three; 17th, four; 18th, six; 20th, thirteen; 29th, nineteen. On returning on 20 May after a 3-week absence, there were only eight birds present, the following day eleven. It was suggested to Frazier by one of the labourers that there might even be some movement between Aldabra and Assumption, only 32 km away.

Ecology and food. In Malagasy Rand (1936, p. 495) found it common around villages, as did Benson (1960*a*, p. 87) in the Comoros. In southern Africa it is a scavenger at refuse dumps and abattoirs, even following trains for scraps (McLachlan & Liversidge 1957, p. 277). On Aldabra too it is essentially dependent on human activity and a scavenger. At Settlement it was often observed feeding on fish opened up for drying in the sun, laid out on racks, and in a rubbish pit into which cooked rice etc. had been thrown. Frazier saw 14 there on 25 January feeding at turtle bones. Again, on 27 March he noted that about 30 appeared there on a beach, 'like magic', after a turtle had been slaughtered; on 3 April there were about 20 feeding at fish-heads on the beach; on 10 April there was an accumulation of some 40 around the remains of a turtle. The six to eight birds recorded by Diamond at East Channel in November sometimes fed on fish offal on the beach. Beach-scavenging is illustrated in figure 7, plate 31. The unusually large numbers at Jean-Louis on 19 March can be attributed to the slaughtering of two turtles. Voeltzkow (1897) states that great damage is caused in maize fields, but this is probably no more than an indication of commensalism with man.

The Malagasy Kestrel was recorded on a number of occasions as mobbing Pied Crows. Crows are also mobbed by drongos, as related under that species (*Breeding*), and are suspected of taking some eggs. Fryer (1911, p. 419) records that the drongo 'attacks any frigate or crow (*Corvus scapularis*) which approaches near its perch'. Diamond actually observed Pied Crows

taking and eating eggs of noddies *Anous stolidus* at one very small colony, and suspected that they took them quite widely. He also saw them attacking the nest of a pair of Black-naped Terns *Sterna sumatrana*, and thinks they were successful. Certainly *something* was removed. Abbott (in Ridgway 1895, p. 537) states that on Gloriosa crows were plentiful—'very destructive to the eggs of boobies and other birds'.

Behaviour and voice. The notes in this section are entirely from Frazier, from around Settlement. On 25 January, when at 17h30 14 were feeding at turtle bones, a Grey Heron, *Ardea cinerea*, flew over. All the crows flew away in a flock. The reason for their apparent fear of the heron is not clear. But a number of interactions of this nature were recorded, the heron always dominant to the crows, and often calling on arrival. Possibly young crows are preyed on.

On 3 April, about 20 crows were feeding on fish-heads on the beach. A number of bill-up threat-displays were noted. One bird would approach another which was feeding. When a few cm apart both suddenly raised their bills. During one of these performances the bird which appeared dominant kicked at the other with its right leg (ravens, *C. corax*, also kick in social interactions). A bird which was apart from the group gave a series of two-syllable calls, a long, nasal 'wonk wooo'. The head was protruded forward, the wings squeezed together, and the tail lowered as the call was produced. Later, many more of these displays were seen. Once, bill-clacking was heard, possibly due to contact of bills. On several occasions, a bird which ruffled the head-feathers, the bill held at a slight angle (about 30°) downward, and the head having a rounded appearance, seemed to be submissive in that it cowered and moved off (in *C. corone* this rounded head—bill down display is apparently aggressive). One bird walked around at the edge of the water with its tail up. The cloaca was very conspicuous, but the bird may merely have been trying to keep its tail dry. Also, a number of chases and charges were seen, in which one bird ran after or at another which had food. At one point, it appeared as if a bird was waiting for the right moment to charge. On 10 July, after Frazier sat down at the Bassin Cabri at 15h00, birds began to appear, mostly from the north-east, but some from the west. At one point, three were walking towards him, one (possibly an immature) getting to 3 m from him, the others being 10 m away. Some turned small rocks, and seemed to peer under them. The one which was 3 m from him was manipulating an opened coconut shell.

A very low-frequency gurgling sound was often heard, possibly of courtship or pair-bond significance. It seemed to be given by one of two birds sitting close together. Soaring and riding on up-draughts was seen a few times, an altitude of some 200 m being attained. This was also seen over the University College, Nairobi, on 27 December 1967, when a considerably greater altitude was attained. It might serve two functions:

(*a*) Social behaviour, a kind of group display, which all corvids seem to have.

(*b*) A means of finding food a long way off, as practiced by vultures.

On 18 July, Frazier and Lowery caught five birds, two of which they placed in a cage trap 2.5 × 2.5 × 1.5 m. Within a minute, six others perched in *Casuarina* trees 7 m above the trap. They called continuously, but the captives remained silent. The only call ever heard from the captives was when one of them was held out so that it could see a cat which was a metre away. The call was a long nasal 'conk' repeated several times. When in the hand, the birds were either very quiet, 'frozen', or fought vigorously. This included a 'biting' with the bill—grabbing something, alternately squeezing and relaxing—squeezing 'like iron' with the feet.

Abbott (in Ridgway 1895, p. 577) states that crows are shyer and more wary than any other bird on Aldabra and Assumption. Frazier's observations do not indicate any particular shyness —one bird approached to 3 m from him, as already mentioned. But it is Benson's impression that Pied Crows in African markets are not more shy than on Aldabra.

Breeding. Grubb found a nest containing three eggs, in a coconut palm, northwest of Cinq Cases, on 20 December. On 11 January it was without eggs or any sign of occupation (it was unsoiled). He also saw a nest in tall trees (*Pisonia grandis*) at Point Hodoul, 10 m up, on 22 November. One bird was on the nest, another was flying around. On 27 January, when it was climbed up to, it was empty, and no bird was present. Nor did Frazier find any bird there on 24 February. Penny saw a nest on West Island, in Settlement area, on 6 December, 12 m up near the top of a *Casuarina*. It was inaccessible, but two birds were seen nearby. They were not present when Benson visited the site on 19 January, though Frazier saw one nearby on 30 January. On 19 January Frazier noted a nest at Anse Cèdres, South Island, near the top of a *Casuarina*, and on the previous day saw a pair apparently copulating in the vicinity. Lowery also saw a pair apparently doing so at Settlement on 22 May. One of three possibly resident birds seen by Frazier at Dune Jean-Louis between 22 January and 15 February had a high pitched voice, and seemed to follow the other two. It may have been immature.

Frazier made an observation of possible courtship significance, on 26 July, at the east end of West Island, in a small bay bordering on Main Channel. There were seven or nine birds in all, all in two's except for the odd extra bird. The 'pairs' were flying about, the individual of each chasing the other. The extra bird was trying to break into a 'pair'. This performance went on for some 10 min.

There is evidence from above of nesting at widely spread localities. Nests are easy to see, and it might be thought that more would have been noticed. Possibly breeding only takes place at infrequent intervals. Rand (1936, p. 495) records incubation in Malagasy in October, and two records by Benson (1960*a*, p. 87) for the Comoros seem to indicate egg-laying in September/October. Forbes-Watson (1970) saw 15 occupied nests in the Comoros in October. For south central Africa, Benson *et al.* (1964, p. 91) give one egg-laying record for June, 96 for August/December (peak of 50 in October). By comparison, the scanty evidence of the breeding season from Aldabra is rather different. Nicoll (1906, p. 693) saw empty nests on Assumption in March. Frazier saw two birds active at a nest on a tall tower in Mombasa, 28 and 29 December 1967.

Systematics. Benson (1967, p. 98) provided no systematic discussion, and some comments are now called for. Besides occurring in Malagasy, the Comoros, Gloriosa, Astove, Cosmoledo, Assumption and Aldabra, *Corvus albus* ranges through the greater part of Africa south of the Sahara. It seems always to have been treated binomially. Examination of the material in London does not suggest any alternative, either from the aspect of colour or measurements. Over 100 African specimens have been available, together with lesser numbers from the Malagasy region. The following are some measurements, using only a sample of the African material, but adding a few Malagasy region specimens in Cambridge:

	wing	tail	culmen from base	tarsus
		Malagasy		
5♂♂	335, 346, 362, 362, 366	166, 167, 172, 177, 183	53, 53, 54, 55, 57	61, 61, 61, 62, 62
2♀♀	327, 347	165, 170	50, 51	57, 58
4oo	320, 337, 356, 362	151 (+), 161, 170, 180	53, 54, 55, 62	60, 60, 61, 62

	wing	tail	culmen from base	tarsus
		Comoros		
3♂♂	323 (+), 326, 345	150 (+), 165, 175	55, 55, 59	58, 62, 64
1♀	344	155 (+)	53	58
1♂	345	174	55	61
		Gloriosa		
1♂	342	174	59	60
		Assumption		
1♂	322	159	54	63
		Aldabra		
3♂♂	330, 343, 350	166, 172, 175	56, 57, one broken	57, 62, 65
		southern Africa, south of Zambezi		
6♂♂	330–380 (356.5)	162–183 (172.6)	53–61 (57.3)	58–67 (62.8)
4♀♀	326, 353, 363, 380	142 (+), 146 (+), 165, 168	52, 54, 55, 56	61, 61, 63, 63
8♂♂	332–362 (345.2)	163–185 (172.2)	60–65 (62.4)	60–65 (62.4)
		Malawi, north to Kenya and Uganda		
4♂♂	333, 365, 370, 376	169, 169, 170, 178	52, 56, 56, 61	60, 61, 61, 62
10♀♀	337–370 (356.4)	157–189 (170.7)	53–60 (57.1)	57–65 (60.8)
4♂♂	343, 343, 355, 368	150 (+), 165, 165, 168	56, 59, 61, one broken	58, 60, 61, 61

A plus sign accompanying any measurement above indicates that the wing or tail, as the case may be, is worn, and that the measurement is therefore not complete. The culmen and tarsus figures for the unsexed southern African specimens are identical. This does not reflect a clerical error.

There are also the following further wing lengths of Malagasy region material in Washington, New York and Paris, most kindly provided by Watson, Keith and Roux respectively:

	Malagasy
7♂♂	334, 336, 342, 344, 354, 357, 358
5♀♀	340, 341, 346, 355, 371
6♂♂	325, 330, 337, 341, 360, 366
	Comoros
1♀	347
5♂♂	336, 339, 340, 355, 362
	Assumption
1♀	341
	Aldabra
5♂♂	331, 335, 341, 353, 360
2♀♀	334, 337
2♂♂	345, 361

The wing lengths of six live specimens measured by Frazier on Aldabra, and released, were 328, 330, 339, 340, 348, 350 mm. Their masses were respectively 560, 590, 550, 570, 520, 585 g.

The foregoing figures as a whole do not indicate any geographical variation. It may be supposed that colonization of Aldabra and other small islands in the western Indian Ocean did not take place before their occupation by man, with whom *Corvus albus* seems to be so closely associated. In the case of Aldabra and Assumption this was probably less than a century ago.

Soaring and riding on up-draughts has been mentioned above under *Behaviour and voice.* Frazier has suggested that it is this habit which might have led to a group of birds being carried off to colonize a locality such as Aldabra. It might subsequently have helped to maintain some inter-island gene flow and explain the lack of subspeciation. It has already been mentioned that there may be some movement between Aldabra and Assumption, which are only 32 km apart.

Miscellaneous. The vernacular name Corbeau is the normal French word for a crow.

There is a useful account of aerial evolutions in this species by Cooper (1969).

***Nectarinia sovimanga* (Gmelin)** (Souimanga Sunbird), Colibri

Status. Abbott (in Ridgway 1895, p. 536) found this the 'commonest bird' on Aldabra, while Nicoll (1906, p. 699) records it as 'very common'. Without doubt it is the most plentiful land-bird on the atoll, and the population must be numbered by the thousand rather than by the hundred. It occurs virtually everywhere. In the lagoon, it is plentiful on Iles Michel and Esprit. It has also been noted on Ile aux Cèdres (breeding, Benson), Gros Ilot (Penny) and Iles Moustique (breeding, Penny). Penny also found an occupied nest on a dissected, *Pemphis*-covered islet, not more than 20 m across, in East Channel. Diamond saw sunbirds on other such islets, none of them of area more than about 60 m², about 1.5 km south of Gionnet, on which the only other land-bird noted was the fody, *Foudia eminentissima.* He saw an empty nest on another such islet in Passe Femme (West Channel).

Ecology and food. It shows no ecological preference, and many instances of a catholicity in the selection of a nesting site are given below under *Breeding* (including table 4). It seems to be at home in any type of habitat, so long as bushes or trees are available. It shows some association with man, in that there is a record of a nest from the interior of a building and from a recently vacated tent. On the south coast of South Island near Takamaka, dominated by *Scaevola* bushes, Frazier reckoned that he saw a bird every 40 m. Possibly it is nowhere permanently resident in mangroves, but it is often plentiful, and nests, in this habitat.

Insects found in the stomach contents of 17 specimens included: in most: Hemiptera, Homoptera; in seven: Lepidoptera (larvae); in six: Coleoptera, Chrysomelidae; in four: Hymenoptera (?Eurytomidae); Hymenoptera (identification to any lower level not possible); Psocoptera; in two: Hymenoptera (including ants). Also Arachnida (Araneida) were present in the majority. Frazier, at Takamaka, 15 March, saw one fly to the ground and try to catch a tiger-beetle, which flew off but may have been eventually caught. Feeding at flowers of *Euphorbia abbottii* and *Lomatophyllum borbonicum* was noted by Benson in September, and of *Polysphaeria multiflora* by Renvoize on 21 February. This was presumably for extraction of nectar, and doubtless many other flowers are so utilized.

Behaviour and voice. Its habits are typical of the family as a whole. It is active and restless, continually on the move, searching for insects on twigs and leaves, though there is no record of any concentration at particular flowers (for the drinking of nectar) such as Rand (1936, p. 470) records in Malagasy. Abbott (in Ridgway 1895, p. 536) states that it is extremely tame, even alighting on one's arm. It was not noted as being tame to this extent. It certainly is tame, though it is Benson's impression that it is no more so than some *Nectarinia* spp. in southern Africa.

Penny made some notes on the voice. The song of the male is a complex, polysyllabic trill. A particular male will repeat the same song, phrase for phrase, from different singing perches,

TABLE 4. OCCUPIED NESTS OF *NECTARINIA SOVIMANGA ALDABRENSIS* FOUND IN 1967/8

date	locality	particulars of site	height/m†	contents and other remarks‡
31 Aug.	Anse Var	hidden inside shrub, in mixed scrub	+1.0	$N = 2 < 1$ week old
2 Sept.	Settlement	in sinkhole in mixed scrub	−0.7	$C = 1$, perhaps fresh
3 Sept.	Polymnie	mangroves by inland tidal pool	+2.0	$N = 1 < 1$ week old. Nest probably only just above water at high tide
12 Oct.	Anse Mais	*Casuarina* tree	+3.0	$C = 2$, ♀ incubating
18 Nov.	East Channel	*Pemphis* shrub, on small islet	+1.0	$C = 2$, ♀ incubating
30 Nov.	Iles Moustique	*Avicennia* (mangrove fringes)	+5.0(?)	$C = 2$, ♂ singing nearby
2 Dec.	Ile Esprit	*Pemphis* shrub	+2.0	$N = 2 > 1$ week old
9 Dec.	Takamaka	in shrub covered with tent flysheet	no record	$C = 2$. Camp abandoned on 17 Nov., when building had not started
14 Dec.	Takamaka	in a sedge *Cyperus ligularis*	+2.0	$C = 2$
3 Jan.	Cinq Cases	in sinkhole, attached to a creeper *Wedelia*	−2.0	$N = 2$, age not recorded
18 Jan.	East Channel	in upturned roots of a *Casuarina* tree	+1.5	$C = 2$ ($C = 1$ on 16th)
19 Jan.	Ile aux Cèdres	*Casuarina* tree	+2.0	$C = 2$, ♀ incubating
10 Feb.	Settlement	*Casuarina* tree	+2.5	$C = 2$, ♀ incubating. Nest on ground, 16 Feb.; $N = 2$, dead. Nest probably blown down by wind
23 Feb.	Dune Jean-Louis	in sinkhole in mixed scrub, attached to a *Sclerodactylon* runner	−0.7	$C = 2$
25 Feb.	Dune Jean-Louis	*Pemphis* shrub, on very edge of sea coast	+1.5	$C = 2$
29 Feb.	West Island (south end)	*Azima tetracantha* shrub, on cleared land	+1.0	$C = 2$, ♀ incubating. Another fresh nest, empty, 0.7 m away in same shrub
29 Feb.	Settlement	*Casuarina* tree	+2.0	$N = 2 > 1$ week old
10 Mar.	West Island (south end)	*Azima tetracantha* shrub, 20 m from sea coast, intervening ground open	+1.0	$N = 2 < 1$ week old. Another older nest, but still intact, 0.7 m away in same shrub. Two days later, first nest had been pushed up to horizontal, and no sign of young. There had been rain and strong winds in meantime
10 Mar.	Settlement	*Azima tetracantha* shrub, overhanging a sinkhole, in cleared land	+1.0	$C = 2$, ♀ incubating. As for last, two days later eggs had disappeared
12 Mar.	Settlement	inside an unoccupied wooden house, attached to a horizontal beam	+2.0	$N = 2 > 1$ week old. Unlike last two, this nest more sheltered, not affected by storm
16 Mar.	near Dune Jean-Louis	*Pemphis* shrub, 2 m from edge of sea coast	+1.5	$N = 1 > 1$ week old
27 Mar.	Settlement	in upturned roots of a *Casuarina* tree	+1.0	$C = 2$, ♀ incubating. Two days later $N = 2$

† + = above ground level, and − = below ground level.
‡ C = clutch of egg(s); N = nestling(s).

though it may be repeated up to a dozen times from one perch. The song varies individually. Two males heard near to each other at the same time had songs that were not identical. With the use of a tape recorder it should be possible to ascertain whether each male has his own particular, unvarying song, or whether it varies from day to day or over longer periods. Singing was never heard from a female.

The alarm-call varies from a drawn-out 'tweet' to an open-throated rather hoarse 'tweeeh'. It always consists of a single note, but often repeated frequently. A male perched above a coucal (see p. 468) gave this call. It was also heard from a female beside a nest which Penny had under observation. Gaymer (1967, p. 120) refers to a frequent high-pitched 'chink', and Diamond to a cat-like 'miaaw', which he also heard from *N. s. buchenorum* on Astove. Frazier heard a cat-like 'pee awow' from a female whose nest he was investigating. These calls may not be the same as those recorded by Penny. Rand (1936, p. 470) refers to a mewing call in nominate *sovimanga*. This might be the same as the calls heard by Diamond and Frazier.

On taking off, and with each set of wing-beats in its looping flight, a staccato 'chip' is heard, seemingly almost involuntary. Whether this is also to be heard on longer flights is not certain. Sometimes only the noise of the wings can be heard. This is a crisp 'whirrr', occasionally audible even at a distance of 10 m, though not necessarily so when a bird flies past at a lesser distance. Skead (1967, p. 33) refers to the characteristic 'frrrt-frrrt-frrrt...' of a sunbird's wings, which may also be apt for Aldabra.

Skead (1967, p. 36) mentions a subsong, and occasional vocal mimicry, in southern African Nectariniidae. Such have not been recorded on Aldabra, but possibly they exist.

Breeding. Table 4 contains a summary of records of occupied nests found during the recent expedition, to which various observers have contributed. Evidently egg-laying occurs throughout the period August to March. There is no record for April to July, possibly because relatively few observations have so far been possible in this period. There are also some earlier records for August to March. Abbott (in Ridgway, 1895, p. 536) found that two eggs were laid, and that breeding was from September to January, but he does suggest that the season may be longer. Morris (1963, p. 70) found a nest with two eggs in a mangrove on the lagoon shore of South Island in January. Bourne (1966) records several nests, usually low down in *Casuarina* trees, in March. Gaymer (1967, p. 121) counted 11 nests at Anse Mais, some of them evidently occupied, in mid-November. In Malagasy, Rand (1936, p. 470) records *N. s. sovimanga* as breeding in September and October, and (p. 472) *apolis* in October and November. Van Someren (1947, p. 261) found nests with eggs of the former in November and March, and noted that the birds appeared to be paired most of the year round. Records for *N. s. buchenorum* from Cosmoledo and Astove in Benson (1970*a*, *b*) fall within the period August to March, as for Aldabra, and as is to be expected. Benson *et al.* (1964, pp. 93–95) give 630 egg-laying records for Nectariniidae in south central Africa, of which 472 are for September to November, though rather surprisingly, in view of the Aldabra records, only 85 for December to March. But there is much rain in these months in that region, so that observers are relatively inactive. There are also 38 records for April to July, and it is possible that there is some breeding in these months on Aldabra too.

Considering the sites of the nests, it can be seen that they are extremely varied. Many other nests, empty, were also found. It seems unnecessary to detail them in the same way. They include a number from mangroves, including one seen by Penny on West Island at least 50 m from the nearest dry ground. The Anse Var nest (31 August) in table 4 is described as 'hidden',

but usually they are quite unconcealed. To the record of one in a wooden house (12 March) can be added an empty one, apparently complete, attached to string between the poles of a tent flysheet at Gionnet, 9 December (figure 8, plate 31). A nest from Takamaka in table 4 (9 December), placed in a shrub under a flysheet would thereby have been afforded protection not only from wind and rain, but also from possible predators, though the only one suspected is the coucal *Centropus toulou*—see p. 468. The nests are often in sinkholes, described by Stoddart & Wright (1967, p. 21), where there would be protection from wind and perhaps also predators. Those in *Azima tetracantha* shrubs might gain some protection from the spines. The same applies to an empty nest seen by Cogan at Settlement, in a *Solanum aldabrense*, and incidentally only 0.3 m above the ground. Nevertheless, two nests sited in *Azima* shrubs (table 4, 10 March, two entries) evidently became casualties of strong winds. The same thing happened to a nest in a *Casuarina* (10 February). Sites on the sea-coast can also be hazardous. Thus Benson watched a nest under construction (it was almost complete) on the north coast of Middle Island, 14 and 15 January. It was attached to a *Suriana maritima* shrub, and actually slightly overhung the sea. By 16 January it had been soaked by spray and was deserted. There had in the meantime been a rough sea. It can be seen from the table that there is no record of a nest at a height of more than 3 m above the ground, with the exception of the one for 30 November. But in this case there is no record of the state of the tide. However, Benson has four records of empty nests, all at about 4 m above the ground, and all in *Casuarina* trees (Main Channel, Ile Esprit, Anse Cèdres). Gaymer (1967, p. 121) also gives a height of as much as 12 ft (*ca.* 4 m). To the foregoing account of nest-sites, it is worth adding that in southern Africa Skead (1967, p. 74) records *Nectarinia* spp. nesting near wasps' and hornets' nests. Any such association on Aldabra is unlikely, since no exposed nests of wasps or hornets have been found (Hutson, personal communication).

It is evident that the clutch-size is normally two, as for Nectariniidae in southern Africa (Benson *et al.* 1964, pp. 93–95; Skead 1967, p. 77). The $C = 1$ for 2 September may have been fresh. There are, however, two records of a single nestling (3 September and 16 March). For 29 February and 10 March there are records from West Island of nests in the same bush, close together, one occupied, the other not. In one of these cases the empty one was also quite fresh. Two further pairs of nests, each pair in the same bush—all four nests were empty—were seen on West Island on 29 February. In one case they were in a *Lantana* shrub, 0.7 m from each other. In the other they were in a *Plumbago aphylla*, but farther apart. Skead (1967, p. 76) indicates that a fresh nest may be built alongside one which appears to be in good condition, but is from a previous season. However, the second (empty) nest recorded in table 4 for 29 February was also fresh, and Morris (1963, p. 70) notes that 'only the tattered ruins. . . remained' of a nest, 5 ft (1.5 m) above the ground in a mangrove, which a month previously had contained eggs. Conceivably the nest seen by Morris was inundated during a high tide. But it may be that in none of these pairs noted on Aldabra did the age of the two differ by more than a month, that they belonged to the same pair of birds, and that the first nest was not utilized. Nevertheless, if this is correct, it is still not clear why the first one should be abandoned. Catastrophes from wind and high tides apart, one wonders whether a nest can survive from one season to another, as suggested by Skead.

Like Abbott (in Ridgway 1895, p. 536), we have no evidence that the male takes any part in nest-building (or incubation), and this is in agreement with Skead (1967, p. 76) for Nectariniidae in southern Africa. The female came to a nest apparently nearly complete, watched by

Benson between 11h34 and 12h34 on 14 January, 63 times with building material. She usually added material from the outside, only occasionally entering the chamber (Abbott gives some further details about the method of construction). The male only once appeared. He first perched on a bush some 4 m from the nest, and within one minute visited it for a few seconds. But he did not enter it, and apparently did not bring any material. The nest was watched again for 50 min the following day, when the female brought building material 17 times; but the male was not seen at all. Gaymer (1967, p. 121) states that the sexes share incubation, but only the female was ever flushed from eggs, and Morris (1963, p. 70) notes that during the 8 h or so that he was in the vicinity of a nest containing eggs, only the female was seen. According to Skead (1967, p. 77), incubation is the sole province of the female. Morris describes the eggs as dirty white lightly mottled with umber, Frazier as white spotted with red. We did not collect any eggs, nor apparently did Abbott, since Bendire (1894) does not mention this species. According to Abbott (in Ridgway 1895, p. 536), the male assists in feeding the young. We have no observation on this, but Skead also states that he does so, though never so diligently as the female. Skead also states that only the female covers the young.

Due to frequent moves, from camp to camp, it was not possible to determine any incubation or nestling periods. Abbot gives the incubation period as 13 days, the young being born blind, opening their eyes on the seventh day. He also found the period of nest construction to be 8 days. But it would seem from the findings of Skead (1967, p. 76) that it might vary from as little as 24 h to as much as 36 days. The nest at Gionnet illustrated in figure 8, plate 31, had not been started on 24 November, when the camp was vacated, and so took less than 16 days to complete. The one in table 4 from Takamaka, 9 December, could not have taken more than about three weeks. Skead gives the incubation period within a single species as varying from 13 ± 1 to 15 ± 1 days, and states that the nestling period for the seven species for which it has been recorded varies from 14 to 19 days.

The nest illustrated in figure 8, plate 31, is in structure typical for the family, basically the same as that of the various species inhabiting southern Africa (Skead 1967, pp. 74–76, and plates 5, 6). Ten empty ones were collected. Normally, the nest is suspended at the top from a narrow branch a few millimetres thick, and is a dome structure with the entrance at the side. A 'porch' above the entrance, and strands of material dangling untidily below the nest, these latter apparent in the plate, are also typical. Average dimensions in mm are height (exclusive of strands below) 130; width 70; diameter of entrance 30; height of inner chamber 60, depth thereof 35.

In the wall of the nest, *Eragrostis* grass stems often predominate. Stems and tendrils of *Passiflora suberosa*, *Plumbago aphylla* and *Gagnebina* may also be present, and coconut fibres have been noted. The lining usually contains much *Gossypium* wool, seed pappi of *Secamone* and small feathers. A common external decoration is the papery leaves of the marine angiosperm *Cymodocea ciliata*, blown inland off the reef. Fine filamentous algae, likewise blown off the reef, leaves of sedges, and leaves and twigs of *Casuarina*, have also been noted.

Systematics. The subspecies of *N. sovimanga* have been discussed by Benson (1967, pp. 84–86) and again by him (1970*a*), after the collection of further material from the Aldabra archipelago. The more important points of what has already been written may be briefly re-capitulated, with particular reference to the Aldabra endemic, *N. s. aldabrensis*. In colour, considering first males in breeding dress, there is variability in the extent of black on the abdomen. Nominate *sovimanga*, occupying the greater part of Malagasy, has the black restricted to the upper abdomen, the lower part being yellow. *N. s. apolis*, of dry southwestern Malagasy, has the lower

abdomen white instead of yellow. *N. s. aldabrensis* has black more extensive, but shows a considerable resemblance to *apolis* in also having the lower abdomen white, albeit a more dingy, less pure white. *N. s. abbotti*, of Assumption, differs from *aldabrensis* in having black still more extensive, while in *buchenorum* of Cosmoledo and Astove, it has virtually disappeared, the abdomen as a whole being black. The males in breeding dress are illustrated in colour in *Animals* (11), **12**, 497 (1970).

Taking adult females, *aldabrensis*, *abbotti* and *buchenorum* may not be distinguishable from one another, all three being brown on the upperside with little olive tone, and with a wash of dull yellow on the underside. *Apolis* is a trifle paler above, and below it is white with little or no yellow wash. In the nominate form the olive wash above is more pronounced, and it is quite a bright yellow below. Four out of five females of *buchenorum* from Astove have a variable amount of orange-red fringing to the feathers of the chest, and there are slight signs of this in one female of *aldabrensis*. Juveniles of both sexes of *aldabrensis*, *abbotti* and *buchenorum* seem indistinguishable from one another. They are like adult females, but have more olive wash above, and in six very young specimens the chin and throat are a uniform sooty black.

The following are some average measurements, those for nominate *sovimanga* being taken from Benson (1967, p. 85), the remainder from Benson (1970*a*):

sex	number of specimens	wing	tail	culmen from base	$\frac{100 \times \text{culmen}}{\text{wing}}$
		N. s. sovimanga			
♂♂	14	54.1	36.6	22.1	40.8
♀♀	16	49.4	31.1	20.4	41.3
		N. s. buchenorum			
♂♂	14	55.2	40.3	19.0	34.4
♀♀	8	51.1	35.0	17.8	34.8
		N. s. abbotti			
♂♂	6	54.3	39.2	20.0	36.8
♀	1	49.0	34.0	—	—
		N. s. aldabrensis			
♂♂	20	52.7	37.8	19.5	37.0
♀♀	12	48.4	32.5	18.2	37.6

Wing measurements indicate that in comparison to nominate *sovimanga*, *buchenorum* is larger, *abbotti* about the same size, and *aldabrensis* smaller. Benson (1970*a*) includes some masses for collected specimens of *buchenorum* and *aldabrensis*. Although *buchenorum* can be expected to be the heavier, the difference is not marked. Masses for some further specimens of *aldabrensis*, mist-netted by Diamond or Hutson in January and February, and subsequently released, are as follows: 7 ad. ♂♂, 7–8 (7.4), 1 juv. ♂, 7; 6 ad. ♀♀, 6–7 (6.4); 1 juv. ♀ 6.5 g. A male and a female caught by Frazier on 22/23 May had a mass of 7 and 5.5 g respectively.

Neither of these figures (nor those from Gaymer, in Benson 1967, p. 86) support any real difference, since four males of *buchenorum* collected had a mass of no more than 6.8, 7.2, 7.6, 7.6, three females 6.0, 6.9, 7.2 g (the heaviest contained an enlarged, yolking egg). But comparative weighing at the same time of day in the same season might show a more definite difference.

It can be seen that in all the Aldabra archipelago forms the bill/wing ratio is less than in nominate *sovimanga*, the reduction being most pronounced in *buchenorum*. From figures in Benson (1967, p. 85), the bill/wing ratio for *N. dussumieri*, of the Seychelles, works out at 38.2

for males, 40.4 for females. But it is not certain that this species is derived from *N. sovimanga* stock, so that the figures may not be comparable. It is conceivable that *N. dussumieri* is of Asiatic, not Malagasy, origin.

Compared to nominate *sovimanga*, certain species in the Comoros, which may have all originated from that species (see especially Deignan, in Benson 1960*b*, pp. 202–203), also show a reduction in the length of the bill. From the averages in Benson (1960*a*, pp. 94–97), the bill/wing ratio works out as follows:

sex	wing	culmen from base	$\frac{100 \times \text{culmen}}{\text{wing}}$
	N. h. humbloti		
♂♂	52.8	19.8	37.5
♀♀	49.2	18.3	37.2
	N. h. mohelica		
♂♂	53.0	18.4	34.7
♀♀	49.2	17.2	34.9
	N. comorensis		
♂♂	56.2	21.7	38.6
♀♀	52.0	19.0	36.5
	N. coquereli		
♂♂	51.8	19.5	37.6
♀♀	47.6	18.4	38.6

However, it is not possible to offer any rational explanation for these variations, since for another, larger species, *N. notata*, Benson (1960*a*, p. 92) gives ratios indicating an increase, not a decrease, in the bill/wing ratio in the two Comoro subspecies compared to the Malagasy one.

Contrary to Benson (1967, p. 86), he (1970*a*) has drawn attention to the existence of an off-season (eclipse) dress in the male of *aldabrensis* and *abbotti*. In this the metallic feathers of the upperside are usually largely replaced by non-metallic olive ones. To a lesser extent this also applies to the metallic of the chin and throat, and the scarlet chest-band and black upper abdomen, while the white of the lower abdomen is completely replaced by olive-yellow. Ten specimens in this type of dress have been examined. In four in particular it cannot be a sign of immaturity. These were collected during the recent expedition, one on West Island on 10 February, the other three at Dune Jean-Louis on 17 March. All had skull fully ossified, and also showed some gonad-activity, one of the Jean-Louis specimens having both testes measuring as much as 5 × 4 mm. Skead (1967, p. 21), who records the existence of an eclipse dress in the males of some southern African *Nectarinia* spp., mentions three instances of females being attended throughout the breeding cycle by males in the eclipse dress, but apparently fertile. The four Aldabra specimens may also have been fertile. On the other hand, in a specimen in the same type of dress collected at Takamaka on 18 February skull-ossification had not started, and it also had a yellow gape and flesh-coloured palate (see below, p. 496). In this case the dress appears to be a sign of immaturity rather than of an off-season adult. Five other specimens collected in March might be one or the other. But two of these five, collected by Nicoll, only differ from males in breeding dress in having the lower abdomen olive-yellow, while another Nicoll specimen seems to have been in process of having non-metallic olive feathers on the chin, throat and upperside replaced by fresh metallic ones. Unfortunately there is no record of the degree of skull-ossification of these three specimens.

There is one further definite instance of the true off-season (eclipse) dress, from a specimen mist-netted by Hutson at Takamaka on 24 February, and released. It was mostly in metallic

dress, but had some fresh non-metallic olive feathers appearing on the forehead, crown, sides of head and mantle, some of them still in sheath. And see below, it also had a black palate. The three specimens of *abbotti*, dated 12/13 March, referred to by Benson (1970*a*) as in an off-season dress, could alternatively have been immature. Their degree of skull-ossification was not recorded. In any case, it is virtually certain that there is an eclipse dress on Assumption as well as on Aldabra. How long this dress may be worn is quite uncertain, and could only be ascertained by the re-trapping of ringed individuals with black palates. But male specimens in full breeding dress, with lower abdomen white, not olive-yellow (or with only the merest trace of it), the scarlet chest-band fully developed, and the full complement of metallic feathering, have been available for 21 September (collected for Lord Rothschild, borrowed from New York), October (collector Abbott, in Cambridge), November (collector Gaymer), December (collector Hartman, borrowed from Yale), and February (all five with testes enlarged). Presumably there is an eclipse dress in all the subspecies of *N. sovimanga*, but this needs further investigation.

There remain for mention five males collected for Lord Rothschild. One of them is in London, the others have been borrowed from New York. The London specimen, dated 13 July, is like others in full breeding dress except that there is some olive tone on the lower abdomen, but not the pronounced olive-yellow of those discussed above which are adults in eclipse dress or immature. Two others, dated 13 July and 24 August, are very similar. Two more, both dated 14 July, differ in having the scarlet chest-band incomplete, with reduction of metallic (hardly any such feathers on the upperside), but again the lower abdomen has only a little olive tone. For none of these five is there any record of the degree of skull-ossification. Possibly they are not fully adult.

Three adult females of *aldabrensis* collected had the palate flesh. Young birds of either sex also had it flesh, with the gape yellow. But in four out of five males in breeding dress, the palate was black, in one dark blackish flesh. In the four adult males in eclipse it was blackish flesh in three, flesh in one. Blackness of the palate appears to be a peculiarity of the adult male, and may furthermore be confined largely to sexually active individuals. Benson (1970*a*) records the same difference in adult males and females of *buchenorum*. We are grateful to R. K. Brooke, who drew our attention to the importance of recording palate-colours in sunbirds. He has made rather similar observations on the African *N. bifasciata*, but we are unaware of any others (but see also Brooke *Bull. Br. Orn. Club*, 1970, p. 11).

Between 31 August and 6 September, mostly on West Island, Benson counted 37 males (all apparently in full breeding dress) and 30 females. Fewer females than males might have been seen because some females were on nests. Also, males tend to occupy more prominent perches. The ratio of the sexes is probably about equal.

Miscellaneous. The origin of 'souimanga' and 'sovimanga' is not known. The one is no doubt a corruption of the other. They are probably derived from a vernacular language in Malagasy, whence the species was described. 'Colibri' is used for *N. dussumieri* in the Seychelles (Loustau-Lalanne 1962, p. 5), and is the ordinary French name for hummingbirds Trochilidae.

***Zosterops maderaspatana* (Linnaeus)** (Malagasy White-eye), Moineau or Oiseau lunette

Status. Abbott (in Ridgway 1895, pp. 537) records white-eyes as 'very common' on Aldabra, but thought the sunbird was 'the commonest bird'. Nicoll (1906, p. 699) did not find them very abundant, but was only on Aldabra for 3 days. On the recent expedition it was found to range

virtually throughout the atoll. It is doubtful if it has suffered from human interference, and is any more plentiful in the east than in the west, as suggested by Stoddart (1968, p. 480). With the exception of the sunbird *Nectarinia sovimanga*, it would appear to be the most plentiful landbird. It is common on Iles Michel and Esprit, in the lagoon. It may compete to some extent with the sunbird, the latter being perhaps the more successful. On Assumption, although *N. sovimanga* still survives in fair numbers, no white-eye has ever been recorded (Stoddart *et al.* 1970). On Cosmoledo and Astove, white-eyes are the less plentiful of the two (Benson 1970*a*, *b*). But on Aldabra, whose land area is much larger, competition may be less severe. In the Comoros, all four islands of which are still larger than Aldabra, from the accounts of Benson (1960*a*, pp. 88–97) and Forbes-Watson (1970), it would seem that in general white-eyes are no less plentiful than sunbirds.

Ecology and food. It has no particular habitat preference, and occurs in any woody habitat, including coastal *Pemphis* and *Casuarina* trees. But it penetrates mangroves to a limited degree only, and probably no individual lives permanently in this habitat. Benson recorded a few in mangroves on Iles Michel and Esprit, and at Takamaka, as did Macnae on South Island opposite Iles Moustique. He also saw a couple on the edge of mangroves near West Channel, and three within this habitat at Main Channel. But Diamond, who spent much time at the eastern end of Middle Island, never saw it in the narrow belts of mangroves there. However, it was very numerous in mangroves at Grand Cavalier, 20 February; eight were watched together, feeding at *Bruguiera* buds, though possibly on something very small living on the buds. There is no evidence anywhere on Aldabra of it breeding in mangroves.

Insects found in stomach-contents of 12 specimens included: in five: Hemiptera, Homoptera; in four: Coleoptera, Curculionidae; in three: Hymenoptera, including two ants; Dictyoptera (oothecae); in one: Diptera, Ceratopogonidae; Annelida, Oligochaeta; Lepidoptera (larva); Psocoptera.

In three, Arachnida (Araneida) were also represented. Plant material was only present in five, and included *Apodytes dimidiata* and *Flacourtia indica* seeds. At Settlement on 6 September, Benson saw a flock of seven apparently feeding on the flowers of *Azima tetracantha*, and at Takamaka on 17 February, he saw white-eyes picking at the soft ripening fruits of a small *Ficus*. According to Abbott (in Ridgway 1895, p. 537) *Casuarina* seeds are eaten, but we did not notice this. Nor have we any evidence of nectar being taken, as Gaymer (1967, p. 121) claims that it is (with the brush tongue). Skead (1967, p. 307) states that *Z. virens* feeds on nectar in southern Africa, though he makes no mention of this for *Z. pallida* or *senegalensis*. Longer corolla-tubes are pierced by the short bill so as to reach the nectar at the base of the tube.

Behaviour and voice. On Aldabra, as elsewhere, white-eyes are usually to be seen in loose, not at all compact, flocks. They are continually on the move, at an average height of 2 or 3 m above the ground, investigating the buds and stems of a variety of shrubs. Abbott (in Ridgway 1895, p. 537) records flocks of 20 to 30. Penny counted 24 in a flock at Takamaka on 23 October, and Grubb even 35 in one at Cinq Cases on 15 February. But only eight to ten is quite normal. Whether in a flock or not, the birds can be approached to within 2 m. But it is Benson's experience that the same applies to *Z. senegalensis*, for example, in southern Africa. Tameness is not a peculiarity of white-eyes on Aldabra.

Penny records the call made by birds in flocks as a soft, high-pitched 'wee-eet'—two syllables on the same note. It is given almost continually. Birds in very small groups, or alone, are relatively silent, but do give this call occasionally. Frazier noted that white-eyes were plentiful

in mixed scrub at Dune d'Messe when he was there on 21 March and again on 16 July, but that on the second occasion there was no strong morning chorus as there had been on the first.

At Takamaka on 11 November, Penny saw a bird on its own make a trilling call, harsher than the 'wee-eet'. Eventually this was repeated by another bird nearby. The first bird joined this second one, and they perched close together, almost leaning on each other. There was mutual preening around the eye, chin, nape and head generally. The bird which was having its chin preened would fling its head back, the feathers being ruffled. Occasionally the two birds would separate a little to indulge in self-preening before closing up again. This performance lasted for about 5 min before the two birds flew away. Mutual preening in *Z. virens* in South Africa is described and illustrated in Skead (1967, p. 305). The process would appear to be similar to that watched by Penny.

An apparent song-call was heard the once by Penny, at Gionnet on 10 December, at 16h30. He describes it as a series of the normal 'wee-eet' notes, but much louder, and odd ones stressed in very syncopated rhythm, slightly lower in pitch—'tyee tyee *tyou* tyee tyee *tyou* tyee *tyou*...'. It was not a melodious call.

Morris (1963, pp. 69, 70), who spent 3 days ashore on Aldabra in the latter part of January, records groups of 10 birds moving purposefully through the trees and shrubs, searching for insects. As they moved, the group kept up an almost continuous low twittering, presumably the same as the 'wee-eet' calling described by Penny. Morris also noted that individual birds sometimes called with a low, rather bell-like 'tee-eep' repeated up to six times. This description does not tally with any of Penny's, but the recording of bird-calls by non-mechanical methods is liable to be extremely subjective.

There is much information on the habits and voice of *Zosterops* spp. in southern Africa in Skead (1967). His book is recommended for further reading. It might open up lines of comparative investigation on Aldabra.

Breeding. Abbott (in Ridgway 1895, p. 537) found a nest in October, and states that it breeds plentifully in December. He found the nest to be neatly constructed of bark fibre and *Casuarina* needles, placed in a bush 6 ft (*ca.* 2 m) above the ground in thick jungle, two pale green eggs being laid. Bendire (1894) does not describe any nest or eggs taken by Abbott, and presumably none were collected.

During the recent expedition no nest containing eggs or young was found, though a number of fresh, empty, nests were, and several were collected. They are open cups of external diameter 60–70, internal 30–40 mm; external depth 35–45, internal 20–30 mm. Penny collected the following fresh nests:

(*a*) 19 September, lying on inland edge of beach north of Settlement, West Island, under a *Casuarina* tree, two 3 mm thick twigs of the tree supporting the nest underneath. It is made of fine fibres and grass-stems of less than 0.5 mm diameter, with a little decoration on the outside of *Casuarina* leaves and *Gossypium* wool. Later, a flock of six white-eyes was feeding in the tree above.

(*b*) 26 December, on ground at south end of Settlement, made of fine fibres and grass-stems as last, with a *Casuarina* seed incorporated into the wall, and some *Gossypium* wool on the outside.

Benson saw a nest near East Channel, 14 January, 3 m up in a *Pemphis* bush, and inaccessible. The cup structure appeared to be complete, though one of the parents was still adding material. On Ile Esprit, 13 February, he saw four old nests, between 2 and 3 m up in *Pemphis* bushes. One of them was collected. The bottom of the nest is unsupported, but most of the

rim is attached to *Pemphis* stems of diameter about 3 mm. It is constructed mostly of fine filamentous algae strands, and lined with fine *Eragrostis* grass stems. Another nest was seen on Esprit the same day, also in a *Pemphis* bush, 3 m up. It was almost complete, though material was still being added. One of the parents was seen in the cup, shaping it. A fresh empty nest was found on 20 February at Takamaka, and was collected on 25 February, when it was still empty. It was 4 m up in the top of an *Allophylus* bush. It is attached in the same way as the Ile Esprit nest, and the materials are also similar, the lining in addition including some fine rootlets.

Several males collected in February showed some gonad activity. Thus in one from Takamaka, 19 February, both testes measured 6 × 4 mm, and in one on 24 February, both 5 × 4 mm. In a male from Dune Jean-Louis, 15 March, the right testis measured 5 × 4, the left 6 × 5 mm. A female collected on Ile Michel, 20 January, held a yolking oocyte of diameter 3 mm. A juvenile collected at Takamaka on 18 February (see under *Systematics*) might have been from an egg laid in early January. The breeding season would appear to extend from mid-September (when Penny found a fresh nest) to March. Benson (1970*b*) also got evidence of breeding on Astove in March. In Malagasy, Rand (1936, p. 473) records breeding in September and October, and van Someren (1947, p. 262) found a nest with eggs in March. Benson (1960*a*, pp. 89–91) records breeding for *Zosterops* spp. in the Comoros in September and October, but the season is probably more extensive. For south central Africa, Benson *et al.* (1964, p. 93) give 65 egg-laying records for *Z. senegalensis*, all within the period August to March. They include 45 for September to November, but only eight for January to March. Possibly there is some 'tail-off' in the rains, this perhaps applying on Aldabra too.

Systematics. Moreau (1957) has provided a very full discussion of variation in the western Zosteropidae, including the Malagasy region. Benson (1969) has added some further details for the islands northwest of Malagasy, from Gloriosa to Aldabra. *Z. m. aldabrensis* is a recognizable subspecies, endemic to Aldabra. As already mentioned, no white-eye has however ever been recorded from Assumption, and none may ever have existed there. Astove specimens are inseparable from greener backed ones of *Z. m. maderaspatana*, from the more humid parts of Malagasy. Those from Gloriosa are yellower, resembling specimens from the drier areas of Malagasy, mainly in the southwest. Benson separated three specimens from Menai Island, Cosmoledo, as *Z. m. menaiensis*, paler than Astove specimens. But this requires further justifying (Benson 1970*a*). Apart from this, two of the Menai specimens are of special interest because they are a mixture of grey and green above. The only other such specimen known is one which was probably collected in Malagasy, more than 80 years ago, and is the type of Tristram's *Z. hovarum*. Such aberrants might occur on Aldabra, though their numbers could only be extremely small, or they would have already been noticed.

Z. m. aldabrensis is more yellow above than *Z. m. maderaspatana* of Astove, though not so yellow as in the Gloriosa population. The yellower birds may have reduced melanin, a reflexion of a drier climate, that of Gloriosa perhaps being the driest of the three islands. The wing lengths provided by Moreau (1957, p. 428), augmented by Benson (1969), indicate that *aldabrensis* is smaller than nominate *maderaspatana*, five specimens listed by Moreau from Malagasy above 1200 m having the longest wings of all. Possibly this variation is a general reflexion of differences in temperature (Bergmann's Rule). The tail/wing ratio is highest in *aldabrensis*, as detailed by Moreau and Benson. Variation in this respect in African species is discussed by Moreau (1957, pp. 336–337), but he could not suggest any biological reason for such differences, and

this is no more possible in the present case. There are the following figures for a ratio 100 × bill/wing:

number of specimens	area	ratio	notes
	Z. m. maderaspatana		
55	Malagasy below 1200 m	23.7	From Moreau (1957, p. 428)
5	Malagasy above 1200 m	23.2	
7	Gloriosa	24.6	Calculations from Benson (1969). Gloriosa figure identical with Moreau's figure
4	Astove	23.9	
3	Cosmoledo (Menai Island)	23.8	
	Z. m. aldabrensis		
15	Aldabra	24.2	

Unlike those for *Nesillas aldabranus* and *Dicrurus aldabranus*, these figures do not indicate any tendency to a longer bill on the small islands compared to Malagasy. Nor do Moreau's figures, augmented by Benson (1960*a*, p. 88), suggest any such tendency in the Comoros either. In fact *Z. mouroniensis*, of Grand Comoro above 1700 m (over 5000 ft), has a shorter bill. Nevertheless, an increase in bill length is well marked in Moreau's (1957, p. 429) figures for *Z. curvirostris* of Mauritius and *haesitata* of Réunion, particularly the former (for changes of these names to *Z. olivacea* subspp, see Moreau, in Paynter & Mayr (1967, p. 336)).

Measurements and masses (the latter all for January/March specimens) are given by Benson (1969). Eight more specimens were mist-netted by Frazier and Lowery on 22/25 May, and released. These had wing 48–52 (50.8), tail 39–43 (41.1) mm, and had a mass of 6–8 (6.9) g. These figures agree fairly closely with the earlier ones.

The colours of soft parts of specimens were: bill, upper mandible black, lower pale grey; legs and feet bluish grey, soles dull ochre; irides red-brown; palate white or very pale flesh. A fledged juvenile, in which skull ossification had not started, collected at Takamaka on 18 February, only differed from the foregoing description in having the irides greyish brown instead of red-brown. The only difference in plumage is that the ring of white feathers around the eye, although fully developed, is slightly tinged with yellow instead of being plain white. Still younger birds, but otherwise fully feathered, may be expected to lack the ring (Moreau 1957, p. 417; Benson & Irwin 1967, p. 92).

Miscellaneous. The vernacular name Moineau is French for a sparrow, while Oiseau lunette is French for a white-eye. Both names are presumably importations from the Seychelles, though Loustau-Lalanne (1962, p. 12) gives Oiseau Banane for *Z. modesta.*

***Foudia eminentissima* Bonaparte** (Red-headed Forest Fody), Cardinal, Toq Toq or Serin

Status. This is another plentiful and widespread species, though there are few records from Dune d'Messe or Dune Jean-Louis, in the southwest of South Island. In the lagoon it occurs (and nests) on Iles aux Cèdres, Michel and Esprit, and even on tiny islets south of Gionnet and in East Channel. It has also been recorded from Iles Moustique (Macnae) and Gros Ilot (Penny).

Care should be taken to avoid any introduction of *F. madagascariensis* onto Aldabra. Through competition, this might adversely affect the status of *eminentissima. F. madagascariensis* has been introduced from Malagasy, probably through human agency, to various islands in the Malagasy region, but it is unknown at present anywhere in the Aldabra archipelago. Admittedly there is little apparently suitable feeding habitat on Aldabra itself for this savanna species, though

at least it might thrive around Settlement. Furthermore, in the Seychelles *madagascariensis* nests in coconut palms (Crook 1961, p. 546), which on Aldabra are numerous at Anse Mais and on Ile Michel as well as at Settlement, and are virtually unoccupied by *eminentissima*.

Ecology and food. It is much in evidence in *Casuarina* trees, which are relatively extensive at Settlement, and occur at other scattered points on the northern side of Aldabra. Abbott (in Ridgway 1895, p. 539) stresses this association, the trees providing nesting sites, their needles (leaves) being used in the building of nests, and the seeds being eaten. This tree may be a recent colonizer of Aldabra, its subsequent spread thereon perhaps aided by man, within the last 100 years. The arrival of the fody was surely much earlier. Its degree of differentiation is considerable. This may have taken a long time to achieve, and 1968 specimens show no difference from those collected by Nicoll in 1906 (in London) or from a male in Cambridge collected by Abbott in 1892. The association with the *Casuarina* should not be stressed unduly. Fodies and their nests are particularly easily seen when in these trees, and the area occupied by the latter relative to that of Aldabra as a whole is but small.

In Abbott's time the fody was already associated with man, since he (in Ridgway 1895, p. 539) found that it came to feed on crumbs and scraps around houses. It still does so at Settlement today, as reported by Gaymer (1967, p. 122). Nicoll (1906, p. 699) reports in similar terms, and suggests (quite reasonably) that 'it seems to take the place of the English Sparrow'. Legrand (1964) found that a broom which he had bought in Mahé for sweeping his hut was spoiled by the birds, which pulled out the tips of the rice straws with which it was made, for building a nest. No such association with man has been noted for this species in Malagasy (Rand 1936, p. 482) or in the Comoros (Benson 1960*a*, p. 101), though in the Seychelles Crook (1961, p. 526) records both *F. sechellarum* and *madagascariensis* as taking human food debris frequently near habitations. On Aldabra it is a peculiarity of Settlement. Man does not live permanently elsewhere on the atoll, and unlike the crow the fody is not particularly in evidence at temporarily occupied camps.

It may be said that, wherever there is woody vegetation on Aldabra, the species is probably present. Its sparseness at Dune d'Messe and Dune Jean-Louis has already been noted. Around the camp at the former, on 8–9 September, Benson and Penny saw only two birds—both males, one in full, one in partial, breeding dress. At least in the latter locality this sparseness must be real, since Frazier was camped there for 92 days but has only one record. Possibly the scrub in these areas is too low and thick to be suited to fodies. Around Takamaka, where it is taller and generally more open, they are plentiful. It needs stressing that in Malagasy *F. e. omissa* is evidently essentially a forest species, even though it does venture into more open country to occur alongside *madagascariensis* (Rand 1936, p. 482). In the Comoros, Benson (1960*a*, p. 99) found rather strict segregation between the two species, *eminentissima* inhabiting mainly the interior of evergreen forest. It is interesting that it should have managed to colonize Aldabra, where the climate appears to be relatively arid. The habitat originally occupied might have been mangroves, physiogonomically perhaps the closest approach to evergreen forest. Subsequently the scrub on the raised parts of the atoll could have been invaded, and finally, after their establishment, *Casuarina* trees. To what extent (if any) *F. eminentissima* may inhabit mangroves in Malagasy in the present time is unknown. In the Comoros they are relatively inextensive, and Benson got no record of his own from this habitat, though spent little time in it. On Aldabra it occurs widely in mangroves, and there are three records in table 5 of occupied nests in the interior of this habitat. But possibly no individual resides therein permanently.

Thus on Ile Michel, 17 January, Benson saw a male in breeding dress make several visits into mangroves, from a *Casuarina* grove in which it had a nest. In the case of very small islets used for nesting, see table 5, the parents probably obtain much food elsewhere. This is discussed further under *Breeding*. At Cinq Cases Penny noted that fodies were not common in open woodland on platin, but the numbers increased with the density of cover, until in thick bush (especially mangroves) it was abundant.

TABLE 5. OCCUPIED NESTS OF *FOUDIA EMINENTISSIMA ALDABRANA* RECORDED IN 1967/8

date	locality	particulars of site	height above ground/m	contents and other remarks†
20 Nov.	East Channel	*Pemphis* shrub, on small islet	1.0	*C* = 3, overhanging water
6 Dec.	Cavalier	*Avicennia* (mangrove fringes)	2.0	*C* = 2
11 Dec.	Gionnet	*Pandanus* tree	1.0	*C* = 3, ♀ incubating, ♂ nearby
18 Dec.	Takamaka	*Pandanus* tree	1.5	*C* = 3
23 Dec.	East Channel	*Ceriops* bush	1.2	*C* = 3. At 17h00 on 10 Jan., *N* = 3; at 12h00 on 11 Jan., empty, but one feathered young below nest (Ald. 1 in table 6)
11 Jan.	East Channel	*Pemphis* shrub, on small islet	1.0	*N* = 2 recently hatched, plus one egg. On 22 Jan., *N* = 2 only, which 'exploded' out of nest
16 Jan.	East Channel	*Pemphis* shrub	1.2	*C* = 1 dead fresh, which fell out of nest when ♀ left
31 Jan.	1.75 km south of Gionnet	low bush next to a *Scaevola*, on islet of 60 m²	0.6	*C* = 3
1 Feb.	1.75 km south of Gionnet	on top of a sedge *Cyperus*, on another small islet	0.6	*N* = 2 *ca.* 4 days old
2 Feb.	Main Channel	interior of mangroves	1.0	*C* = 1. Height is that above water at high tide
7 Feb.	Anse Mais	*Euphorbia abbottii* shrub	1.5	*C* = 3
7 Feb.	Anse Mais	*Euphorbia abbottii* shrub	1.5	*C* = 1
13 Feb.	Ile Esprit	*Pemphis* shrub	2.5	*N* = 3 feathered, two of which 'exploded' out of nest
16 Feb.	Takamaka	*Polysphaeria* shrub	1.5	*C* = 2, still so on 16 and 19 Feb., warm on both occasions
18 Feb.	Takamaka	*Sideroxylon inerme* shrub	3.0	*C* = 3
26 Feb.	Takamaka	interior of mangroves (in *Ceriops*)	4.0	contents not known, but ♀ flew out, and ♂ nearby. Canopy of mangroves at 7.5 m
27 Feb.	Takamaka	interior of mangroves (in *Rhizophora*)	6.0	contents not known, but ♀ entered nest. Canopy as in previous record
11 May	Settlement	*Casuarina* tree	7.5	*N* = 2, plus one egg. Nestlings (two) fledged on 21 May

† *C* = clutch of egg(s); *N* = nestling(s).

With regard to the one record from Dune Jean-Louis mentioned in the last paragraph, Frazier tells us that he saw the bird very early in his stay there. It almost seemed to him that he, his tent, etc., were being investigated by the bird. On 22 January he had a similar experience while resting under a large *Pemphis* bush, between Dune Jean-Louis and the turn-off to Takamaka, in the course of a walk along the south coast. A male fody and two bulbuls 'inspected' him, disappearing after a few minutes.

As discussed under *Systematics*, the Aldabra form has an unusually heavy bill, suggesting that it is adapted to a wide range of food sizes. Abbott (in Ridgway 1895, p. 539) records feeding on crumbs and scraps around houses. He also found that besides *Casuarina* seeds, they ate unripe maize if opened by rats. As Gaymer (1967, p. 122) points out, since the bill is very powerful, they must have been so unfamiliar with maize that they only ate it when exposed. We did not see any maize, and so cannot say whether by now they might have learned to eat it when unopened. Gaymer records feeding on seeds, flowers and beetles, taken from among bushes and trees, or from the ground. As in Abbott's day, as noted both by Gaymer and by ourselves, crumbs, rice and kitchen scraps are eaten around the houses at Settlement, and *Casuarina* seeds are also taken. At East Channel in mid-November, Penny watched three recently fledged birds (judging from their 'fluffy' appearance) taking insects from twigs and the backs of leaves, only 0.6 m from his face. The stomach contents of 11 specimens collected during January/March were preserved. Ten of these were adults, and they contained a surprisingly high proportion of small-sized insects. In fact only five of them had been taking any plant material, none of which was identifiable. Insects were represented as follows: in all ten—Coleoptera (mainly Curculionidae, including some larvae); in five—Dictyoptera (oothecae); in two—Hymenoptera (ants), Orthoptera.

Arachnida (Araneida) were represented in three of these adults, and some sand also in three. The stomach contents of a juvenile (Ald. 1 in table 6) were in order of abundance Coleoptera (mainly Curculionidae), Dictyoptera (oothecae), Arachnida (Araneida), and some pieces of a Mollusca shell, though possibly in reality sand. At present there is no actual evidence that the heavy bill is used for the taking of any particularly large-sized food, but obviously further investigation is required.

Behaviour and voice. The association of *F. eminentissima* with man at Settlement has been mentioned on p. 501. It is everywhere tame on Aldabra, but more especially there. It will take crumbs off a table on a verandah, and can almost be caught by hand. No such tameness was noted by Benson (1960*a*, p. 24) in the Comoros, though in the Seychelles Crook (1961, p. 525) records *F. sechellarum* as entering a house fearlessly to pick at an over-ripe banana in a fruit dish.

The following extract in regard to display may be quoted from Gaymer (1967, p. 122):

'Males are strongly territorial, with a characteristic threat display, in which the wings and tail are drooped, and the head, breast and rump feathers puffed out. The intruder is then challenged with a series of wheezing or fizzing calls, and a metallic "ching-ching".' A female may be so challenged, but on recognition the calls become a series of thin high whistles at about half-second intervals, uttered by one or both sexes. The male then raises his wings high and quivering above his back (in obvious contrast with the threat posture) and if accepted mounts and copulates with the crouching female, keeping his wings raised.'

On Ile Michel, 17 January, Benson watched a male near a nest not yet complete, in a *Casuarina*, some 2 m up. Although no female or intruder was apparent, he flew from one

prominent perch to another, at about 3 m above the ground. At each perch the rump feathers in particular were puffed out, and the wings drooped. Once he went to the entrance of the nest, facing into the interior with the wings spread out (perhaps merely for support). On an islet in the lagoon, south of Gionnet, 30 January, Diamond saw a male facing a female, less than 1 m away. The male had the feathers of the rump, back and crown raised, particularly of the rump, the wings half opened and the head slightly lowered. When the female flew off, he followed her.

TABLE 6. SPECIMENS OF *FOUDIA EMINENTISSIMA ALDABRANA* COLLECTED IN 1968

collector's number	date	gonad activity	remarks
		males	
		(*a*) in breeding dress	
Ald. 26	24 Jan.	both testes 8 × 8 mm	red on head, chest and rump fully developed, also black around eye. Feathers of mantle and wing coverts worn, margined with olive. Rectrices partially very worn. Bill black
Ald. 35	29 Jan.	right testis 9 × 6, left 11 × 6 mm	
Ald. 49	10 Feb.	both testes 9 × 7 mm	
Ald. 127	19 Mar.	both testes 5 × 4 mm	
		(*b*) moulting to non-breeding dress	
Ald. 126	19 Mar.	both testes 4 × 3 mm	as above four specimens, but assuming ♀-like pattern on head. Crown and chest partially rufous brown; bill change to 'blackish horn'
		(*c*) in non-breeding dress	
Ald. 27	25 Jan.	testes small	no red, or black around eye. Crown and rump rufous brown, likewise margins to mantle and wing-covert feathers (not olive as above). Dress fresh. Skull only *ca.* 50 % ossified. Bill 'brownish horn'
Ald. 131	23 Mar.	testes small	As Ald. 27, but with a few red feathers scattered on underside, and olive rather than rufous brown tones on upperside. Dress mainly fresh, but remiges and rectrices in moult. Skull fully ossified. Bill 'brownish horn'
JF. Ald. 5	22 May	right testis 2 × 2, left 3 × 3 mm	no. 5 has red fully developed except for some reduction on rump; black around eye fully developed. Other two with red much reduced (in no. 7 it is partially orange), and no black around eye. Mantle and wing-covert feathers margined with olive. No moult apparent, dress fresh. Bill 'black and horn'
JF. Ald. 6	21 May	testes small	
JF. Ald. 7	22 May	testes small	
		(*d*) juvenile	
Ald. 1	11 Jan.	testes minute	rufous brown tones above, as in Ald. 27. In fresh dress. Not fully grown, see measurements in text. Bill 'pinkish white, gape yellow'
		females	
Ald. 2	12 Jan.	oocytes up to 5 mm in diameter, yolking	Ald. 28 is the aberrant 'yellow' specimen, see text. The others are like Ald. 27, lacking any red, or black around eye, but the tones above are olive, not rufous brown. Ald. 28 is in a fresher dress than the other four, which, like Ald. 26, 35, 49 and 127, are markedly worn on the mantle and wing-coverts, the rectrices partially very worn. All five specimens have bill 'horn'
Ald. 19	20 Jan.	oocytes up to 2 mm in diameter	
Ald. 23	22 Jan.	oocytes up to 2 mm in diameter	
Ald. 28	25 Jan.	ovary(?) very small	
Ald. 79	24 Feb.	no record	

The above specimens were collected by Benson; except JF. Ald. 5–7, by Frazier.

Penny describes the display song of the male, sometimes heard from birds not in full breeding dress, as in three parts: two or three pairs of 'yodelled' notes, the first of each pair being an octave above the second, and quite high in pitch; then a very high pitched trill ('fizzing'); finally a hollow, rather faint series of notes on a rising scale ('bottle-filling'). The whole might be expressed as 'tsee-oo tsee-oo tsee-oo fsssssss looklooklooklooklook'. This song, which is made from a perch, is accompanied by characteristic postures, in which the breast and rump feathers are raised, and the wings depressed. On one occasion in mid-November, about 1 h before sunset, Penny saw two males chasing each other over East Channel from the direction of the camp at the eastern end of Middle Island. One bird was routed. The successful bird then returned over the camp, performing a 'parachute' flight, in which the wings were held at right angles to the body, which was inclined upwards. The bird then fell about 4 m vertically. Finally it alighted on a tree, and gave the display song.

Penny also finds that there is a wide range of calls by birds near their nests, and while feeding. They are based on a metallic, high-pitched 'tweet' or 'tee' call. One of the most common consists of about three quick lower notes followed by two or three higher, more deliberate ones—'teetiti twee twee'. Also frequently heard is a series of single deliberate 'tweet' notes, in which both the 't' and the 'w' can clearly be heard. A male building a nest at Cinq Cases went through a large part of the fody vocabulary before delivering the full song. Starting with a series of staccato 'twits', he built up the call to a longer one of several high notes followed by two lower, more mellow notes—'tee tee tee tee, too too'. Gradually, a stress was placed on the last 'tee' until the 'yodelling' notes ('tsee-oo tsee-oo') were heard. Then the 'fizzing' came in, and after several false starts the whole display song-call was given. Other calls are too numerous and similar to be listed; but the single 'tweet' and piercing variants of it may be thought of as warning or alarm calls, and the 'tee tee tee tee, too too' group as territorial and communicative calls.

A few notes on behaviour when nest building are included on p. 507. Flocking is mentioned on pp. 506 and 510. But normally the birds are solitary, in pairs, or possibly family parties.

Breeding. Table 5 contains a summary of occupied nests found during the recent expedition, by various observers.† According to Bendire (1894), Abbott collected four clutches of eggs, between 13 November and 10 December, while Gaymer (1967, p. 122) also records four clutches, for some time during the period 4 October/14 December (1967, p. 114). Possibly egg-laying starts as early as September, since Benson noted two fresh, complete nests at Settlement on 5 September, also one under construction at Anse Cèdres on 12 September, and Penny a fresh, complete one at Takamaka on 22 September. However, the earliest record of eggs is 13 November (Bendire 1894). There are a number of records in the table indicating egg-laying in February, and one for well on into April, though this is probably exceptional. It would seem that breeding starts before the rainy season, and continues through it, as in general is the case with the genus *Ploceus* in south central Africa but not *Euplectes*, whose breeding coincides largely with the rains—see the data in Benson (1963*b*, p. 631) and Benson *et al.* (1964, pp. 97–100). In the Comoros, Benson (1960*a*, pp. 101, 102) records gonad activity in *F. eminentissima* in

† A nest containing a single egg was found at Settlement, 19 February 1969. It was 1 m up, in a *Casuarina* tree. A female was in attendance. A female perched on a branch 3 m up in dense mangroves on Grand Cavalier, 20 February, laid an egg which broke on the ground. There was a male nearby, displaying with a wheezing song. But an intensive search for a nest was fruitless. The shells of two recently hatched eggs were found on an islet ⅓ km south of Polymnie, 5 April. No nest was found, but there were adults present giving loud alarm calls.

September, feathered young on 19 October, and (on Moheli) Forbes-Watson (1970) found eggs soon to hatch on 19 October also.

There is only one record in the table, plus one later record, of nesting in *Casuarina* trees, though we have over 20 records of nests under construction or old ones, or whose contents could not be ascertained, in this habitat. Gaymer (1967, p. 122) notes that nests in mangroves are rare, though there are three records in the table from the interior of this habitat, and we have a couple more of old nests therein. Bendire (1894) mentions a nest with eggs found by Abbott 'in a mangrove'. There is one record in the table from an *Avicennia*, in mangrove fringes, and several more of unoccupied ones—in one case in an isolated bush well out in the open, quite unconcealed. In the mixed scrub around Takamaka, besides the records in the table of nests in shrubs of *Polysphaeria* and *Sideroxylon*, old ones were noted in *Calophyllum inophyllum*, *Jasminum*, *Mystroxylon* and *Tarenna*; and at Settlement, in addition to *Casuarina* trees, old ones in low shrubs of *Azima tetracantha* and *Ochna ciliata*. There is also one record from Settlement of an old nest in the fronds of a coconut palm, commonly utilized by *F. madagascariensis* in the Seychelles, as already noted.

The two records in the table from islands south of Gionnet provide a striking contrast, so far as site is concerned, with those from the interior of mangroves or *Casuarina* trees, for example. These islets are deeply dissected, largely covered with *Pemphis*, each of area not more than about 60 m^2. The southernmost is some 1.75 km south of the northern entrance to the Passe Gionnet. On 10 December Diamond saw nest building on a number of them, more especially those on which the coverage of *Pemphis* was dense. Gaymer (1967, p. 122) suggests that 'Territories may be as small as 1000 square yards in groves of larger trees'. But the situation on these islets is quite different. Presumably food is largely obtained elsewhere. There is a relatively large mangrove-covered island in the vicinity which has been called Gros Ilot, but is not to be confused with the island of this name, almost due south, on the lagoon side of South Island. One of the two occupied nests was on an islet only about ½ km southeast of this island, but unless food is obtained in the mangroves thereon, a journey of about 1 km would be involved, to the nearest more open habitat available, at the western extremity of Middle Island. Possibly there are no birds on these islets except in the breeding season, and even when breeding they might flock to feed elsewhere, although Gaymer notes that 'Flocks of breeding adults may be formed while breeding, but this is unusual'. However, Penny saw a flock of 11 males, with red fully developed, on West Island on 30 November, and another of similar size there the following day. Benson saw three such males feeding in the same *Casuarina* tree, on the seeds, on the east side of Main Channel, 1 February.

According to the table, the height of a nest above the ground can vary from 0.6 (as on the islets south of Gionnet) to 7.5 m, as in the one in a *Casuarina*, and in several others in these trees, and the only one in the fronds of a coconut palm, which are not in the table. A clutch size of three seems more usual than two, one egg of a $C = 3$ sometimes not developing. Although Abbott (in Ridgway 1895, p. 539) gives the clutch size as four, according to Bendire (1894) he collected two $C = 2$ and two $C = 3$, between 13 November and 10 December, while Gaymer (1967, p. 122) records four $C = 3$. Thanks to him and R. A. A. Blackman (personal communication), the following are further details of these clutches, in fact five separate ones, all found at Takamaka in 1964: 23 November, $C = 3$; 26 November, $C = 3$; 26 November, empty nest, $C = 2$ on 27 November, $C = 3$ on 28 November; 30 November, two young and one egg; 1 December, $C = 3$.

There are few data for the species from elsewhere than Aldabra for comparison. Rand (1936, p. 482) makes no mention of a nest at all. In the Comoros, the only occupied nest found by Benson (1960*a*, p. 102) contained two young and an infertile egg, while Forbes-Watson (1970) found a $C = 3$ soon to hatch on Moheli, 19 October. It is interesting that the clutch size of *F. sechellarum* is less. Loustau-Lalanne (1962, p. 7) gives it as two, occasionally three, but Crook (1961, p. 528) is more specific, recording 15 $C = 1$ and 51 $C = 2$. It would be interesting to ascertain the clutch size of *F. flavicans* on Rodriguez. Sharpe (1879, p. 462) mentions 'Two eggs taken by Mr Gulliver'. Gulliver also collected two nests, and it is possible that there was one egg in each.

Gaymer (1967, p. 122) states that the male assists in nest construction but not in incubation. A nest still incomplete on Ile Michel, in a *Casuarina*, was watched by Benson between 08h45 and 09h45 on 20 January. The male visited the nest on 18 occasions, entering it, apparently to shape the interior, but only twice bringing building material. Once he plucked a *Casuarina* seed from the immediate vicinity of the nest, and may have done so on other occasions too. The female visited the nest only three times, apparently without any material. The first time she entered it, while the male was immediately below. The second time, when the male was inside the nest, she perched immediately below. He came out, and chased her away. The last time, the male arrived first and perched below the entrance. He was immediately followed by the female, who entered the nest, staying inside for $\frac{1}{2}$ min after which they both flew off. Penny saw a male in partial breeding dress carrying building material at Takamaka on 11 November, and a male building at Cinq Cases on 7 November, likewise at Gionnet on 10 December. These scanty observations suggest that most of the construction is done by the male, though the female does take some part. This is in accord with the observation of Crook (1961, pp. 537, 538). There are two records in the table of the female incubating eggs, and probably the male takes no part. There is no information about the feeding of the nestlings, though Crook (1961, p. 538) found that in *F. sechellensis* and *madagascariensis* both parents do so. Nor are there any data on the incubation and fledging periods, for comparison with those given by Crook (1961, p. 529).

The eggs are described by Bendire (1894) as pale glaucous green in colour. We did not collect any, but all seen appeared to resemble Bendire's description. It is sufficient to call them pale blue, as did Gaymer (1967, p. 122). None had any markings. From the Comoros, Forbes-Watson (1970) describes Moheli eggs as pale plain blue, though an Anjouan egg had a few tiny black dots and specks (Benson 1960*a*, p. 102). The domed nest with side-entrance has been described by Bendire and by Gaymer. The walls of four nests which we collected were made of roots, including in one a few of a grass *Dactyloctenium aegyptium*, while those of two contained some tendrils and stems of *Passiflora suberosa*, and of one some *Achyranthes* stems. In one there was a little outside decoration of *Usnea* lichen, in another a little of the marine angiosperm *Cymodocea ciliata* and a few *Casuarina* leaves. All four were lined with *Eragrostis* grass stems, and in one there was also a little cotton lining. Legrand (1964) describes a nest which was apparently made entirely of rice straws from his brush, and inside there was padding used for the cleaning of his entomological instruments, collected, so he says, by the female in the early morning.

Nests in *Casuarina* trees are often very conspicuous, though those in thick scrub, in which a number were found around Takamaka, are much less so.

Systematics (including seasonal changes and aberrant plumages). Benson (1967, p. 87) has

summarized the characters of *F. e. aldabrana*. It is a very well-marked subspecies, with an unusually stout bill, and showing colour characteristics which seem to be in reflexion of a rather dry climate. The contrast with the slender bill of *F. rubra*, of Mauritius, said to subsist on insects (Moreau 1960, p. 39) is particularly striking. The bills of the various forms of the genus *Foudia* are illustrated in Moreau (1960, p. 34).

Whether *F. e. aldabrana* is derived from Malagasy or from the Comoros is a matter for conjecture only. Moreau (1960, p. 45) does suggest as one possibility that the *omissa* (i.e. *eminentissima*) type was evolved in the Comoros (ex Africa), and thence established itself in Malagasy. If this was the case, it is quite possible that it is of Comoro rather than Malagasy origin. Of course, the fact that *eminentissima* is unknown on other islands in the Aldabra archipelago between Aldabra itself and Malagasy does not preclude the possibility of a Malagasy origin. These islands are all so small that they might not be able to support a population of fodies. The number of species of land birds on them is considerably smaller than on Aldabra (p. 420). But they might nevertheless have been utilized as 'stepping stones' in the colonization of Aldabra.

Benson (1967, p. 88) gives measurements for eleven males and three females of *F. e. aldabrana* collected and preserved. The following additional figures are available from recently collected material:

	wing	tail	culmen from base
10♂♂	78–82 (81.0)	52–57 (53.8)	18–20.5 (18.7)
5♀♀	72–77 (74.2)	46–50 (48.6)	17–19.0 (18.2)

Six of these males had a mass of 24.5–27 (26.2) g, the five females 20–27.5 (22.5) g. These figures agree fairly closely with Gaymer's (in Benson 1967, p. 89). A fully feathered juvenile male caught by hand below an empty nest on 11 January—18 h previously it had contained three young—had wing 52, tail 20, culmen 13 mm, and had a mass of 19 g. All these specimens are further detailed in table 6.

The following data are available from specimens mist-netted by Diamond at East Channel or Gionnet during January, and released:

number of specimens	wing/mm	mass/g	notes
		presumed males	
20	76–83 (80.0)	21.5–30 (25.2)	19 with red fully developed, other with some red
		immature male (?)	
1	78	24	(*a*)
		presumed females	
11	73–77 (74.4)	21–27 (23.7)	(*b*)

Notes. (*a*) This specimen had no red feathers at all. Conceivably it was an unusually large female. It had a mass of 24 g at 10h00 on 11 January, 23.5 g on re-capture at 08h30 the following day.

(*b*) None of these had any red feathers except for one (wing 73 mm) which had three on one cheek and two on the chin. Gaymer (Benson 1967, p. 89) gives three juvenile males showing traces of red as having wing 72 (misprinted as 62), 76, 76 mm, but these might all also be females. All eleven specimens above are assumed to be females, and they show hardly any overlap in wing length with the presumed males. The mass of one of the females (30.5 g, with wing

76 mm) is not included above. This is exceptionally heavy. Possibly it was laying eggs. The one which had a few red feathers had a mass of 23 g at 14h30 on 11 January. It was subsequently re-captured twice, when it had a mass of 23 g again at 13h00 on 13 January, and 21.5 g at 08h30 on 23 January. Another specimen in this series had a mass of 22.5 g at 18h15 on 11 January, but 25 g on re-capture at 14h30 on 16 January. On the second occasion it had been flushed 2 h previously from a nest containing a single egg, which fell out. This egg was dead fresh.

Other specimens were caught by Hutson at Takamaka in February, and released. They gave the following results (some were only weighed):

wing/mm	mass/g
(i) presumed males (red fully developed)	
79, 80, 81, 81, 83	23, 26, 26, 26, 27
(ii) presumed females (red absent)	
72, 74, 74	18, 20, 23, 23, 24, 25

One of the specimens under (i), caught on 24 February 1968, is of particular interest because it bore a single red ring on the left leg, not overlapping. This bird was ringed at Takamaka in late November 1964 by the Bristol Seychelles Expedition, so that at the time of recovery it was more than three years old.

Further specimens were caught by Lowery at Settlement on 21/24 May, measured and weighed by Frazier, and released. They give the following results, divided as seems justifiable according to the wing lengths:

	wing/mm	tail/mm	mass/g
7♂♂	78–82 (80.3)	51–58 (55.4)	21–26 (25.1)
8♀♀	70–76 (73.0)	49–55 (51.5)	18–24 (20.6)
3 juvs.	67, 67, 72	33, 47, —	19, 22, 23

Of the presumed males, two had red on the head and chest fully developed, bill black; three had some red, one with bill black, two 'horn' coloured; two with no red, bill 'horn'; one with no record as to red (if present), bill 'horn'. Of the presumed females, one (wing 72 mm, mass 20 g only) had some red, the remainder none, while all had bill 'horn'. Two of the males, and all of the females, had the remiges and/or the rectrices in moult. All of these birds were ringed.

Lowery and Frazier caught six more specimens at Settlement on 30 July. Three presumed males, with some red on the head, had wing 79, 81, 83, tail 57, 61, 61 mm, and had a mass of 25, 26, 27.5 g. Three presumed females, lacking any red, had wing 73, 74, 77, tail 53, 54, 58 mm, and had a mass of 19.5, 23.5, 26 g. Another specimen was a re-capture from 23 May, when it had the head and chest completely red, the bill black, and this was still the case. None of these specimens showed any moult.

The specimens recently collected and preserved are detailed in table 6. Benson (1967, p. 88) records a non-breeding dress, on the basis of two males and two females in Paris, collected in May. But it is doubtful whether, as he indicates, rufous brown tones on the upperside (as against olive in a breeding dress) can be taken as a characteristic of a non-breeding dress, though it may be that young birds are always this tone of colour. The juvenile in the table is decidedly rufous brown, as also is Ald. 27, evidently also not adult. In older birds there seems to be individual variation. Thus in the males Ald. 126 and 131, and JF. Ald. 5, 6 and 7, either moulting into or in a non-breeding dress, the tones are olive rather than rufous brown, with the exception of Ald. 126, which is acquiring a rufous brown crown and chest. The brownish

wash across the chest and flanks, also mentioned by Benson as a characteristic of a non-breeding dress, may also be variable. It is actually best marked in the two young birds Ald. 1 and 27. Nevertheless, Ald. 126, which may be regarded as adult, and is losing the red, shows rufous brown on the chest. Benson did not see any such moulting birds in January, nor in February until the 27th, when he saw one at Takamaka with a yellowish female-like superciliary becoming apparent. Another such bird was seen at West Channel on the 29th, and in March birds with only partial red on the head were frequent. But it is evident from JF. Ald. 5 that in some individuals the red is either retained, or moulted and replaced almost entirely by red feathers. The mantle and wing-covert feathers, as in Frazier's two other males, are fresh, in contrast to the first six specimens in the table. They are also fairly fresh in two males collected by Gaymer on 30 November. Frazier also noted a flock of some 30 birds on 11 June containing two or three with the head completely red, and several with it mottled. Again on 28 July he saw a flock of eight birds, consisting of one with the head completely red, one with it mottled red, and six 'yellow' birds (presumably females or young birds). During the period 30 August/17 September red was noted by Benson as in various stages of development, though even on 30 August one bird was seen with it apparently fully developed.

That there is at least some replacement of red by dull feathers in the male in the non-breeding season would seem not to be a peculiarity of *F. eminentissima* on Aldabra. Benson (1960*a*, p. 101) could not obtain evidence of it in the Comoros. But Moreau (1960, p. 34) quotes Rand (in litt.) that there is a dull non-breeding plumage in *F. e. omissa*, of Malagasy, though without any supporting detail. The material in London of *omissa* collected by the Franco–Anglo–American Expedition of 1929–31 was divided by wing lengths into males (wing 69 to 74 mm) and females (wing 64 to 69 mm). In only one instance was there disagreement with the collector's sexing. Nine males lacking red completely were collected in the following months: May, two; June, four; August, two; September, one. Two males collected on 11/12 July have a little red, as has one on 16 August and one on 15 October. In five others, dated as follows, it is fully developed: 20 July, 2 and 16 August, January (two). In plumage, eleven females are like the males in what is apparently a non-breeding dress, in which red is lacking. In all of these specimens the bill is 'horn' coloured, except the five males with red fully developed, three of which have it black, in the two for August changing from 'horn' to black. Benson (1960*a*, p. 9) arrived in the Comoros on 6 August. If he had been there a month earlier he might well have found many males in process of acquiring red and changing the colour of the bill. As it is, the males which he collected (p. 101) on Grand Comoro in August, with red not fully developed, 'the bill sepia instead of black', may indeed have been moulting into breeding dress, and are not immature, as he suggests.

One of the five females collected—at East Channel on 25 January (Ald. 28 in the table)—is in an aberrant plumage. At the time it was thought to be a male in which the normal red had been replaced by bright yellow, especially as it also has black feathering encircling the eye, as in males in breeding dress. Moreover, a number of males of *F. madagascariensis* are known, in which the normal red of the breeding dress is replaced by yellow, see most recently Crook (1961, p. 521). Consequently it was surprising to find that its measurements were as small as follows: wing 73, tail 49, culmen 19 mm. It was also very light, having a mass of only 20 g. It had an apparent, but extremely small, ovary, which was preserved in order to obtain a further opinion. Slides have been prepared from it, though Dr T. S. Kemp, of the Department of Zoology, Cambridge University has been unable to make a definite determination of the sex.

But in view of its small measurements and light weight, it is assumed to be a female. Also, the bill was not black, as in breeding males, but 'horn' in colour. Apart from the black around the eye, the whole head is yellow, as is the underside as a whole—there is no contrast between the chest (red) and abdomen (yellow-olive), as in males. The rump is also yellow, though duller, and some of the feathers of the mantle and wing-coverts are margined with this same colour. For some reason, not understood, it is in fresher dress than the other four females. This specimen was mist-netted on the western side of East Channel, and in view of its aberrant plumage, retained. Benson had seen a similarly coloured individual about 400 m to the east, on an islet in the channel itself, 2 weeks previously (11 January). On 22 January on the same islet he saw two such birds, also two with the normal red fully developed (males in breeding dress), but no olive coloured birds (females). There was an occupied nest on this islet, see table 5, entry for 11 January. Conceivably one of these two yellow birds was the female parent involved.

Penny saw a bird at Grand Cavalier on 30 November which he noted as being a male in full breeding dress, but flavistic. The distribution of colours was normal, but he noted that the normal 'red' colour was replaced by 'orange'. The beak was black, as in normal breeding males. There is further support for Penny's interpretation in the field being correct, from a specimen collected by Frazier (JF. Ald. 7, see table 6). It has relatively few bright feathers, but those on the crown have red tips but orange-yellow bases, while the few bright feathers on the rump are orange-yellow rather than red. A male in breeding dress seen by Benson on Ile Esprit, 17 January, had the head red but the rump orange-yellow. Another one mist-netted by Diamond at East Channel, 23 January, showed some tendency to yellow rather than red on the nape. It would seem, from the suggestion of Crook (1961, p. 543), that yellow might quite easily become the normal colour of the breeding dress. It seems that on Aldabra (and perhaps elsewhere too) two types of aberration can arise in *F. eminentissima*: (*a*) acquisition of yellow coloration by female, with male-like character of black around eye, though 'horn' colour of bill retained; (*b*) replacement of red coloration of male in breeding dress by orange-yellow, black colour of bill retained.

In specimens with red coloration, it is not necessarily confined to the head, breast and rump. The odd red feather is liable to occur on the abdomen or under tail-coverts, and there is sometimes some red suffusion on the mantle and wing-coverts (as has the aberrant female yellow thereon). Benson (1960*a*, p. 100) mentions white margins to the wing-coverts in the Comoro forms, in both sexes. In the specimens listed in table 6, they are well marked in those which are in fresh dress, but are not apparent in those in worn dress. Thus such margins are absent in the first five males, but apparent in the other five.

The majority at least of the specimens, both males and females, caught by Diamond, and also those preserved, had a few (from two to seven) very fine black filoplumes protruding from the base of the red on the nape for a few millimetres. No other reference to the presence of such filoplumes in the genus has been traced. They could be very easily overlooked, and can no longer be discerned in the preserved specimens. Unfortunately no further attention was paid to this point, but possibly they only occur in adults in the breeding season.

It may be helpful to summarize the preceding discussion in regard to seasonal changes and aberrant plumages:

(1) The male is larger than the female, wing lengths suggesting that there is no overlap, though see footnote to Benson (1967, p. 88) re an unusually large apparent female. It is also heavier, but with some overlap.

(2) In the breeding season (probably normally from about September to March, see under *Breeding*) the male has the head, chest and rump red, sometimes with the odd red feather elsewhere too, and black around the eye. The bill is black. In the non-breeding season the red is usually partially lost, though is sometimes either completely retained or replaced, including also the black around the eye. The bill usually changes to a 'horn' colour.

(3) There is no conspicuous seasonal change in the female, and the bill is always a 'horn' colour. A few apparent females (from small wing lengths) have a few red feathers.

(4) Some males start to lose red on the head as early as late February. Some males and all females caught by Frazier on 21/24 May were moulting the remiges and rectrices, but males and females caught by him on 30 July showed no moult. There is probably a prenuptial moult about August/September, but no definite information is available.

(5) Two young birds have rufous brown rather than olive tones on the upperside, but some older birds are also this tone, at least in the non-breeding season.

(6) An apparent female collected in January has the head and whole underside bright yellow. The rump is also yellow, and it has black around the eye, as in the male in breeding dress.

(7) There are a few instances of the male in breeding dress having the normal red colour wholly or partially replaced by orange-yellow.

(8) In both the male and the female, at least in the breeding season, there are inconspicuous black filoplumes on the nape.

Miscellaneous. The proportion of the sexes may be about equal. During the period 30 August/7 September, Benson counted 23 birds with some red on the head as against 20 without any. In Lowery and Frazier's two trapped samples, the proportions are equal. In Diamond's and Hutson's, males outnumber females, but if there is any disproportion it seems more likely that females would outnumber males rather than the opposite.

The name Cardinal is Seychellois for *F. madagascariensis* (Loustau-Lalanne 1962, p. 8), Toq Toq for *sechellensis* (*ibid.* p. 6). Serin is a Seychellois name for the female of either species.

The paper by Crook (1961) on the two species occurring in the Seychelles is recommended as a basis for further comparative study on the breeding biology and behaviour of *F. eminentissima* on Aldabra.

(*c*) *Migratory species*

The species in this category, the original draft of which was read by R. E. Moreau, can be divided as follows:

(1) Breeding in the Palaearctic region, wintering in southern Africa: *Cuculus canorus* subsp., *Apus a. apus*, *Merops superciliosus* (*M. s. persicus*), *Coracias garrulus*, *Motacilla flava* (*M. f. lutea*), *Muscicapa striata*, *Oenanthe oenanthe*, *Hirundo rustica*, *Riparia riparia*, *Lanius minor*, *Oriolus oriolus*. An *Anthus* sp. may also be assignable here. Conceivably, Malagasy is a wintering area for a few *Apus apus*, *Hirundo rustica* and *Riparia riparia*, some of the Aldabra records thus being of birds on passage. One of the records of *Muscicapa striata* might also be of an individual which had wintered in Malagasy. Possibly, too, *Motacilla flava* and *Oenanthe oenanthe* winter regularly in very small numbers on Aldabra, while *Muscicapa striata* might pass through regularly, again in very small numbers, on northward passage from southern Africa. The remaining are probably no more than vagrants, in the case of the *Merops*, *Coracias*, *Lanius* and *Oriolus* blown off the African coast on northward passage. Moreau (1938, p. 8) lists a number of palaearctic migrants from Zanzibar and Pemba, including several of the species recorded from Aldabra, among

them *Hirundo rustica* and *Oriolus oriolus* only on passage, which he accordingly suggests cut across the wide re-entrant curve between Malindi and Dar es Salaam, on the African coast. When making such a cut they might be blown off course and conceivably eventually strike land on Aldabra.

Doubtless the list of these strays could be augmented considerably. For instance, Benson (1970*a*) saw a *Lanius collurio* on Cosmoledo in March. The number of species in this division is already unexpectedly high, and an investigation on Grand Comoro, for example, which is only about half the distance from the African coast than Aldabra is, might prove much more rewarding. Benson (1960*a*, p. 9) was on that island from 6 August to 10 September. This was too early for the occurrence of any palaearctic land birds. Forbes-Watson (1970), who was there for a few days in mid-October, did not see any either, but his stay was very short.

(2) Breeding in the palaearctic region, wintering in Malagasy: there is one probable record of *Falco eleonorae*, and some others most likely referable to either this or *F. concolor*. In addition, some of the records of certain of the species under (1) might be of individuals wintering on Malagasy, as already suggested. Further investigation in Malagasy is indicated.

(3) Breeding in Malagasy, wintering in Africa: *Milvus migrans* (*M. m. parasitus*), *Eurystomus glaucurus* (*E. g. glaucurus*), *Phedina borbonica* (*P. b. madagascariensis*). The status of *Milvus migrans* in Malagasy is obscure, though the breeding population there may winter in equatorial Africa, likewise that of southern Africa (Benson 1967, p. 97).

(4) Breeding in the Ethiopian region, including southern Africa, populations from the latter area possibly wintering mainly in equatorial Africa: so far the only examples are *Threskiornis aethiopica* and *Porzana marginalis*. There is little doubt that this list could be augmented considerably. Probably all such occurrences would be of mere strays, of no particular significance. But here again an investigation on Grand Comoro might be more rewarding. Moreau (1966, pp. 243–245) gives a list of nearly 50 species which move towards the equator, or in a few cases even cross it, after breeding.

The difficulty of movement on Aldabra, owing to the nature of the terrain, needs stressing. This makes a proper assessment of the status of the palaearctic migrants *Motacilla flava*, *Muscicapa striata*, *Oenanthe oenanthe*, *Hirundo rustica* and *Riparia riparia*, possibly more than mere strays, all the more difficult. The same applies to the Malagasy breeding *Eurystomus glaucurus*.

Details of these migrants now follow:

Dendrocygna viduata (White-faced Tree-Duck)

Diamond saw a White-faced Tree-Duck at 09h45 on 21 September 1969. He first heard it whistling as it flew up the Bras Cinq Cases Creek. It then turned and flew over him towards the lagoon, when he was able to see its characteristic shape and white face. This is the first record from Aldabra, where this species can obviously only be a vagrant, the same apparently applying even in the Comoros (Benson 1960*a*, p. 35). The source of this individual is actually quite indeterminate. It could either be Malagasy or somewhere in Africa.

***Threskiornis aethiopica* (Latham)** (Sacred Ibis)

An adult photographed by Grubb at Cinq Cases on 23 February is undoubtedly an African *T. a. aethiopica*, well developed dark wing-tips showing up clearly in his picture. In *T. a. bernieri* of Malagasy and *abbotti* of Aldabra they are much less developed, not extending for more than 15 mm in either, as against 40 to 60 mm in the African form (Benson 1967, p. 69). Also, Grubb

recorded the iris in this bird as red, whereas in the adult of *abbotti* it is china-blue, brown in young birds. In the adult of *bernieri* it is white. While McLachlan & Liversidge (1957, p. 37) simply give the colour of the eye of nominate *aethiopica* as dark brown, Bannerman (1930, p. 113) gives it as dark brown, lower eyelid pinkish, Jackson & Sclater (1938, p. 81) say 'Iris brown, with a crimson or reddish outer rim', Mackworth-Praed & Grant (1962, p. 86) 'eye brown with outer rim crimson'.

This bird was seen at Cinq Cases between 17 December and 23 February, but not any later. According to McLachlan & Liversidge (1957, p. 37), the species is restless but not a regular migrant in South Africa, while Mackworth-Praed & Grant (1962, p. 87) state that it is restless in the south of its range, many leaving the mainland to breed on islands. Dowsett (1969) was able to be more factual, and gives 48 records of birds ringed, mostly as nestlings, in the Transvaal and Orange Free State, recovered in southwestern Zambia, every month being represented in the recoveries except November and December. Conceivably the bird seen on Aldabra had become lost on a northward migration from South Africa. Admittedly this is mere conjecture, but in view of the position of Aldabra, nearly 10 degrees south of the equator, this is at least more likely than that it was an off-season bird from breeding quarters in the northern Sudan, whence there is a southward movement during December/February (Chapin 1932, p. 485).

***Milvus migrans* (Boddaert)** (Black Kite)

Abbott (in Ridgway 1895, p. 533) collected two specimens, on 2 October and 19 December, which Benson (1967, p. 97) assumed to be *M. m. parasitus*. This has been confirmed by Dr Zusi (personal communication), according to whom the October specimen is a juvenile female, having the bill black, the cere yellow. The other is an adult female, the bill as well as the cere yellow. According to Dr D. Amadon and Mrs M. LeCroy (personal communication), there are also two Aldabra specimens of this subspecies in New York, as follows: juvenile male, 18 November 1903 (collector F. R. Mortimer); female 6 August 1906 (collector Thibault). These collectors worked for Lord Rothschild. Benson (1967, p. 97) suggests the possibility of the odd pair of this subspecies breeding on Aldabra. But no evidence of this is forthcoming. There are, however, some further sightings, probably all of mere stray individuals of *parasitus*.

The nominate subspecies, which has a black bill (with yellow cere) at all ages, is well known as a winter visitor to southern Africa, see, for example, Clancey (1965/66, p. 242). A bird, which Grubb obtained a good coloured photograph of, might be thought to be this subspecies, since not only has it a black bill, but the head is pale, contrasting with the wings and mantle. It arrived at Cinq Cases on the evening of 14 January, apparently very tired, and remained there the whole of the following day. Incidentally, it was mobbed on one occasion by a Malagasy Kestrel, *Falco newtoni*, and Blue Pigeons, *Alectroenas sganzini*, of which 56 were counted, were very restless when near it. Moreau (personal communication) has queried its identification as *M. m. migrans*, and states that in the Mediterranean this subspecies is almost unknown, even at Malta. Rather it concentrates its crossings to and from north Africa at Gibraltar and the Bosphorus. It follows that it is unlikely to make the crossing from the African coast to Aldabra. The specimen photographed by Grubb may in reality be a juvenile *parasitus* with an unusually pale head. Rand (1936, p. 498) quotes an alleged record of *M. m. migrans* from Malagasy, but believed to be a misidentification of a juvenile (*parasitus*). This specimen was originally recorded by Newton (1863, p. 336) as *M. ater* (= *M. m. migrans*), and was collected on 8 September 1862. It is now in London (Brit. Mus. reg. no. 1955.6.N.20.836), and is marked in Newton's handwriting

as *M. ater*. But it is a black-billed juvenile *parasitus*. Another specimen in London (Brit. Mus. reg. no. 1931.8.18.14), collected at Vondrozo, Malagasy, 27 July 1929, placed with material of *M. m. migrans*, is also a black-billed juvenile *parasitus*, with a rather unusually pale head.

Three further sightings of *M. migrans* from Aldabra are probably all referable to *parasitus*. Around midday on 17 September Benson saw a bird fly in from the west, from the direction of Africa, onto West Island. Ninety minutes later he saw it again, over Settlement. He never got a really good view of it, but concluded that it was a juvenile *parasitus*. It had a blackish, not a yellow, bill. Macnae saw one soaring over Ile Esprit on 13 January, but did not see it sufficiently well to form any opinion as to the subspecies. The same applies to one seen by Grubb, on the west side of East Channel, 17 March.

***Pernis apivorus* (Linnaeus)** (Honey Buzzard)

Delacour (1932, p. 86) and Rand (1936, p. 498) both accept a Malagasy record of this palaearctic migrant, based on a specimen collected by A. Smith. It might accordingly be expected on Aldabra. The specimen, which is in London, is merely labelled 'Madagascar'. This must be regarded as suspect. Smith is well known for his ornithological work in South Africa around 1820–40, but seems never to have visited Malagasy. For examples of references to his work, see Sharpe (1906, p. 485) and Macdonald & Grant (1953).]

***Falco* spp.** (Falcons)

Benson (1967, p. 93) thought it likely that both *F. eleonorae* and *concolor* would be recorded, on passage to and from Malagasy, where they winter. There are the following sightings of single birds, all larger than *F. newtoni*, all from the vicinity of Settlement:

7 December 1967: 'dark brown above, with definite "moustache", underside streaked (Grubb & Taylor).

20 December 1967: 'mid-brown above, head pale, underside creamy coloured' (Penny).

4 March 1968: 'very dark slate above, streaked below', in a *Casuarina* tree (Benson).

23 March 1968: 'medium sized, slaty coloured' (Hutson).

8 April 1968: 'larger and blacker than *F. newtoni*' (Hughes).

Possibly all of these records refer to either *eleonorae* or *concolor*, the first two being of birds on southward, the others on northward, passage. Examination of specimens in London shows that *eleonorae* is always darker slate above than *concolor*. In all probability the record for 4 March is referable to *eleonorae*. Dr R. H. Carcasson, who was with Benson while on a day visit to Aldabra, was also struck by the very dark slate upperside. The bird was not as large as *F. peregrinus*, for example. But difficulties of identification must be stressed. Even in the hand *eleonorae* and *concolor* have been confused. Thus Hartlaub (1877, p. 16) identified a specimen collected by E. Newton at Grand Port, Mauritius, in December as *concolor*. This specimen, which is in Cambridge, is in fact an *eleonorae*, with a wing length of 304 mm. Of the specimens from Malagasy in London, 10 *eleonorae* have wing 297–324, 31 of *concolor* 243–294 mm. The error has been copied by Rountree *et al.* (1952, p. 188) and by Watson *et al.* (1963, p. 142).

Conceivably some of these Aldabra sightings refer to some other *Falco* sp. There is a specimen in Cambridge, collected on Mauritius on 23 December 1870, and considered to be an immature female of the palaearctic breeding *F. peregrinus calidus*, for the wide winter range of which see Vaurie (1965, p. 220). Its wing length is 359 mm.

Benson (1967, p. 93) gives several records of *F. concolor* collected on passage in eastern Africa.

There are in addition three specimens in Nairobi: B. 1041, ♀, Lake Naivasha, 15 December 1963; B. 1057, ♀, Sabaki River, near Lali Hills, eastern Kenya, 20 November 1960; B. 1058, ♀, Nairobi, 21 January 1957. The last specimen was kept in captivity after being found with a fractured wing, and the date may be that of its death rather than of its capture. It had previously been identified as *F. subbuteo*, thus providing further evidence of the necessity for caution in identifying these species. The status of *F. concolor*, including its breeding range and migrations, has been reviewed by Moreau (1969).

***Porzana marginalis* Hartlaub** (Striped Crake)

One was collected on West Island on 10 December 1904 (Benson 1964, p. 56). We do not know of any other record from the Malagasy region of this intra-African migrant.

***Cuculus canorus* Linnaeus** (Grey Cuckoo)

One was seen by Diamond and Penny on West Island, at Settlement, 21 September. It did not appear any smaller than specimens of this species seen in England, and so the possibility of *C. poliocephalus* can be excluded. Benson (1967, p. 94) suggests that *C. p. rochii*, which breeds in Malagasy, might occur on passage to and from Africa. The palaearctic breeding *C. p. poliocephalus* is possible as well as *rochii*. In Africa it is known from as far south as Durban (Clancey 1965/66, p. 332), and there are records from the Seychelles (Gaymer *et al.* 1969, p. 176). Nicoll (1906, p. 700) thought that he saw a *C. cuculus* on Aldabra, in mid-March. Gaymer *et al.* (1969, p. 176) mention two specimens of some palaearctic breeding subspecies, not the African *C. c. gularis*, from Mahé, in the Seychelles. In the case of the two Aldabra records, too, a palaearctic form seems the most likely.

***Apus apus* (Linnaeus** (Eurasian Swift)

Benson (1967, p. 91) records a specimen of the nominate subspecies collected by Abbott on 1 December. One, presumably also this form, was seen by Benson and Hutson moving northwards over Dune Jean-Louis on 15 March *ca.* 08h00, with some eight *Hirundo rustica*, see below.

One of two birds which were hawking over the beach off Settlement throughout the morning of 8 September was caught by Diamond in a mist-net around midday, and is now in the British Museum (Natural History). It is attributed to this species, not to *A. pallidus* or *barbatus*, the differences from which are given by Lack (1956, pp. 45–46, 50–51), and it most probably belongs to the nominate subspecies. The date seems unusually early. Furthermore, it is a very young bird, with the inner web of the outermost rectrix unreduced, and white fringes to the feathers of the crown (Brooke 1969, pp. 79–80). Except that it is a little more blackish below (probably because it is a fresh specimen), and has the white of the throat more extensive, it agrees well with a juvenile male, registered number 1937.7.17, in London, from Warwick, England, 23 July 1937. Lack (1956, p. 46) indicates that the juvenile of *A. apus* has more extensive white on the throat than in the adult. This Aldabra specimen was a male with very small testes, and had very little fat. It had a mass of 29.9 g, and had wing length 169 mm.

These are the only three records from the Malagasy region of which we are aware. In Malagasy itself the species would be hardly distinguishable in the field from *A. barbatus balstoni*. Incidentally, it can also be confused with *A. pallidus*, of which Irwin & Benson (1967, p. 8) give two records from southern Africa. Possibly a few individuals of *A. apus* winter in Malagasy,

whence the bird seen by Benson and Hutson could well have emanated, judging from its position and direction of travel.

***Merops superciliosus* Linnaeus** (Blue-cheeked Bee-eater)

Benson and Renvoize had an excellent view of two birds at Anse Var, in champignon scrub, shortly before sunset on 22 March. Benson satisfied himself beyond all reasonable doubt that they were *M. s. persicus* Pallas rather than *M. s. superciliosus*. Both appeared to be in fresh dress, and had the crown green rather than brown, while in both also blue rather than white markings on the sides of the head and on the forehead showed up clearly. Renvoize saw one of them catch a dragonfly in flight. What were presumably the same two birds were seen again 24 h later near West Channel.

M. s. persicus does not appear to have been previously recorded from the Malagasy region. It is well known as a winter visitor to southern Africa, and doubtless these two individuals had been blown off course on the return northward passage. Benson (1967, p. 94) suggests that nominate *superciliosus*, which allegedly migrates between Malagasy and eastern Africa, might occur on Aldabra. Gaymer (in Benson 1970*a*) saw an individual on Cosmoledo which from the early date (1 October) was most probably this form.

***Coracias garrulus* Linnaeus** (European Roller)

A male was collected in a mixed plantation of coconuts and *Casuarina* trees at the north end of Settlement, around sunset on 19 March. The previous evening there had been a strong wind from the southwest, and this bird must have been blown across from the African coast when on northward passage. Disregarding a dubious record quoted by Delacour (1932, p. 86) and Rand (1936, p. 499), this is still not the first definite one from the Malagasy region, because Keith tells us that there are two specimens in New York from Desert Island, in the Seychelles, collected on 9 and 14 October 1904. We are unable at present to trace Desert Island, but it could be the same as Ile Aride. Vaurie (1965, p. 659) suggests that *C. g. semenowi* may winter in northeastern Africa as well as in Arabia. Many African specimens are in such worn dress that it is quite impossible to suggest to which subspecies they belong, though this one from Aldabra, which is in fresh dress, seems best placed with the somewhat more richly coloured *C. g. garrulus*. Its wing length is 192 mm, and it had a mass of 137 g. The stomach contents were: many Chilopoda (Miriapoda): ?*Scolopendra* sp.; Orthoptera, Acridoidea: ?*Aiolopus thalassinus*.

***Eurystomus glaucurus* Müller** (Broad-billed Roller)

The nominate subspecies is fairly well known as a migrant between Malagasy, where it breeds, and eastern Africa. Benson (1967, p. 91) mentions four Aldabra specimens, two for November, two for December. He (1970*a*) gives three sight-records from Cosmoledo, two for October, one for November. The only further possible record from Aldabra is of a bird seen by A. Graham between Dune d'Messe and Anse Mais, flying inland at 11h30 on 25 March. It was 'dark brown with contrasting blue in the wings'. This species is inherently more likely to have been involved than another *Coracias garrulus*. Nevertheless, the numbers which pass through must be quite small, or others would have been noticed during 1967/68. Records for October/December presumably refer to birds returning to Malagasy, albeit rather late, since the breeding season starts in October. Graham's record, and one for April from the Comoros mentioned by Benson (1967, p. 91), must refer to post-breeding birds.

***Anthus* sp.** (Pipit)

On 11 January Grubb and Hutson disturbed a pipit near Cinq Cases. It flew up into a tree. Grubb thought that it was larger than a Meadow Pipit, *A. pratensis*. It had a white throat and was heavily streaked on the chest. It is impossible to suggest what the species may have been. The Tree Pipit, *A. trivialis* Linnaeus, is plentiful as a palaearctic migrant at similar latitudes in Africa. But both observers already knew this species, which in any case is about the same size as *pratensis*. The record of a supposed Tawny Pipit, *A. campestris* has been shown by Benson (1967, p. 92) to refer in fact to *Motacilla flava lutea*.

***Motacilla flava* Linnaeus** (Yellow Wagtail)

Benson (1967, p. 92) attributes a specimen collected by Abbott on 20 December to *M. f. lutea*, noting that green-crowned birds so far east are unlikely to be *M. f. flavissima*, whose breeding range is in the British Isles and extreme western Europe. There are three further sightings. Benson and Grubb saw one at a dried up freshwater pool near Cinq Cases, 22 February. It was dingy yellow below, and dingy green above (including the crown). Hutson saw (and heard calling) one flying over Dune Jean-Louis on 15 March *ca.* 08h00, at about the same time as there was a small movement of *Hirundo rustica* and one *Apus apus*. Diamond saw one at East Channel on the same day at 13h40. It had a green crown. It might have been the same bird as Hutson had seen earlier the same day. In any case, the Cinq Cases and East Channel birds seem referable to *M. f. lutea*.

There appears to be no other record of *M. flava* (*sensu lato*) from the Malagasy region. Conceivably *M. f. lutea* winters in extremely small numbers at the freshwater pools in the southeast of Aldabra. But the bird seen by Hutson (? and by Diamond) might have done so in Malagasy.

A small point in the account by Benson (1967, p. 92) is that Abbott's specimen does not have 'brownish' feathers on the underside, but 'whitish'.

***Muscicapa striata* Pallas** (Spotted Flycatcher)

An unsexed specimen was collected on West Island, in *Casuarina* trees at the north end of Settlement, on the morning of 11 March. It agrees better in colour with material collected in Britain rather than in Siberia, and so may be placed with the nominate subspecies, not *M. s. neumanni*. It had a mass of 14.5 g. Moreau (personal communication) gives a mean of 15.1 for birds weighed in spring at Malta, and of 13.7 at Azraq (31° 50′ N, 36° 50′ E), while autumn means for northwestern Egypt and Cyprus are respectively 16.6 and 16.5 g.

Another individual of this species was seen later the same morning at Settlement. The previous afternoon and evening there had been some rain and a strong wind from the west. There were the following subsequent sightings, by Benson and/or Hutson, all of single individuals, all in March: 12th, West Channel; 16th (18h00) and 17th (13h00), Dune Jean-Louis (in *Tournefortia* bushes); 19th, Anse Var; 22nd and 23rd, Settlement (in same site); 23rd, between Settlement and Anse Var, and at Anse Var itself; 27th, Settlement; 28th, Settlement (*ca.* ⅔ km from observation for 27th). In addition, Grubb saw one in a *Casuarina* grove to the west of East Channel on the 16th, and one at Settlement on the 30th. Doubtless some of these records refer to one and the same individual, this applying, for instance, to the two Dune Jean-Louis records, from the same group of bushes. But the three records for the 23rd were made

by Hutson in the course of the same walk, and are almost certainly of three different individuals.

These are the first records of this species for the Malagasy region. Possibly it passes through Aldabra regularly in very small numbers on northward passage, even though the atoll is nearly 650 km from the nearest point on the African coast. But the Dune Jean-Louis records, from the south coast, might be of a bird which had wintered in Malagasy. Both the nominate subspecies and *neumanni* are well known as winter visitors to southern Africa, see, for example, Clancey (1965/66, p. 503).

In order of predominance (numbers of individual specimens in each group), the stomach contents of the specimen collected were: Orthoptera, Acridoidea: *Aiolopus thalassinus*; Hemiptera, Homoptera; Hymenoptera; Coleoptera, Cerambycidae: *Glaucytes aldabrensis*; Coleoptera, Cicindelidae: *Cicindela melancholica*‡; Coleoptera, Curculionidae; other Coleoptera; Isoptera.

***Oenanthe oenanthe* Linnaeus** (Wheatear)

A female was collected on West Island, at the north end of Settlement, on 11 March. Its wing length is 92 mm. It had a mass of 18.5 g, and had skull fully ossified. It is best placed with the nominate subspecies.

There are, in addition, the following sightings:

January: 21st: two at Cinq Cases (Grubb), 30th: grey-backed male on Polymnie (Benson). Also a bird on West Island, near West Channel (Frazier), and again the following day (Hutson).

March: 10th: brown-backed bird on West Island at Settlement (Cogan), probably the individual which was collected the following day, 13th: partially grey-backed male at Jean-Louis, on *Sporobolus* grass closely cropped by tortoises. Apparently this same individual was there continuously until the 20th at least (Benson, Hutson). 30th: one at Anse Var (Benson).

These seem to be the first definite records for the Malagasy region. However, Abbott (in Ridgway 1895, p. 535) reported 'a small grey flycatcher, about 6 inches long, with white rump, noticed at North Island (Aldabra) in December'. In view of the white rump, it is difficult to suggest any alternative to an *Oenanthe*, most probably this species. It seems unlikely that even the March records are referable to birds lost on northward passage from winter quarters in Africa. The species barely occurs south of the Zambezi, see the few records in Clancey (1965/66, p. 443), while Benson (1953, p. 55) only records it in Malawi as far south as Diampwe, *ca.* 14° 30′ S, and Benson & White (1957, p. 83) give it as 'undoubtedly sparse' in Zambia. While some of these Aldabra records may refer to one and the same individual, clearly they cannot all do so. Thus there are recordings of at least two individuals, and quite likely three, in March. Possibly *O. oenanthe* winters regularly on Aldabra, albeit in extremely small numbers. The distance from the African coast (*ca.* 650 km at the shortest) is much less than in the case of *O. o. leucorrhoa*, which crosses regularly from southeast Greenland to the west coast of Europe, distances of from 1500 to 2000 miles (*ca.* 2400 to 3200 km) (Snow 1953, p. 377).

In order of predominance (numbers of individual specimens in each group), the stomach contents of the specimen collected were: Orthoptera, Acridoidea: *Aiolophus thalassinus*; Coleoptera, Curculionidae; Hemiptera.

***Hirundo rustica* Linnaeus** (European Swallow)

Benson (1967, p. 95) quotes a record of one seen by Crook in the Seychelles in November, and of six or seven at Tulear, southwestern Malagasy, in January. From Aldabra there are

the following recent sightings, by either Benson, Cogan, Diamond, Frazier or Hutson, during March:

14th: Dune Jean-Louis—one moving northwesterly, at 08h00, another likewise 1 h later. 15th: Dune Jean-Louis—at least eight moving in a general northerly direction *ca.* 08h00. Two of these birds remained for about 20 min, perched on dead exposed branches near the coast. One of them was distinctly rufous on the belly, the other white. The previous afternoon there had been strong winds from the south. 15th: East Channel—one at 13h25, possibly one of the Dune Jean-Louis birds of earlier the same day. 16th: East Channel—three at 18h30. 18th: Dune Jean-Louis—one at 08h00. 25th: West Island—one hawking over the reef opposite Settlement *ca.* 10h00, at low tide. 27th: West Island—one hawking over champignon scrub north of Settlement, 17h30, belly markedly rufous.

It would seem that during the second half of March 1968 there was a passage over Aldabra in small numbers. The birds seen at Dune Jean-Louis, on the south coast, could well have come from Malagasy, whence there is already a record from Tulear. Stoddart *et al.* (1970) refer to a probable individual of *H. rustica* seen on Assumption on 13 December 1957. Possibly the species winters in Malagasy, though the numbers would be very small compared to those which do so in southern Africa. The rufous-bellied individuals recorded (by Benson) at Dune Jean-Louis and on West Island were not so dark as to have possibly been *H. r. transitiva*, and according to White (1961, p. 54) it is doubtful if that form winters in Africa. It is worth noting that in Cambridge there are two old specimens of nominate *rustica* from remote Ascension Island, in the Atlantic Ocean. They were collected in March 1833 by A. Strickland 'off Ascension Island'. They could only have been strays, since there is no mention of the species in the reports on Ascension in *Ibis* **103***b* (1961–3). There is another Aldabra record by Stoddart, who on the afternoon of 10 April 1970, after heavy rain the previous day, saw at least six over coastal vegetation north of Settlement.

***Riparia riparia* (Linnaeus)** (Sand-Martin)

Benson (1967, p. 92) quotes three records from the Malagasy region, where it is apparently no more than a casual visitor, though it might winter in very small numbers in Malagasy itself, whence one of these records emanates. The other two are based on a specimen collected by Abbott on Aldabra on 2 December, another on Gloriosa on 29 January. A further definite record is of two seen by Diamond at West Channel on 2 January. He and Penny did also have a poor view of two small hirundines, 'dark with light bellies', which flew westward across East Channel on 23 November at 18h30, and could have also been this species.

***Phedina borbonica* (Gmelin)** (Mascarene Martin)

Benson (1967, p. 92) refers to a specimen of *P. b. madagascariensis* collected by Abbott on 19 November. There is no further record from Aldabra, and it can only be an uncommon visitor from its breeding quarters in Malagasy. For a recent summary of records outside Malagasy, see Clancey, Lawson & Irwin (1969), who found it numerous at Inhaminga, southern Mozambique, during 26 June/13 July 1968.

***Lanius minor* Gmelin** (Lesser Grey Shrike)

A male in adult dress was collected on West Island, 28 March. It was perched at the top of a *Euphorbia abbottii* tree on the edge of champignon scrub. It had a mass of 36 g. Vaurie (1959,

pp. 106–107) recognizes two subspecies, but as they are only distinguishable on the juvenile dress this specimen is not identifiable beyond species level. In Africa at similar latitudes it is a passage migrant (Benson 1953, p. 66; Benson & White 1957, p. 104), wintering further south. This specimen had no doubt been blown off the African coast while on northward passage. Its stomach contents, in order of predominance (numbers of individual specimens in each group), were: Orthoptera, Acridoidea: including *Aiolopus thalassinus*; Coleoptera, Scarabidae: Cetoniinae; Miriapoda, Chilopoda.

***Oriolus oriolus* (Linnaeus)** (European Golden Oriole)

A female was collected in *Casuarina* trees at Settlement on 28 March. It may have been the same individual as had been reported by Lokiru from the same locality earlier in the month, on the 11th and 12th. Its wing length is 154 mm, and it had a mass of 57 g. This is remarkably light. Moreau (personal communication) points out that 51 birds weighed on the north-west coast of Egypt, having just crossed about 650 km over the eastern Mediterranean, averaged 79 g (lightest 59.7, heaviest 91 g).

Undoubtedly this specimen can be attributed to the nominate subspecies, which winters in southern Africa. Disregarding a dubious record quoted by Delacour (1932, p. 86) and Rand (1936, p. 449), this again is a first definite record for the Malagasy region, and again, it would seem, of an individual which had got lost on northward passage. In order of predominance (numbers of individual specimens in each group), the stomach contents of this specimen were: Orthoptera, Mantoidea: one adult, and egg-cases; Coleoptera, Curculionidae.

We are very grateful to Dr D. R. Stoddart, leader of the Royal Society Aldabra Expedition, for much advice and assistance. Many observations from our fellow members of the expedition are included in this paper, and we wish particularly to thank B. H. Cogan, A. W. Diamond, J. Frazier, Dr P. Grubb, A. M. Hutson, Dr W. Macnae, and E. N. Wright. The names of others who have contributed information will be found in the appropriate context. We must also thank Hutson, who works in the Department of Entomology, British Museum (Natural History), for spending much time on the identification of insects in the stomach contents of birds collected, and likewise S. A. Renvoize, of the Royal Botanic Gardens, Kew, who has identified plant material. Dr F. R. Fosberg, of the Smithsonian Institution, made a number of identifications of plants in the field. Diamond and Hutson have made available data from birds mist-netted and released. Thanks to J. Frazier and Dr R. S. Lowery, some observations are available from phase IV of the expedition, which lasted from April to July 1968. They went to much trouble in keeping records from birds mist-netted and released. Frazier also preserved some specimens, and has contributed much information on the behaviour of *Corvus albus* in particular. Dr R. H. Carcasson and A. D. Forbes-Watson, of the National Museum of Kenya, Nairobi, very kindly seconded to the Royal Society for phase III of the expedition a skinner, Loriu Lokiru. They also assisted Benson in many ways, while he was staying in Nairobi, *en route* to and from Aldabra.

During the whole period that he has been studying the avifauna of Aldabra, Benson has been assisted by a grant from the Leverhulme Trust, realized at the instigation of Professor W. H. Thorpe, F.R.S. After the conclusion of phase III, work on the systematics of Aldabra birds was resumed. Periodical visits were made to the Bird Room, British Museum (Natural History), where we have been assisted by Dr D. W. Snow, I. C. J. Galbraith, Mrs B. P. Hall,

D. Goodwin, C. J. O. Harrison, P. R. Colston and J. Freeman. Benson must also thank Dr F. R. Parrington, F.R.S., for the provision of facilities to work in the University Museum of Zoology, Cambridge. He is especially grateful to G. S. Keith, of the American Museum of Natural History, who has answered many questions about the specimens collected for Lord Rothschild on Aldabra (Benson 1967, p. 64). Keith also arranged a loan of some of them. Some specimens collected in the Aldabra archipelago in December 1957 (Hartman 1958), in the Peabody Museum of Natural History, University of Yale, have also been borrowed, thanks to Professor Charles G. Sibley and Mrs Eleanor H. Stickney. With reference to Benson (1967, p. 66), Dr G. E. Watson and Dr R. L. Zusi have provided some further information about Aldabra specimens collected by Dr W. L. Abbott, and Dr F. Roux about those collected by G. Cherbonnier, others of which were examined by Benson when he had a day in Paris in November 1967. In the course of writing this report, we have been advised by R. E. Moreau, Dr W. R. P. Bourne, R. K. Brooke, R. J. Dowsett, R. Gaymer, M. P. Stuart Irwin, and others as mentioned in the text.

ABRSTRACT

An account is given of the investigations on the land birds made during phases I, II and III of the Royal Society Aldabra Expedition, from 30 August to 31 March 1968. Some further information collected during phase IV, from April to July 1968, when officially there was no ornithologist on the atoll, is also included.

These birds are divided into three categories:—

(*a*) Seven species in the order Ciconiiformes, five of them in the family Ardeidae (herons and egrets), an ibis *Threskiornis aethiopica* and a flamingo *Phoenicopterus ruber*. The ibis is an endemic subspecies, *T. a. abbotti*, and that of the Green-backed Heron, *Butorides striatus crawfordi*, is only otherwise so far known from Assumption and the Amirante Islands.

(*b*) Fourteen species of land birds proper, ranging from a kestrel *Falco newtoni* to a fody *Foudia eminentissima* (family Ploceidae). Two of these, a drongo *Dicrurus aldabranus* and a warbler *Nesillas aldabranus*, are regarded as endemic full species. The latter was only discovered during phase I of the expedition, in December 1967. Seven of the others are endemic subspecies. Another one, a turtledove *Streptopelia picturata coppingeri*, probably occurred formerly throughout the Aldabra archipelago, and on Gloriosa, but may only now survive on Aldabra. Yet another, *Centropus toulou insularis*, was formerly on Assumption as well as Aldabra, but has probably been extirpated on the former.

(*c*) Twenty migratory species (mostly palaearctic breeders), but exclusive of shore-frequenting species in the families Charadriidae, Scolopacidae and Dromadidae, are dealt with in a separate paper.

The species in these categories (*a*) and (*b*) are considered under the same headings, the main points from which can be summarized:—

Status: A barn owl *Tyto alba* has not been recorded since 1906, and is believed to be extinct, though the cause of this is uncertain. Colonization was probably unaided by man. It had not developed into an endemic subspecies. Neither have any of the others been introduced by man directly. His impact on the avifauna has indeed been relatively slight in comparison to that on many other islands in the western Indian Ocean. Nonetheless the numbers of *Threskiornis aethiopica* and *Streptopelia picturata* are thought to be less than formerly, because of killing for food around Settlement at the western end of the atoll. But they still thrive further east, as does a blue pigeon *Alectroenas sganzini*, which may have suffered likewise. A rail *Dryolimnas cuvieri* has been extirpated on South and West Islands, probably because of the introduction of cats and rats. Cats may eat appreciable numbers of a nightjar *Caprimulgus madagascariensis*. Care should be taken to avoid the introduction of a fody *Foudia madagascariensis*, brought by man from Malagasy to some other islands in the western Indian Ocean, and which might compete with the endemic subspecies of *F. eminentissima*. At Settlement the latter fills to some extent the role of the house sparrow *Passer domesticus* in some other parts of the world, being unusually tame and picking up scraps of food around houses.

Threskiornis aethiopica readily deserts its nesting colonies, which should be left undisturbed. Moreover the population probably does not exceed 200. Of the other Ciconiiformes, the numbers of the Malagasy Squacco Heron *Ardeola idae* may be only about 100. But it is believed to be a recent colonizer, probably resulting from its migrations from breeding quarters in Malagasy to winter in eastern Africa. On Aldabra it was found breeding in November 1967 in a mixed colony with other Ardeidae. This is the only known breeding area outisde Malagasy. The Cattle Egret *Bubulcus ibis* may also have been quite recently established, although a specimen in breeding dress was collected as long ago as about 1903. The numbers in

South Africa, and probably Malagasy, have increased because of new methods of land usage by man, which may have caused an overflow of this species into neighbouring areas. It apparently associates with the goats introduced by man, and its increase would therefore be favoured by any increase in the numbers of goats. The status of *Phoenicopterus ruber* is uncertain. Aldabra may be a dead-end for wanderers from elsewhere. An egg was found on 25 September 1967. But it was not on a nest-mound, and this is not accepted as evidence of breeding.

Most of the land birds proper, in category (*b*), are still numerous. An exception is the kestrel *Falco newtoni*, whose numbers may never have exceeded 100. Another is the recently discovered *Nesillas aldabranus*, only so far known from the western end of Middle Island. It may be a relic from a former wetter regime. Although the numbers of a crow *Corvus albus* may not exceed 100, it thrives, especially around Settlement. As elsewhere, it is a commensal of man, and but for this it is unlikely that it would have colonized Aldabra. In turn *Falco newtoni*, perhaps dependent on man or the crow for nesting sites, may have followed them to Aldabra.

A warbler *Cisticola cherina* has recently colonized Cosmoledo and Astove, from Malagasy, and may eventually reach Aldabra. Another possible colonizer is the Palm-Swift *Cypsiurus parvus*, which could utilize coconut palms, introduced by man, for breeding.

The most plentiful species, in descending order as follows, are probably four passerines:—A sunbird *Nectarinia sovimanga*, a white-eye *Zosterops maderaspatana*, a fody *Foudia eminentissima*, and a bulbul *Hypsipetes madagascariensis*. The drongo *Dicrurus aldabranus* is much less numerous, and can probably be numbered by hundreds, rather than by thousands as for the sunbird. But at present is is not possible to make more than an informed guess as to the numbers of any species, even the less numerous ones. It can however be added that a count at East Channel resulted in a total of 3 168 *Streptopelia picturata* crossing the channel in 3 h.

Ecology and food: Some of the Ciconiiformes are shore-feeders, this applying in particular to three of the Ardeidae, *Ardea cinerea*, *Egretta garzetta* and *Butorides striatus*, which feed alongside each other, *E. garzetta* being much the most numerous. *Butorides striatus* also feeds inland. The two other Ardeidae, *Ardeola idae* and *Bubulcus ibis*, feed almost entirely inland, the latter largely on insects. *Threskiornis aethiopica* feeds principally at inland pools on the platin in the southeast of the atoll.

The category (*b*) species feed inland, showing in general no particular ecological preference. Most of them occur to some extent in mangroves, especially *Alectroenas sganzini* and *Dicrurus aldabranus*, possibly a reflection of an ancestral evergreen forest habitat. *Nectarinia sovimanga* and *Foudia eminentissima* and their nests are much in evidence in the scattered groves of *Casuarina* trees on the north side of the atoll. The spread of this tree on Aldabra may have been assisted by man. But it is not thought that there is any particular association of these birds with this relatively open habitat, in which observations are especially easy.

Ardea cinerea is suspected of taking some chicks of the noddy tern *Anous stolidus*. The crow *Corvus albus* certainly takes some noddy eggs, and probably of some land birds too.

Behaviour and voice: No detailed ethological studies were possible in the limited time available, though many random observations were. A detailed study is available from the Seychelles for *Foudia sechellarum*, and *F. eminentissima aldabrana* might be a suitable subject for a similar study on a comparative basis. There is also much information available on sunbirds Nectariniidae and white-eyes Zosteropidae from southern Africa, which could be utilized in studies of the Aldabra representative of each of these families.

Tameness was noted in a number of species, though in some (but not all) this also applies to related species in Africa. Examples of species whose tameness is probably peculiar to Aldabra are *Threskiornis aethiopica* and *Streptopelia picturata*, but both may be rather less so than formerly. *Dicrurus aldabranus*, which has been long enough on Aldabra to have developed into a full species, is not particularly tame, yet is not known to have any enemies.

The song-call of *Streptopelia picturata* on Aldabra and the Comoros appears to differ markedly. This should be verified by tape-recordings.

Breeding: Although much further information is needed, it would appear that breeding seasons are generally similar to those in Malagasy and south-central Africa, where the incidence of the seasons is also similar. A possible exception is *Threskiornis aethiopica*, egg-laying in Aldabra being apparently confined to November and December, whereas egg-dates for Zambia are much more extensive.

Clutch-sizes are less in several of the Ciconiiformes than in South Africa. In the land birds proper, there is some evidence of a progressive reduction in clutch-size northwards from Malagasy to the Seychelles, this apparently being much accentuated in *Falco newtoni* (Malagasy and Aldabra)/*F. araea* (Seychelles). The 1967/68 season may have been a poor one for breeding by *Hypsipetes madagascariensis*, the ultimate cause of this being perhaps a shortage of rain.

There is a mixed breeding colony of species of Ardeidae on Ile aux Aigrettes, in the southeast of the lagoon. The identity of a group of 79 nests therein was undetermined, though it may have been a case of colonial breeding by *Butorides striatus*, which is normally a solitary breeder.

Systematics, including origins and variation: Excepting *Butorides striatus crawfordi*, perhaps of direct Asiatic origin, the Aldabra avifauna is predominantly of Malagasy origin, though in at least one species

(*Alectroenas sganzini*) an immediate one in the Comoros is much more likely. Colonization from Malagasy could have been via Gloriosa and the other islands of the Aldabra archipelago. Compared to Aldabra, these islands are so small that they can maintain viable populations of only a fraction of the number of species that Aldabra can. A case in point is *Caprimulgus madagascariensis*, only known outside Malagasy from Aldabra. Poor fliers such as *Dryolimnas cuvieri* and *Centropus toulou* could have been brought to Aldabra on rafts of floating vegetation, of which there were examples off the north coast of the atoll in February 1968.

Certain trends of variation are apparent. The most general one would appear to be the result of a fairly dry climate, leading to reduction in melanin, usually manifest as pallor. A case in point is *Nesillas aldabranus*, which is most similar in colour to a form in dry southwestern Malagasy. There are several cases of a reduction in size (inferred from a relatively short wing-length), perhaps the result of unusually high temperatures. But the reduction in wing-length, which has resulted in almost complete flightlessness, in *Dryolimnas cuvieri*, is a special adaptation also known in Rallidae on various other islands. There are some instances of an increase in length or size of bill, which might be an adaptation to deal with a greater range of food-sizes. There are three examples of an increase in tail-length, but the significance of this is not understood.

Migrants: The 20 migratory species which have been recorded are for the most part mere strays. They are mostly palaearctic breeders which winter in southern Africa. But a wagtail *Motacilla flava* and a wheatear *Oenanthe oenanthe* may also do so on Aldabra in very small numbers. A proper assessment of their status is difficult, owing to the nature of the terrain, over which quick movement is not possible. Other species, especially a flycatcher *Muscicapa striata* and a swallow *Hirundo rustica*, may pass through regularly on northward passage, and it is possible that they winter in very small numbers in Malagasy as well as in much larger numbers in southern Africa. There is one probable record of *Falco eleonorae*, already known to winter in Malagasy, and another such species likely to occur is *F. concolor*. There are a few species known to breed in Malagasy and winter in eastern Africa, notably a roller *Eurystomus g. glaucurus*. But it was only once recorded on Aldabra in 1967/68. There are many species which breed in southern Africa and winter further north, some even crossing the Equator. There is one record each from Aldabra of *Threskiornis a. aethiopica* and a rail *Porzana marginalis*, which could have been blown there accidentally during the course of such movements. Many more records of this kind are likely to be forthcoming. Further investigations on migrants generally should be carried out on an island nearer to the coast of Africa, such as Grand Comoro, and could prove still more fruitful than those already made on Aldabra.

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FIGURES 1, 2. *Threskiornis aethiopica abbotti*; 1, adults (by A. W. Diamond); 2, immature (by M. J. Penny). FIGURE 3. *Egretta garzetta dimorpha* white phase (by P. Grubb). FIGURE 4. *Alectroenas sganzini minor* adult (by M. J. Penny).

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FIGURE 5. *Caprimulgus madagascariensis aldabrensis* apparent male (see p. 474) (by M. J. Penny).

FIGURE 7. *Corvus albus* beach scavenging (by P. Grubb).

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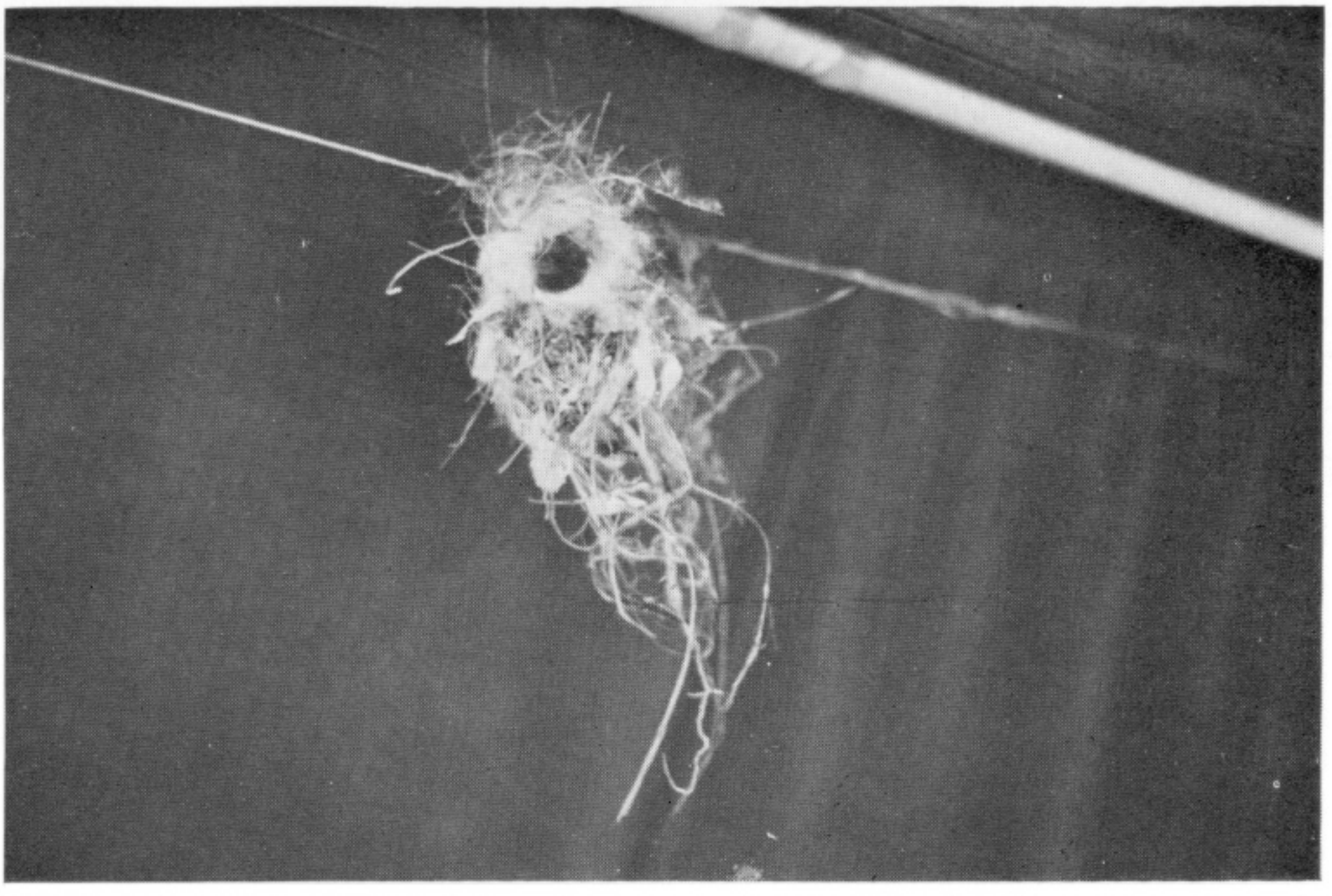

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FIGURE 6. *Dicrurus aldabranus* adult in *Casuarina* tree (by M. J. Penny).
FIGURE 8. *Nectarinia sovimanga aldabrensis*: nest attached to tent flysheet (by M. J. Penny).