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THE BIRDS OF THE ILES GLORIEUSES

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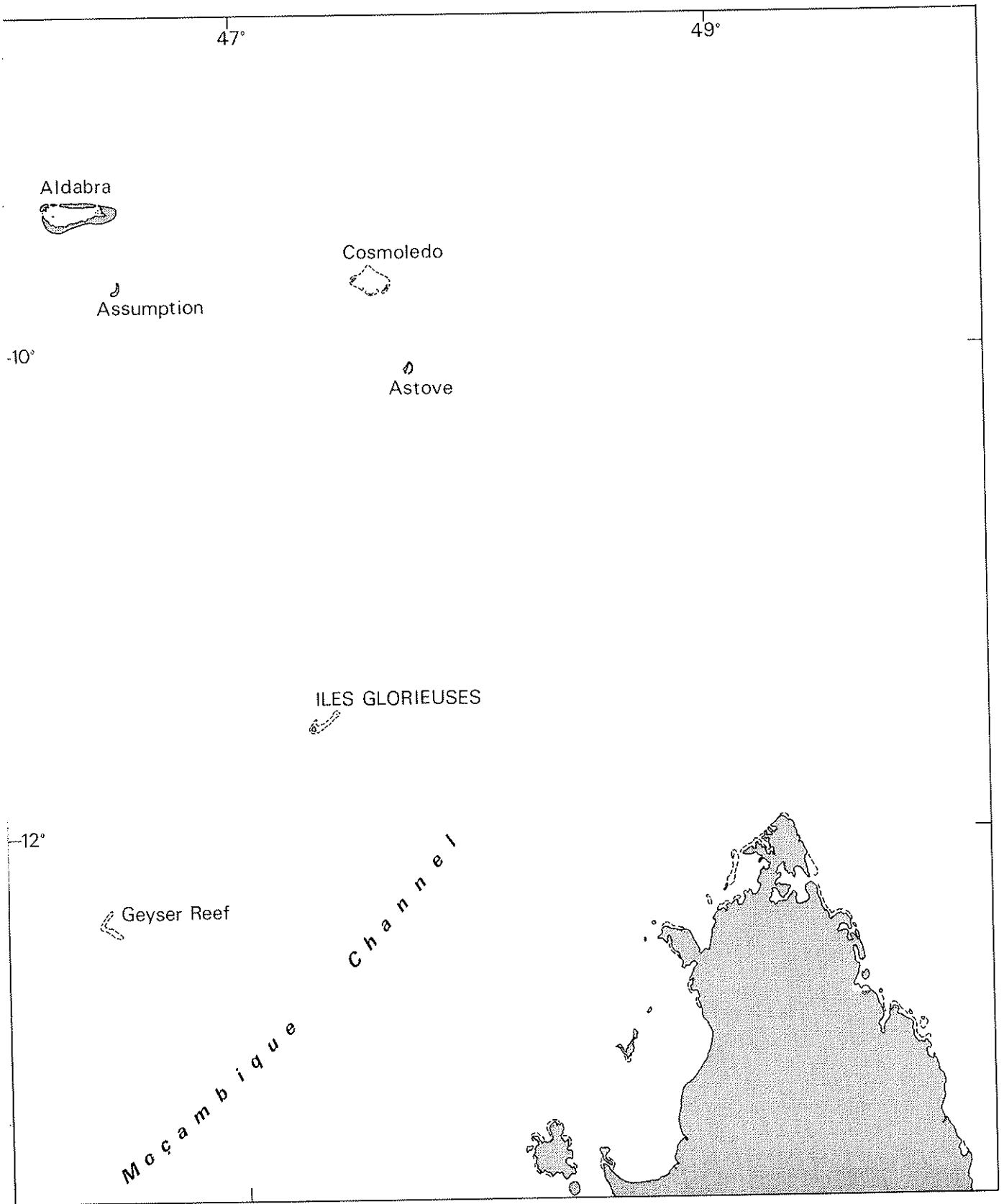


Fig. 1. Location of Iles Glorieuses

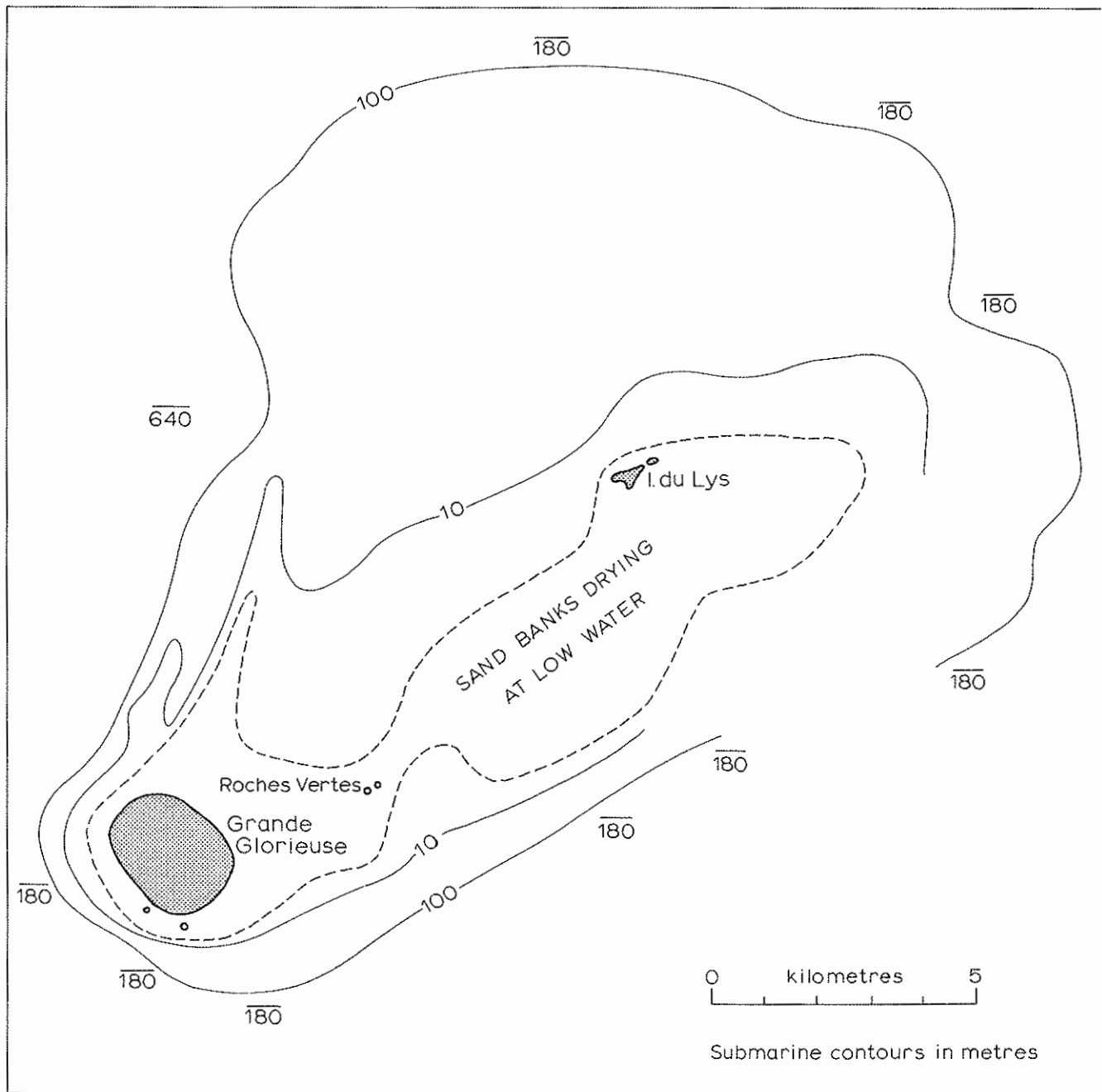


Fig. 2. Iles Glorieuses, in part after hydrographic chart (from ARB 159)

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INTRODUCTION

This paper is an account of ornithological observations made during two series of short visits to the Iles Glorieuses (Gloriosa or Glorioso Island) in 1970-71. The first series was undertaken by the following: Major J. Salvan, 29 October 1970, to Grande Glorieuse; C. Jouanin, 2-4 November 1970, to Grande Glorieuse and Ile du Lys; A. Barau, 17-19 April 1971, to Grande Glorieuse, Ile du Lys and Roches Vertes (sometimes known as Roches Noires).

Their observations have been collated by Jouanin. Jouanin and Barau collected 11 specimens which are deposited in the Muséum National d'Histoire Naturelle, Paris, and have been studied by Benson. Salvan only had time to search the northern part of Grande Glorieuse, particularly the scrub area ca. 0.8 km west and east of the Old Meteorological Station. But he was also in his ship off-shore, ca. 1.5 km north of the island, for 12 hours, when he had the opportunity to observe several species of terns, but he saw no boobies at all.

The second series of visits was made during day calls by the cruise ship Lindblad Explorer at the Iles Glorieuses, between August 1970 and June 1971. Visits, lasting the greater part of the day, were always made to Grande Glorieuse by the full complement of 50 to 60 passengers (the personnel differed from cruise to cruise), although on 20 April 1971 Ile du Lys was also visited. From time to time the passengers included some well known naturalists, among them Dr. D. Backhaus (Frankfurt Zoo), Prof. F. Bourlière (President, International Biological Programme), C. Cadbury (Society for Promotion of Nature Reserves), Dr. H. Frädrich (Berlin Zoo, who published a short account of his visit [Frädrich 1972]), the late Earl of Mansfield, P. M. Scott (Wildfowl Trust, Slimbridge), N. Sitwell (Editor, *Animals*) and Dr. G. E. Watson, a co-author of this paper who contributed his observations directly. Dr. Lyall Watson, resident zoologist on the ship, also made three visits. Prof. Bourlière, who visited Grande Glorieuse on 28 August 1970, gave his observations to Jouanin, who collated them with those of the first series of visits. The remainder have been mainly collated by Beamish, who was in charge of the subsequent visits,

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of which there were two in November, two in April, one in May and one in June. The actual drafting of this paper has been the responsibility of Benson.

Previous visits to the Iles Glorieuses have been few. Published accounts of earlier observations are as follows:

The recording of three species ('fou', 'colibri' and 'cicogne') seen during a visit to Ile du Lys in 1818 (Frappaz 1820, 1824). The last of these was probably a heron or egret. The record is unaccompanied by any comment, and is only in the 1820 report. It is not referred to again below.

Dr. R. W. Coppinger visited Ile du Lys and Grande Glorieuse on 3-8 May 1882, during the cruise of the Alert in 1878-82 (Coppinger 1883). The four birds which he collected were listed by Sharpe (1884), and are in the British Museum (Natural History).

Dr. W. L. Abbott was on Grande Glorieuse during 18-29 January 1893 where his ship was incapacitated. On February 1 he also called at Ile du Lys. In a brief field report he described the island and some of the birds (Abbott 1894), while the ornithological results were detailed by Ridgway (1894, 1896), who included abstracts from Abbott's field notes but without the benefit of personal discussion with the collector. The birds he collected and his field notes are in the National Museum of Natural History, Smithsonian Institution.

M. J. Nicoll visited Grande Glorieuse and Ile du Lys on 10-11 March 1906, during the voyage of the Valhalla in 1905-6 (Nicoll 1906, 1908). His collections are in the British Museum (Natural History).

Arnoux (1950) has given a brief account of a breeding colony of Sooty Terns Sterna fuscata on Ile du Lys, inspected on 5 April 1948.

Coppinger's and Nicoll's specimens have been re-examined by Benson, and Abbott's specimens and field notes by G. E. Watson.

Earlier lists of species of birds on certain islands in the western Indian Ocean are available in Dupont (1907) and Watson et al. (1963). The former is simply a bare list, unaccompanied by any supporting detail. The latter, by contrast, contains a much fuller and more informative account although based only on a survey of the literature. No cognisance is taken in the present paper of the sea bird observations by Bailey (1968), during voyages of the Discovery in 1963-64, although around 20-21 July 1964 he appears to have been close to the Iles Glorieuses.

There is a brief summary of the ecology of the Iles Glorieuses by Stoddart (1967), and a longer account on the geomorphology and vegetation by Battistini and Cremers (1972).

ACKNOWLEDGEMENTS

Jouanin is most grateful to M. l'Ingénieur en chef Marcel Malik, directeur de la Météorologie Nationale à la Réunion, who

made all the arrangements for his journey, and also for that of A. Barau, to the Iles Glorieuses. Jouanin is grateful too to M. Paul Cousseran, Préfet de la Réunion, who lent his own outboard, making possible the visit to Ile du Lys.

We are also most grateful to Dr. D. R. Stoddart for assistance in various ways, especially for making available the papers by Frappaz and by Battistini & Cremers in manuscript. M. J. Penny, who was on several visits from the Lindblad Explorer to the Iles Glorieuses towards the end of 1971, has been kind enough to comment on certain points. It is hoped that he will publish his own observations from these cruises in due course.

THE INDIVIDUAL SPECIES

The term 'Aldabra Archipelago,' wherever used, includes Assumption, Cosmoledo and Astove, as well as Aldabra. An asterisk denotes that the species under discussion on the existing evidence cannot be regarded as of entirely certain occurrence, either now or at some time in the past.

1. Land birds

A. Resident species

Gallus gallus Domestic Fowl

Abbott (in Ridgway 1896, as G. ferrugineus) records Domestic Fowl as wild and plentiful on Grande Glorieuse, but 'quite shy and by no means easy to shoot.' Nicoll (1906, 1908) writes in similar terms. But in 1970-71 there was no sign of them and they must have been extirpated. Coppinger (1883) makes no mention of fowl. At the time of his visit there was a population of 29 humans on Grande Glorieuse. Obviously chickens must have been introduced directly by man, presumably between 1882 and 1893.

Turnix nigricollis Madagascar Buttonquail or Hemipode

Madagascar Buttonquail were widespread on Grande Glorieuse during 1970-71, inhabiting more open grassy areas near beaches, bare ground under Casuarina trees, the lower slopes of sandhills, and the airfield and its edges. Beamish estimated that there might be as many as 300 pairs on the island; G. E. Watson found them particularly abundant in long grass near the airfield in early April 1971. Although no specimen was collected there can be no doubt about the identification, as Beamish sent Benson four colour slides of the birds for comparison with specimens. One of these was good enough for it to be possible to determine the sex (female).

There is no earlier record of the species. M. J. Penny (pers. comm.) has the impression that it was deliberately introduced by man many years ago for sport, despite its small size. He has been told that plantation labourers were forbidden to kill it. Like Geopelia striata, see below, it may have been brought from Réunion, where it is very common in cultivation (A. Barau in litt. to Jouanin), and has been so for a long time (Berlioz 1946: 38; Milon 1951: 159). Abbott (1894) and Nicoll (1906) write of Grande Glorieuse being covered with a thick growth of trees and scrub (Abbott's specimen notes refer to "jungle") except for a coconut plantation and a large maize field. Recent activities by man, especially the clearing of the airfield, must have favoured the Buttonquail. In Madagascar, Rand (1936: 369) found it associated with treeless, grassy areas and cultivation, much as T. sylvatica in Africa.

Dr. L. Watson found a nest containing three eggs in low grass on 18 March 1971. When Beamish and G. E. Watson visited the site on 8 April it was deserted, the young having presumably been hatched and left. G. E. Watson observed two families of small chicks in heavy forest along the road. The data in Rand (1936: 369) indicate egg-laying during September to February in Madagascar, though if those for T. sylvatica in south-central Africa (Benson et al. 1964: 53) are a guide, egg-laying may occur virtually throughout the year. Beamish found that the birds could be approached to within 5 metres without being disturbed, the yellow eye being most noticeable.

Streptopelia picturata Madagascar Turtledove

Coppinger (1883) collected a Turtledove specimen on Ile du Lys which served as the type of Turtur coppingeri Sharpe (1884). Coppinger apparently also saw it on Grande Glorieuse, since he states that he saw the same land birds there as on Ile du Lys, with the addition of the "Madagascar crow" (i.e. Corvus albus). Abbott also collected a female on Grande Glorieuse (Ridgway 1896), but in his field notes, states that although 'a few exist on Gloriosa it is not common' and 'has very probably been introduced.' Nicoll (1906, 1908) made a special search for it, but without success, and suspected that it might be extinct. The only possible sighting for 1970-71 is a 'Madagascar Turtle Dove' recorded by Bourlière on 28 August 1970. But in April 1971 G. E. Watson could not find it, despite a determined search. It is curious that it should otherwise have been overlooked, although Benson & Penny (1971: 462) note that on Aldabra it is conspicuous early in the day, albeit skulking in cover later on. Possibly it was already extinct on the Iles Glorieuses before Nicoll's visit.

Benson (1967: 75-79) applied the name coppingeri not only to the above two purple-headed specimens, both of which were available to him, but also to similar colored birds from Assumption and Aldabra. It appears that S. p. coppingeri now survives

only on Aldabra. Even there, on West Island, its numbers have been reduced, probably due to a combination of tameness and human predation (Benson & Penny 1971: 462). It has apparently been extirpated on Assumption (Stoddart et al. 1970: 134). Presumably this was also the form that inhabited Cosmoledo and Astove, but there is no definite evidence of its occurrence on either atoll to-day (Benson 1970a: 68; 1970b: 115). Benson & Penny (1971: 425) suggest that turtle doves colonised the Iles Glorieuses from Aldabra, not from Madagascar, which is occupied by the grey-headed S. p. picturata. The land area of Aldabra is much larger than that of the Iles Glorieuses, Assumption, Cosmoledo or Astove, and so the most likely place for the evolution of coppingeri, which subsequently spread to these smaller islands.

Geopelia striata Barred Ground Dove or Zebra Dove

Several individual Barred Ground Doves were seen on every visit from the Lindblad Explorer, mainly around the northern and extreme southern ends of Grande Glorieuse. Salvan saw one or perhaps two small doves, presumably also this species, 200 m west of the Old Meteorological Station. There is no previous record. It was presumably deliberately introduced by man into the Seychelles, and thence in 1960 to Diego Garcia (Bourne 1971). This surely also applies to the Iles Glorieuses. Indeed, M. J. Penny (pers. comm.) was told that it was introduced from Réunion about 1969 by one of the meteorologists, Harry Desramais. As with Turnix nigricollis, recent ecological changes must favour it. Thus, Goodwin (1967) writes that it is characteristic of 'cleared areas, gardens and agricultural land.' Parker (1970) found it common on North Island, Farquhar Atoll, and Benson (1970a) gives a single record from Menai Island, Cosmoledo, which he suggests 'may represent a not very successful artificial introduction.'

Hypsipetes madagascariensis Madagascar Bulbul

The Madagascar Bulbul was first recorded by Abbott who collected three specimens on Grande Glorieuse (Ridgway 1896, as Ixocincla madagascariensis). In his field notes Abbott states that it was not common and had an 'entirely different note' from that of Aldabra birds. Nicoll (1906) also found it, but only saw four birds and collected one. No record was made of it in 1970-71, unless the following from Beamish's notes applies: 'Both Dr. Backhaus and Dr. Frädrieh reported seeing a small group of birds of thrush-like appearance near the high sandhills at the extreme northern tip of Grande Glorieuse. I did not see these birds myself.' Frädrieh (1972) did not mention it in his account. It is perhaps relevant that the Seychellois name (reasonably apt) for Hypsipetes is 'Merle,' i.e. French for Turdus merula, and that on Aldabra it is usually in two's or three's (Benson & Penny 1971: 476). Nevertheless, with every respect, it is far from certain that it still survives in

the Iles Glorieuses. During his visit in April 1971 G. E. Watson could not find it, despite a determined search. He had no difficulty in finding the species on Grand Comoro and Aldabra, and H. crassirostris on Mahé and Praslin in the Seychelles, the birds responding readily to squeaking. It appears never to have been common on Gloriosa, in contrast to Aldabra, where Benson & Penny found it numerous, and it has never been recorded from Assumption, Cosmoledo or Astove (Stoddart et al. 1970; Benson 1970a, 1970b).

The question now to be resolved is whether or not there is a subspecies H. m. grotei Friedmann (1929) endemic to the Iles Glorieuses. Benson accepts entire responsibility for the ensuing discussion. He has examined all the material of the species in the British Museum (Natural History) from Madagascar (virtually throughout), the Comoros (Grand Comoro, Anjouan, Moheli, Mayotte), Aldabra and the Iles Glorieuses (Nicoll's single specimen, a female). This, including also 14 in the University Museum of Zoology, Cambridge, amounted to over 100 specimens, the measurements of which, exclusive of a few from Madagascar, are shown in the table below. Furthermore, of special importance he has had the loan of the two Gloriosa paratype females collected by Abbott, and Watson has examined the type of grotei, a male, and sent comments to Benson. Most of the material has also been seen by R. Wagstaffe, who in particular has checked certain culmen lengths, of critical importance.

The problem is best considered against this relatively wide background of possible variation among the islands mentioned above. There has already been some discussion by Benson (1960, 1967) and by Benson & Penny (1971), but the validity of the Gloriosa subspecies was not established. In Benson (1960) the sexes were not separated (while there is no difference in colour, males are normally a little larger than females). In the second and third references, attention was concentrated on the Aldabra form, H. m. rostratus.

Friedmann (1929) compared Iles Glorieuses birds only with specimens from Aldabra and bestowed the name grotei on them, on account of the longer, stronger bill, differing also in colour, being wholly orange-red, not dusky, almost blackish, towards the tip as in the former. These possible differences can be considered in turn, and also possible differences in colour of plumage:

(a) Bill-length: Wing and tail-lengths, as well as culmen-lengths, are set out in the table. These first two are remarkably uniform, and the only point worth noting is that males are a little larger than females, but with an appreciable amount of overlap. Friedmann (1929) does not indicate how he took culmen-lengths. His figures do not show even any overall overlap between rostratus and grotei, and there is none in the present set

between females. On the other hand, the single male of grotei is at the minimum for males of rostratus. Furthermore, while the females of grotei are around the maximum for Madagascar females (nominative madagascariensis), the male is near the mean for Madagascar males. There are a number of unusually long-billed individuals from Grand Comoro, Anjouan and Moheli, in the Comoros, though none from Mayotte, the nearest of these four islands to Madagascar. It is well known that island forms often have longer bills than their mainland counterparts (in this taking Madagascar as 'mainland'), and this has been shown for various Comoro forms in comparison with Madagascar (see most recently Benson 1971). In the present case it is curious that, in comparison with Madagascar, while no tendency to lengthening is apparent on Mayotte or Aldabra, there is on the Iles Glorieuses, less remote from the 'mainland'. In any case, the lengthening on the Iles Glorieuses is not such as to justify the recognition of grotei on this ground alone.

(b) Bill-colour: On only a relatively few specimens is there any record of what was the colour of the bill in life. Nevertheless it does appear that everywhere (in life) the colour approximates to orange-red, with the apical half of the culmen dark brown. The orange-red soon fades after death. Thus in specimens collected by Benson on Aldabra in the first three months of 1968, which he recorded at the time as having bill 'vermillion, sepia towards tip of upper mandible,' the bright colour has changed four years later to pale yellow, as in the remainder of the specimens, all of them older, some of which were collected more than a century ago. But the dark brown seems not to fade at all, so that the contrast is still easily discerned. In Aldabra birds this darkening on the culmen is consistently apparent. Of those from the Iles Glorieuses, in Abbott's three it is reduced to a trace at the extreme tip and Abbott's notations on the label of the male and one female read, 'bill orange-red.' On the other hand, in Nicoll's specimen it is quite well marked. Most Madagascar specimens have it well marked, although four have been found in which it is reduced or absent as in Abbott's two. Reduction of the darkening seems best marked on Grand Comoro, in contrast to the other islands in the Comoro archipelago. However, apart from this possibility, the variability would appear to be on an individual rather than geographical basis. Incidentally there may be little or no variation in the colour of the iris. Benson & Penny (1971: 478) give it as 'red-brown' on Aldabra ('greyish brown' in a juvenile), and Benson (1960: 67) 'chestnut-brown' in the Comoros. Nicoll (1906) gives it as 'brown' for his Grande Glorieuse specimen, although on the label it is recorded as 'hazel.' An old Madagascar specimen in Cambridge, collected by E. Newton, had iris 'reddish brown.' Eleven collected by Benson and A. Williams in Madagascar in 1972 had it 'dark red' or 'rich red-brown.'

(c) Plumage-colour: As remarked by Benson & Penny (1971:

Table of measurements in millimetres of Hypsipetes madagascariensis

∞

	Wing		Tail		Culmen (see footnote 1)	
	number		number		number	
				Madagascar		
male	15	106-117 (110.8)	15	91-99 (94.8)	14	3 at 22, 4 at 23, 3 at 23.5, 3 at 24, 1 at 25 (23.2)
female	17	100-110 (104.8)	16	86-98 (90.9)	16	1 at 21, 1 at 21.5, 4 at 22, 1 at 22.5, 6 at 23, 2 at 23.5, 1 at 24.5 (22.7)
				Iles Glorieuses		
male	1	110	1	95	1	23
female	3	107, 110, 110	3	92, 93, 94	3	23.5, 23.5, 25
				Aldabra		
male	8	106-115 (110.7)	8	93-102 (97.1)	8	2 at 23, 2 at 23.5, 4 at 24 (23.6)
female	9	103-107 (104.7)	8	85-98 (91.1)	9	1 at 21, 3 at 22, 1 at 22.5, 4 at 23 (22.4)
				Grand Comoro ('green' birds, see footnote 2)		
male	9	112-119 (115.9)	7	92-98 (95.1)	9	2 at 23, 2 at 23.5, 1 at 24, 1 at 24.5, 2 at 25.5, 1 at 27 (24.4)
female	3	111, 112, 113	3	93, 93, 95	3	23, 23, 25
				Grand Comoro ('grey' birds)		
male	8	109-116 (112.6)	8	95-100 (97.1)	8	2 at 23, 3 at 24, 1 at 24.5, 2 at 25 (24.1)
female	4	102-107 (105.0)	4	89-93 (90.7)	4	1 at 21, 1 at 22.5, 2 at 23 (22.4)
				Anjouan		
male	10	108-115 (111.9)	10	91-97 (95.5)	10	1 at 22, 1 at 23, 2 at 24, 1 at 24.5, 2 at 25, 1 at 26, 2 at 26.5 (24.6)

female	4	104-110 (106.0)	4	88-92 (89.5)	3	22.5, 23.5, 24.5
						Moheli
male	3	113, 114, 114	2	95, 100	3	23, 24, 25
female	9	103-111 (106.7)	8	86-94 (90.1)	9	1 at 22, 2 at 23, 3 at 23.5, 2 at 24, 1 at 24.5 (23.4)
						Mayotte
male	7	108-118 (112.0)	7	87-101 (92.1)	5	1 at 22.5, 2 at 23, 2 at 23.5 (23.1)
female	9	102-109 (106.6)	6	89-95 (91.2)	7	4 at 22, 1 at 22.5, 2 at 23 (22.4)

1. Measured from base of rhamphotheca to tip, not from skull to tip. This gives a more consistently accurate figure than from the skull, eliminating the possibility of slipping of the point of the dividers on the skull.
2. Normal grey coloured birds, similar to those on all the other islands, may be confined on Grand Comoro to coastal areas, and be replaced at higher altitudes by green coloured birds, perhaps merely a colour phase (Benson 1960: 66), although on Moheli there is a green coloured form, much larger than H. madagascariensis, belonging to another species, H. crassirostris of the Seychelles. Figures for eight further green coloured specimens from Grand Comoro (including the type of H. parvirostris Milne-Edwards & Oustalet 1885: 222), and of 18 grey coloured ones from throughout the Comoros, in the Muséum National d'Histoire Naturelle, Paris, have been added to the figures based mainly on material in the British Museum (see text). A few specimens in the material as a whole were unsexed, but are placed where they seem correctly to belong.

477), specimens collected in the first three months of the year are often so worn in plumage as to be useless in making sub-specific comparisons. The name H. m. parvirostris has been applied to the Comoro birds, which (the 'green' birds apart, see table) are somewhat paler, less bluish in tone than nominate madagascariensis, although the difference is not strongly marked. H. m. rostratus of Aldabra is characterised by a brownish wash on the mantle and flanks. The specimen collected by Nicoll on Grande Glorieuse, on 10 March, is heavily worn on the underparts. However, it is in a fairly fresh dress on the mantle. There is none of the brownish tone of rostratus, and it can be matched with many Madagascar specimens. Abbott's male, collected 20 January, and two females, collected on 18 January, are in worn dress and are molting, both wings and body. The few fresh feathers on the mantle, however, show no sign of the brownish tone, although there is a slight brownish tone on the flanks of all three. But it is not so pronounced as in rostratus, and the three can be matched with individual specimens from Madagascar.

To conclude, there does not appear to be any real justification for recognising H. m. grotei, which is best considered a synonym of nominate madagascariensis. Mr. Wagstaffe and Dr. Watson agree with this decision. Benson is most grateful to them for their advice.

Cisticola cherina Madagascar Grass-Warbler

Benson drew Jouanin's attention to the likelihood that he would find a grass warbler in the Iles Glorieuses. This proved correct, for Jouanin duly found it abundant on Grande Glorieuse, as also did G. E. Watson. Beamish reports that the largest number seen on Grande Glorieuse in one day was approximately thirty. The birds were most numerous around the airfield at the south end of the island, and in degraded vegetation in the centre. During his visit to the north of the island Salvan saw none at all, and suggests that it is restricted mainly to the south, including the airfield. However at the time of his visit a strong wind was blowing, so that the birds might have been overlooked. Beamish found them usually in pairs, and thought them rather more timid than those which he saw on West North Island in the Cosmoledo Atoll, and on Astove. Frädrich erroneously identified this warbler as Nesillas typica, another widespread Madagascar species. There is no record from the Iles Glorieuses prior to 1970-71. It is virtually certain that there has been a colonisation subsequent to Nicoll's visit in 1906, since so competent an observer could scarcely have overlooked it. It is no less sure that a small insectivorous species such as this could not have been deliberately introduced by man, although his activities may have favoured its establishment. In Madagascar, which must be the source of the colonisation, C. cherina frequents 'grasslands ... and other cultivated land' (Rand 1936: 449).

Cisticola cherina has also colonised Cosmoledo and Astove (Benson 1970a, 1970b). Vesey-FitzGerald (1940) found it abundant on both these atolls in 1937, but unfortunately there are no earlier comprehensive ornithological accounts to help determine when it might have originally arrived. Benson & Penny (1971: 420, 479) suggest that it may eventually colonise Aldabra and Assumption. It is possible that it has already colonised Remire in the Amirantes, where Stoddart & Poore (1970c) thought they saw and heard it.

Five specimens from Grande Glorieuse are available, some particulars for which are as follows (measurements are in millimetres):

Paris Museum registr. no. (1971)	Apparent sex	Wing	Tail	Culmen from base
651	male	50	40	12
653	male	50	42	12
654	male	52	40	11
650	female	45	28	10
652	female	47	44	11.5

Specimen 651 was collected on 2 November 1970, the remainder on 18 April 1971. None was sexed at the time of collecting, but wing-lengths suggest sexing as above, in accordance with the figures in Benson (1970a). Numbers 651 and 654 are considered to be adults in worn summer (breeding) dress; the remainder, rusty above and on the flanks, juveniles. Like Cosmoledo and Astove specimens, there is no evidence that they are subspecifically separable from Madagascar C. cherina which is monotypic.

From its measurements, specimen 650 appears to be not fully grown, the tail being especially short. It was probably from an egg laid not earlier than the previous month, i.e. in March. Other evidence of breeding comes from Beamish, who reports a nest with three eggs seen in May 1971. Benson (1970a) reports breeding activity on Cosmoledo and Astove in March, and indicates that the breeding season of C. cherina may be more extensive than that of the related juncidis in south-central Africa.

Corvus albus Pied Crow

One was seen on Grande Glorieuse by Bourlière on 28 August 1970, and a couple by Jouanin on 2 November 1970. Beamish reports that three or four were seen on every visit, around or perched on high Casuarina trees in abandoned cultivation at the north end of the island. Coppinger (1883) noted it (as 'Madagascar crow'). Abbott (field notes) found the crow 'plentiful on Gloriosa where they are very destructive to the eggs of the

boobies and other birds.' Nicoll (1906, 1908) saw a few, and was told that it was resident. Although no nest has been recorded, probably it does breed in small numbers. Even on Aldabra, where it is believed that there are between 50 and 100 individuals, few nests have been found (they are easy to see), perhaps because breeding takes place only at infrequent intervals (Benson & Penny 1971: 484-487).

Corvus albus is well known to be strongly commensal with man, scavenging around his habitations. It is therefore unlikely to have inhabited the Iles Glorieuses before his advent. Coppinger did not see it on Ile du Lys, which was uninhabited by man, but did see it on Grande Glorieuse, where there was a population of 29 humans, and collected a specimen (Sharpe 1884, as C. scapulatus). Benson & Penny (loc. cit.) could not find any variation in this wide ranging species, and took cognisance of a Gloriosa specimen (in fact the one collected by Coppinger). As they suggest, there is probably some inter-island gene-flow; the crows' habit of soaring and riding on up-draughts may take them from one island to another.

Zosterops maderaspatana Madagascar White-eye

Jouanin reports that the white-eye was seen on Grande Glorieuse by all observers, Beamish that it occurred in all parts of the island investigated. The largest number reported by the latter as seen at one time was a flock of 25 feeding on ripe fruit in abandoned cultivation near the north coast, although it was not common in the dense scrub in the central zones. It seemed to prefer the larger trees, and any of these in flower or fruit would be frequented invariably by a few white-eyes. This and the sunbird Nectarinia sovimanga are undoubtedly the two most plentiful species of land bird to-day; Abbott (field notes) specifically states that the white-eye was the commonest land bird during his visit. It is curious that white-eye and sunbird should be able to thrive on so small an island as Grande Glorieuse. In contrast to N. sovimanga, which is common, Z. maderaspatana is uncommon on Menai Island, the only island in the Cosmoledo Atoll from which it has been recorded, and on Astove, and is unknown on Assumption (Benson 1970a, 1970b; Stoddart et al. 1970). On the much larger Aldabra, Z. maderaspatana is the most plentiful land bird after N. sovimanga (Benson & Penny 1971: 497).

Sharpe (1884) lists a specimen of Z. maderaspatana collected by Coppinger, evidently from Ile du Lys (Coppinger 1883), although he also saw it on Grande Glorieuse. Abbott thought it the commonest land bird (Ridgway 1896), as did Nicoll (1906, 1908), both agreeing substantially with the recent observations.

Ridgway (1894) named the four specimens collected by Abbott Z. m. gloriosae, but was not fully convinced that this was justified as he had only one Madagascar specimen for comparison.

Moreau (1957: 416), using the six specimens collected by Nicoll, could not separate them from the yellowest ones from Madagascar (from drier areas), and placed both Madagascar and Gloriosa birds with Z. m. maderaspatana (see also pp. 393, 397). Moreau does however mention that most of the Gloriosa specimens have a little yellow wash on the grey belly, and that an immature female had most of the underparts washed with gamboge, together with a golden tinge on the lores. Measurements (p. 428) also show no difference. Benson (1969) was unable to separate either Gloriosa or Astove specimens from Z. m. maderaspatana, although the latter were the greener of the two series, matching those from the more humid parts of Madagascar. Incidentally, he separated the population of Menai Island, Cosmoledo, as Z. m. menaiensis, but later (1970a) thought that the difference claimed might have been due merely to immersion in alcohol. Particular interest attaches to two of the three known Menai specimens in that they have the green of the upperside partially replaced by grey. A watch should be kept for the occurrence of further such individuals.

One unsexed specimen was collected on Grande Glorieuse on 18 April 1971. It is not in good condition. Its measurements are within the ranges as given by Moreau and by Benson, i.e. it has wing 57, tail 37.5, culmen from base 14 mm. Watson has re-examined Abbott's specimens, measurements of which are:

	<u>Wing</u>	<u>Tail</u>	<u>Culmen from base</u>
2 males	57, 59	35, 35.5	13.5, one broken
2 females	56, 59	35, 36.5	13, 13.5

These figures too are similar to Moreau's and Benson's. Watson finds that these four specimens are similar in colour to those collected in Madagascar by Abbott at Andrangoloaka and Imahatsara (see Richmond 1897: 693) and three by H. G. Deignan at Ambatosoratra, although three collected by Deignan at Didy and Périnet are darker and greener. Following Moreau (1957: 397) all these birds must be known as Z. m. maderaspatana, although if one wishes to use finer divisions only the Didy and Périnet birds would be so known, and the remainder (including of course those from the Iles Glorieuses) as Z. m. ampotakae. But if so, there is the absurdity that in contrast to those in the Iles Glorieuses, Astove birds are nominate maderaspatana (as per Benson 1969). It is surely wise to follow Moreau (loc. cit.) in this matter, and use only the one name for all of these birds, i.e. Z. m. maderaspatana, for the reasons explained by him.

Nectarinia sovimanga, Souimanga Sunbird

The relative abundance of the sunbird and Zosterops maderaspatana, both on Grande Glorieuse and in the Aldabra Archipelago, has been discussed above. Jouanin reports it as

seen on Grande Glorieuse by all observers, Beamish as common and widespread on flowering trees all over the island. Many old nests were seen, usually at a height of about 2 metres, in the outer branches of bushes. Frappaz (1820, 1824) mentions 'colibris' on Ile du Lys, and was presumably referring to this species. Coppinger (1883) saw a sunbird on both Ile du Lys and Grande Glorieuse. Almost certainly it was this species, although Sharpe (1884) does not mention any specimen. Abbott (in Ridgway 1896) found it common, and states that 'A very few were nesting'; he collected a nest and an egg 25 January. This is the only definite record of an occupied nest. Nicoll (1906) states that at the time of his visit (in March) it was 'not in its full beauty,' and that it kept almost entirely to coconut trees (he states that he collected two males, but actually they are females, accordingly lacking any metallic feathering). During his visit in October, Salvan saw no nests at all. Probably, as on Aldabra (Benson & Penny 1971: 491), egg-laying occurs at least from August to March. The same authors record an eclipse dress in the male on both Aldabra and Assumption, and probably this applies in the Iles Glorieuses too.

A female was collected on 3 November 1970 and two males on 18 April 1971. The males have only a little metallic feathering, and only the odd red feather on the chest. They must either be immature or adults in an eclipse dress. Using also the two females collected by Nicoll and Abbott's material (four males, two of which, collected on 18 and 20 January, are in a metallic dress with red chest-band, such as is worn in the breeding season), the following are some comparative figures (in millimetres):

	Wing	Tail	Culmen from base
Madagascar			
14 males	51-56 (54.1)	33-40 (36.6)	20.5-24 (22.1)
14 females	47-52 (49.4)	28-33 (31.1)	19-21.5 (20.5)
Iles Glorieuses			
6 males	54-57 (55.2)	33-40 (35.2)	21-23 (22.0)
3 females	49, 49, 50	30, 31, 32	19, 19.5, one broken

The Madagascar figures are from Benson (1967: 85), from which Nicoll's two females have now been transferred to those for the Iles Glorieuses. The two series of figures do not indicate any appreciable difference. Nor does there seem to be any difference in colour except that Watson finds that Abbott's two Iles Glorieuses males in metallic dress, compared with others such also collected by Abbott at Mahanoro and on the River Sakale, in eastern Madagascar (see Richmond 1897: 693), and by H. G. Deignan at Marovoay, Didy, Périnet, and Ambatosoratra, also in Madagascar, have the red chest-band slightly broader and the black on the abdomen slightly less extensive. But Watson finds that there is enough variation for there to be no

justification for bestowing a name on the Iles Glorieuses birds. Thus we follow all previous workers, including Rand (1967), in placing them with the nominate subspecies. By contrast, there is a very well marked form on Cosmoledo and Astove (N. s. buchenorum), and others on Assumption (abbotti) and Aldabra (aldabrensis); see most recently Benson & Penny (1971: 493). Watson finds that material collected by Abbott supports the validity of these last two names (Abbott did not visit Cosmoledo or Astove).

Foudia madagascariensis Madagascar Fody

In 1970-71 the Madagascar Fody was widely dispersed on Grande Glorieuse both in forest and in bushes and trees in more open areas near the airfield. Beamish notes that it was in the largest numbers at the north end of the island, among Casuarina trees there. He counted over 40 birds on each of two visits in November and December 1970. Two specimens were collected, one by Jouanin on 2 November 1970 with wing-length 66 mm, and one by Barau on 18 April 1971 with wing-length 60 mm. Comparison with the figures in Moreau (1960: 35) and Benson (1960: 98) suggests that the first is a male, the second a female. Both authors give a minimum length for males of 64 mm. The apparent male does not show any red coloration, although it is likely that it was about to assume the breeding dress. Salvan noted that four males had assumed about 50% of the breeding dress on 29 October 1970, while Beamish found that males were assuming it in November, but by the early May following it had almost completely disappeared (as has been noted on some other islands, see for example Benson 1960, some males were orange rather than red in colour). Jouanin, on 2-4 November 1970, found some males just starting to come into breeding dress (and incidentally around the New Meteorological Station behaving like sparrows, Passer domesticus). These observations accord quite well with those of Rand (1936: 481), who found no birds in the red plumage in south-eastern Madagascar during June to October, but was told that it was assumed in November. In the Comoros Benson records birds assuming it in late October, and others still in full breeding dress in mid-June.

This is yet another species which is evidently a recent colonizer. It is not mentioned by Abbott (in Ridgway 1896), who was on the Iles Glorieuses during the breeding season in January when red males would have been conspicuous. The same applies to Nicoll (1906, 1908), who was there in March, thus still in the breeding season. Benson found it to be a recent arrival in the Comoros, and thought that this might have been unaided by man, since he could find no evidence of it being kept as a cage-bird. The earliest record he gives is of a specimen collected by Kirk on Moheli. This would have been about 1860, though colonisation of Anjouan and Grand Comoro was probably much later, since Krishnasamy Naidoo did not collect this fody on either of these two islands in 1906-07. Probably, as in the Comoros, colonisation of the Iles Glorieuses has been unaided

by man, although in both areas man's activities may have favoured it. Thus in the Comoros Benson found it common in scrubland and cultivation. It is common on Farquhar Atoll, but while one report has it that it is 'native,' another is that it was 'introduced' (Stoddart & Poore 1970a). In any case, introductions to some other islands further to the north, such as the Chagos Archipelago and the Seychelles (see for example Watson *et al.* 1963), must have been deliberately effected by man. There is still no record from the Aldabra Archipelago, unless an old record of a 'Sourin' (? Serin) from Cosmoledo, attributed by Benson (1970a) to Serinus mozambicus, was in reality of a female F. madagascariensis. 'Serin' is in fact a Seychellois name for Foudia spp. In any case, whatever the species may have been, it appears no longer to exist there.

B. Migratory species, and species of uncertain status

There have been so few and infrequent bird observers in the Iles Glorieuses that the following list of migrants is undoubtedly incomplete. Thus almost any of those recorded by Benson & Penny (1971: 512-521) on Aldabra might be expected, as visitors from the palaeartic or on passage between Madagascar (breeding area) and Africa (wintering area), although lost intra-African migrants such as Porzana marginalis, Striped Crake, are obviously of less likely occurrence than on Aldabra, much nearer to Africa.

Milvus migrans Black Kite

Ridgway (1896, as M. aegyptius) records 'No specimens,' although evidently Abbott saw it. Nicoll (1908) states that 'Now and again a black kite Milvus migrans was observed sailing overhead.' There is no record of it seen during 1970-71. Benson & Penny (1971: 514) discuss a few records from Aldabra, for August-October and December-January, and conclude that it occurs there only as a stray. This must also be the case on the Iles Glorieuses.

Eurystomus glaucurus Broad-billed Roller

Ridgway (1896) gives the same comment as for the last species. There is no further record. Benson & Penny (1971: 517) discuss a few records from Aldabra and Cosmoledo for October-December, considered to be of birds returning to Madagascar to breed (E. g. glaucurus), and one from Aldabra for 25 March, considered to be post-breeding (also this subspecies). Doubtless it can be seen periodically on the Iles Glorieuses too. Abbott would have seen it in January, either very late or very early. The breeding records in Rand (1936: 417) indicate egg-laying in October and November, while Benson & Pitman (1962) record an oviduct egg in November.

*Terpsiphone mutata Madagascar Paradise Flycatcher

Bourlière saw a 'paradise flycatcher' on Grande Glorieuse on 28 August 1970. Quite independently, Beamish has provided some further records of an 'unidentified paradise flycatcher':

"A very reliable observer saw at close quarters on 12 November 1970, near the west coast of the island, a bird closely resembling the female of Terpsiphone corvina, at rest in the lower branches of a tree. The observer, a former resident of La Digue in the Seychelles, the only island on which T. corvina still survives, was already well acquainted with that species. A similar bird was seen again two weeks later. Despite an intensive search, no further observation was made."

Kym Morton, the observer, told G. E. Watson that the bird had wholly rufous underparts, characteristic of the Madagascar species and unlike the white-bellied Seychelles form. Later Lindblad visitors to the island, including G. E. Watson, were alerted to watch for the bird, but none was seen. One possible interpretation of these records is that there is a very small resident population of T. mutata on Grande Glorieuse. If so, it must represent a recent colonisation from Madagascar, since there is no earlier record. The November records would appear to fall within the breeding season, since Rand (1936: 433) records eggs in Madagascar in November, and males with enlarged testes in October-January, while Benson (1960: 74) gives various records for the Comoros indicating egg-laying in October. Alternatively, the observations might refer to one and the same individual, which was either a vagrant or a migrant T. mutata from Madagascar which had failed to return. We are not aware that this species has any regular movements, although T. viridis in southern Africa is well known to be a long distance migrant (see for example McLachlan & Liversidge 1970).

Riparia riparia Sand Martin

Ridgway (1896) records a male specimen collected on 29 January by Abbott who states in his notes that several were seen but that it was not common. Benson & Penny (1971: 520) also mention a few records from Aldabra and Madagascar (its main wintering area is in Africa). Probably it can be seen in the Iles Glorieuses occasionally.

*Nectarinia notata Green Sunbird

Beamish reports that a number of observers, including Dr. Frädrieh (1972), Dr. Backhaus and himself, saw a sunbird larger than N. sovimanga, several times in association with that species for comparison. It was a yellowish green colour, resembling in this respect a Zosterops. The large size suggests N. notata, the only other species of sunbird also found in

Madagascar, while the colour suggests a female, although the female of notata is not yellowish as in Zosterops, being brownish olive above, dingy yellow streaked dark brown below. As with Terpsiphone mutata, this is a problematical case. At all events, like that species, N. notata has colonised the Comoros, and could also the Iles Glorieuses.

C. Species of purely hypothetical occurrence

*Dryolimnas cuvieri White-throated Rail

No evidence has been traced of this species ever having inhabited the Iles Glorieuses. Coppinger (1883) found no sign of Ile du Lys ever having been inhabited (by man), but does not mention it either there or on Grande Glorieuse. This is less surprising so far as the latter is concerned, since he states that there were 29 people living on the island, and moreover that it was so infested with rats that it was impossible to raise any vegetables. However, he does also mention the presence of a 'brown rat' on Ile du Lys, and these as well as cats would be inimical to the rail (Penny & Diamond 1971: 534). Nicoll (1908) made particular inquiries about the rail, but obtained no information. Nevertheless, in view of its former existence apparently throughout the Aldabra Archipelago (it now survives only on parts of Aldabra, Penny & Diamond 1971: 529), it is strange if it never existed on the Iles Glorieuses. Possibly some old account of its former existence will eventually be brought to light, such as has recently been revealed of its occurrence on Astove in 1836 (Stoddart 1971).

2. Shore birds

The following species were listed among others by Dupont (1907) without supporting documentation:

Butorides striatus (as B. atricapillus), Green-backed Heron
Numenius arquata, Curlew
Actitis hypoleucos, Common Sandpiper
Tringa minuta, Little Stint
Charadrius leschenaultii (as Aegialitis geoffroyi), Greater Sand Plover

Probably all of these do occur, although this should be confirmed. Thus Butorides striatus occurs throughout the Aldabra Archipelago (Benson & Penny 1971: 421). It would be interesting to know whether the subspecies is B. s. rutenbergi, as in Madagascar, or crawfordi, as on Aldabra and Assumption (or perhaps even both, as mere strays). The four other species have all been recorded from Aldabra (Penny 1971). Indeed the last named occurs throughout the Aldabra Archipelago (see also Stoddart *et al.* 1970; Benson 1970a, 1970b), and is surely regular as a visitor. Bubulcus ibis, Cattle Egret, occurs throughout the Aldabra Archipelago (actually inland), and breeds on Aldabra (see the same references), and must occur occasionally

on Gloriosa. Probably all of the species recorded by Penny (1971) from Aldabra occur, at least occasionally. In particular, the extensive sandy beaches of Grande Glorieuse must surely be frequented regularly at the right season by Crocethia alba, Sanderling.

The species which now follow may be considered as mostly of reasonably definite occurrence:

Ardea cinerea Grey Heron

The Grey Heron was evidently seen by Abbott, since it is listed by Ridgway (1896), with the bare comment 'No specimens.' There is no further record.

Egretta garzetta Little Egret

Beamish reports that white phase Little Egrets were seen flying singly over the north-west corner of Grande Glorieuse on 8 April (observed by G. E. Watson) and 19 June 1971--the only records. Apparently it is no more than a vagrant, although E. g. dimorpha occurs throughout the Aldabra Archipelago (Benson & Penny 1971: 421), as well as in Madagascar.

*Ardeola ralloides Squacco Heron

Jouanin identified a Squacco Heron on Ile du Lys on 2 November 1970. There is no other record, nor from the Aldabra Archipelago, although A. idae, Madagascar Squacco Heron, well known as an off-season migrant from Madagascar to eastern Africa, breeds on Aldabra (Benson & Penny 1971: 431). There is a single record of A. ralloides from the Comoros (Benson 1960: 34). Except when A. idae is in white breeding dress, these two species are not easily distinguished.

Numenius phaeopus Whimbrel

Abbott evidently saw the Whimbrel (Ridgway 1896) on Grande Glorieuse in January and Nicoll (1906) mentions it as seen in company with Dromas ardeola in March. Bourlière saw it on Grande Glorieuse on 28 August 1970, and Jouanin on Ile du Lys on 2 November 1970. Salvan saw two on Grande Glorieuse on 29 October 1970.

Limosa lapponica Bar-tailed Godwit

Beamish reports that six godwits were seen at a distance of only about 14 metres, feeding in the pond (called 'lagoon' by Battistini & Cremers 1972, figure 3) in the north-west of Grande Glorieuse, 12 November 1970.

Tringa nebularia Greenshank

Abbott may have seen the Greenshank (Ridgway 1896), but his notes record only 'Totanus sp.' Salvan saw an individual

of either this or T. stagnatilis, Marsh Sandpiper, on Grande Glorieuse, 29 October 1970. But as it did not call, it was not possible to decide to which of the two it belonged. The former seems much more likely. Thus on Aldabra Penny (1971) records T. nebularia as regular, but does not even mention stagnatilis.

Arenaria interpres Turnstone

Sharpe (1884) records a Turnstone specimen collected by Coppinger. Abbott evidently saw it (Ridgway 1896). Bourlière saw it on 28 August 1970, and Jouanin on 2 November 1970. Salvan saw a few on Grande Glorieuse on 29 October 1970.

Dromas ardeola Crab Plover

Abbott evidently saw the Crab Plover in January (Ridgway 1896). Nicoll (1906) saw a flock in March. Jouanin saw it on Ile du Lys on 2 November 1970. Penny (1971) found it to be a common visitor to Aldabra presumably from the population that breeds on the coast of Somalia during March to October.

3. Sea birds

Salvan saw an individual of a Pachyptila sp., Prion, 'fishing' for ten minutes around his ship, 1.5 km north of Grande Glorieuse, 29 October 1970. Watson et al. (1963: 17) record P. forsteri (=vittata), desolata and turtur from the western Indian Ocean, and Benson (1970c) records yet another species, P. belcheri. Bailey (1968: 504) saw prions, species indeterminate, on six occasions, south of 10°S in the western Indian Ocean during June and July 1964, and refers to some other recent records. In the absence of a specimen it is impossible to be sure which species Salvan saw.

There is no definite record of Phaethon lepturus, White-tailed Tropicbird, on Gloriosa but it is likely to occur since it is common on Aldabra (Diamond 1971), and it is also known from Cosmoledo (Bayne et al. 1971a). Watson et al. (1963, based on the discussion in Gibson-Hill 1950: 68), suggest that Sula abbotti, Abbott's Booby, possibly used to breed on Gloriosa as well as Assumption, where it has not been seen since about 1926. Abbott (1894), in a preliminary report from the islands, cites 'a booby, which seems to be peculiar to the island. They breed in large numbers upon the 'fouche' (also called 'fig' by Abbott in notes with egg specimens and possibly the 'Ficus sp.' of Battistini & Cremers 1972) trees, in company with frigates and common boobies [probably S. sula].' Abbott fails to mention S. abbotti in his discussion of Assumption Island in the same paper. Possibly there may have been some confusion in his letter from the Seychelles, or he may have been referring to the dark phase of S. sula (see below). The original label on the type of S. abbotti shows it was definitely collected on Assumption. There is no certain record of Fregata ariel,

Lesser Frigatebird, but its possible occurrence is mentioned below under F. minor. Sterna albifrons, Little Tern, is listed without documentation by Dupont (1907, as S. minuta), and apparently again by him as S. balaenarum (in fact unknown in the Indian Ocean, and breeding on the coasts of south-western Africa). The Little Tern probably occurs, since Diamond (1971) records non-breeding flocks as common on Aldabra in January-March, and Milon (1950) saw it in south-western Madagascar in September-May. Gygis alba, Fairy Tern, is also likely, even though it only appears on the undocumented list of Dupont (1907). It breeds on Aldabra (Diamond 1971), and probably on Assumption (Stoddart et al. 1970).

The occurrence of the majority of the species which follow may be accepted as definite:

Phaethon rubricauda Red-tailed Tropicbird

A female Red-tailed Tropicbird and four eggs collected by Abbott January 23 and 24 (partly in Ridgway 1896) appear to be the only record from the island. The nests, containing a single egg each were on the 'ground under a bush, generally in a thick bit of jungle.'

Sula dactylatra Blue-faced Booby

Coppinger (1883) found 'gannets' abundant and breeding on Ile du Lys, possibly this species (S. dactylatra is more like the Gannet S. bassana in colour than are two other local species, S. sula and leucogaster). Abbott collected a female and an egg on Ile du Lys 1 February reporting that it bred on the ground in considerable numbers (Ridgway 1896, as S. cyanops). There is no later record. Breeding has also been reported from the Cosmoledo Atoll, where Diamond (in Bayne et al. 1970a) saw at least 200 pairs and five occupied nests on Wizard Island in March 1968. It also used to breed on Assumption, but probably no longer did so even in 1937 (Stoddart et al. 1970).

Mention must also be made of the information by Frappaz (1820, 1824) from Ile du Lys. In his first account he writes of sea-birds ('Des fous: ils ont le bec long et pointu, les narines latérales, les pattes palmées et la serre du milieu dentelée comme une scie; ils sont blancs et gris.') which having probably never previously seen men allowed such a close approach that several were killed with sticks. Some females were brooding on a hillock in shelter from the wind. There were two eggs to a clutch, but in the case of those which had hatched, only one young. The second account is almost identical except that the birds are described as 'blancs et bruns', not 'blancs et gris.'

The birds were apparently nesting on the ground, so that it is unlikely that they were S. sula, which only rarely so nests (Nelson 1969: 358) and furthermore is recorded below as nesting

in trees on Grande Glorieuse. Most probably they were S. dactylatra, as recorded by Abbott from Ile du Lys. In both accounts Frappaz seems to indicate the predominant colour as white ('blanc'), since it takes precedence. If the birds had been leucogaster, then brown ('brun') would surely have had priority. Moreover in the first account there is no mention of brown.

Sula sula Red-footed Booby

Abbott (original field notes, and in Ridgway 1896, as S. piscator) collected three male Red-footed Boobies and noted it as 'the most common species of booby on the Grand Glorieuse Island.' It was nesting on 'Fouche' trees 5 to 7 metres above the ground, with from 4 to 20 nests in a tree. At the time of his visit to Grande Glorieuse in January, nests were being loosely constructed of sticks, and some already had eggs of which he collected six. Nicoll is not specific about breeding when he was there in March. However he (1906: 691) collected a 'male breeding' and 'female immature,' and indicates that the birds were crowded in tree-tops in company with frigatebirds (1908: 102; photograph facing page 16). The latter at least had nests, apparently near the tops of the same trees (on Aldabra they commonly nest together, see Diamond 1971: 564). There is no record for 1970-71 even of the presence of any species of Sula. Thus the colony which flourished in Abbott's and Nicoll's times appears to have been extinguished. Visits in 1971 included January and March, the months respectively of Abbott's and Nicoll's visits. Moreover, on Aldabra, Diamond (loc. cit.) indicates laying peaks for S. sula in early November, early January and mid-March, as well as August-September, in 1967-68. In March 1968 Diamond (in Bayne et al. 1970a) also found eggs and young on Cosmoledo.

Nicoll's male specimen was made by Grant & Mackworth-Praed (1933) the type of a new species, Sula nicolli, characterised by having the normal white plumage of S. sula replaced by brown, only the rump, tail, vent and thighs being white. But Murphy (1936: 864) was surely justified in casting doubt on the validity of nicolli, which he regarded as a mere colour phase of Sula sula, and in any case the name is probably antedated by S. autumnalis (see also Nicoll 1906: 690-691). Nicoll found that at least 90% of the Gloriosa population was in this brown phase. According to Ridgway (1896: 524) 'only the gray, white-tailed plumage of this species seems to have been seen on Gloriosa' by Abbott. On the other hand he had already visited Aldabra and Assumption before arriving on Gloriosa, and was therefore familiar with the white phase of S. sula which he presumably thought of as the 'common booby' (Abbott 1894: 764). The field label on eggs of S. sula collected on Gloriosa reads 'Brown booby (Sula) with white Tail.' This 'Capuchin' (Ridgway 1896: 532) probably was the 'booby which seems peculiar to the island' (Abbott 1894: 764) rather than Sula abbotti as presumed by Gibson-Hill (1950: 68). On Aldabra, Diamond (1971) found only two dark adult S.

sula with white tails (one of them also with white scapulars), out of an estimated breeding population of 5000 pairs. Nelson (1969: 382) has discussed the possible significance of the phases, and suggests that there may be a difference in hunting habits. It is unfortunate that the problem cannot be pursued further in the Iles Glorieuses, since this interesting population is apparently extirpated.

*Sula leucogaster Brown Booby

Nicoll (1906, 1908) mentions 'one or two pairs' of Brown Boobies on Roches Vertes, but gives no details. It is believed to breed on Cosmoledo (Diamond in Bayne et al. 1907a: 50), but on Aldabra is no more than a regular visitor (Diamond 1971: 569). There is no further record from the Iles Glorieuses.

Fregata minor Great Frigatebird

Coppinger (1893: 238) found that frigatebirds were abundant and bred on Ile du Lys, and that they were also numerous all over Grande Glorieuse. He did not distinguish between the two species F. minor and F. ariel. Abbott (1894 and in Ridgway 1896) records frigatebirds as breeding on Grande Glorieuse in the 'Fouche' trees with boobies but he did not collect any specimens. In his field notes for Aldabra and Assumption Islands, he records under F. minor (= F. ariel), 'some appear to be the greater frigate but there seems to be all gradations of size between the two... Also plentiful on Gloriosa.' Nicoll (1906, as F. aquila) collected F. minor. The specimen is a male, and had a brilliant red pouch. It is considered to be correctly identified, since the wing-length is as much as 615, with culmen (from base) 109, (exposed) 103 mm.

Nicoll (1906) found that frigatebirds were breeding in numbers on Grande Glorieuse (on 10-11 March), in the tallest trees of the island. 'Many were sitting on their nests and on the tree-tops with their scarlet pouches extended, some were flying about with extended pouches, while others were in the air with the pouch collapsed.' Nicoll (1908) gives a similar account. Although there is no mention of the contents of any nest, the recording of extended pouches seems indicative of males about to breed. This is in contrast to Aldabra where in 1967-68 Diamond (1971: 565) found that F. minor and ariel lay from June to December, with a concentration between August and October, the largest colony being a mixed one of the two species. Both species are said to breed also on Cosmoledo, but dates are not available (Diamond in Bayne et al. 1970a: 50).

The only records of frigatebirds from the Iles Glorieuses in 1970-71 are from Salvan, Jouanin and Barau. Salvan saw one or possibly two F. minor circling around his ship off Grande Glorieuse on the afternoon of 29 October 1970. Jouanin saw an immature F. minor over Grande Glorieuse on 2 November 1970, and

two more such birds over Ile du Lys the following day. Barau saw five immature birds in April 1971. It is surprising that there are no observations of frigatebirds by the passengers of the Lindblad Explorer. It must be concluded that frigatebirds do not now feed habitually around the Iles Glorieuses, although the contrary might have been expected. It also appears that the breeding colony (with which S. sula may also have been associated) on Grande Glorieuse has been extirpated since Nicoll's visit. Coppinger (1883) found that both 'gannets' and frigatebirds were abundant and bred on Ile du Lys, but Jouanin is sure that this no longer applies.

Except that it appears on the undocumented list of Dupont (1907), there is no record of F. ariel, Lesser Frigatebird, although it may well have formerly bred, in association with F. minor.

Sterna sumatrana Black-naped Tern

The Black-naped Tern was evidently seen by Abbott, since it is listed by Ridgway (1896, as S. melanauchen), with the bare comment 'No specimens.' There is no further record, although Diamond (1971: 561) thought there might be 70 pairs breeding on Aldabra, and it is also known from Cosmoledo and Assumption (Bayne et al. 1970a; Stoddart et al. 1970).

Sterna fuscata Sooty Tern

Abbott collected three Sooty Terns, two males on Grande Glorieuse and a female on Ile du Lys, 1 February, where he also collected 13 eggs (partly in Ridgway 1896, as S. fuliginosa). The egg data labels read 'breeds in vast numbers upon this islet' and the eggs are 'laid upon bare sand, amongst grass or beneath shrubs.' Nicoll (1908) saw a few overhead on Roches Noires (Roches Vertes). On Ile du Lys he saw none at all, but from dried remains found he thought that there must be a large colony nesting at some time of the year. Arnoux (1950) writes of a 'très importante colonie' on Ile du Lys on 5 April 1948. An accompanying photograph shows adults sheltering the eggs from the sun by their shadows. Milon (1950), evidently writing of the same colony, quotes an estimate by a Dr. Cachan of 200 pairs, all with eggs on 4 April 1948.

On the late afternoon of 29 October 1970, from his ship lying 1.5 km north of Grande Glorieuse, Salvan saw at least 200 birds flying towards Ile du Lys. Four days later (2 November) Jouanin found an enormous breeding colony on Ile du Lys. There was not a single egg. All the chicks were hatched and already of large size. The growth of chicks being very variable (Ashmole 1963), it is impossible to determine precisely when the eggs had been laid, although it is probably that laying had commenced at the beginning of September. Two chicks were collected, the bigger of which regurgitated some little squids.

When Dr. Lyall Watson visited Ile du Lys in mid-December 1970 he found only an enormous number of dead chicks, possibly as many as 80,000. They were all almost fully fledged, and were thought to have been dead more than one month. Evidently there had been a major calamity after Jouanin's visit. Lyall Watson has suggested that a cyclone might have hit the island. However, Jouanin has made inquiries with regard to this possibility, through Barau, resident in Réunion. There was no meteorological event between Jouanin's visit on 2 November and the mid-December following which could explain the disaster to the chicks. This is stated on the authority of M. Marcel Malik, directeur de la Météorologie Nationale à la Réunion, who is also patron of the Meteorological Station on Grande Glorieuse.

Barau visited Ile du Lys on 18 April 1971, but got no evidence whatever of the birds' presence (although two days later Beamish saw 300 or 400 adults, either in the air near the island or resting on the sandspit at the western end). This is in contrast to the findings of Arnoux in April 1948. Possibly the reproductive cycle on Ile du Lys is not on an annual rhythm, albeit not necessarily on a nine and a half month cycle as on Ascension (Ashmole 1963). Milon's quoted estimate of 200 pairs in April 1948 may be quite unduly low. By contrast Arnoux writes of the colony being 'très importante' without suggesting any figure.

Jouanin did not have the time to visit the Roches Vertes in November 1970. But with his binoculars he made out large numbers of birds, wheeling like a cloud of mosquitos above the islets. They were too far away for it to be possible to determine the species. However, on 18 April 1971, Barau found there 200 young Sterna fuscata of variable age, including some ten still in down to others much larger (yet in March 1906, Nicoll 1908: 104, merely saw a few birds overhead, and got no evidence of breeding). In the Aldabra Archipelago the species apparently breeds on Cosmoledo and Astove (Diamond in Bayne et al. 1970a, 1970b), but no dates are available, although on islands further north in the western Indian Ocean breeding is apparently seasonal, during June-August inclusive (Vesey-FitzGerald 1941, and see also Ashmole 1963: 355). Salvan (1971) found some 5,500 pairs breeding on Nosy Dombala, an islet south of Tamatave, eastern Madagascar, 29 May 1971. About 30% had eggs, 70% chicks aged up to 15 days. Also (unpublished) he found a colony on Juan de Nova, in the Mozambique Channel, 2 November 1970, in which egg-laying had just started. Thus in 1970 the season on Juan de Nova was about two months later than it was on Ile du Lys (see Jouanin's observations above).

Thalasseus bergii Crested Tern

Abbott collected an adult Crested Tern in breeding dress (Ridgway 1896, as Sterna bernsteini) on Grande Glorieuse. Nicoll (1906) states that he collected a specimen (in March) of Sterna

cantiaca (=S. sandvicensis), Sandwich Tern. Actually it is a specimen in breeding dress of T. bergii (see Benson 1960: 45). Salvan saw a flock of about 20 off Grande Glorieuse, 29 October 1970. It is possible that it breeds in the Iles Glorieuses. Diamond (1971) records breeding on Aldabra, with laying concentrated in July. Milon (1950) found a colony at Diego Suarez, northern Madagascar, in which eggs were laid in April. Salvan (1971) found a small colony containing eggs on Nosy Dombala, eastern Madagascar, 29 May 1971.

Thalasseus bengalensis Lesser Crested Tern

Abbott collected a male Lesser Crested Tern (in Ridgway 1896, as Sterna media) in non breeding dress and molting the primaries on 25 January on Grande Glorieuse. Salvan saw one or two fishing near his ship, on the north side of Grande Glorieuse, 29 October 1970. Jouanin saw a flock of about 50 on a sandbank in the lagoon near Ile du Lys, 2 November 1970. It may be regular as a non-breeder. Diamond (1971) records it as seen regularly as a winterer on Aldabra in January-April, and thought it might have been overlooked earlier in the season. Milon (1950) records it from Tuléar, south-western Madagascar, between September and May, and it was common on Mayotte, in the Comoros, in February (Nicoll, in Benson 1960: 45).

Anous stolidus Brown Noddy

Nicoll (1908: 104) states that thousands of 'Noddy terns' were sitting on their eggs, most of them fresh (on Roches Vertes, 11 March). On Ile du Lys, 2 November 1970, Jouanin found two breeding colonies, each consisting of about 50 pairs. One colony was on the edge of the sea, on an ancient limestone cliff, some 3 metres above the level of the sea. The other was some 20 metres inland. There were all stages of development, from fresh eggs to young ready to fly. Barau saw no birds at all when he visited Ile du Lys and Roches Vertes on 18 April 1971.

In comparison with Sterna fuscata, it seems that the breeding season may be prolonged. On Aldabra Diamond (1971) found a few eggs in September-November, but records a peak of laying between early December and early March.

DISCUSSION

This section is confined to the more important and significant points arising from the preceding one.

Land birds

The comprehensive discussion by Peake (1971) on the evolution of terrestrial faunas in the western Indian Ocean is not an excuse for failure to offer some comment on the composition

of the land avifauna of the Iles Glorieuses. Benson & Penny (1971: 421) drew up a list of species of land birds breeding on different islands in the Aldabra Archipelago. The first seven (herons etc.) would be under shore birds in the present paper, and so are excluded from the immediate discussion. Including species which have become extinct and those for which breeding cannot be assumed (actually only Corvus albus, on Cosmoledo and Astove), the totals are:

	land area sq. km*	number of species
Aldabra	155	13
Assumption	11	5
Cosmoledo	6	6
Astove	5	6

*from Peake (1971: 585)

The chief source of colonisation is Madagascar, even though Benson & Penny (1971: 424) suggest that one or two of the species on Aldabra may be of direct Comoro origin. Nevertheless, Aldabra, the most remote from Madagascar, is much the richest in species, having the following which are absent elsewhere in the archipelago and from the Iles Glorieuses:

Falco newtoni, Madagascar Kestrel
Alectroenas sganzini, Comoro Blue Pigeon
Centropus toulou, Madagascar Coucal (it did formerly occur also on Assumption)
Tyto alba, Barn Owl (extinct)
Caprimulgus madagascariensis, Madagascar Nightjar
Nesillas aldabranus, Aldabra Tsikurity
Dicrurus aldabranus, Aldabra Drongo
Foudia eminentissima, Red-headed Forest Fody

The relative richness in species on Aldabra is related to its much greater land area, with more room for viable populations. The area of Grande Glorieuse is 4 sq. km, with Ile du Lys much smaller, so that the total area for the Iles Glorieuses cannot exceed 5 sq. km. At the time of Abbott's visit in 1893, there were only five land birds (exclusive of Gallus gallus which must have been introduced directly by man), i.e. Streptopelia picturata, Hypsipetes madagascariensis, Corvus albus, Zosterops maderaspatana and Nectarinia sovimanga. This list can be compared with that for Astove, of similar area, and the nearest island in the Aldabra Archipelago to Madagascar (i.e. 250 km to the northwest, Iles Glorieuses 180 km to the west-north-west; as per map of Africa and Madagascar by J. Bartholomew & Son, Edinburgh, 1966). Common to the two areas are all of these five species except the Hypsipetes, only known in the Archipelago from Aldabra. The other two from Astove are: Dryolimnas cuvieri, now believed extinct there. At present there is no evidence that it ever existed in the Iles Glorieuses.

Cisticola cherina, which may have colonised Astove since the turn of the century, as it surely has the Iles Glorieuses.

The Cosmoledo list is the same as that for Astove, and the circumstances in regard to the last two species are the same.

Turning now to the present, there has been a considerable change since Nicoll's visit in 1906. Nicoll was a competent observer, and although he spent only two days in the Iles Glorieuses his list is probably complete. He failed to find Streptopelia picturata, and it was possibly already extinct. It formerly occurred throughout the Aldabra Archipelago, but now survives only on Aldabra. Although Hypsipetes madagascariensis was found by Nicoll (in fact he saw only four), it is very far from certain that it still survives. On the other hand, the following four species have become established: Turnix nigricollis, Madagascar Buttonquail or Hemipode Geopelia striata, Barred Ground-Dove Cisticola cherina, Madagascar Grass-Warbler Foudia madagascariensis, Madagascar Fody

It seems that Turnix nigricollis and Geopelia striata have been deliberately introduced by man. But this could hardly be so for a tiny insectivorous species such as Cisticola cherina. Ecological changes wrought by man must have favoured these colonisations. All four species are associated with grassland or cultivation. In their conclusion Battistini & Cremers write that the vegetation has been transformed, and that the number of plants has increased from 30 in 1893 to 48 in 1971, the influence of man being the main reason. There is only one record of Geopelia striata from the Aldabra Archipelago, from Cosmoledo in 1968. But Cisticola cherina is abundant on Astove and Cosmoledo, which it might have colonised from the Iles Glorieuses a little later. Foudia madagascariensis is at present unknown from the Aldabra Archipelago, though it may well reach it in due course. The ecology of Astove, Cosmoledo and Assumption, like that of Iles Glorieuses, has been much affected by man, in favour of all four of these species.

The status of Zosterops maderaspatana and Nectarinia sovimanga appears to be much the same as in Abbott's and Nicoll's time, both still being abundant, as they are on the much larger Aldabra. But the former was perhaps always less so on Astove and Cosmoledo, and has never been recorded from Assumption. Thus the difference on the Iles Glorieuses, with no larger a land area, is remarkable. In 1882 Coppinger found Corvus albus on Grande Glorieuse, which had already been colonised by man, although neither crow nor man existed on Ile du Lys. This is yet another species which must owe its introduction indirectly to man.

Benson & Penny (1971: 424) have drawn attention to a degree of endemism in the Aldabra Archipelago, even to species level on

Aldabra. But there is no convincing evidence of this at all in the Iles Glorieuses. By contrast, Astove and Cosmoledo share a well marked form of Nectarinia sovimanga.

However, the subspecies of Streptopelia picturata of the Iles Glorieuses is (or was) certainly different from that on Madagascar, but even so is shared with the Aldabra Archipelago, whence it might have been derived.

Shore birds

Benson & Penny (1971: 421) list (under land birds) five species of herons as breeding on Aldabra, and also Threskiornis aethiopica, Sacred Ibis. Several of the herons are also accepted as breeding on other islands in the archipelago. Although three are recorded from Iles Glorieuses, they appear to be no more than casual visitors. Perhaps there is insufficient ecological diversity for breeding populations to be supportable. Battistini & Cremers write of the beach of Grande Glorieuse being 'always sandy', at least in the west and south. On Aldabra in particular, there is certainly a much greater variety of feeding niches--thus in addition to sandy beaches there is a large mangrove-fringed interior lagoon, where many shore birds feed among rocks uncovered at low tide, and a series of freshwater pools in the southeast of the atoll.

Sea birds

On Grande Glorieuse in 1893 and 1906 respectively, Abbott and Nicoll found Sula sula breeding in forest trees in association with frigatebirds. There is no modern evidence of its presence at all. This is all the more unfortunate because the population was preponderantly brown phase, in contrast to Aldabra, where a white phase exists almost exclusively. Thus there is no longer the possibility for local comparisons of the hunting habits of the two phases. Again, there is no recent evidence of the breeding of frigatebirds, although Nicoll found occupied nests and collected a specimen of Fregata minor. The reason for these disappearances is not clear, although cutting of the native forest for a coconut plantation and attendant increase in human activity may have been contributing factors. Also the breeding season was apparently different from that indicated by recent observations on Aldabra.

On Ile du Lys Abbott found Sula dactylatra breeding, but there is no further record, so that it also has presumably disappeared. On the other hand in 1970 both Sterna fuscata and Anous stolidus were breeding there. The former was in thousands. Even so it is regrettable that some unexplained disaster wiped out the nearly fully fledged chicks. There is a stone-built house on the island, which it might be suspected has been used by a resident egg-collector. But Jouanin found that it bears a date 8th July 1927, and is thus of relatively recent construction. According to the information which he obtained, it was

built with a view to the establishment of a coconut plantation, which proved a failure. The few inhabitants of the Iles Glorieuses (four in 1970, 1971) certainly eat terns' eggs, but Jouanin got no evidence that there has been any systematic collecting with a commercial purpose.

Some Sterna fuscata also breed on Roches Vertes. Nicoll found one or two pairs of Sula leucogaster breeding there, but this is the only record of this species from the Iles Glorieuses as a whole.

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