

ATOLL RESEARCH BULLETIN

136. Coral Islands of the Western Indian Ocean

Edited by D. R. Stoddart



Issued by
THE SMITHSONIAN INSTITUTION
Washington, D.C., U.S.A.

ATOLL RESEARCH BULLETIN
No. 136

CORAL ISLANDS OF THE WESTERN INDIAN OCEAN

Edited by
D. R. Stoddart

Issued by
THE SMITHSONIAN INSTITUTION
Washington, D.C., U.S.A.

August 28, 1970

ACKNOWLEDGEMENT

The Atoll Research Bulletin is issued by the Smithsonian Institution as a part of its Tropical Biology Program. It is co-sponsored by the Museum of Natural History, the Office of Environmental Sciences, and the Smithsonian Press. The Press supports and handles production and distribution. The editing is done by the Tropical Biology staff in the Museum of Natural History.

The Bulletin was founded and the first 117 numbers issued by the Pacific Science Board, National Academy of Sciences, with financial support from the Office of Naval Research. Its pages were largely devoted to reports resulting from the Pacific Science Board's Coral Atoll Program.

The sole responsibility for all statements made by authors of papers in the Atoll Research Bulletin rests with them, and statements made in the Bulletin do not necessarily represent the views of the Smithsonian nor those of the editors of the Bulletin.

Editors

F. R. Fosberg
M.-H. Sachet

Smithsonian Institution
Washington, D. C. 20560

D. R. Stoddart

Department of Geography
University of Cambridge
Downing Place
Cambridge, England

Contributors

- C. J. Bayne
Museum of Zoology, University of Michigan, Ann Arbor, Michigan,
U.S.A.
- C. W. Benson
Department of Zoology, University of Cambridge, Cambridge, England
- B. H. Cogan
Department of Entomology, British Museum (Natural History),
London, S.W.7.
- A. W. Diamond
Culterty Field Station, Newburgh, Aberdeenshire, Scotland
- F. R. Fosberg
Smithsonian Institution, Washington, D.C., U.S.A.
- J. Frazier
Department of Zoology, University of Oxford, Oxford, England
- P. Grubb
Department of Zoology, University of Ghana, Legon, Ghana
- A. Hutson
Department of Entomology, British Museum (Natural History), London,
S.W.7.
- J. F. G. Lionnet
Department of Agriculture, Port Victoria, Mahé, Seychelles
- I. S. C. Parker
Box 21199, Nairobi, Kenya
- J. F. Peake
Department of Zoology, British Museum (Natural History), London,
S.W.7.
- M. E. D. Poore
The Nature Conservancy, 19 Belgrave Square, London, England
- S. A. Renvoize
The Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey,
England
- F. Staub
Royal Road, Curepipe, Mauritius
- D. R. Stoddart
Department of Geography, University of Cambridge, Cambridge, England

ii

J. D. Taylor

Department of Zoology, British Museum (Natural History), London,
S.W.7.

Contents

	Page
1. Introduction D. R. Stoddart	1
2. Geography and ecology of Farquhar Atoll D. R. Stoddart and M. E. D. Poore	7
3. Plants of Farquhar Atoll F. R. Fosberg and S. A. Renvoize	27
4. An old record of a Blue Pigeon <u>Alectroenas</u> species and sea-birds on Farquhar and Providence D. R. Stoddart and C. W. Benson	35
5. Geography and ecology of Cosmoledo Atoll C. J. Bayne, B. H. Cogan, A. W. Diamond, J. Frazier, P. Grubb, A. Hutson, M. E. D. Poore, D. R. Stoddart, and J. D. Taylor	37
6. Plants of Cosmoledo Atoll F. R. Fosberg and S. A. Renvoize	57
7. Land (including shore) birds of Cosmoledo C. W. Benson	67
8. Geography and ecology of Astove C. J. Bayne, B. H. Cogan, A. W. Diamond, J. Frazier, P. Grubb, A. Hutson, M. E. D. Poore, D. R. Stoddart and J. D. Taylor	83
9. Plants of Astove F. R. Fosberg and S. A. Renvoize	101
10. Note on the Lepidoptera of Astove Atoll J. F. G. Lionnet	113
11. Land (including shore) birds of Astove C. W. Benson	115
12. Ecological change and effects of phosphate mining on Assumption Island D. R. Stoddart, C. W. Benson, and J. F. Peake	121
13. Plants of Assumption Island F. R. Fosberg and S. A. Renvoize	147
14. Geography and ecology of Desroches D. R. Stoddart and M. E. D. Poore	155

	Page
15. Plants of Desroches F. R. Fosberg and S. A. Renvoize	167
16. Geography and ecology of Remire D. R. Stoddart and M. E. D. Poore	171
17. Plants of Remire (Eagle) Island, Amirantes F. R. Fosberg and S. A. Renvoize	183
18. Geography and ecology of African Banks D. R. Stoddart and M. E. D. Poore	187
19. Plants of African Banks (Iles Africaines) F. R. Fosberg and S. A. Renvoize	193
20. An introduction of <u>Streptopelia picturata</u> into the Amirantes C. W. Benson	195
21. Geography and ecology of Tromelin Island F. Staub	197
22. Some ornithological observations from the western Indian Ocean I. S. C. Parker	211
Appendix: Names of Islands J. F. G. Lionnet	221

TABLES

	Page
1. Scientific studies at Farquhar Atoll	10
2. Marine fauna recorded from Farquhar Atoll	18
3. Insects recorded from Farquhar Atoll by the Percy Sladen Expedition	18
4. Scientific studies at Cosmoledo Atoll	38
5. Mollusca collected on Cosmoledo Atoll, 1968	46
6. Crustacea (Decapoda) collected on Cosmoledo Atoll, 1968	46
7. Insects recorded from Cosmoledo Atoll by the Percy Sladen Expedition	47
8. Scientific studies at Astove	85
9. Mollusca collected on Astove, 1968	91
10. Crustacea (Decapoda) collected on Astove, 1968	92
11. Insects recorded from Astove by the Percy Sladen Expedition	92
12. Scientific studies at Assumption Island	123
13. Monthly rainfall at Assumption	126
14. Insects recorded from Assumption by the Percy Sladen Expedition	133
15. Scientific studies at Desroches	157
16. Insects recorded from Desroches by the Percy Sladen Expedition	160
17. Scientific studies at Remire	173
18. Insects recorded from Remire by the Percy Sladen Expedition	175
19. Scientific studies at African Banks	188
20. Meteorological data, mean monthly figures 1955-1968, Tromelin	200

	Page
21. <u>Fregata minor</u> colonies on Tromelin	207
22. Breeding birds and occasional visitors, Tromelin	208

FIGURES

1. The Southwest Indian Ocean	Frontispiece
	Page
2. Farquhar Atoll	8
3. Cosmoledo Atoll	39
4. The Aldabra Group	40
5. Astove	84
6. Assumption	122
7. Desroches	156
8. Remire	172
9. Ombrothermic diagram for Tromelin	198
10. Tromelin, showing distribution of breeding bird colonies	198

PLATES

Farquhar Atoll (following p. 26)

1. Scaevola community on high dunes, north end of South Island
2. Unvegetated barachois, lagoon shore, north end of South Island
3. Cay sandstone outcrop on eroding lagoon shore, North Island
4. Scaevola and Casuarina on eroding seaward shore, North Island
5. Prograding lagoon shore with Scaevola and Casuarina, North Island
6. Conglomerate platform outcropping on the sides of the channel between the northern Manaha Island and North Island; view towards the lagoon
7. Open Casuarina woodland on old dunes, North Island
8. Woodland of Cocos and Casuarina on old dunes, North Island; note the hurricane damage to coconuts
9. Replanting of coconuts in hurricane-damaged area of North Island
10. Open woodland of Cocos with Fimbristylis on flat gravel spread, North Island
11. Coconut woodland with grove of wild Carica papaya, north end of North Island
- 12-16. Sooty Terns and Noddies on Goelette Island. Note the low herb-mat vegetation, and the scarcity of dwarf shrubs
17. Copra sheds at Settlement, North Island

Assumption Island (following p. 145)

18. Low champignon cliffs and perched beach, east coast, view towards the south
19. Pocket beach in the champignon cliffs, continuous with the higher perched beach; north of the high dunes, east coast
20. Eroded inner edge of the reef flat where it passes beneath the beach at the foot of the high dunes, east coast

21. Transverse erosional grooves in the reef flat, backed by a rocky erosion ramp, beach, and high dunes; east coast
22. Outer edge of the reef flat near the high dunes, east coast
23. Small dunes on the perched beach, which is densely covered with grasses; east coast, looking north
24. Clumps of Suriana maritima and scattered Fimbristylis on the eroding seaward face of the highest dune
25. Scaevola and Fimbristylis on the high dunes
26. View from the summit of the highest dune, with Tournefortia scrub, across the low mixed scrub of the centre of Assumption. The line of Casuarina trees on the west shore marks the Settlement
27. The lee slope of the highest dune, with Tournefortia and Scaevola
28. Tournefortia and Suriana forming the littoral hedge on the prograding west coast, view north from Settlement
29. Suriana and Pemphis forming the littoral hedge near the northern end of the west coast
30. Leafless Pisonia in the low mixed scrub in the centre of the island
31. Flat plain almost devoid of soil and vegetation, northern end of the island; Ficus in the foreground
32. Nephrolepis biserrata in a solution hole, north end
33. Agave, massive Terminalia, and Cocos at the site of the old settlement; note the water tank behind the coconut
34. Labourers' huts at Settlement; compare with the illustration given of similar quarters in Fryer (1910)
35. Guano railway and sheds at Settlement

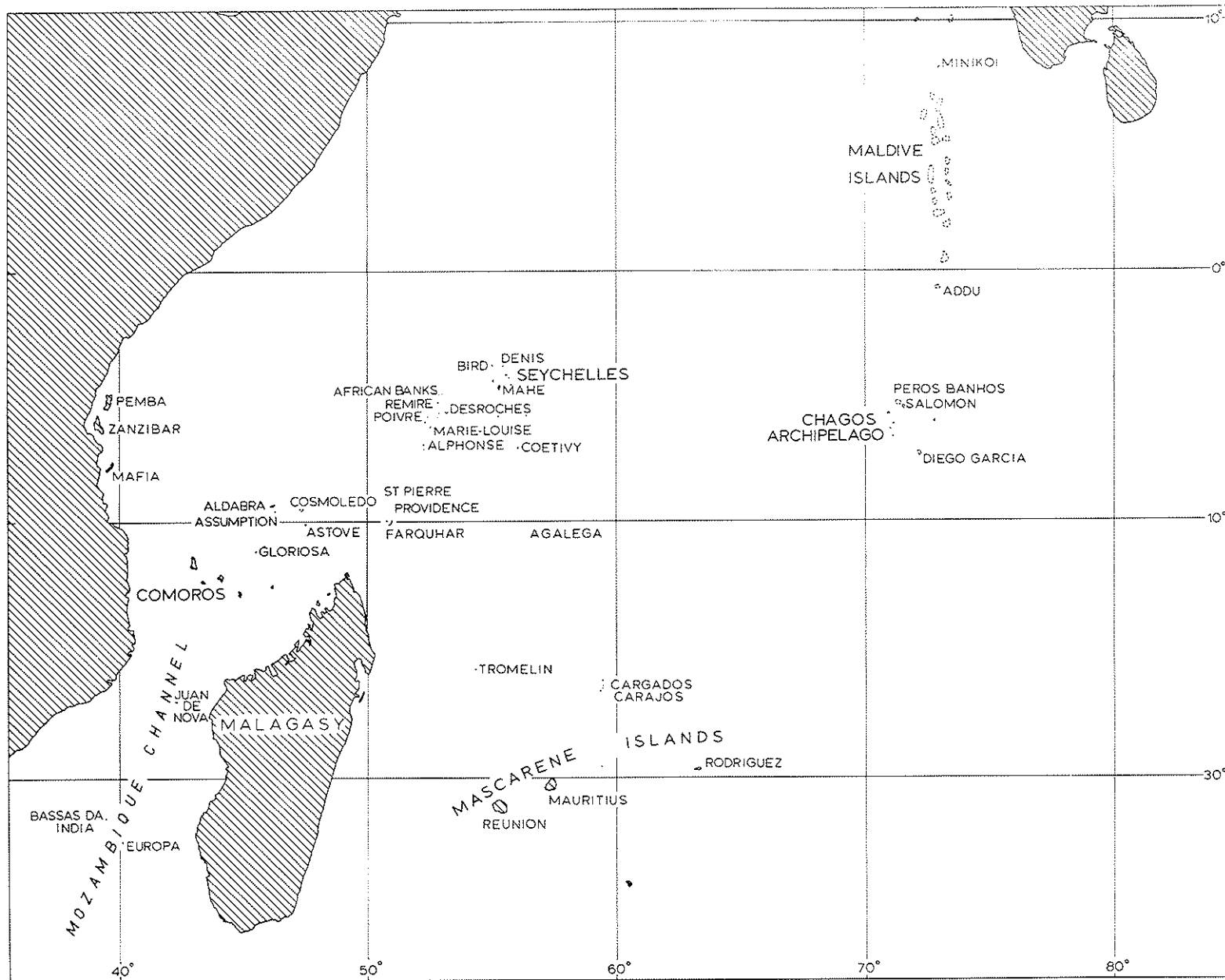
Desroches (following p.165)

36. Scaevola and Casuarina on the south coast near Pointe Helene
37. Suriana on the south coast near Muraille Bon Dieu
38. Massive beachrock near the centre of the south coast
39. Massive beachrock at the southwest point
40. Scaevola and Cocos on the lagoon shore at Settlement
41. Mixed Cocos and Casuarina woodland near La Guigui
42. Labourers' quarters at Settlement, the path flanked by Cocos and Hymenocallis
43. Labourer's quarters at Settlement

Tromelin (following p. 209)

44. Sula sula rubripes: chick with "brown and white" parents
45. Sula sula rubripes: chick nearly fledged to "brown" juvenile form
46. Sula sula rubripes: "brown" juvenile
47. Sula sula rubripes: adult "brown and white" form with few white scapular markings.
48. Sula sula rubripes: adult "brown and white" form with back nearly white
49. Sula sula rubripes: adult "white" form
50. Sula dactylatra melanops: parents with chick
51. Tromelin Meteorological Station
52. Male and four females of Fregata minor with Red-footed Booby in flight
53. Nesting colony of Fregata minor and Sula sula rubripes near airstrip, with Tournefortia thickets and herb-mat vegetation

Fig. 1. The Southwest Indian Ocean



CORAL ISLANDS OF THE WESTERN INDIAN OCEAN

1. INTRODUCTION

D. R. Stoddart

As part of the programme of research on Aldabra Atoll in the southwest Indian Ocean, which began in August 1967 (Stoddart 1967, 1969a), it has been possible for parties from the Royal Society Expedition to Aldabra to visit other western Indian Ocean coral islands from time to time. These visits, though brief, have been important for two reasons. First, the arguments for the conservation of Aldabra itself for scientific research rested, at least in part, on a comparative analysis of the ecological status of neighbouring islands. Second, much of the available information on these islands is many decades old, and some have never been described. This series of reports aims first, therefore, to record the new information obtained during visits in 1967 and 1968 to seven such islands, and second, to provide succinct summaries and guides to the large but scattered literature, much of it taxonomic in nature, but which contains occasional references to them. In this way it is hoped to provide convenient accounts of these islands for the use of future workers, and also to indicate to visiting scientists at the Aldabra Research Station the possibilities for investigation of particular problems or particular groups elsewhere in the western Indian Ocean. A certain amount of repetition in bibliographical lists, acknowledgements etc., has been unavoidable to maintain the independence of the chapters on the different islands.

The coral islands of the western Indian Ocean (Figure 1) may be taken to comprise the following groups:

- (a) the islands of the Mozambique Channel, including Europa;
- (b) the Aldabra group, including Aldabra, Assumption, Cosmoledo and Astove;

- (c) the Farquhar group, comprising Farquhar, St Pierre and Providence;
- (d) the Amirantes, including (from north to south) African Banks, Remire, D'Arros, St Joseph, Desroches, Poivre, Etoile, Boudeuse, Marie-Louise, and Desnoeuufs;
- (e) Bird and Dennis Islands, northern Seychelles Bank;
- (f) Cargados Carajos;
- (g) isolated islands, including Gloriosa, Agalega, Tromelin, Coetivy and Alphonse.

Most early navigators completely neglected the coral islands in the accounts of their travels. Thus Owen, who surveyed Farquhar and other islands in the 1820s, referred to the islands of the Amirantes simply as "low, sandy, sterile, and altogether insignificant" (Owen, 1833, II, 159), and neither he, nor Fairfax Moresby, after whose ships the Menai and Wizard islands on Cosmoledo Atoll are named, nor Wharton, who carried out the first thorough hydrographic survey in the 1870s, pay much attention to island form, vegetation or animal life. The first useful accounts are generally those dated from the period 1890-1910, by Abbott, Dupont and others. Two major expeditions, in H.M.S. Alert in 1882, to the Amirantes and Gloriosa, and by H.M.S. Sealark in 1905, to most of the western Indian Ocean islands, resulted in large collections and many records scattered through a large literature. While the collections in total were large, however, individual islands were often represented by small and inadequate collections. Gardiner (1936, Gardiner and Cooper 1907) contributed brief accounts of many islands to the Reports of the Percy Sladen Trust Expedition, and J. C. F. Fryer (1910) wrote useful accounts of Bird and Dennis Islands in addition to his work on the Aldabra group.

Apart from Vesey-FitzGerald's work in the 1930s, the most important subsequent investigations have been those of Baker (1963) and Piggott (1961, 1968), who visited all of the British-administered islands during a geological and soil survey in 1960, and of Gwynne, Wood and Parker, who collected plants and birds during a cruise in 1967 (Gwynne and Wood 1969). Summaries of the earlier work on Assumption, Astove, Gloriosa, Cosmoledo, Farquhar, St Pierre and Providence were published by Stoddart (1967b).

The present series of studies is based on visits by Royal Society Expedition personnel to Farquhar, Cosmoledo, Astove, Assumption, Desroches, Remire, and African Banks. In addition, there have been excellent recent reports on Europa Island (Legendre 1966) and on Cargados Carajos Shoals (Staub and Guého 1968). Gibson-Hill (1952) summarised data from Agalega, and Brygoo (1955) published observations on Tromelin. These western Indian Ocean studies are linked with others

in the central Indian Ocean, in the southern Maldives (Stoddart 1966) and in the Chagos Archipelago (Stoddart and Taylor, in preparation). These permit some preliminary generalisations on regional variation in Indian Ocean reefs and islands (Stoddart 1969b).

Important gaps remain, however, even at the level of the summary reports presented in this Bulletin. Though large collections of marine and terrestrial fauna were made at Coetivy in 1905, there is no account of this island available. There has been no study in this century of Gloriosa (though Guilcher and others (1965) give aerial photographs), in spite of its probable importance in the colonisation of the Aldabra group from Malagasy. Apart from the three islands discussed here, there is no account of the fauna and flora of the Amirantes, and our knowledge of Agalega is very patchy. Tromelin has been among the least well known of all these islands; the account included here (Staub 1970) follows a visit to the island in 1968 by M. France Staub of Curepipe, Mauritius.

It is, of course, unfortunate that more comprehensive accounts were not compiled seventy years ago, for Coppinger, Abbott, Gardiner and others were able to give tantalising references to island features then largely unaltered by man. Since that time the sandy islands have been almost entirely planted with coconuts, and the rocky islands generally devastated by surface guano mining. The effect of the latter on island ecology is well illustrated by Assumption, though the case of Remire suggests that at least partial recovery is possible over a period of a few decades, but endemic species once extinct cannot be brought back. It is possible that more information on the former state of these islands still exists in manuscript form or in Government archives: we have, for example, been fortunate to have had the loan of diaries and papers belonging to Mr H. A'C. Bergne and Sir John Fryer, dating from 1900-1910, which contain important information on the islands they visited. There is no doubt that modern work can now in many cases only record the state of island ecologies intensely disturbed and modified by man, and with the exception of marine life it is now difficult to attempt to reconstruct the state of island ecosystems before human exploitation began.

The islands treated in this report fall into two main groups: (a) elevated reef-limestone islands, including Cosmoledo, Astove and Assumption, which share many of the characteristics of Aldabra; and (b) sand cays on sea-level reefs, including Farquhar, Desroches, Remire and African Banks. They also experience considerable variation in rainfall, though records have not been kept on any of them except Assumption and Tromelin. Interpolation from known island records (Stoddart 1969b) suggests that Cosmoledo, Astove and Assumption have 1000 mm or less per annum, Farquhar about 1200 mm, and Desroches, Remire and African Banks, in the northern Amirantes, about 1500 mm.

Acknowledgements

Specific acknowledgements and thanks are given in many individual papers in this Bulletin, but I wish to thank here the following:

Captain C. R. K. Roe, D.S.C., R.N., and the officers and crew of H.M.S. Vidal, for making the 1967 visit to Assumption possible; and Captain M. Williams and Captain T. Phipps for their aid with M.F.R.V. Manihine during visits to the other islands in 1968. The cooperation of Mr Basil Bell, Director of the East African Marine Fisheries Research Organization, Zanzibar, helped to make these visits in Manihine a success.

The Lessees and Managers of the islands visited, for their hospitality and assistance during our short visits.

The Royal Society of London, which is sponsoring the Aldabra investigations, and whose support thus made these visits possible.

The Frank M. Chapman Memorial Fund, whose grant to C. W. Benson enabled the March 1968 visit to Astove and Cosmoledo to take place.

Mr J. A'C. Bergne and Lady Joan Fryer for the loan of manuscript records made by the late Mr H. A'C. Bergne and the late Sir John Fryer, respectively; and the Librarian of the Old India Office Library, for access to Fairfax Moresby's manuscripts.

References

- Baker, B. H. 1963. Geology and mineral resources of the Seychelles Archipelago. Mem. Geol. Surv. Kenya, 3: 1-140.
- Brygoo, E. 1955. Observations sur les oiseaux de Tromelin. Naturaliste Malgache, 7: 209-214.
- Fryer, J. C. F. 1910. Bird and Dennis Islands, Seychelles. Trans. Linn. Soc. London, ser. 2, Zool., 14: 15-20.
- Gardiner, J. S. 1936. The reefs of the western Indian Ocean. I. Chagos Archipelago. II. The Mascarene Region. Trans. Linn. Soc. London, ser. 2, Zool., 19: 393-436.
- Gardiner, J. S., and Cooper, C. F. 1907. Description of the Expedition, II. Mauritius to Seychelles. Trans. Linn. Soc. London, ser. 2, Zool., 12: 111-175.
- Gibson-Hill, C. A. 1952. Notes on the birds reported from the Agalega Islands, western Indian Ocean. Bull. Raffles Mus. 24: 257-269.

- Guilcher, A., Berthois, L., Le Calvez, Y., Battistini, R., and Crosnier, A. 1965. Les récifs coralliens et le lagon de l'île Mayotte (Archipel des Comores, Océan Indien). Paris: Office de la Recherche Scientifique et Technique Outre-Mer, 1-210.
- Gwynne, M. D., and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M.F.R.V. "Manihine", Sept.-Oct. 1967. Atoll. Res. Bull. 134: 1-15.
- Legendre, R. 1966. Mission scientifique à l'île Europa. Mém. Mus. Nat. Hist. Natur., N.S., sér. A, Zool., 41: 1-220.
- Owen, W. F. W. 1833. Narrative of voyages to explore the shores of Africa, Arabia and Madagascar; performed in H.M. Ships Leven and Barracouta. London, 2 vols.
- Piggott, C. J. 1961. A report on a visit to the Outer Islands between October and November 1960. Directorate of Overseas Surveys, Land Resources Division, typescript, 1-71.
- 1968. A soil survey of Seychelles. Directorate of Overseas Surveys, Land Resources Division, Tech. Bull. 2: 1-89.
- Staub, F. 1970. Geography and ecology of Tromelin Island. Atoll Res. Bull. (this issue).
- Staub, F., and Guého, J. 1968. The Cargados Carajos Shoals or St Brandon: resources, avifauna and vegetation. Proc. Roy. Soc. Arts Sci. Mauritius, 3(1): 7-46.
- Stoddart, D. R. 1966. Reef studies at Addu Atoll, Maldives Islands: preliminary results of an expedition to Addu Atoll in 1964. Atoll Res. Bull. 116: 1-122.
- 1967a. Ecology of Aldabra Atoll, Indian Ocean. Atoll Res. Bull. 118: 1-141.
- 1967b. Summary of the ecology of coral islands north of Madagascar (excluding Aldabra). Atoll Res. Bull. 118: 53-61.
- 1969a. Retrospect and prospect of Aldabra research. Nature, 221: 1004-1006.
- 1969b. Regional variation in Indian Ocean coral reefs. Marine Biological Association of India, Symposium on Corals and Coral Reefs, in press.
- Stoddart, D. R., and Taylor, J. D., editors. In preparation. Geography and ecology of Diego Garcia Atoll, Chagos Archipelago. Atoll Res. Bull.

2. GEOGRAPHY AND ECOLOGY OF FARQUHAR ATOLL

D. R. Stoddart and M. E. D. Poore

Introduction

Farquhar Atoll (10°11'S, 51°07'E) lies 285 km northeast of Madagascar and 1150 km from the coastline of Africa. It is roughly triangular in shape, with an area of 170 sq km. Apart from small sand cays on the northern rim (Iles des Déposés, du Milieu, Lapin) dry land is confined to the eastern or windward side. Total land area, by planimetry from Figure 2, is 7.5 sq km or 4.4 per cent of the area of the atoll.

The first chart of Farquhar was made by Margaro in 1776 and published, with additions by W. F. W. Owen in 1824, as Admiralty Chart 718 in 1878. This chart is very rudimentary. The atoll was surveyed by Cdr W. J. L. Wharton in 1878, with a large-scale survey of the lagoon entrance by Lt. J. T. A. White, and these surveys formed the basis of a revision of Chart 718 in 1879. Wharton's survey, with some recent additions, is the basis of present charts; it is detailed only for the northern rim and the eastern islands. Figure 2 is based on air photograph cover of the atoll flown in 1960, with topographic control and bathymetry from the Admiralty chart: while reef features are shown in detail, this map should not be used for navigational purposes.

The first biological observations on record are those of Fairfax Moresby in 1822, but these remained unpublished. The Percy Sladen Expedition spent three days on Farquhar in 1905, when Stanley Gardiner worked over North Island, especially the seaward reef, and the entomologist Bainbrigge Fletcher, over South Island. The collections made were small and heterogeneous; determinations published for various groups in the Percy Sladen Expedition Reports are listed, with citations, in Table 1. Most attention was given during this visit to the insects, and Table 2 lists the determinations on insects, by orders and families, in the Expedition Reports. Collections made in some groups, such as the corals, remain unpublished; other groups were neglected. Thus it is difficult to gain an impression of the ecology of Farquhar from the work of the Percy Sladen team.

Apart from a visit in 1937 by Vesey-FitzGerald, who reported on the birds (1940, 1941), little further work was done on Farquhar until

the 1960s. The atoll was visited in 1960 by the geologist B. H. Baker and the agronomist C. J. Piggott, and though no collections were made several useful accounts were published (Baker 1963, 80-85; Piggott 1968, 56-57; Piggott, unpublished, 48-53). In 1967 M.F.R.V. Manihine called at Farquhar with a party collecting for the National Museum, Nairobi, and including I. S. C. Parker, D. Wood and M. D. Gwynne; birds and plants were collected (Gwynne and Wood 1969, Parker 1970). On 19 September 1968 Manihine revisited Farquhar with a Royal Society party comprising T. S. Westoll, M. E. D. Poore and D. R. Stoddart. Stoddart and Poore traversed North Island, Iles Manahas, and the northern half of South Island, and visited Goelette; plants were collected and observations made on birds. In spite of the brevity of these visits, and of the others listed in Table 1, it is possible to give some account of the ecology of the atoll, and to indicate areas in which more detailed work is required.

Table 1. Scientific Studies at Farquhar Atoll

<u>Date</u>	<u>Study</u>	<u>Reference</u>
1504	Discovered by João de Nova; named after him.	
1776	Charted by M. Margaro	Adm.Ch.718(1878)
1821 May	Lieut. Hay, schooner <u>Eliza</u>	
1822 March 12	Lieut. Hay, <u>Wizard</u> and <u>Menai</u>	Moresby (1842)
1822 July 26	Visit by Fairfax Moresby, bird notes	Stoddart and Benson (1969)
1824	Chart additions by W. F. W. Owen; renamed after Sir R. Farquhar, Governor of Mauritius	Adm.Ch.718(1878)
1831	Further charting by Lt Hay	
1867	French chart by M. Lieutard	<u>Ann.hydrograph.</u> (1868, 32)
1878	Hydrographic chart by W. J. L. Wharton	Adm.Ch.718(1879)
1905 Sept. 28- Oct. 2	Percy Sladen Expedition: J. S. Gardiner, C. F. Cooper, T. B. Fletcher	Gardiner and Cooper (1907), Gardiner (1936)
1937	L. D. E. F. Vesey-FitzGerald, bird studies, economic insects	Vesey-FitzGerald (1940, 1941)
1956	W. Travis, underwater and general observations	Travis (1959)
1957 Dec. 7	W. D. Hartman, land birds	Hartman (1958)
1960 Sept. 26- 29	B. H. Baker (geology) and C. J. Piggott (soils)	Baker (1963) Piggott (1961, 1968)
1961 Sept. 28- Oct. 3	P. O. Wiehe, plants	Fosberg and Renvoize, this issue
1967 Oct. 3	M. D. Gwynne, D. Wood, I. S. C. Parker, collections of plants and birds	Parker (1970); Gwynne and Wood (1969)
1968 Sept. 19	D. R. Stoddart, M. E. D. Poore, T. S. Westoll, collection of plants, observations of geomorphology and birds	This report

Geomorphology

Lagoon and reefs

Knowledge of the reefs and submarine topography comes entirely from hydrographic surveys and aerial photographs (Figure 2), but it is clear that Farquhar lagoon is one of the most complex in topography and presumably in geomorphic history in the world. Three main divisions may be noted: (1) the main lagoon basin, 17 km long and with a greatest width of 7.5 km; (2) a triangular area on the south side, extending 4.5 km southwards from the rim of the main lagoon basin; and (3) a submerged spur at the northwest corner, extending for 7 km northwestwards with depths of 11-30 m.

The main lagoon basin is crossed by a series of narrow continuous ridges, up to 5 km long, trending approximately NE-SW. Air photographs suggest that these are not active reefs at the present time. These ridges divide the basin into three parts: a western part with apparently smooth floor at depths of 10-15 m, with hardly any reef knolls; a central part with very numerous knolls and patches, and depths probably about 8-10 m; and an eastern part with ridges and few knolls, and depths of 4-11 m. The southern triangular extension is crowded with knolls and patches, with deep holes of up to 16.5 m. The southern reef flat here is wide, with much coral growth around broad shallow entrances. Nothing is known of the northwest extension apart from the bathymetry shown in Figure 2.

The asymmetry of the shallow features of the atoll is thus marked; it is emphasised further by the character of the peripheral reef. The eastern reef flat is rocky, straight, and tidally emergent; it is largely covered with detrital islands. The reef on the south side is apparently actively growing, and its flat is low enough for coral growth. The reef flat on the west and north sides is poorly defined, with only small patches rising to intertidal levels. Air photographs show that the peripheral reef flats, both of the main basin and of the southern triangle, truncate structures within the lagoon. Thus lagoonal ridges near Goelette and South Island pass into reef flat deposits, and in the southern triangle debris sheets from the reef front are burying reef knolls in the back reef area.

There is only one entrance to the lagoon, a narrow channel 6-10 m deep near the north point, though much water must enter the lagoon over the windward reef flat south of Goelette and leave over the leeward reefs.

Bottom topography seaward of the peripheral reefs is also unusual. On the eastern side depths of less than 30 m are found between 1 and 2.5 km from the reef edge, though the floor then falls more steeply to depths of hundreds of metres. Along the north coast the zone less than 30 m deep is 1 km or less wide, though broadening at the northwest point.

These features are impossible to interpret without field investigation, but they probably result from a complex history, possibly involving differential movement or tilting of the atoll itself. The central oval lagoon is probably an old feature, though its linear ridges are uncommon in atoll lagoons elsewhere. The straight windward reef appears to be retreating lagoonward, truncating lagoon features and leaving a shelf at 20-30 m to seaward. It is possible that the southern triangular reef area is a recent addition to the atoll, perhaps formed by reef growth on a former submarine spur similar to that now extending to the northwest. The sharp distinction in the main lagoon between ridges, apparently largely reefless, and the adjacent deeper floor may result from karst erosion of old reef ridges during Pleistocene low sea level stands.

There is no information on the modern reefs. Gardiner (1936, 432-433) noted the absence of a boulder zone and fissured (algal) zone on the eastern reef flat, which he correctly stated was a rock flat with few corals. He described Heliopora and Porites in the lagoon, together with much Cymodocea. Living reefs are certainly damaged by frequent tropical cyclones, and some effects are described by Travis (1959, 69-73).

Islands

The eastern reef flat has a width of 1-1.5 km, and the islands standing on it are of simple form and structure. South Island, the largest, is 5.7 km long, 0.6-0.9 km wide, and has an area of 3.9 sq km. The crescentic North Island measures 8.5 km in length along its axis, is 0.2-1 km wide, and has an area of 3.2 sq km. Most of South Island is formed of dunes, both active coastal dunes up to 20 m high (Plate 1), and older inland dunes forming a hummocky surface. The lagoon shore of South Island is formed by a wide sand ridge, in places enclosing infrequently-flooded unvegetated areas (Plate 2), floored with poorly-sorted sands and gravels, which resemble the barachois of the Chagos atolls. On North Island the dunes are lower, and are found in the centre and on the lagoon side of the island as well as on the seaward side. Beaches are generally sandy, with local beachrock on the lagoon side up to 1 m above low water level (Plate 3). Seaward beaches on North Island are eroding (Plate 4), with resulting truncation of vegetation zones: dune faces are also eroding both on North Island and at the north end of South Island. Lagoon beaches by contrast are prograding (Plate 5). The only cobble beach seen was on the north side of South Island, facing the channel between it and the Manahas. Gravel is found in places on the island surfaces and on the floors of the South Island barachois, but is not common.

The three small Manahas islands are of considerable physiographic interest. Each is a cay of sand and gravel, resting on a platform of cemented cay deposits which extends up to 200 m seaward of the islet (Plate 6). The platform outcrops along the sides of channels between the islets, where it has a width of only a few metres, and

resembles outcrops of clastic rocks on the sides of similar channels (hoa) in the Tuamotu atolls. Such a conglomerate platform, which is quite distinct from the intertidal reef platform, was not seen on the main islands, except patchily on the lagoon shore of North Island, but may be forming beneath them as a cay sandstone. The surface of the Manahas conglomerate stands about 0.5 m above high water level, and is fretted by subaerial erosion.

Goelette is a small flat featureless island with seaward beaches of imbricate cobbles; it consists of sand and gravels, partly phosphatised (Baker 1963, 85). It has no beachrock. There are several small islets on the northern reef, but they have not been visited.

Gardiner (1936, 432) claimed to find "evidence in isolated masses of rock on the outer sides of the encircling reef, and especially on the islets, of an almost continuous or quite continuous reef that stood up for 10 feet or more above the water level, and formerly surrounded the whole bank, apparently about covering the existing reef". If these features exist they may be storm-cast reef-blocks: no trace of them was seen in 1968, though elevated reef-rock would be expected if the history of the atoll has been as complex as the lagoon bathymetry suggests.

Piggott (1968) distinguishes four soil series on the Farquhar islands: (1) the Farquhar Series, developed on fine dune sands; (2) Shioya Series, on non-dune calcareous sands; (3) small areas of phosphatic hardpan soil described as Jemo Series, though differing in some respects from the type Jemo Series described by Fosberg (1954); and (4) a small area of Saline Marsh on South Island. The parent materials of the Farquhar Series are relatively homogeneous, finer and more angular than those of Shioya Series, and Farquhar Series soils are generally developed on rolling topography with a deep water table. Parent materials of Shioya Series range from sands to gravels. Baker (1963) has given analyses of guano and phosphatic rock from Piggott's Jemo Series.

Tropical cyclones are common on Farquhar, and major storms occurred in 1893, 1926, 1950 and 1954. Apart from their effects on reefs, these storms have led to beach erosion, cutting back of dunes, and the mantling of island surfaces with coarse deposits.

Vegetation

Though plants were collected on Farquhar by Fletcher during the Percy Sladen Expedition in 1905, no list was ever published. The following paper by Fosberg and Renvoize describes collections made by Gwynne and Wood in October 1967 and by Stoddart and Poore in September 1968. The latter collection totalled 62 species of flowering plants, one moss and one lichen, to which can be added ten species of flowering plants recorded as sight records only. Gwynne and Wood (1969) record 47 species, including 16 sight records.

Both flora and vegetation differ markedly from those of elevated limestone islands in the Aldabra group, and resemble more those of the sand cays of the Amirantes and the central Indian Ocean. No rainfall records have been kept, but with probably 1200 mm/yr Farquhar is considerably wetter than Aldabra and Assumption. Both the raised limestone community and the mangrove community are absent on Farquhar. The islands are simple sand cays with dunes, but the vegetation, though characteristic of such habitats, is complicated by a long history of human interference, with the result that there is a strong gradient in number of introduced species southwards from the settlement on the North Island. The channel between North and South Islands forms a major break in this gradient, and though both of the main islands are largely covered with coconuts, North Island has many more introduced species of herbs and grasses in the ground layer than has South. Nesting seabirds also influence the vegetation, particularly on the smaller islands. Farquhar is affected by a major cyclone about once in 25 years, when the littoral vegetation and also the trees, especially the coconuts, are subject to major damage.

Nine vegetation types can be distinguished on Farquhar on the basis of our brief reconnaissance in 1968:

- (1) Seaward beach without dunes: where the beach is stable there is a hedge of Scaevola, Tournefortia, Pemphis and Suriana; where the beach is retreating, inland species such as Casuarina are found at the beach crest.
- (2) Seaward coastal dunes: these are covered with a mosaic of Suriana, Scaevola and Tournefortia, with Fimbristylis and Portulaca.
- (3) Inland stable dunes: mainly under coconuts and Casuarina, with a ground cover of grasses (Plates 7, 8 and 9).
- (4) Inland sand or fine gravel areas, under coconuts or Casuarina, with considerable diversity in ground cover (Plate 10).
- (5) Lagoon beach, mainly edged by Scaevola, Suriana and Pemphis.
- (6) Barachois, edged by Pemphis and Suriana, with a sparse irregular cover of grasses and sedges.
- (7) Inland depressions with standing water or wet ground. These are uncommon; one on North Island has a solitary Rhizophora.
- (8) Herb mat community dominated by Boerhavia and Achyranthes, found in the tern-nesting area on Goelette Island.
- (9) Vegetation in the main settlement and also adjacent to individual houses elsewhere, dominated by introduced decorative and cultivated plants.

North Island

The vegetation of North Island has been much affected by recent cyclones: the seaward beach has eroded, and many coconuts and Casuarina trees have been broken inland. The main vegetation type is coconut woodland in the flatter inland areas. Apart from Casuarina and, especially in the north, wild Carica papaya (Plate 11), few other trees

are present, and those which are found are concentrated near the lagoon shore beach hedge. They include Cordia subcordata, a Ficus, and Hernandia sonora, none of them common; Guettarda speciosa and Thespesia populnea were not seen. According to Piggott (1968, 36) wild Carica is an indicator of phosphatic soils, and groves of this species were growing wild on North Island as early as 1905 (Gardiner and Cooper 1907, 144).

The sward beneath the coconuts is extremely variable, more especially in the north where it is clearly frequently cut. In addition to grasses (Cenchrus echinatus, Digitaria horizontalis, Stenotaphrum dimidiatum, Dactyloctenium aegyptium, Chloris barbata) and sedges (Fimbristylis cymosa, Cyperus dubius, Cyperus ligularis), and the vine Cassytha, there are more than twenty species of flowering plants present. Those collected include:

<u>Achyranthes aspera</u>	<u>Parthenium hysterophorus</u>
<u>Bidens pilosa</u>	<u>Passiflora suberosa</u>
<u>Boerhavia diffusa</u>	<u>Phyllanthus amarus</u>
<u>Euphorbia hirta</u>	<u>Phyllanthus maderaspatensis</u>
<u>Euphorbia prostrata</u>	<u>Portulaca oleracea</u>
<u>Gynandropsis gynandra</u>	<u>Sida cf. parvifolia</u>
<u>Ipomoea tuba</u>	<u>Stachytarpheta jamaicensis</u>
<u>Kalanchoe pinnata</u>	<u>Striga asiatica</u>
<u>Laportea aestuans</u>	<u>Tribulus cistoides</u>
<u>Launaea intybacea</u>	<u>Turnera ulmifolia</u>
<u>Lippia nodiflora</u>	<u>Vernonia cinerea</u>

Turnera is particularly conspicuous in many places, but often there is a very diverse assemblage with no single dominant. The fern Nephrolepis biserrata is present and locally abundant on the ground.

The coconuts are generally 10-12 m tall. In the middle of the island many are snapped off and crownless (Plate 8). Newly planted coconuts towards the southern end are 2-3 m tall. Mature Casuarina trees throughout the island reach 20 m in height.

The seaward beach on North Island is sandy and retreating (Plate 4). Broken, sometimes dead, juvenile Casuarina line much of the beach crest, with a zone of spindly Scaevola taccada to landward. Pemphis is also found on the seaward beach. The ground under the shrubs is often bare, but Triumfetta procumbens was collected on the beach itself. The lagoon shore is prograding, with a dense hedge of Scaevola taccada and Suriana maritima, and occasional trees of Casuarina and Cordia.

Dunes carry a distinctive vegetation. On active dunes, as at the southern tip of the island, there is a shrub layer of bushy Scaevola taccada 1.5 m high, with a largely bare ground surface dotted with rosettes of Fimbristylis cymosa and Eragrostis: the ground here is being eroded by wind and the sedges and grasses stand on small

pinnacles. Non-active dunes are common over the island and carry mature Casuarina woodland with a mixed ground vegetation.

One small marshy area in the centre of the island contains a solitary tall Rhizophora, the only mangrove seen on Farquhar, with a dense ground cover of Stenotaphrum.

The main settlement at the north end of North Island contains several trees not seen elsewhere, in addition to tall Casuarina and Hernandia sonora. These include Ochrosia oppositifolia, Moringa oleifera, Terminalia catappa, Calophyllum inophyllum, and Tabebuia pallida, the last a New World decorative. Cultivated plants of economic value include Gossypium hirsutum, Agave, Musa, Ricinus communis, various cucurbits, and maize; decoratives include a red-flowered Opuntia, Catharanthus roseus, Bidens sulphurea, Heliotropium indicum, Solanum cf. melongena, Malvastrum coromandelianum, Gaillardia lanceolata and Zinnia elegans. The whole area of the settlement has the appearance of long-continued human occupation and alteration.

Manaha Islands

These three small islets between North and South Islands are covered with a tall woodland of Cocos and Casuarina. Each has a littoral hedge of Tournefortia argentea, Scaevola taccada and Suriana maritima. The ground vegetation beneath the coconuts consists of abundant vines of Ipomoea tuba, clumps of Fimbristylis cymosa, and little else. The contrast with the diversity of similar ground vegetation on North Island is very striking.

South Island

Like North Island, South Island has a small settlement, not permanently occupied, at its northern end; a large part of the island is covered with dunes; and most of the rest by coconut or Casuarina woodland. In the coconut woodland few other trees are present (rare Hernandia sonora and Cordia subcordata) and there are few shrubs. The ground cover is similar to that under coconuts on North Island, but fewer species are present. Grasses include Eragrostis sp., Cenchrus echinatus, and Dactyloctenium aegyptium; the sedges Fimbristylis cymosa and Cyperus ligularis. Other flowering plants noted in the ground layer include:

<u>Achyranthes aspera</u>	<u>Phyllanthus amarus</u>
<u>Boerhavia diffusa</u>	<u>Portulaca</u> cf. <u>australis</u>
<u>Cassytha filiformis</u>	<u>Sida</u> sp.
<u>Euphorbia prostrata</u>	<u>Striga asiatica</u>
<u>Ipomoea tuba</u>	<u>Turnera ulmifolia</u>
<u>Kalanchoe pinnata</u>	<u>Vernonia cinerea</u>
<u>Malvastrum coromandelianum</u>	

A single bryophyte, collected on the surface of old dunes in heavy shade, can only be determined as Bryum sp. or Pohlia sp. by C. C. Townsend.

The seaward dunes are covered with a dense growth of Scaevola taccada, with Suriana maritima and some Tournefortia argentea. The lagoon beach is lined mainly with Scaevola and Suriana, and the long inlets or barachois by Suriana and Pemphis acidula. The lichen Usnea was collected from Suriana on the margins of one of the barachois.

The small settlement has introduced trees, particularly Moringa oleifera but also including a single young Barringtonia asiatica. Musa sp., Ricinus communis and Amaranthus dubius are cultivated, and the decoratives include Mirabilis jalapa and Gaillardia lanceolata.

Goelette Island

The tern-breeding island of Goelette is almost devoid of trees (one Cocos and one Casuarina, both small and sickly) and shrubs (some low Suriana maritima and Tournefortia argentea on the northwest shore). Almost the whole island is covered with a low mat of Ipomoea pes-caprae vines, the sedges Fimbristylis cymosa and Cyperus ligularis, and especially Boerhavia diffusa and Achyranthes aspera, the latter forming the tallest vegetation apart from the rare trees and shrubs. No species not present elsewhere on the atoll were found on Goelette, but the absence of Stachytarpheta jamaicensis, dominant in similar bird colonies on Desnoeufs, Amirantes (Ridley and Percy 1955), and present on North Island, may be noted.

Fauna other than Birds

Both the land and marine fauna of Farquhar are very inadequately known, for apart from Gardiner's party in 1905 no attention has been paid to any group except the birds. Gardiner's own collections were small by comparison with those he made on other islands during the Percy Sladen Expedition. A single marine alga is recorded (Gepp and Gepp 1909), but the collections of marine fauna, other than pelagic forms, are very small (Table 2). Gardiner and Cooper (1907, 144-145) described the Green Turtle nesting on Farquhar, and it still does so.

According to Rothschild (1915) the Giant Land Tortoise Geochelone gigantea formerly existed on Farquhar but has become extinct. No evidence for this statement is known, either historically or in the fossil record. However, two Giant Tortoises from Aldabra are present on North Island: one of these was seen in 1968, in the coconut woodland near the south end of the island, and is considerably larger than any tortoise now living on Aldabra, presumably in response to the wetter climate, richer vegetation, and absence of competition. Boulenger (1909) recorded two reptiles, a Hemidactylus and a Phelsuma, but neither was seen in 1968. Two crabs (Cardisoma, Coenobita) are

Table 2. Marine Fauna recorded from Farquhar Atoll

<u>Group</u>		<u>Number of species</u>	<u>Reference</u>	
Coelenterata	Hydroids	4	Jarvis (1922)	
	Siphonophorae	19	Browne (1926)	
	Medusae	8	Browne (1916)	
	Alcyonaria	1	Thomson and Mackinnon (1910)	
Annelida	Polychaeta	1	Potts (1910)	
Echinodermata		3	Bell (1909)	
Crustacea	Decapoda	Anomura	1	Laurie (1926), Borradaile (1907)
		Brachyura	1	Borradaile (1907), Rathbun (1911)
Mollusca	Stomatopoda	5	Tattersall (1912)	
	Gastropoda	4	Melvill (1909)	
	Pteropoda	8	Tesch (1910)	
	Heteropoda	4	Tesch (1910)	

recorded by Borradaile (1907), and nine species of Arachnida (Neumann 1907, Hirst 1911). There are no native mammals. Bainbrigge Fletcher collected insects in 1905, and this accounts for the 66 species of insects recorded in the Percy Sladen Reports: citations of Farquhar material in these Reports are keyed in Table 3.

Table 3. Insects recorded from Farquhar Atoll
by the Percy Sladen Expedition

<u>Group</u>	<u>Number of Species</u>	<u>Reference</u>
Apterygota	1	Carpenter (1916)
Orthoptera	9	Bolivar (1912, 1924)
Dermaptera	2	Burr (1910)
Hemiptera	7	Distant (1909, 1913), Green (1907)
		Needham (1913)
Neuroptera	1	Fletcher (1910), Fryer (1912), Meyrick (1911)
Lepidoptera	16	Arrow (1922), Champion (1914), Fleutiaux (1923), Gebien (1922), Grouvelle (1913), Scott (1912)
Coleoptera	18	Cameron (1907), Cockerell (1912), Forel (1907), Meade-Waldo (1912)
Hymenoptera	11	Lamb (1922)
Diptera	1	

It is clear from this record that little can be said about the invertebrate fauna of Farquhar, either marine or terrestrial, without further collecting.

BirdsBreeding land birds

The number of land birds is very small by comparison with that on the elevated limestone islands, and all four species recorded may have followed human settlement. Apart from a possible Alectroenas, now extinct (Stoddart and Benson 1970), and a dubious sighting of "a solitary and shy warbler which I could not identify" by Travis (1959, 66), the native land bird fauna of Farquhar may have been nil. The following species are recorded.

Foudia madagascariensis

Native according to Gardiner, introduced according to Hartman (1958). Common everywhere, especially on North Island in 1968.

Streptopelia picturata

Recorded (as Turtur picturatus) as "very common in Farquhar", probably introduced from Madagascar, by Gadow and Gardiner (1907, 107). No other record known; not seen in 1968.

Geopelia striata

Introduced before 1905 and then common around North Island settlement (Gardiner and Cooper 1907, 144). ♂ collected on North Island by Parker, 3 October 1967. Common, especially on the northern half of North Island, 1968.

Bubulcus ibis

♀ collected on Goelette by Parker, 3 October 1967. Breeding in Suriana bushes on Goelette, September 1968; six adult birds.

Possibly resident shore birdsArdea cinerea

Sight, Manahas, September 1968.

Butorides striatus

Sight, North Island, September 1968.

MigrantsArenaria interpres

Sight, Manahas, September 1968.

Squatarola squatarola

As S. helvetica in Gadow and Gardiner (1907), 1 specimen.

Charadrius alexandrinus

Sight record, as Aegialitis cantiana, in Gadow and Gardiner (1907).

Limosa lapponica

1 specimen taken, 1905 (Gadow and Gardiner 1907).

Crocethia alba

Sight, Manahas, September 1968.

Erolia testacea

♀ collected by Parker, Goelette, 3 October 1967.

Dromas ardeola

Sight, Manahas, September 1968.

Other species are recorded from Providence Bank by Watson and others (1963, 187). Charadrius leschenaultii and Numenius phaeopus in particular are likely to occur.

Sea birds

The main sea bird breeding ground is on Goelette Island (Plates 14, 15 and 16), and has been exploited in the past for terns' eggs (Ridley and Percy 1955). Vesey-FitzGerald (1941, 525) recorded that "about 25,000 birds [Sterna fuscata] were reared in 1937 after heavy egg-collecting" on this island; he also recorded Sterna sumatrana and roosting Anous tenuirostris. Travis (1959, 62-63) found few if any Sooty Terns on Goelette, the whole being covered with Noddies, but the time of year of his visit is not clear. Parker in October 1967 collected four species of terns (Sterna albifrons, S. fuscata, S. sumatrana, S. dougalli) on Goelette, and saw Thalasseus bergii. He found several thousand young Sooty Terns on the island, all more than half fledged and the majority fully fledged, and he noted a large number of dead or dying birds (Parker 1970). A large number of Noddies Anous stolidus also nest on Goelette, but were already fledged at the time of Parker's visit. In September 1968 we found many thousands both of Sterna fuscata and Anous stolidus on Goelette, in large discrete flocks. Again most of the terns were fledged, and there were large numbers of dead birds. The whole island was covered with ticks (Amblyomma sp.), in contrast to similar bird colonies on African Banks.

The only other sea bird definitely known to nest on Farquhar is the Red-footed Booby Sula sula. Travis (1959, 64-65) records nesting boobies with chicks in Casuarina on the east side of South Island. This colony was seen, in tall Casuarina stained white by the birds, on the lagoon shore of South Island in 1968. Other sea birds may nest on the small remote sand cays of the northern reef, but these have not been investigated.

The following sea birds have been recorded from Farquhar:

Sula dactylatra

Recorded by Vesey-FitzGerald (1941) from Goelette.

Sula sula

Recorded from South Island by Vesey-FitzGerald (1941) and Travis (1959), and seen in 1968. Breeds in Casuarina.

Fregata minor

Sight, September 1968; not common.

Sterna dougallii

♀ collected by Parker on Goelette, 3 October 1967.

Sterna sumatrana

Recorded by Vesey-FitzGerald (1941) on Goelette; ♂ collected by Parker on Goelette, 3 October 1967.

Sterna fuscata

Breeds in thousands on Goelette. Recorded by Vesey-FitzGerald (1941) and later visitors. ♂♀ collected by Parker on Goelette, 3 October 1967.

Sterna albifrons

♀♀♂♂ collected by Parker on Goelette, 3 October 1967.

Anous stolidus

Recorded by Parker on Goelette; present in thousands in September 1968.

Anous tenuirostris

Recorded as roosting on Goelette by Vesey-FitzGerald (1941).

Gygis alba

Recorded by Stoddart and Poore, September 1968: probably the "small white gull" noted by Moresby in 1821-2 (Stoddart and Benson 1969).

Settlement

Farquhar was discovered by Joao de Nova in 1504, but apart from the French hydrographic survey in 1776 and the British in 1824, nothing is known of its history until the early nineteenth century. The atoll was apparently uninhabited when a ship named the St Abbs was wrecked there in 1855, though Lieut. Hay had found a fishing settlement established on 12 March 1822 (Moresby 1842, 680). A small fishing station was established soon afterwards (Lieutard 1868), and planting of coconuts followed: a considerable number were planted on North Island by a Mauritian firm in 1870 (Findlay 1882, 546-547). According to a visiting Stipendiary Magistrate (reported in Bergne 1900), however, coconut trees were not bearing by 1879. At this time the population numbered 40 men, with an export of salt fish and turtle valued at Rs 14,000. More coconuts were planted by James Spurs about 1885 (Gardiner and Cooper 1907, 143), but many were destroyed in the

cyclone of 1893. In 1895 the coconuts which survived were in full bearing, producing about 70,000 nuts per month, and supporting a population of 100 men, women and children (Bergne 1900). Planting began on South Island as late as 1905 (Gardiner and Cooper 1907, 143).

Piggott (1961, 82) has summarised the history of the coconut plantations. By 1950 they were yielding 30 tons of copra per month. 30,000 trees were destroyed, however, in the major cyclone of that year. In spite of replanting, copra production in 1960 was only 20 tons per month, and 24 tons in 1967.

The settlement (Plate 17) in 1968 consisted of 39 people, all resident on North Island, with 31 head of cattle, 2 donkeys, and 2 horses, pigs, chickens, turkeys, ducks, geese and bees. Maize has been cultivated at least since 1905. The economic development of the atoll is limited both by the recurrent cyclones and by the great distance to Mahé, in both respects comparing unfavourably with competing plantations in the Amirantes and on Coetivy.

From 1814, when Mauritius came under British rule, Farquhar was administered as part of the Colony of Mauritius, and while the new Colony of Seychelles was formed in 1903, Farquhar was not transferred to it until December 1921. In 1965 Farquhar was detached from the Seychelles and became part of the British Indian Ocean Territory. As such it is covered by the provisions of an agreement between Britain and the United States governing the use of B.I.O.T. for defence purposes for a period of not less than fifty years.

References

- Arrow, G. J. 1922. Coleoptera, Erotylidae and Endomychidae, from the Seychelles, Chagos, and Amirantes Islands. *Ann. Mag. Nat. Hist.*, ser. 9, 10: 73-83.
- Baker, B. H. 1963. Geology and mineral resources of the Seychelles Archipelago. *Mem. Geol. Surv. Kenya*, 3: 1-140.
- Bell, F. J. 1909. Report on the Echinoderma (other than Holothurians) collected by Mr J. Stanley Gardiner in the western parts of the Indian Ocean. *Trans. Linn. Soc. London*, ser. 2, Zool., 13: 17-22.
- Bergne, H. A'C. 1900. Fair record of islands in the Indian Ocean. Manuscript.
- Bolivar, I. 1912. Orthoptera: Acrydiidae, Phasgonuridae, Gryllidae. *Trans. Linn. Soc. London*, ser. 2, Zool., 15: 263-292.
- 1924. Orthoptera Dictyoptera (Blattidae and Mantidae), and supplement to Gryllidae, of the Seychelles and adjacent islands. *Ann. Mag. Nat. Hist.*, ser. 9, 13: 313-359.

- Borradaile, L. A. 1907. Land and freshwater Decapoda. Trans. Linn. Soc. London, ser. 2, Zool., 12: 63-68.
- Boulenger, G. A. 1909. A list of the freshwater fishes, batrachians and reptiles obtained by Mr J. Stanley Gardiner's expedition to the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 12: 291-300.
- Boulton, F. R. P. 1960. Bird notes of a visit to islands in the Seychelles and adjacent groups north of Madagascar. Sea Swallow, 13: 48-50.
- Bourne, W. R. P. 1966. Observations on islands in the Indian Ocean. Sea Swallow, 18: 40-43.
- Browne, E. T. 1916. Medusae from the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 17: 169-210.
- 1926. Siphonophorae from the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 19: 55-86.
- Budde-Lund, G. 1912. Terrestrial Isopoda, particularly considered in relation to the distribution of the southern Indo-Pacific species. Trans. Linn. Soc. London, ser. 2, Zool., 15: 367-394.
- Burr, M. 1910. Dermaptera. Trans. Linn. Soc. London, ser. 2, Zool., 14: 123-133.
- Cameron, P. 1907. Hymenoptera. Trans. Linn. Soc. London, ser. 2, Zool., 12: 69-86.
- Carpenter, G. H. 1916. The Apterygota of the Seychelles. Proc. Roy. Irish Acad. B, 33: 1-70.
- Champion, G. C. 1914. Coleoptera, Curculionidae. Trans. Linn. Soc. London, ser. 2, Zool., 16: 393-497.
- Cockerell, T. D. A. 1912. Hymenoptera, Apoidea. Trans. Linn. Soc. London, ser. 2, Zool., 15: 29-41.
- Distant, W. L. 1909. 'Sealark' Rhynchota. Trans. Linn. Soc. London, ser. 2, 13: 29-48.
- 1913. Rhynchota, Part I: suborder Heteroptera. Trans. Linn. Soc. London, ser. 2, Zool., 16: 139-190.
- Findlay, A. G. 1882. A directory for the navigation of the Indian Ocean, with descriptions of its coasts, islands, etc. London: R. H. Laurie, 4th edition, 1-1304.

- Fletcher, T. B. 1910. Lepidoptera, exclusive of the Tortricidae and Tineidae, with some remarks on their distribution and means of dispersal amongst the islands of the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 13: 265-323.
- Fleutiaux, E. 1923. Coleoptera: Melasidae et Elateridae des Séchelles et des îles voisines. Trans. Ent. Soc. London, 1922: 398-436.
- Forel, A. 1907. Fourmis des Seychelles, Amirantes, Farquhar et Chagos. Trans. Linn. Soc. London, ser. 2, Zool., 12: 91-94.
- Fosberg, F. R. 1954. Soils of the northern Marshall atolls, with special reference to the Jemo series. Soil Sci. 78: 99-107.
- Fryer, J. C. F. 1912. The Lepidoptera of Seychelles and Aldabra, exclusive of the Orneodidae and Pterophoridae and of the Tortricina and Tineina. Trans. Linn. Soc. London, ser. 2, Zool., 15: 1-28.
- Gadow, H. and Gardiner, J. S. 1907. Aves, with some notes on the distribution of the land-birds of the Seychelles. Trans. Linn. Soc. London, ser. 2, Zool., 12: 103-110.
- Gardiner, J. S. 1936. The reefs of the western Indian Ocean. I. Chagos Archipelago. II. The Mascarene Region. Trans. Linn. Soc. London, ser. 2, Zool. 19: 393-436.
- Gardiner, J. S. and Cooper, C. F. 1907. Description of the Expedition, II. Trans. Linn. Soc. London, ser. 2, Zool., 12: 111-175.
- Gebien, H. 1922. Coleoptera, Heteromera: Tenebrionidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 261-324.
- Gepp, A. and Gepp, E. S. 1908. Marine algae (Chlorophyceae and Phaeophyceae) and marine phanerogams of the 'Sealark' expedition, collected by J. Stanley Gardiner, M.A., F.R.S., F.L.S. Trans. Linn. Soc. London, ser. 1, Botany, 8: 163-188; reprinted in ser. 2, Zool., 12: 373-398, 1909.
- Green, E. E. 1907. Notes on the Coccidae collected by the Percy Sladen Trust Expedition to the Indian Ocean, supplemented by a collection received from Mr. R. Dupont, Director of Agriculture, Seychelles. Trans. Linn. Soc. London, ser. 2, Zool., 12: 197-207.
- Grouvelle, A. 1913. Coleoptera: Nitidulidae, Heteroceridae. Trans. Linn. Soc. London, ser. 2, Zool., 16: 93-116.
- Gwynne, M. D. and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M. F. R. V. "Manihine", Sept.-Oct. 1967. Atoll Res. Bull. 134: 1-15.

- Hartman, W. D. 1958. Report on some land birds of Farquhar, St Pierre, Astove, Cosmoledo, Assumption and Aldabra. Seychelles Govt. Bull. 21.
- Hirst, S. 1911. The Araneae, Opiliones and Pseudoscorpiones. Trans. Linn. Soc. London, ser. 2, Zool., 14: 379-395.
- Jarvis, F. E. 1922. The hydroids from the Chagos, Seychelles and other islands and from the coasts of British East Africa and Zanzibar. Trans. Linn. Soc. London, ser. 2, Zool., 18: 331-360.
- Lamb, C. G. 1922. Diptera: Asilidae, Scenopinidae, Dolichopodidae, Pipunculidae, Syrphidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 361-416.
- Laurie, R. D. 1926. Anomura collected by Mr J. Stanley Gardiner in the western Indian Ocean in H.M.S. 'Sealark'. Trans. Linn. Soc. London, ser. 2, Zool., 19: 121-167.
- Lieutard, M. 1868. Ilots de Jean de Nova. Ann. Hydrogr. 31(445): 32-33.
- Lorenz-Liburnau, L. von. 1899. Die Säugetiere von Madagaskar und Sansibar. Abhand. Senck. naturf. Gesellsch. 2: 441-469.
- Meade-Waldo, G. 1912. Hymenoptera, Diploptera. Trans. Linn. Soc. London, ser. 2, Zool., 15: 43-44.
- Melvill, J. C. 1909. Report on the marine mollusca obtained by Mr J. Stanley Gardiner, F.R.S., among the islands of the Indian Ocean in 1905. Trans. Linn. Soc. London, ser. 2, Zool., 13: 65-138.
- Meyrick, E. 1911. Tortricina and Tineina. Trans. Linn. Soc. London, ser. 2, Zool., 14: 263-307.
- Moresby, F. 1842. On the Seychelle Islands. Naut. Mag. 11: 585-590, 676-682, 739-746.
- Needham, J. G. 1913. Neuroptera, Myrmeleonidae from the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 16: 243-246.
- Neumann, L. G. 1907. Note sur les Ixodidae recueillis dans les îles de l'Océan Indien par M. J. Stanley Gardiner. Trans. Linn. Soc. London, ser. 2, Zool., 12: 193-196.
- Parker, I. S. C. 1970. Some ornithological observations from the western Indian Ocean. Atoll Res. Bull., this issue.
- Piggott, C. J. 1961. A report on a visit to the Outer Islands between October and November 1960. Department of Overseas Surveys, Land Resources Division, typescript, 1-71: Chapter 11, Farquhar, 48-53.

- Piggott, C. J. 1968. A soil survey of Seychelles. Directorate of Overseas Surveys, Land Resources Division, Tech. Bull. 2: 1-89.
- Potts, F. A. 1910. Polychaeta of the Indian Ocean. Part II. The Palmyridae, Aphroditidae, Polynoidae, Acoetidae, and Sigalionidae. Trans. Linn. Soc. London, ser. 2, Zool., 13: 325-353.
- Rathbun, M. 1911. Marine Brachyura. Trans. Linn. Soc. London, ser. 2, Zool., 14: 191-261.
- Ridley, M. W. and Percy, R. 1958. The exploitation of sea birds in the Seychelles. Colonial Res. Studies, 25.
- Rothschild, W. 1915. On the gigantic land-tortoises of the Seychelles and Aldabra-Madagascar group, with some notes on certain forms of the Mascarene group. Novitates Zool. 22: 418-442.
- Scott, H. 1912. Coleoptera, Lamellicornia and Adephaga. Trans. Linn. Soc. London, ser. 2, Zool., 15: 215-262.
- Stoddart, D. R. and Benson, C. W. 1970. An old record of a Blue Pigeon Alectroenas species and sea birds on Farquhar and Providence. Atoll Res. Bull., this issue.
- Tattersall, W. M. 1912. On the Mysidacea and Euphausiacea collected in the Indian Ocean during 1905. Trans. Linn. Soc. London, ser. 2, Zool., 15: 119-136.
- Tesch, J. J. 1910. Pteropoda and Heteropoda. Trans. Linn. Soc. London, ser. 2, Zool., 14: 165-189.
- Thomson, J. A. and Mackinnon, D. L. 1910. Alcyonarians collected on the Percy Sladen Trust Expedition by Mr J. Stanley Gardiner, M.A., F.R.S. Part II. The Stolonifera, Alcyonacea, Pseudaxonia, and Stelechotokea. Trans. Linn. Soc. London, ser. 2, Zool., 13: 165-211.
- Thornely, L. R. 1912. The marine Polyzoa of the Indian Ocean, from H.M.S. Sealark. Trans. Linn. Soc. London, ser. 2, Zool., 15: 137-157.
- Travis, W. 1959. Beyond the reefs. New York: E. P. Dutton (London: Allen and Unwin), 1-221.
- Vesey-FitzGerald, L. D. E. F. 1940. The control of Coccidae on coconuts in the Seychelles. Bull Entom. Res. 31: 253-286.
- 1941. Further contributions to the ornithology of the Seychelles Islands. Ibis, ser. 14, 5: 518-531.
- 1950. Nesting habits of some aculeate Hymenoptera in the Seychelles. Proc. Entom. Soc. London, ser. A, 25: 75-80.

FARQUHAR ATOLL



1. Scaevola community on high dunes, north end of South Island



2. Unvegetated barachois, lagoon shore, north end of South Island



3. Cay sandstone outcrop on eroding lagoon shore, North Island



4. Scaevola and Casuarina on eroding seaward shore, North Island



5. Prograding lagoon shore with Scaevola and Casuarina, North Island



6. Conglomerate platform outcropping on the sides of the channel between the northern Manaha Island and North Island; view towards the lagoon



7. Open Casuarina woodland on old dunes, North Island



8. Woodland of Cocos and Casuarina on old dunes, North Island; note the hurricane damage to coconuts



9. Replanting of coconuts in hurricane-damaged area of North Island



10. Open woodland of Cocos with Fimbristylis on flat gravel spread, North Island



11. Coconut woodland with grove of wild Carica papaya, north end of North Island



12. Sooty Terns and Noddies on Golette Island. Note the low herb-mat vegetation, and the scarcity of dwarf shrubs



13-14. Sooty Terns and Noddies on Goelette Island. Note the low herb-mat vegetation, and the scarcity of dwarf shrubs



15-16. Sooty Terns and Noddies on Goelette Island. Note the low herb-mat vegetation, and the scarcity of dwarf shrubs



17. Copra sheds at Settlement, North Island

3. PLANTS OF FARQUHAR ATOLL

F. R. Fosberg and S. A. Renvoize

USNEA sp.

South I., Stoddart & Poore 1368 (K). On Suriana.

Unidentified moss

Stoddart & Poore s. n.

NEPHROLEPIS BISERRATA (Sw.) Schott

S. I., Wiehe 10174 (MAU)*; North I., Stoddart & Poore 1342
(K, US); Gwynne & Wood 1179 (EA).

CYMODOCEA CILIATA Ehrenb. ex. Aschers.?

South I. "Alt. 10 ft", Gwynne & Wood 1216 (EA).

Small, internodes condensed, leaf-tips sharply and prominently
denticulate.

THALASSIA HEMPRICHII (Ehrenb.) Aschers.

South I., Gwynne & Wood 1216 (EA). (Fragment mixed with
Cymodocea coll.)

CENCHRUS ECHINATUS L.

South I., Gwynne & Wood 1201 (K, EA); North I., Stoddart &
Poore 1341 (K).

CHLORIS BARBATA Sw.

North I., Stoddart & Poore 1364 (K).

DACTYLOCTENIUM AEGYPTIUM (L.) Willd.

S. I., Wiehe 10162 (MAU); North I., Stoddart & Poore 1361 (K,
US); South I., seen by Stoddart, 1968.

DIGITARIA TIMORENSIS (Kunth) Bal.

South I., Gwynne & Wood 1202 (K, EA); North I., Stoddart &
Poore 1357 (K, US)

DIGITARIA sp.

Wiehe 10163 (MAU)

*Wiehe collections cited from Mauritius Herbarium have not been
seen by the authors.

ELEUSINE INDICA (L.) Gaertn.

South I., Gwynne & Wood 1200 (K, EA), 1206 (EA).

ERAGROSTIS sp.

S. I., Wiehe 10178 (MAU); North I., Stoddart & Poore 1360 (K);
South I., seen by Stoddart, 1968.

LEPTURUS REPENS R. Br.

North I., Gwynne & Wood 1186 (EA).

PANICUM MAXIMUM Jacq.

S. I., Wiehe 10179 (MAU); South I., Gwynne & Wood 1203 (EA).

PANICUM (near) UMBELLATUM Trin.

S. I., Wiehe 10183 (MAU).

PASPALUM DISTICHUM L. (*P. vaginatum* Sw.)

S. I., Wiehe 10187 (MAU); North I., Gwynne & Wood 1182 (K, EA).

PENNISETUM POLYSTACHION (L.) Schult.

North I., Stoddart & Poore 1332 (K, US).

PENNISETUM PURPUREUM Schum.

S. I., Wiehe 10160 (MAU); North I., Gwynne & Wood 1184 (EA).

STENOTAPHRUM DIMIDIATUM (L.) Brongn.

S. I., Wiehe 10161 (MAU); North I., Stoddart & Poore 1359 (K, US).

STENOTAPHRUM MICRANTHUM (Desv.) Hubb.

S. I., Wiehe 10159 (MAU); South I., Gwynne & Wood 1197 (EA).

ZEA MAYS L.

South I., seen by Stoddart, 1968.

CYPERUS DUBIUS Rottb.

S. I., Wiehe 10165 (MAU); North I., Stoddart & Poore 1348 (K,
US); South I., seen by Stoddart, 1968.

CYPERUS KYLLINGIA Endl.

North I., Gwynne & Wood 1183 (EA); Stoddart & Poore 1334 (K, US).

FIMBRISTYLIS CYMOSA R. Br.

S. I., Wiehe 10164 (MAU); North I., Gwynne & Wood 1181 (EA);
Stoddart & Poore 1349 (K); South I., Gwynne & Wood 1213 (EA);
Stoddart & Poore 1370 (K, US); Manaha Islets, seen by Stoddart,
1968.

COCOS NUCIFERA L.

North, South, and Manaha Islets, seen by Stoddart, 1968.

- AGAVE SISALANA Perr.
North I., seen by Stoddart, 1968.
- MUSA SAPIENTUM L.
North and South Islets, seen by Stoddart, 1968.
- CASUARINA EQUISETIFOLIA L.
North, South, and Manaha Islets, seen by Stoddart, 1968.
- LAPORTEA AESTUANS (Gaud.) Chew
North I., Stoddart & Poore 1344 (K).
- FICUS BENGHALENSIS L.
North I., Stoddart & Poore 1336 (K, US); Gwynne & Wood 1188 (EA).
- BOERHAVIA DIFFUSA L.
S. 1., Wiehe 10173 (MAU); North I., Gwynne & Wood 1185 (EA);
Stoddart & Poore 1352 (K, US); South I., Gwynne & Wood 1211 (K,
EA).
- MIRABILIS JALAPA L.
South I., Gwynne & Wood 1199 (EA); Stoddart & Poore 1371 (K, US).
- ACHYRANTHES ASPERA L.
S. 1., Wiehe 10172 (MAU); North I., Stoddart & Poore 1346 (K, US);
South I., Gwynne & Wood 1189 (K, EA).
- AMARANTHUS DUBIUS Mart. ex Thell.
North I., Stoddart & Poore 1324 (K, US); South I., seen by
Stoddart, 1968.
- AMARANTHUS sp.
S. 1., Wiehe 10190 (MAU).
- PORTULACA cf. AUSTRALIS Endl.
South I., Stoddart & Poore 1369 (K).
- PORTULACA OLERACEA L.
S. 1., Wiehe 10193 (MAU); South I., Gwynne & Wood 1205 (EA); North
I., Stoddart & Poore 1328 (K, US).
- PORTULACA sp.
S. 1., Wiehe 10177 (MAU).
- CASSYTHA FILIFORMIS L.
S. 1., Wiehe 10196 (MAU); North I., Stoddart & Poore 1321 (K, US);
South I., seen by Stoddart, 1968.
- HERNANDIA SONORA L.
North I., Stoddart & Poore 1345 (K, US); South I., seen by Stoddart,
1968.

GYNANDROPSIS GYNANDRA (L.) Briq.

S. I., Wiehe 10167 (MAU); South I., Gwynne & Wood 1204 (K, EA);
North I., Stoddart & Poore 1343 (K, US).

MORINGA OLEIFERA Lam.

North I., Settlement, Stoddart & Poore 1379 (K, US); South I.,
seen by Stoddart, 1968.

KALANCHOE PINNATA (Lam.) Pers.

North I., Stoddart & Poore 1322 (K, US); South I., seen by Stoddart,
1968.

DESMANTHUS VIRGATUS Willd.

S. I., Wiehe 10184 (MAU).

INDIGOFERA sp.

S. I., Wiehe 10175 (MAU).

LEUCAENA LEUCOCEPHALA (Lam.) de Wit

North I., Gwynne & Wood 1186 (K, EA).

TRIBULUS CISTOIDES L.

North I., Stoddart & Poore 1339 (K, US); South I., Gwynne & Wood
1193 (K, EA).

SURIANA MARITIMA L.

North I., Gwynne & Wood 1187 (EA); Stoddart & Poore 1333 (K, US);
South and Manaha Islets, seen by Stoddart, 1968.

ACALYPHA INDICA L.

S. I., Wiehe 10192 (MAU) "first observed after 1950 cyclone";
North I., Settlement, Stoddart & Poore 1382 (K).

EUPHORBIA HIRTA L.

S. I., Wiehe 10188 (MAU); South I., Gwynne & Wood 1198 (EA);
North I., Stoddart & Poore 1354 (K).

EUPHORBIA PROSTRATA Ait.

North I., Stoddart & Poore 1355 (K); South I., seen by Stoddart,
1968.

PEDILANTHUS TITHYMALOIDES (L.) Poit.

North I., Stoddart & Poore 1326 (K).

PHYLLANTHUS AMARUS Schum. & Thonn.

North I., Stoddart & Poore 1350 (K); South I., seen by Stoddart,
1968.

PHYLLANTHUS MADERASPATENSIS L.

S. I., Wiehe 10170 (MAU); South I., Gwynne & Wood 1212 (EA);
North I., Stoddart & Poore 1362 (K, US).

- PHYLLANTHUS (near) TENELLUS Roxb.
S. 1., Wiehe 10189 (MAU).
- RICINUS COMMUNIS L.
North and South Islets, seen by Stoddart, 1968.
- TRIUMFETTA PROCUMBENS Forst.
North I., Stoddart & Poore 1329 (K, US).
- ABUTILON sp.
S. 1., Wiehe 10198 (MAU).
- GOSSYPIUM HIRSUTUM L.
S. 1., Wiehe 10186 (MAU); South I., Gwynne & Wood 1191 (K, EA).
- MALVASTRUM COROMANDELIANUM (L.) Garcke
S. 1., Wiehe 10191 (MAU); North I., Settlement, Stoddart & Poore 1378 (K, US); South I., Stoddart & Poore 1367 (K, US).
- SIDA PARVIFOLIA DC.
North I., Stoddart & Poore 1327 (K, US); South I., Gwynne & Wood 1210 (K, EA).
- CALOPHYLLUM INOPHYLLUM L.
North I., Settlement, Stoddart & Poore 1384 (K).
- TURNERA ULMIFOLIA L.
S. 1., Wiehe 10169 (MAU); North I., Stoddart & Poore 1351 (K, US);
South I., seen by Stoddart, 1968.
- PASSIFLORA FOETIDA var. HISPIDA (DC.) Killip
S. 1., Wiehe 10189 (MAU).
- PASSIFLORA SUBEROSA L.
North I., Stoddart & Poore 1366 (K, US).
- CARICA PAPAYA L.
North I., seen by Stoddart, 1968.
- CUCURBITA cf. MAXIMA Duch. ex Lam.
North I., Stoddart & Poore 1323 (K, US).
- CUCURBITA PEPO L.
South I., Gwynne & Wood 1190 (EA).
- MELOTHRIA MADERASPATANA (L.) Cogn.
North I., Stoddart & Poore 1340 (K); South I., Gwynne & Wood 1194 (K, EA); Ile Goelette, Gwynne & Wood 1219 (EA).
- PEMPHIS ACIDULA Forst.
S. 1., Wiehe 10197 (MAU); North I., Gwynne & Wood 1180 (K, EA);
Stoddart & Poore 1330 (K, US).

- RHIZOPHORA MUCRONATA Lam.
North I., Stoddart & Poore 1331 (K, US).
- TERMINALIA CATAPPA L.
North I., Settlement, Stoddart & Poore 1381 (K).
- BARRINGTONIA ASIATICA (L.) Kurz
South I., Stoddart & Poore 1386 (K, US).
- OPUNTIA FICUS-INDICA (L.) Mill.
North I., photo by Stoddart, 1968 (determination verified by Lyman Benson, 1969).
- CATHARANTHUS ROSEUS (L.) G. Don
North I., Stoddart & Poore 1338 (K, US).
- OCHROSIA OPPOSITIFOLIA (Lam.) K. Schum.
North I., Settlement, Stoddart & Poore 1385 (K).
- IPOMOEA TUBA (Schlecht.) G. Don
S. I., Wiehe 10200 (MAU); Goelette I., Gwynne & Wood 1218 (EA);
North I., Stoddart & Poore 1337 (K, US); South I., Gwynne & Wood 1209 (K, EA); Manaha Islets, seen by Stoddart, 1968.
- CORDIA SUBCORDATA Lam.
North I., Stoddart & Poore 1335 (K, US); South I., seen by Stoddart, 1968.
- HELIOTROPIUM INDICUM L.
North I., Settlement, Stoddart & Poore 1375 (K, US).
- TOURNEFORTIA ARGENTEA L. f.
North and South and Manaha Islets, seen by Stoddart, 1968.
- LIPPIA NODIFLORA (L.) Michx.
S. I., Wiehe 10166 (MAU); North I., Stoddart & Poore 1365 (K, US).
- STACHYTARPHETA JAMAICENSIS (L.) Vahl
S. I., Wiehe 10180 (MAU); North I., Stoddart & Poore 1358 (K, US).
- SOLANUM MELONGENA L.
North I., Settlement, Stoddart & Poore 1376 (K).
- SOLANUM NIGRUM L.
North I., Settlement, Stoddart & Poore 1383 (K).
- STRIGA ASIATICA (L.) O. Ktze
S. I., Wiehe 10195 (MAU); North I., Stoddart & Poore 1347 (K, US);
South I., seen by Stoddart, 1968.
- TABEBUIA PALLIDA (Lindl.) Miers
North I., Settlement, Stoddart & Poore 1380 (K).

ASYSTASIA BOJERIANA Nees

S. 1., Wiehe 10182 (MAU).

SCAEVOLA TACCADA (Gaertn.) Roxb.

North, South, and Manaha Islets, seen by Stoddart, 1968.

BIDENS PILOSA L.

S. 1., Wiehe 10194 (MAU); North I., Stoddart & Poore 1363 (K, US).

BIDENS SULPHUREA (Cav.) Sch.-Bip.

North I., Settlement, Stoddart & Poore 1374 (K).

GAILLARDIA LANCEOLATA Michx?

South I., Stoddart & Poore 1372 (K, US), 1373 (K, US); Gwynne & Wood 1207 (K, EA), 1208 (K, EA).

LAUNAEA INTYBACEA (Jacq.) Beauv.

S. 1., Wiehe 10181 (MAU); North I., Stoddart & Poore 1325 (K).

PARTHENIUM HYSTEROPHORUS L.

S. 1., Wiehe 10185 (MAU); South I., Gwynne & Wood 1195 (EA); North I., Stoddart & Poore 1353 (K, US).

SPILANTHES sp.

S. 1., Wiehe 10176 (MAU).

VERNONIA CINEREA (L.) Less.

S. 1., Wiehe 10171 (MAU); South I., Gwynne & Wood 1196 (EA); North I., Stoddart & Poore 1356 (K, US).

ZINNIA ELEGANS Jacq.

North I., Settlement, Stoddart & Poore 1377 (K).

4. AN OLD RECORD OF A BLUE PIGEON ALECTROENAS SPECIES
AND SEA-BIRDS ON FARQUHAR AND PROVIDENCE

D. R. Stoddart and C. W. Benson

While working on manuscripts in the Old Indian Office, London, Stoddart found the following statement in a document about voyages in the southwest Indian Ocean in 1821-22, written by Captain (later Admiral of the Fleet Sir) Fairfax Moresby:

"Jean de Nova i.e. Farquhar and Providence ... like the Amirantes, Coetivy and Alphonse are the resort of Millions of Birds of which, the Frigate Bird, the Fou, a beautiful small white gull, a variety of various coloured Gannet, and the Tropic Bird are the principle: In S. Pierre and Providence a species of small blue pigeon are in great abundance, and so seldom disturbed that they do not fly at Man's approach, but are knock'd down with Sticks, we found them excessively good eating, these birds build and nest on the Mapou tree and other Dwarf trees which cover the surface of the islands ..."

The "small blue pigeon" must have been a species of Blue Pigeon, Alectroenas. We know of no other reference to its occurrence on Farquhar, Providence or St Pierre. Stoddart spent 19 September 1968 on Farquhar, traversing most of the atoll land (see maps in Stoddart and Poore 1970 and Watson, Zusi and Storer 1963, 184), but saw no blue pigeons. The genus Alectroenas is endemic to the Malagasy Region. It was formerly represented on Mauritius, and is still so on Malagasy (Madagascar), the Comoros, Aldabra and the Seychelles (Goodwin 1967, 380-384). There may also have been a form on Rodriguez, A. rodericana (Milne-Edwards), known only from bones (Hachisuka 1953, 180). According to Rountree and others (1952, 187), the Mauritius form, A. nitidissima (Scopoli), became extinct about 1831, though Renshaw (1939) gives the date as early as 1826. Penny (1967, 272) writes of the "declining numbers" and edibility of A. pulcherrima (Scopoli) in the Seychelles. The Comoro form, A. s. sganzi (Bonaparte), was reported by Benson (1960, 52) as very confiding and excellent eating, though still plentiful. Nevertheless representations were made at the Conference of the International Council for Bird Preservation in New York in 1962 for its proper protection (IX Bull. I.C.B.P., 1963, 38, 41). We can confirm that on Aldabra A. sganzi minor Berlepsch is extremely confiding. It is still plentiful in the southeast of the atoll. Tameness and palatability, both mentioned in Moresby's account, were undoubtedly the undoing of Alectroenas on St Pierre and Providence, and presumably Mauritius too.

Of the other species (sea birds) mentioned in Moresby's account, Watson and others (1963, 185-188) mention neither frigatebirds Fregata spp. nor tropicbirds Phaethon spp. "Fou" is French for a gannet, so that it would appear that there were at least two Sula spp. Watson and others (1963) list both S. dactylatra and sula as breeding on Farquhar. The "beautiful small white gull" was presumably the Fairy Tern Gygis alba, which according to Watson and others (1963) breeds on Providence.

Acknowledgement

Unpublished Crown-copyright material in the India Office Records transcribed in this paper appears by permission of the Secretary of State for Foreign and Commonwealth Relations.

References

- Benson, C. W. 1960. The birds of the Comoro Islands. *Ibis*, 103b: 105-106.
- Goodwin, D. 1967. Pigeons and doves of the world. London.
- Hachisuka, M. 1953. The dodo and kindred birds. London.
- Moresby, F. No date (?1822). Memoir on the isles in the Indian Ocean. Manuscript. London, India Office, Records Department, MS 51: 1-70.
- Penny, M. 1968. Endemic birds of the Seychelles. *Oryx*, 9: 267-275.
- *
Renshaw, G. 1939. Some extinct birds. 5. The Pigeon Hollandais. *Bird Notes and News*, 18(5): 109-110.
- Rountree, F. R. G., Guérin, R., Pelte, S., and Vinson, J. 1952. Catalogue of the birds of Mauritius. *Mauritius Inst. Bull.* 3(3).
- Stoddart, D. R. and Poore, M. E. D. 1970. Geography and ecology of Farquhar Atoll. *Atoll Res. Bull.*, this issue.
- Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington.

5. GEOGRAPHY AND ECOLOGY OF COSMOLEDO ATOLL

C. J. Bayne, B. H. Cogan, A. W. Diamond, J. Frazier, P. Grubb,
A. Hutson, M. E. D. Poore, D. R. Stoddart, J. D. Taylor

Introduction

Cosmoledo Atoll, 9°41'S, 47°35'E, is located 110 km east of Aldabra. It consists of eight main islands and numerous islets on the atoll rim, surrounding a large and open lagoon. The two largest islands, Wizard and Menai, are those usually visited by scientists. There has been no detailed survey of Cosmoledo at any time, though many expeditions have called there for brief visits (Table 4). The main published accounts are those by Dupont (1907, 8-12), Fryer (1911, 428-430), Travis (1959, 111-156), Baker (1963, 86-92), and Piggott (1961, 27-30; 1968, 53-54). Ten members of the Royal Society Expedition to Aldabra visited Menai and Wizard Islands in March 1968, and five more visited Menai only in September 1968: this paper summarises earlier work and adds new information from the Royal Society surveys.

The main hydrographic survey of Cosmoledo was by W. J. L. Wharton in 1878, published as Admiralty Chart 718 in 1879. This chart, with revisions by H.M.S. Owen in 1964, is still current. The atoll was covered by aerial photography in 1960, and Baker (1963, 87, 89, 91, 93) used air photographs to prepare sketch maps of the geology of the main islands. Figure 3 is based primarily on the 1960 air photograph cover, with topographic control and bathymetry from the 1967 edition of Admiralty Chart 718. This map should not be used for navigational purposes without further field survey.

Geomorphology

Cosmoledo stands on the northern of two presumably volcanic peaks, 45 km apart, rising from the ocean floor at 4000-4400 m depth. At the 4000 m isobath the volcanic massif is 85 km long N-S and 33-52 km wide: the Cosmoledo peak becomes distinct from that on which Astove stands at a depth of 1000 m (Figure 4). Outside the peripheral reef of Cosmoledo, the sea floor falls gently to 50 m, over a distance of 0.5-1 km, and then more steeply: the 500 m isobath generally lies 1-1.5 km from the surface reefs.

The atoll has maximum dimensions of 14.5 x 11.5 km, and a total area of 152 sq km. The peripheral reef flat varies in width from 1 to 2.5 km, averaging about 1.5 km, and encloses a shallow lagoon, opening to the south in two major channel systems. The greatest depths in the lagoon

Table 4. Scientific Studies at Cosmoledo Atoll

<u>Date</u>	<u>Study</u>	<u>Reference</u>
1822 July 31	Capt. F. Moresby in ships <u>Wizard and Menai</u>	Moresby (1822)
1875 Oct. 17	Capt. <u>Niejahr, Hermann</u> <u>Friedrich</u>	Niejahr (1876)
1878	Hydrographic survey by W. J. L. Wharton	Adm. Ch. 718 (1879)
1895	Agricultural survey by S. C. E. Baty	Bergne (1900)
1901 Oct. 9-12	Visit by H. A'C. Bergne	Bergne (1901)
1906	Chart emendations by L. Ferrari	
1907	H. L. Thomasset, insects	
1908 Sept. 1-5	J. C. F. Fryer: general observations, insects	Fryer (1911, 428-30)
1906 Sept. 14-19	R. Dupont: plants, insects	Dupont (1907, 8-12)
1937 Sept.-Nov.	L. D. E. F. Vesey-FitzGerald: vegetation, birds	Vesey-FitzGerald (1940, 1941, 1942)
1953 Nov.	Italian Zoological Expedition: C. Prola, F. Palombelli, F. Prosperi, S. Nievo	Berio (1956)
1956	H. Legrand: Lepidoptera	Legrand (1965)
1957 Dec. 10-12	W. D. Hartman: land birds	Hartman (1958)
1959 Oct. 9-Nov. 27	H. Legrand, M. Gerber: Lepidoptera	Legrand (1965)
1960 Oct. 9-12	B. H. Baker, geology; C. J. Piggott, soils	Baker (1963); Piggott (1961, 1968)
1964	R. E. Honegger: birds, reptiles	Honegger (1966, unpub. a, unpub.b)
1964 March 13-14	H.M.S. <u>Owen</u> ; Cmdr D. W. Haslam: survey, birds	Bourne (1966)
1967 Oct. 5-6	M. D. Gwynne, D. Wood, I. S. C. Parker: plants, birds	Parker (1970); Gwynne and Wood (1969)
1968 March 6	C. W. Benson, B. H. Cogan, A. W. Diamond, F. R. Fosberg, J. Frazier, A. Graham, P. Grubb, A. Hutson, K. McKenzie, S. A. Renvoize	This report; Benson (1970); Fosberg and Renvoize (1970)
1968 Sept. 14	C. J. Bayne, J. C. Gamble, M. E. D. Poore, D. R. Stoddart, T. S. Westoll	This report

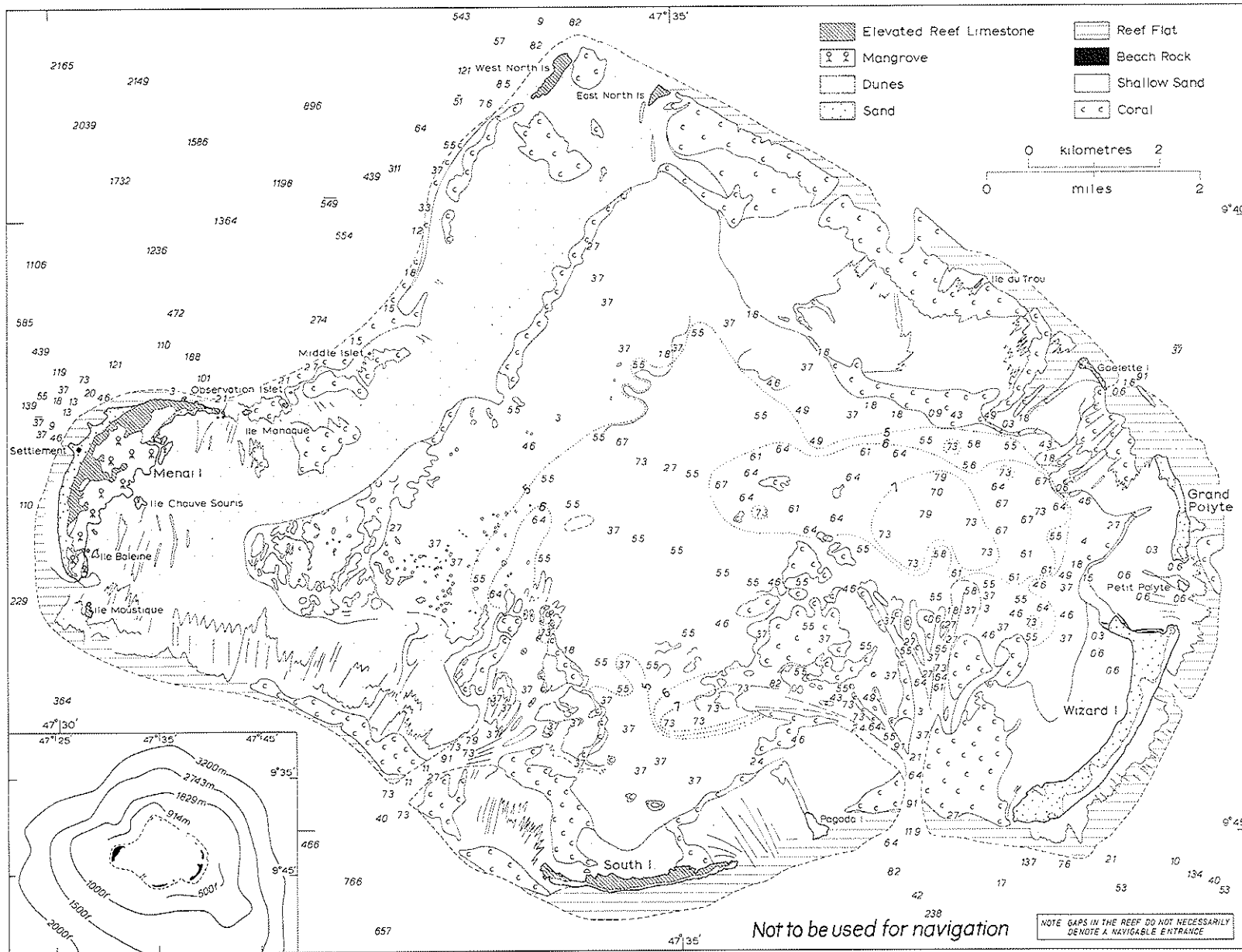


Fig. 3. Cosmoledo Atoll. Data reproduced from BA Chart No. 718 with the sanction of the Controller, HM Stationery Office and of the Hydrographer of the Navy.

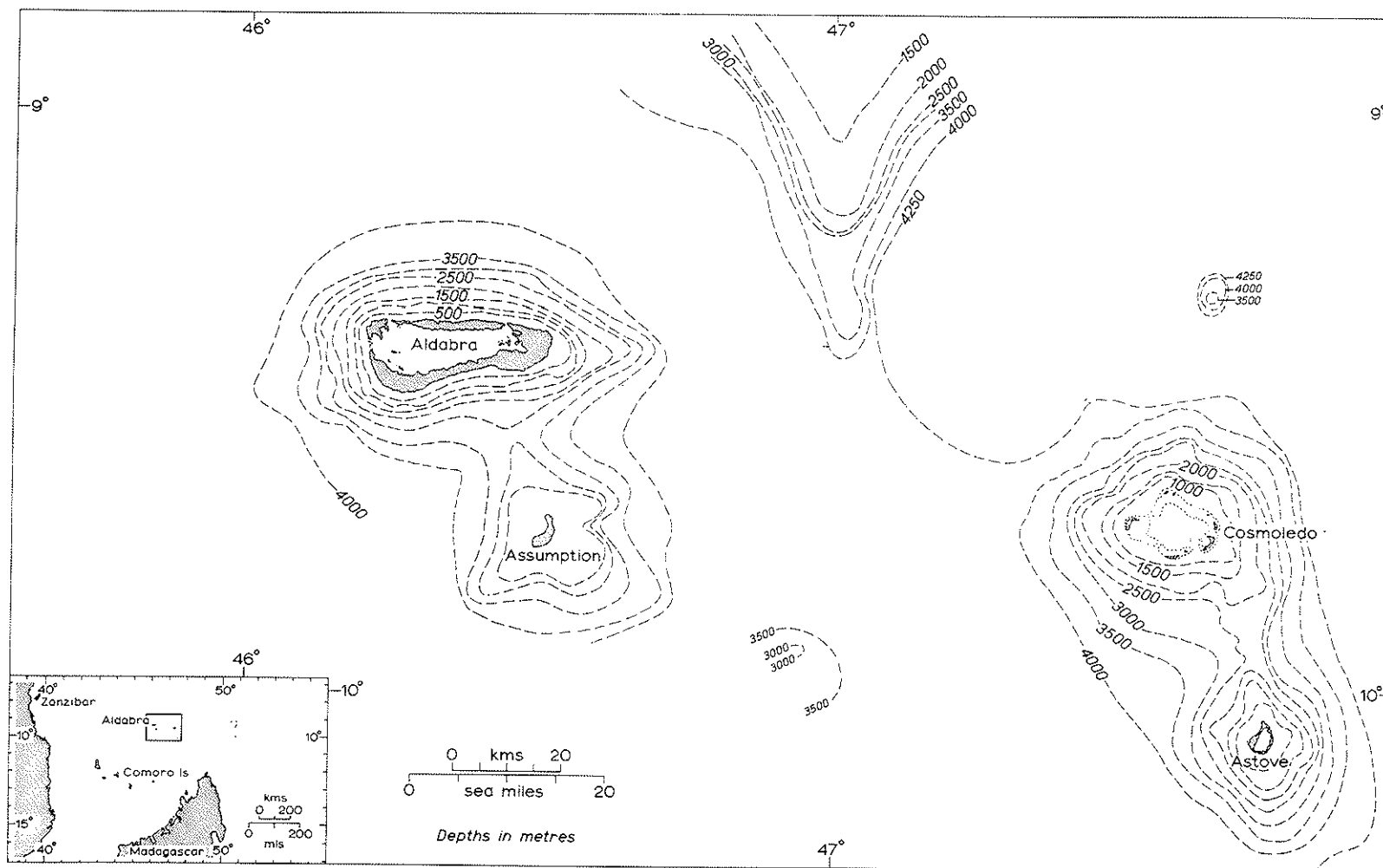


Fig. 4. The Aldabra Group

are found at the inner ends of these two channels and in the channels themselves, though where these bifurcate and disappear there is much coral growth between the branches with depths of less than 1 m. Most of the central lagoon basin is more than 5 m deep; a small area at the head of the southwest channel reaches more than 6 m, and a larger area at the head of southeast channel more than 7 m. Maximum recorded depth is 8.2 m. Coral growth is important only around the branching channel systems and also where the lagoon narrows towards Menai Island, here forming a reticulate reef network similar to that at Hitaddu, Addu Atoll. Irregularities on the lagoon floor can be seen on air photographs, but the general simplicity of form and absence of knolls and patches contrasts markedly with the Farquhar lagoon. Maximum depths in the main channels range from 5 to 11 m; other passages through the peripheral reef which are navigable by small boats do not intersect the reef flat itself, and have depths of 1 m or less.

There are eight main islands on the atoll rim, with numerous small islets; the total land area is approximately 5.2 sq km, or 3.4 per cent of that of the whole atoll. Wizard Island (Grande Ile), on the windward side of the atoll, is 3.2 km long and has an area of 1.6 sq km. It consists of low elevated reefrock largely covered with sand and gravel, and with coastal dunes on the seaward side up to 17 m high. The crests of these dunes are aligned parallel to the prevailing Trades, and Baker (1963) states that reefrock pavement is exposed in the dune slacks. The seaward beach, at least in the centre, consists of sand and cobbles overlying a smooth inclined rock pavement, rising from a potholed and eroded reef flat. The central part of the island is formed by a sand plain, and the lagoon shore is a gently sloping sand beach with, in places, ledges of reef limestone.

Menai Island on the lee side has a land area of 2.3 sq km. The area of raised reefrock is larger than on Wizard. On the seaward side the rock reaches 2-4 m in height, forming undercut headlands separated by sandy beaches. The rock declines in height to about 1 m on the lagoon side, where there is a large area of mangrove. Several dune areas are located between the reefrock and the mangrove, and the dunes at the south point, about 8-10 m high, are still active. Older vegetated dunes at the north end rise to 10-15 m. On the seaward side the raised reefrock is partly covered with sand, and north of the settlement the old undercut cliffline is fronted by a wide area of recent sand. The elevated reefrock at the south point is a massive reef limestone with much Acropora; it resembles the main Aldabra limestones but there is no inland ridge at about 8 m as on Aldabra. There is probably no basis in fact for Niejahr's (1876, 244) report of lava blocks on Menai.

The other islands of the atoll rim were not visited by Royal Society parties, but Piggott (1961) visited North, Grand Polyte, Pagoda and South Islands. North Island he describes as being formed entirely of eroded champignon, with some sand on the south side, the whole formerly covered with guano, now largely scraped away and remaining only in holes. Grand

Polyte, about 250 m wide, is formed in the north of raised reefrock standing about 1.6 m above high water, and in the south of sandy flats; central dunes rise to about 5 m. South Island, about 200 m wide, consists entirely of raised reef limestone.

The soils of the Cosmoledo islands can be classed into Piggott's (1968) main soil series: most of the islands, especially on rock, are covered with phosphatic Desnoeufts Series with a very shallow A horizon; Farquhar Series soils are forming on dunes; and in some areas there are soils approximating to Shioya Series, but always mixed with dune sands.

Vegetation

The flora of Cosmoledo is similar to that of Aldabra, and plants collected in 1968 and by Gwynne and Wood (1969) in 1967 are listed by Fosberg and Renvoize (1970). Three main vegetation types can be distinguished: (1) raised reefrock vegetation; (2) sand vegetation, including dunes; and (3) mangrove vegetation. The raised reefrock vegetation has some of the species present on Aldabra, and notably Pemphis, Sideroxylon and Ficus, with Sarcostemma, but the small area, degree of human interference, and lack of investigation combine to explain the absence in recent records of such characteristic species as Lomatophyllum and Solanum. Sand vegetation has been much affected by man, except for the littoral vegetation of Scaevola, Tournefortia and Suriana. Most of the sand areas, except the dunes, support coconuts, with a ground cover of grasses, sedges, herbs and vines, including many introduced weeds and cultivated species. Stable dunes are covered either with Casuarina woodland or with a scrub of Scaevola and Suriana. The mangrove vegetation is tall and includes at least six species: Avicennia marina, Rhizophora mucronata, Bruguiera gymnorhiza, Sonneratia alba, Xylocarpus granatum and Ceriops tagal. Apart from the extension of coconut woodland and attendant introduction of aliens on the sand areas, and the clearing of reefrock vegetation during guano digging on the North Island, the vegetation of Cosmoledo has probably changed little since Moresby (1822, 30) recorded that "here we saw a few Cocoa Nut trees, the Mapou Pisonia, some Latannia, and trees that resemble the Filahoe Casuarina of the Mauritius".

Recent observations of vegetation are available only for Menai and Wizard Islands. Piggott (1961) mentions a mixed scrub with Pemphis and much wild cotton on raised reefrock at North Island, with Scaevola on recent sand. He again found a Pemphis scrub on reefrock on Grand Polyte, and the same species on the dunes and also on the southern sand flats, together with Scaevola and Tournefortia. On the raised reefrock of South Island he describes "a few Pemphis and Pisonia grandis (mapou) shrubs but little other vegetation".

Menai Island

The seaward shore of Menai has a characteristic beach-crest hedge of Scaevola taccada, Tournefortia argentea and Suriana maritima, with Cordia subcordata on the landward side of the hedge. Pemphis acidula is found on rocky headlands. The vegetation of the sandy area north and south of the settlement is most diverse. Cocos nucifera is common though patchy in its distribution. Tall Casuarina equisetifolia is found at the settlement itself; this species was noted by Moresby in 1822, and Fryer (1908) found it "apparently of great age" sixty years ago. Guettarda speciosa, Cordia subcordata, Thespesia sp., and Grewia salicifolia are the only other trees noted. Scattered shrubs are more numerous near the southern end of the island, where they include Allophylus africanus (3 m tall), Premna obtusifolia (4 m), Azima tetracantha, Acalypha claoxyloides, and Caesalpinia major; north of the settlement we also noted Vernonia aldabrensis. The ground cover is very diverse. North of settlement Fimbristylis cymosa is dominant; to the south there is a cover of grasses (Eragrostis sp., Dactyloctenium aegyptium, Lepturus repens), sedges (Fimbristylis cymosa, Cyperus ligularis), the vine Cassytha filiformis, and a number of flowering plants, including Launaea intybacea, L. sarmentosa, Ipomoea pes-caprae, Boerhavia repens, Pleurostelma cernuum, Passiflora suberosa, Euphorbia sp., Sida parvifolia, Evolvulus alsinoides, Hypoestes aldabrensis, Cleome strigosa and Asparagus umbellulatus.

At and near the settlement other species are found. These include cultivated trees Moringa oleifera, Terminalia catappa and Carica papaya, decoratives such as Pedilanthus tithymaloides, Catharanthus roseus and Solanum melongena, and a number of other introductions, such as Agave, Gossypium hirsutum, Ricinus communis and Panicum maximum. Maize is also cultivated.

The sand dune vegetation varies with the age and stability of the dune. The active southern dunes are covered with clumps of the sedges Fimbristylis cymosa and Cyperus ligularis, and patches of the grass Dactyloctenium aegyptium. On the lower dunes there is a mosaic of the shrubs Scaevola, Tournefortia and Suriana; two trees of Pisonia grandis nestle in the lee of the southernmost dune, as they do in the lee of Dune Jean-Louis on Aldabra. The northern dunes are most subdued and closely vegetated, with an open woodland of Casuarina, scattered shrubby growths of Colubrina asiatica and Turnera ulmifolia, and a surface cover with much Fimbristylis, together with Eragrostis sp., Dactyloctenium aegyptium, Crotalaria laburnoides and Achyranthes aspera.

The lagoon sand beach, where not directly colonised by mangrove, is a narrow ledge with low Scaevola, Tournefortia and Suriana, with such plants as Tribulus cistoides and Portulaca oleracea. At the north end Sesuvium portulacastrum forms a thick mat between the beach proper and the mangrove zone.

The mangrove vegetation has not been examined in detail. At the north end it consists of mature Avicennia marina and Rhizophora mucronata 10-15 m tall; at the south end of an outer zone of Avicennia, much of it dying, apparently because of the burial of pneumatophores by sediment, together with Rhizophora and Sonneratia alba. Bruguiera gymnorhiza and Ceriops tagal are found in open inlets south of the settlement, lagoonward of the raised reefrock.

The champignon zone was crossed north of the settlement, where it is not very deeply dissected. Euphorbia abbotti was not seen, though previously reported from the atoll. The vegetation of shrubs (Pemphis acidula, Sideroxylon inerme) and a tree (Ficus thonningii) is 2-3 m high. Sarcostemma viminale is abundant (but curiously not Plumbago aphylla, also previously recorded), together with the low, spreading woody shrub Salvadora angustifolia.

Wizard Island

Less is known of the vegetation of Wizard than of Menai. The seaward beach has a scrub of Scaevola and Suriana, with a ground cover of Sporobolus virginicus, Launaea sp., and Euphorbia sp. The dunes have a dense growth of Tournefortia argentea, 1-2 m tall with about 30 per cent dead wood, and Suriana maritima. Sporobolus is not common on the dunes, where the ground cover consists of clumps of Fimbristylis, rosettes of Eragrostis, and Boerhavia.

Between the seaward dunes and the lagoon coast there is a meadow of Dactyloctenium 0.5 m thick, extending up to a line of Agave at the foot of the dunes. This central plain also includes Ipomoea, Achyranthes, Boerhavia, Microstephanus, Plumbago aphylla, Solanum nigrum, species of Portulaca, Sporobolus virginicus, Cassytha, Cassia occidentalis, and a very few dwarf Sideroxylon and Premna. Near the lagoon beach, there is a belt of tall scrub, which is less diverse than similar communities on Aldabra. It includes Acalypha, Azima, Achyranthes, Thespesia populneoides, Allophylus, and Ipomoea pes-caprae. The first three of these species tend to be locally dominant, the Azima reaching up to 3 m in height. Achyranthes is the commonest species, often forming pure stands in which Blue-faced Boobies nest, and in places extending up to the top of the lagoon shore dunes. Vines of Ipomoea tuba drape many of the shrubs.

South of the tall scrub is an area of extremely uneven champignon. The vegetation is dominated by Pemphis, with Ipomoea tuba and Cassytha. Other species noted include Phyllanthus, Acalypha, Achyranthes and Abutilon. Red-footed Boobies nest in this champignon scrub, which appears to be very little disturbed by human activities.

A coastal woodland on the lagoon shore includes moderate-sized mangroves, mostly Avicennia but also Xylocarpus. Other trees include Pisonia, Abutilon, Cordia, and the shrubs Suriana and Pemphis.

Fauna other than Birds

Little is known of the marine fauna of Cosmoledo, though it is probably similar in composition and zonation to that of Aldabra. Marine animals were collected in the boulder zone at the edge of the reef flat immediately south of Menai settlement, on a small cliffed promontory close to the village, and to the south of it. In the first area the fauna was rather limited, and hermit crabs were the most conspicuous animals, although on the edge of the reef flat the fauna resembled the inshore fauna under boulders at West Island settlement, Aldabra. The champignon promontory rose steeply, and while not heavily pinnacled, had rock pools nearly 1 m in diameter. The fauna resembled the spray-zone fauna on the top of cliffs on the south coast of Aldabra, and included Nerita textilis, Littorina, Crassostrea cucullata, and several species of grapsid crabs. From this promontory southwards the cliffs are colonised by chitons, dorid nudibranchs, barnacles and small prosobranchs. The reef flat is covered with marine angiosperms, and coral growth on the edge is not luxuriant. Animals noted on the lagoon beach at Wizard include Grapsus tenuicrustatus, Ocypode ceratophthalma, Coenobita perlatus, C. rugosa and Acanthopleura brevispinosa. Table 5 lists marine mollusca collected on Cosmoledo by P. Grubb in 1968 and identified by J. D. Taylor, and Table 6 Decapod Crustacea, also collected by Grubb and identified by Taylor; both collections are now in the British Museum (Natural History).

Turtles nest on Cosmoledo. On Wizard, the central part of the seaward beach, for a distance of about 100 m, is riddled with at least 50 turtle pits, though there was no sign of turtle activity on the lagoon beach. There is a turtle pen on Menai north of the settlement. Before the August 1968 Green Turtle Protection legislation, at least two Green Turtles were taken each month for food, according to the Manager, and Hawksbill were taken for export.

The terrestrial fauna, so far as is known, is a small one. Land mollusca are represented by two (possibly three) species collected by Thomasset (Connolly 1925). Land crustacea, apart from some of the species listed in Table 6, include Birgus latro, reported by Honegger (no date) on Wizard, Grand Polyte and South Islands, and Cardisoma carnifex. The reptile fauna formerly included the Giant Land Tortoise Geochelone gigantea. The date of its extinction is not known, nor do we know of any historical account of it still living, but Fryer (1911) reports finding fossil eggs in the champignon. There are three other reptiles (Boulenger 1911). Ablepharus boutonii has been recorded from Wizard and Menai; none were seen on Menai in 1968, though it was common on Wizard. Hemidactylus mercatorius occurs on both islands, and was seen on Menai in 1968. Phelsuma abboti was seen in 1968 on

Table 5. Mollusca collected on Cosmoledo Atoll, 1968

Gastropoda

<u>Monodonta australis</u> Lamarck	<u>Thais aculeata</u> Deshayes
<u>Turbo marmoratus</u>	<u>T. hippocastanum</u> (Linnaeus)
<u>Phasianella aethiopica</u> Philippi	<u>T. tuberosa</u> (Röding)
<u>Nerita albicilla</u> Linnaeus	<u>Engina mendicaria</u> (Linnaeus)
<u>N. plicata</u> Linnaeus	<u>Cantharus undosus</u> (Linnaeus)
<u>N. textilis</u> Dillwyn	<u>Chrysame fraga</u> (Quoy and Giamard)
<u>Littorina undulata</u> Gray	<u>Strigatella acuminata</u> (Swainson)
<u>Cerithium echinatum</u> Lamarck	<u>S. litterata</u> (Lamarck)
<u>Hipponyx conica</u> Schumacher	<u>S. paupercula</u> (Linnaeus)
<u>Lambis lambis</u> (Linnaeus)	<u>Imbricaria filum</u> (Wood)
<u>Strombus gibberulus</u> Linnaeus	<u>Oliva episcopalis</u> Lamarck
<u>S. mutabilis</u> (Swainson)	<u>Vasum turbinellus</u> (Linnaeus)
<u>Cypraea arabica</u> Linnaeus	<u>Conus arenatus</u> Hwass
<u>C. caputserpentis</u> Linnaeus	<u>C. chaldeus</u> Röding
<u>C. carneola</u> Linnaeus	<u>C. ebraeus</u> Linnaeus
<u>C. caputdraconis</u> Melvill	<u>C. flavians</u> Lamarck
<u>C. helvolis</u> Linnaeus	<u>C. musicus</u> Hwass
<u>C. histrio</u> Gmelin	<u>C. tessulatus</u> Born
<u>C. lynx</u> Linnaeus	<u>Terebra affinis</u> Gray
<u>C. moneta</u> Linnaeus	<u>T. cerithina</u> Lamarck
<u>C. tigris</u> Linnaeus	
<u>C. vitellus</u>	<u>Amphineura</u>
<u>Cymatium nicobaricum</u> (Röding)	<u>Acanthopleura brevispinosa</u>
<u>C. pileare</u> (Linnaeus)	(Sowerby)
<u>Drupa ricinus</u> (Linnaeus)	<u>Bivalvia</u>
<u>Morula granulata</u> (Duclos)	<u>Isognomon dentifer</u> (Krauss)
<u>M. uva</u> Röding	<u>Donax faba</u> (Gmelin)

Collected by P. Grubb; identified by J. D. Taylor; incorporated into the collections of the British Museum (Natural History), accession number 2213. All species were collected on the beach of Menai Island.

Table 6. Crustacea (Decapoda) collected on Cosmoledo Atoll, 1968

Wizard Island

Ocypode ceratophthalma (Pallas): 1♂ Leptodius quinquentatus
(Krauss): 4♂

Menai Island

Grapsus tenuicrustatus (Herbst):
2♂, 2♀ Petrolisthes lamarckii (Leach)
Geograpsus stormi (de Man): 1♂ Pagurus pedunculatus (Herbst)
Eriphia laeuimana (Guerin): 1♂ Clibanarius striolatus (Dana)
Epixanthus frontalis (Milne
Edwards): 3♂ Calcinus laevimanus (Randall)
Coenobita rugosus (Milne Edwards)

Collected by P. Grubb; identified by J. D. Taylor; incorporated into the collections of the British Museum (Natural History).

Menai but not on Wizard; it is more brightly coloured than the Aldabra *Phelsuma*. Honegger (1966) distinguished *P. abbotti menaiensis* on Menai and *P. abbotti* subsp. on Wizard, Grand Polyte and South Island.

Insects were collected on Cosmoledo by Fryer in 1908, and forty species are recorded in the Percy Sladen Expedition Reports; these records are keyed in Table 7. Of these, only two species were Lepidoptera. Legrand's (1965) collections of Lepidoptera on Menai totalled 70 species, including 1 new genus, 24 new species, and 3 new subspecies, mostly Microlepidoptera, though some of these may need revision. B. H. Cogan and A. Hutson made a transect of Wizard Island in March 1968, collecting insects on a transect at the narrowest point between lagoon and seaward shore. Insects were abundant in number if not in variety, but unlike Astove only the smaller species appeared to be well represented. Many of the larger species were apparently scarce, perhaps as a result of the lack of permanent fresh water. Acridid grasshoppers were present in some numbers, and females of the large *Cyrtacanthacris tatarica tatarica* L. were common. Butterflies and Odonata were nowhere common, and the small Lycaenid *Syntarucus pirithous* L. was the only species to be seen in any number. The morning visit to Wizard was followed in the afternoon by 3-4 hours on Menai, but because of rain the collections were totally unrepresentative of the fauna there. The only insect of note recognised in the collections so far is a species of Pipunculid fly, the first record of this interesting parasitic family of Diptera in the Aldabra group. Most of Legrand's collecting was carried out on Menai, and the 1968 collections may be the first on Wizard. Cosmoledo has a small faunal element that it shares with Astove and none of the other islands in the

Table 7. Insects recorded from Cosmoledo Atoll
by the Percy Sladen Expedition

<u>Group</u>	<u>Number of species</u>	<u>Reference</u>
Orthoptera	11	Bolivar (1912, 1924)
Dermoptera	1	Burr (1910)
Hemiptera	8	Distant (1913)
Lepidoptera	2	Fryer (1912)
Coleoptera	11	Champion (1914), Gebien (1922), Schenkling (1922), Scott (1912, 1926), Sicard (1912)
Hymenoptera	5	Cockerell (1912), Turner (1911)
Diptera	1	Lamb (1922)
Odonata	1	Campion (1913), Blackman and Pinhey (1967)

group, for example a Dolichopodid fly genus Sciapus sp. n. and a Trypetid fruit fly Coelotrypes vittatus. The majority of species, however, found on Cosmoledo are found throughout the Aldabra group of islands.

Birds

The bird fauna of Cosmoledo is smaller than that of Aldabra and has attracted little attention. Earlier treatments are those of Fryer (1911), Vesey-FitzGerald (1940, 1941), Hartman (1958), Bourne (1966), and Watson and others (1963). Benson (1970a) deals in detail with the land and shore birds in the following chapter, drawing on the earlier literature and on collections and observations made during the Royal Society visits and from that by I. S. C. Parker.

Of the seven recorded land birds, only two are common: Cisticola cherina, which Benson believes to be native and not introduced, and, less abundant, Nectarinia sovimanga. Hartman (1958) reported Zosterops maderaspatana to be common on Menai; the March 1968 party did not see it at all, though Stoddart and Poore saw it on Menai in September. Two land birds are probably extinct, the flightless Rail Dryolimnas cuvieri and the Turtledove Streptopelia picturata. Abbott (in Ridgway 1895) and Fryer (1911) both reported the existence of a rail on Cosmoledo, the latter specifying South Island, though he did not land there and observe it. It is possible but very doubtful that both Dryolimnas and Streptopelia both still survive on South Island. Two other land birds are recorded: Geopelia striata was seen briefly by Benson, and there are a few crows Corvus albus. Possible resident shore birds, all seen in 1968, are Ardea cinerea, Egretta garzetta, Bubulcus ibis, and Butorides striatus. Benson (1970a) lists a dozen migrants recorded from the atoll. This paucity in species (seven true land birds at most, plus four possibly resident shore birds) contrasts with the eighteen species of land birds recorded for Aldabra. Endemism is also low, though Benson (1970b) has discussed a well-marked subspecies of Nectarinia sovimanga, only otherwise known on Astove.

Sea birds have been briefly noticed by several previous workers, notably Dupont (1907), Vesey-FitzGerald (1941), Honegger (unpublished), Gaymer (unpublished), and observers on H.M.S. Owen in 1964 (Bourne 1966). Diamond visited Wizard in the morning and Menai in the afternoon of 6 March 1968. Three species nest in large numbers on Wizard: Sula dactylatra, Sula sula and Sterna fuscata. At least 200 pairs of White Booby S. dactylatra were occupying clearings in the long grass on the west side of the island or on the dune ridge to the east. Most were displaying at empty nest sites or in apparently inactive attendance at past sites. Only five occupied nests were found, four with single eggs and the other with two. There were also two fully-feathered juveniles, both of which regurgitated large flying-fish (probably Cypsilurus sp.). On Ascension Island in the Atlantic, Dorward (1962) found that territories of this species were defended outside the breeding season, and that

although eggs were laid in most months of the year there was a marked peak of laying in one or two months. He found the incubation period to be 42-46 days, and fledging to take about 120 days; so that the near-fledged chicks found on Wizard in March would have come from eggs laid in the previous October. The eggs found would have been laid in the previous six weeks, and there were no younger chicks; hence, as the great majority of the birds had neither eggs nor young, the main laying period must be between March and October. Vesey-FitzGerald (1941) describes this species as breeding on four islands of the atoll (West North, East North, Grand Polyte, South) but not on Wizard, presumably during his visit between September and November 1937.

Towards the south end of Wizard, low bushes appear among the long grass and finally merge into dense clumps 2-3 m high, covered with thorny creepers and penetrable only with the greatest difficulty. These bushes were occupied by nesting Red-footed Boobies Sula sula, whose numbers were impossible to estimate with any accuracy but which were well in excess of 150 pairs. On the lagoon shore at least 20 pairs were nesting in a small clump of Avicennia mangrove, which on Aldabra is avoided as a nesting site. Those nests whose contents could be seen either contained eggs or were empty, while on Aldabra, and on Menai Island on Cosmoledo, most nests contained eggs or half-grown chicks. All the adults seen were of the white phase.

Along the dune ridge, and in clearings in the long grass to the north of the landing place on the lagoon shore, many fragmented skeletons and feathers of the Sooty Tern Sterna fuscata were found; Vesey-FitzGerald (1941) describes this species as nesting on Wizard. They clearly suffer heavy mortality, similar to that on Goelette Island, Farquhar Atoll (Stoddart and Poore 1970); whether this is from predation, starvation or disease on Cosmoledo is not known, but the most likely culprits would seem to be cats, of which two were seen and one shot, and which cause serious losses to Sooty Terns on Ascension Island (Ashmole 1963). Baker (1963) refers to a tern-breeding area at the north end of Wizard, and though no living Sooty Terns were seen on the island they were heard and seen over the ships at night, and a few were seen between Astove and Cosmoledo early on 5 March.

The other sea birds seen on Wizard were three Red-tailed and two Yellow-billed Tropicbirds Phaethon rubricauda and P. lepturus; two Black-naped Terns Sterna sumatrana; and a single female Great Frigate Bird Fregata minor. Honegger (unpublished) reported that P. rubricauda nests on Cosmoledo in March.

Diamond also covered the northern half of Menai Island, from the settlement round to the lagoon shore mangroves. Red-footed Boobies, many with half-grown chicks, were nesting in the mangroves, particularly the tall Rhizophora on the landward fringe. A few Frigate birds Fregata sp. were seen soaring over tall mangroves on Chauve-souris island; the only Frigate bird certainly identified on the atoll was a female Great Frigate bird Fregata minor harrying White Boobies on Wizard. At dusk there was a large flight of Red-footed Boobies in from the sea, flying

low and fast over the dunes and usually avoiding the attention of the few Frigate birds soaring in wait.

Stoddart and Poore noted soaring Frigates over the south end of Menai in September 1968, and large numbers of boobies on an island to the south of Menai. Piggott (1961) mentions large numbers of boobies on Grand Polyte, and also bird colonies on Pagoda and South Island, all of which need investigation.

The following list summarises the records of sea birds on Cosmoledo; for similar lists of the land and shore birds, see the accompanying paper by Benson (1970a).

Puffinus l'herminieri

Heard at night over the settlement on Menai; reported by local fishermen to Diamond.

Phaethon rubricauda

Said to breed by Vesey-FitzGerald (1941) and reported by Honegger (unpublished) on the nest in March. H.M.S. Owen reported this species over Menai (Bourne 1966), and Diamond saw three on Wizard.

Phaethon lepturus

Sight record by R. D. T. Gaymer on 1 October 1965; two seen by Diamond on Wizard.

Sula dactylatra

Reported breeding by Vesey-FitzGerald (1941) on West North, East North, Polyte and South Islands, and by Diamond on Wizard. Also recorded by H.M.S. Owen (Bourne 1966).

Sula sula

Reported by Vesey-FitzGerald (1941) on Menai, East North, Grand Polyte, Wizard and South Islands. Reported by Honegger (unpublished) breeding in trees on Grand Polyte, by Diamond in mangroves on Menai, and by Stoddart and Poore on island south of Menai. Gaymer (unpublished) found a large colony with many young, 1 October 1965, on Chauve-souris, 200 per annum reportedly being taken for food. Recorded by H.M.S. Owen in March (Bourne 1966); collected by Parker in September.

Sula leucogaster

Reported by locals to Diamond as breeding. Collected by Parker, 5 October 1967.

Fregata ariel

Reported by locals to Diamond as breeding. Said to breed on islets by Vesey-FitzGerald (1941).

Fregata minor

Diamond identified one female on Wizard; locally reported to breed. Said to breed on islets by Vesey-FitzGerald (1941).

Hydroprogne caspia

Sight, Vesey-FitzGerald (1941).

Sterna anaethetus

On islets in October (Vesey-FitzGerald 1941).

Sterna fuscata

Breeds on Wizard Island (Vesey-FitzGerald 1941; Diamond, this paper).

Sterna albifronsSterna sumatrana

2 seen by Diamond on Wizard, 1968.

Thalasseus bergii

Sight record by Gaymer, 1 October 1965.

Anous stolidus

Breeding on islets, according to Vesey-FitzGerald (1941).

Settlement

Little is known of the history of settlement on Cosmoledo. It is more hospitable than Aldabra and presumably more attractive to early sailors, though permanent settlement may have been hindered by lack of fresh water. Moresby (1822, 30) reported that "the Cosmoledo Isles are sometimes resorted to for fish, where a few blacks are left, who wait the vessels return". The atoll was settled by the time of a visit by Sebert Baty in 1895 (Bergne 1900). Two to three hundred coconuts had been planted, maize grew fairly well, and goats thrived in numbers. There was at that time a reservoir on Menai holding 1300 velts (1950 gallons) of water, and one iron roof for catchment, together with one roof and 500 velts (750 gallons) capacity on Wizard. There was also on Menai a "large iron pan in which one man is able to distill 6 velts (9 gallons) of water a day including wood cutting and carrying". It was said that the atoll could provide work for twelve labourers. When H. A'C. Bergne visited it in 1901 there were two men on Menai, though seventeen were left there in the season: nine to take turtle, six for fishing, and two for preparing fish and shell. James Spurs was in charge of the atoll, which had two pirogues, a corrugated iron house, and labourers' huts made from piled-up turtle carapaces. Bergne (1901) found that half a dozen goats on Menai were not doing well, in contrast to the rats. In a good season 5000 lb of maize could be produced, but there were frequent failures of the harvest. In addition to the 2 persons on Menai, there was one on Wizard, though no plantation, and four on Northeast. The exploitation of guano had already begun on Northeast Island: Bergne stated that 120 tons had already been removed, at Rs 60 per ton, and that 300-400 tons were left.

The only island now inhabited is Menai, where there is a settlement with water tanks, a manager's house, labourers' houses and a small cemetery. There are fishing huts on Wizard and some of the other islands.

Guano is no longer worked on Northeast Island, though several hundred tons remain in cavities; Baker (1963) also estimates reserves on Grand Polyte, not yet worked, at 3700 tons.

The goats formerly reported on Menai are no longer there, but are reported by Piggott (1961) for Northeast Island. Rabbits have been introduced on South Island, according to Dupont (1907) before 1906, though according to Honegger (unpublished) about 1930. Two cats were seen on Wizard in 1968.

Until 1903, when it was transferred to the new colony of Seychelles, Cosmoledo was administered as part of Mauritius: it still forms part of Seychelles, and was not included in the British Indian Ocean Territory in 1965. The atoll is now leased, with Aldabra and Assumption, by Mr H. Savy of Mahé, and is used primarily as a fishing station. There are few coconuts, and Piggott (1961) reported the average yield to be only two nuts per palm per annum.

Acknowledgements

We thank the Director, East African Marine Fisheries Research Organization, Zanzibar, Mr Basil Bell, and Captain M. Williams and Captain T. Phipps, M.F.R.V. Manihine, for the opportunities for Royal Society parties to visit Cosmoledo in March and September 1968; and also the Frank M. Chapman Memorial Fund, a grant from which to C. W. Benson made the first visit possible. Unpublished Crown-copyright material in the Indian Office Records quoted in this paper appears by permission of the Secretary of State for Foreign and Commonwealth Relations. We thank Lady Joan Fryer for the loan of the late Sir John Fryer's manuscript diary of his visit to Cosmoledo in 1908, and other material, and Mr J. A'C. Bergne, for the loan of his father's journal of a visit to Cosmoledo in 1901, and other papers, and both Lady Fryer and Mr Bergne for permission to quote from these documents.

References

- Ashmole, N. P. 1963. The biology of the Wideawake or Sooty Tern Sterna fuscata on Ascension Island. *Ibis*, 103b: 297-364.
- Baker, B. H. 1963. Geology and mineral resources of the Seychelles Archipelago. *Geol. Surv. Kenya Mem.* 3: 1-140.
- Benson, C. W. 1970a. Land (including shore) birds of Cosmoledo. *Atoll Res. Bull.*, this issue.
- 1970b. The white-eye Zosterops maderaspatana (Linn.) of Menai Island, Cosmoledo Atoll. *Bull. Brit. Ornith. Club*, 89: 24-27.

- Bergne, H. A'C. 1900. Fair record of islands in the Indian Ocean. Manuscript.
- 1901. Rough notes of a voyage to the Aldabra group. Manuscript.
- Berio, E. 1956. Eteroceri raccolti dal Dr Carlo Prola durante la spedizione alle isole dell'Africa orientale, con descrizione die specie nuove. Bull. Soc. Entom. Ital. 86: 82-87.
- Blackman, R. A. A. and Pinhey, E. C. G. 1967. Odonata of the Seychelles and other Indian Ocean island groups, based primarily on the Bristol University Expedition of 1964-1965. *Arnoldia*, 3(12): 1-38.
- Bolivar, I. 1912. Orthoptera: Acrydiidae, Phasgonuridae, Gryllidae. Trans. Linn. Soc. London, ser. 2, Zool., 15: 263-292.
- 1924. Orthoptera Dictyoptera (Blattidae and Mantidae), and supplement to Gryllidae, of the Seychelles and adjacent islands. Ann. Mag. Nat. Hist., ser. 9, 13: 313-359.
- Boulenger, G. A. 1911. List of the Batrachians and Reptiles obtained by Prof. Stanley Gardiner on his second expedition to the Seychelles and Aldabra. Trans. Linn. Soc. London, ser. 2, Zool., 14: 375-378.
- Bourgogne, J. 1963. Sur deux Psychidae exotiques, dont une espèce inconnue des îles Aldabra-Cosmoledo. Bull. Soc. Entom. France, 68: 260-263.
- Bourne, W. R. P. 1966. Observations on islands in the Indian Ocean. *Sea Swallow*, 18: 40-43.
- Burr, M. 1910. Dermaptera. Trans. Linn. Soc. London, ser. 2, Zool., 14: 123-133.
- Campion, H. 1913. Odonata. Trans. Linn. Soc. London, ser. 2, Zool., 15: 435-446.
- Carcasson, R. H. 1964. New African butterflies. *J. East Afr. Nat. Hist. Soc.* 24(4): 67-72.
- Champion, G. C. 1914. Coleoptera, Curculionidae. Trans. Linn. Soc. London, ser. 2, Zool., 16: 393-497.
- Cockerell, T. D. A. 1912. Hymenoptera, Apoidea. Trans. Linn. Soc. London, ser. 2, Zool., 15: 29-41.
- Connolly, M. 1925. Notes on a collection of non-marine Mollusca from the islands of the Indian Ocean. *J. Conchol.* 17: 257-266.

- Distant, W. L. 1913. Rhynchota. Part I: suborder Heteroptera. Trans. Linn. Soc. London, ser. 2, Zool., 16: 139-190.
- Dorward, D. F. 1962. Comparative biology of the White Booby and the Brown Booby Sula spp. at Ascension. Ibis, 103b: 174-220.
- Dupont, R. 1907. Report on a visit of investigation to St Pierre, Astove, Cosmoledo, Assumption and the Aldabra Group. Mahé: Seychelles Government, 1-51.
- Fosberg, F. R., and Renvoize, S. A. 1970. Plants of Cosmoledo Atoll. Atoll Res. Bull., this issue.
- Fryer, J. C. F.. 1908. Diary. Manuscript.
- 1911. The structure and formation of Aldabra and neighbouring islands--with notes on their flora and fauna. Trans. Linn. Soc. London, ser. 2, Zool., 14: 397-442.
- 1912. The Lepidoptera of the Seychelles and Aldabra, exclusive of the Orneodidae and Pterophoridae and of the Tortricina and Tineina. Trans. Linn. Soc. London, ser. 2, Zool., 15: 1-28.
- Gebien, H. 1922. Coleoptera, Heteromera: Tenebrionidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 261-324.
- Gwynne, M. D., and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M.F.R.V. "Manihine", Sept.-Oct. 1967. Atoll Res. Bull. 134: 1-15.
- Hartman, W. D. 1958. Report on some land birds of Farquhar, St Pierre, Astove, Cosmoledo, Assumption and Aldabra. Seychelles Govt. Bull. 21.
- Honegger, R. 1966. Beobachtungen an der Herpetofauna der Seychellen. Salamandra, Zeitschr. f. Herpet. u. Terrarienkunde, 2(1-2): 21-36.
- 1967. The Green Turtle (Chelonia mydas japonica Thunberg) in the Seychelles Islands. Brit. J. Herpetol., 4: 8-11.
- Unpublished a. Some notes on wildlife and wildlife conservation on the Seychelles and other Indian Ocean islands. World Wildlife Fund Project 28. Typescript, 1-11.
- Unpublished b. Some notes and observations on Giant Tortoises Testudo gigantea Schweigger living and extinct of the Indian Ocean Islands. World Wildlife Fund Project 28. Typescript, 1-30.

- Lamb, C. G. 1922. Diptera: Asilidae, Scenopinidae, Dolichopodidae, Pipunculidae, Syrphidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 361-416.
- Legrand, H. 1965. Lépidoptères des îles Seychelles et d'Aldabra. Mém. Mus. Nat. Hist. Natur., Sér. A, Zool., 37: 1-210.
- Mamet, R. 1943. A revised list of the Coccoidea of the islands of the western Indian Ocean, south of the equator. Mauritius Inst. Bull., 2: 137-170.
- Moresby, F. No date (1822?). Memoir on the isles in the Indian Ocean. London, India Office, Records Department, MS 51: 1-70.
- Niejahr, Capt. 1876. Aus den Reiseberichten der Brigg "Hermann Friedrich", Captain Niejahr. Ann. Hydrogr. Marit. Meteorol. 4: 243-250.
- Piggott, C. J. 1961. A report on a visit to the Outer Islands between October and November 1960. Directorate of Overseas Surveys, Land Resources Division, typescript, 1-71; Chapter 6, Cosmoledo, 27-30.
- 1968. A soil survey of Seychelles. Directorate of Overseas Surveys, Land Resources Division, Tech. Bull. 2: 1-89.
- Ridgway, R. 1895. On birds collected by Dr W. L. Abbott on the Seychelles, Amirantes, Gloriosa, Assumption, Aldabra and adjacent islands, with notes on habits, etc., by the collector. Proc. U.S. Nat. Mus. 18: 509-546 (actual date of publication June 24, 1896).
- Schenkling, S. 1922. Coleoptera: Cleridae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 325-329.
- Scott, H. 1912. Coleoptera, Lamellicornia and Adephaga. Trans. Linn. Soc. London, ser. 2, Zool., 15: 215-262.
- 1926. Coleoptera from the Seychelles and adjacent islands: Carabidae (supplement), Cryptophagidae (supplement), Dermestidae, Lymexylonidae, Rhipiceridae, Sphindidae, Throscidae, Brenthidae. Ann. Mag. Nat. Hist., ser. 9, 18: 50-76.
- Sicard, Dr. 1912. Coleoptera, Coccinellidae. Trans. Linn. Soc. London, ser. 2, 15: 361-366.
- Smith, J. L. B. 1955. The fishes of the family Anthiidae of the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 337-350.
- 1955b. The fishes of the family Pomacanthidae in the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 377-384.

- Smith, J. L. B. 1956. The fishes of Aldabra, Part VI. *Ann. Mag. Nat. Hist. ser. 12*, 9: 817-829.
- Stoddart, D. R. and Poore, M. E. D. 1970. Geography and ecology of Farquhar Atoll. *Atoll Res. Bull.*, this issue.
- Travis, W. 1959. *Beyond the reefs*. New York: E. P. Dutton (London: Allen and Unwin), 1-221.
- Turner, R. E. 1911. Fossorial Hymenoptera from the Seychelles and other islands in the Indian Ocean. *Trans. Linn. Soc. London, ser. 2, Zool.*, 14: 367-374.
- Vesey-FitzGerald, L. D. E. F. 1940. The birds of the Seychelles. I. The endemic birds. *Ibis, ser. 14*, 4: 480-489.
- 1941. Further contributions to the ornithology of the Seychelles Islands. *Ibis, ser. 14*, 5: 518-531.
- 1942. Further studies of the vegetation on islands in the Indian Ocean. *J. Ecol.* 20: 1-16.
- Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. *Preliminary field guide to the birds of the Indian Ocean*. Washington: Smithsonian Institution, 1-214.

6. PLANTS OF COSMOLEDO ATOLL

F. R. Fosberg and S. A. Renvoize

CYMODOCEA CILIATA Ehrenb. ex Aschers.

Menai I., south part, Fosberg 49854 (US, K).

HALODULE WRIGHTII Aschers.

Menai I., south part, Fosberg 49851 (US, K).

THALASSIA HEMPRICHII (Ehrenb.) Aschers.

Menai I., south part, Fosberg 49852, 49853 (US, K).

DACTYLOCTENIUM AEGYPTIUM (L.) Willd.

Menai I., s. l., Gwynne & Wood 1263 (K, EA); south of Settlement, Stoddart & Poore 1228 (K); north of Settlement, Stoddart & Poore 1254 (K); Wizard I., central part, Fosberg 49794 (US, K); Renvoize 1264 (US, K).

DACTYLOCTENIUM PILOSUM Stapf

Wizard I., central part, Fosberg 49800 (US, K), Renvoize 1262 (US, K); north end, Fosberg & McKenzie 49828 (US).

DAKNOPHOLIS BOIVINII (Camus) Clayt.

Wizard I., central part, Fosberg 49805 (US, K); Renvoize 1263 (US, K); Menai I., s. l., Gwynne & Wood 1237 (K, EA).

DIGITARIA HORIZONTALIS Willd.

Menai I., s. l., Gwynne & Wood 1238 (K, EA); north end, Fosberg 49786 (US, K).

ENTEROPOGON SEHELLENSIS Dur. & Schinz

Wizard I., central part, Fosberg 49814 (US, K); Renvoize 1265 (US, K).

ERAGROSTIS sp.

Wizard I., Fosberg 49813a (US); north end, Fosberg 49830 (US, K); central part, Renvoize 1261 (US, K); Menai I., south of Settlement, Stoddart & Poore 1224 (K); north of Settlement, Stoddart & Poore 1260 (K); south part, Fosberg 49849 (US, K).

LEPTURUS REPENS R. Br.

Menai I., s. l., Gwynne & Wood 1249 (EA); north end, Fosberg & McKenzie 49789 (US); north of Settlement, Stoddart & Poore 1261 (K, US); Renvoize 1240 (US, K), Renvoize 1252 (US, K).

PANICUM MAXIMUM Jacq.

Menai I., s. 1., Fosberg 49776 (US); south of Settlement, Stoddart & Poore 1221 (K, US); north end, Fosberg & Grubb 49776 (US).

PANICUM VOELTZKOWII Mez

Wizard I., near south end, Fosberg & Grubb 49819 (US, K); north end, Fosberg & McKenzie 49827 (US, K).

SPOROBOLUS VIRGINICUS Kunth

Wizard I., near south end, Fosberg & Grubb 49825a (US).

STENOTAPHRUM MICRANTHUM (Desv.) Hubb.

Menai I., Fosberg 49783 (US); north of Settlement, Renvoize 1241 (US, K).

ZEA MAYS L.

Menai I., north of Settlement, Renvoize 1251 (US, K).

CYPERUS LIGULARIS L.

Menai I., south of Settlement, Stoddart & Poore 1227 (K); south part, Fosberg 49838 (US, K).

FIMBRISTYLIS CYMOSA R. Br.

Wizard I., central part, Fosberg 49806b (US); Menai I., south of Settlement, Stoddart & Poore 1235 (K, US).

COCOS NUCIFERA L.

Menai I., seen by Stoddart, 1967, and by Fosberg, 1968; north of Settlement, Renvoize 1254 (US, K).

AGAVE SISALANA Perr.

Wizard and Menai I., seen by Fosberg, 1968. Menai I., Renvoize s. n. March 1968, spirit collection only (K, US).

ASPARAGUS UMBELLULATUS Sieb.

Menai I., s. 1., Gwynne & Wood 1265 (K, EA); north end, Fosberg & Grubb 49774 (US); south of Settlement, Stoddart & Poore 1207 (K); north of Settlement, Renvoize 1237 (US, K).

LOMATOPHYLLUM BORBONICUM Willd.

Reported by Hemsley (1919) on authority of Dupont, no specimen seen by Hemsley.

CASUARINA EQUISETIFOLIA L.

"Dupont records this from all islands [in the Aldabra Group]", Hemsley (1919); seen by Stoddart, 1967, and by Fosberg on Menai I., 1968.

FICUS AVI-AVI Bl.

Menai I., north of Settlement, Renvoize 1249 (US, K).

FICUS NAUTARUM Baker

"Dupont records this species from all of the islands [in Aldabra group]", Hemsley (1919).

FICUS THONNINGII Bl.

"Dupont records this species from ... Cosmoledo ..." Hemsley (1919); Menai I., north of Settlement, Stoddart & Poore 1257 (K); Gwynne & Wood 1241 (EA); north end, Fosberg & Grubb 49765 (US, K), 49768 (US, K).

BOERHAVIA DIFFUSA L.

Menai I., Gwynne & Wood 1258 (EA).

BOERHAVIA ELEGANS Choisy

Wizard I., s. 1., Thomasset in 1902 (K); central part, Renvoize 1226 (US, K).

BOERHAVIA REPENS L.

Wizard I., central part, Fosberg 49792 (US, K), 49806 (US, K); Menai I., south part of Settlement, Stoddart & Poore 1240 (K, US).

PISONIA GRANDIS R. Br.

Wizard I., central part, Fosberg 49807 (US, K); Menai I., south of Settlement, Stoddart & Poore 1241 (K).

ACHYRANTHES ASPERA L.

Wizard I., s. 1., Gwynne & Wood 1224 (EA); central part, Renvoize 1219 (US, K); Menai I., north of Settlement, Stoddart & Poore 1249 (K); central part, Fosberg 49748 (US, K); south part, Fosberg 49850 (US, K).

ACHYRANTHES CANESCENS R. Br.

E. North I., Vesey-FitzGerald 5990 (K); Wizard I., Thomasset in 1902 (K).

SESUVIUM PORTULACASTRUM L.

Menai I., Gwynne & Wood 1266 (EA).

PORTULACA cf. AUSTRALIS Endl.

S. 1., Thomasset 214 (K); Wizard I., near south end, Fosberg & Grubb 49823 (US, K); Renvoize 1260 (US, K); Renvoize 1221 (US, K).

PORTULACA OLERACEA L.

Wizard I., s. 1., Gwynne & Wood 1223 (EA); central part, Fosberg 49802 (US, K); Menai I., north of Settlement, Stoddart & Poore 1245 (K).

CASSYTHA FILIFORMIS L.

Wizard I., near south end, Fosberg & Grubb 49818 (US); Menai I., south of Settlement, Stoddart & Poore 1233 (K); north of Settlement, Renvoize 1246 (US, K).

CLEOME STRIGOSA (Boj.) Oliv.

Wizard I., s. l., Thomasset in 1902 (K); central part, Fosberg 49796 (US, K); Renvoize 1229 (US, K); Menai I., s. l., Gwynne & Wood 1251 (K, EA); south of Settlement, Stoddart & Poore 1216 (K).

MORINGA OLEIFERA Lam.

Menai I., north end, Fosberg & Graham 49782 (US, K); south of Settlement, Stoddart & Poore 1218 (K).

CAESALPINIA BONDUC (L.) Roxb. ?

Menai I., Gwynne & Wood 1248 (EA).

CAESALPINIA MAJOR (Medic.) Dandy & Exell

Menai I., south of Settlement, Stoddart & Poore 1211 (K).

CASSIA OCCIDENTALIS L.

Menai I., south of Settlement, Stoddart & Poore 1200 (US, K, EA); Wizard I., central part, Renvoize 1220 (US, K).

CROTALARIA LABURNOIDES Klotzsch

Menai I., north of Settlement, Stoddart & Poore 1250 (K, US).

GAGNEBINA PTEROCARPA (Lam.) Baill.

"Very common and also in Cosmoledo"--Thomasset" Hemsley (1919).

ERYTHROXYLON ACRANTHUM Hems1.

Menai I., Gwynne & Wood 1233 (K, EA); north end Fosberg & Grubb 49771 (US, K).

TRIBULUS CISTOIDES L.

Wizard I., s. l., Thomasset in 1903 (K); central part Renvoize 1225 (US, K); Menai I., north of Settlement, Stoddart & Poore 1248 (K).

SURIANA MARITIMA L.

Wizard I., central part, Renvoize 1231 (US, K); Menai I., Vesey-FitzGerald 5986a (K); south of Settlement, Stoddart & Poore 1238 (K).

XYLOCARPUS MOLUCCENSIS (Lam.) Roem.

Wizard I., near south end, Fosberg & Grubb 49820 (US, K); Renvoize 1266 (K).

ACALYPHA CLAOXYLOIDES Hutch.

S. l., Thomasset 243 (K); Menai I., s. l., Gwynne & Wood 1240 (K, EA); south of Settlement, Stoddart & Poore 1231 (K); E. North Is., Vesey-FitzGerald 5989 (K); Wizard I., central part, Fosberg 49804 (US, K, Fo).

ACALYPHA INDICA L.

Menai I., Fosberg 49844 (US, K).

EUPHORBIA ABBOTTII Baker

"Dupont records this from all the islands of the Seychelles region except Gloriosa, but not from the Seychelles Archipelago" Hemsley (1919); s. l., Fryer 52 (K); Menai I., north end, Fosberg & Grubb 49764 (US, K).

EUPHORBIA HIRTA L.

Menai I., south part, Fosberg 49848 (K, US).

EUPHORBIA sp. (near E. PROSTRATA Ait.)

S. I., Thomasset 232 (K); Wizard I., s. l., Gwynne & Wood 1230 (K, EA); near south end, Fosberg & Grubb 49816 (US, K); central part, Fosberg 49799 (US, K); dunes in center, Fosberg 49806a (US, K); central part, Renvoize 1228 (US, K); Menai I., south of Settlement, Stoddart & Poore 1222 (K).

PEDILANTHUS TITHYMALOIDES (L.) Poit.

Menai I., south of Settlement, Stoddart & Poore 1214 (K), 1202 (US, K, EA).

PHYLLANTHUS AMARUS Schum. & Thonn.

Wizard I., north end, Fosberg & McKenzie 49826 (US); central part, Renvoize 1222 (US, K).

PHYLLANTHUS CHELONIPHORBE Hutchinson

Menai I., north end, Fosberg & Graham 49788 (US); Renvoize 1242 (US, K).

PHYLLANTHUS sp.

Wizard I., north end, Fosberg & McKenzie 49831, 49826 (US); near south end, Fosberg & Grubb 49815a (US).

RICINUS COMMUNIS L.

Menai I., north end, Fosberg & Grubb 49775 (US).

MAYTENUS SENEGALENSIS (Lam.) Exell

Menai I., north end, Fosberg & Grubb 49781 (US); north of Settlement, Renvoize 1245 (US, K).

ALLOPHYLUS ALDABRICUS Radlk.

Menai I., south of Settlement, Stoddart & Poore 1205 (K, US); north end, Fosberg & Grubb 49770 (US, K); north of Settlement, Renvoize 1248 (US, K).

COLUBRINA ASIATICA (L.) Brongn.

Wizard I., central part, Fosberg 49811 (US, K); Renvoize 1257 (US, K); Menai I., s. l., Gwynne & Wood 1262 (K, EA), 1256 (EA); north of Settlement, Stoddart & Poore 1246 (K).

GOUANIA TILIAEFOLIA Lam.

Wizard I., s. l., Thomasset in 1903 (K).

SCUTIA MYRTINA (Burm. f.) Kurz

Menai I., s. l., Gwynne & Wood 1244 (EA); Fosberg & Grubb 49773 (US).

CORCHORUS AESTUANS L.

Wizard I., central part, Fosberg 49810 (US, K); Renvoize 1234 (US, K).

GREWIA SALICIFOLIA Schinz

Menai I., s. l., Gwynne & Wood 1257 (K, EA); north of Settlement, Renvoize 1239 (US, K); south of Settlement, Stoddart & Poore 1212 (K); north end, Fosberg & Grubb 49763 (US, K).

ABUTILON ANGULATUM (G. & P.) Mast.

S. l., Thomasset 226 (K); Wizard I., central part, Fosberg 49803 (US, K).

GOSSYPIUM HIRSUTUM L.

Wizard I., s. l., Gwynne & Wood 1226 (K, EA); central part, Fosberg 49812 (US, K); Renvoize 1233 (US, K); Menai I., south of Settlement, Stoddart & Poore 1220 (K).

SIDA PARVIFOLIA DC.

S. l., Stoddart & Poore 1217 (K); Wizard I., near south end, Fosberg & Grubb 49815 (US, K); central part, Renvoize 1235 (US, K); Menai I., south of Settlement, Stoddart & Poore 1230 (K).

SIDA "VESCOANA Baillon"

Wizard I., s. l., Thomasset in 1902 (K), (possibly a form of S. parvifolia DC.).

THESPESIA POPULNEOIDES (Roxb.) Kostel.

Menai I., north end, Fosberg & Grubb 49766 (US); Renvoize 1238 (US, K).

TURNERA ULMIFOLIA L.

Menai I., north of Settlement, Stoddart & Poore 1247 (K).

PASSIFLORA SUBEROSA L.

Menai I., south of Settlement, Stoddart & Poore 1208 (K).

CARICA PAPAYA L.

Seen on Menai I. by Stoddart, 1967.

CUCUMIS MELO L.

Menai I., s. l., Gwynne & Wood 1255 (EA); Wizard I., central part, Fosberg 49797; Renvoize 1224 (US, K); Renvoize 1267 (K).

CUCURBITA MAXIMA L.

Menai I., north end, Fosberg 49787 (US).

PEMPHIS ACIDULA Forst.

S. 1., Thomasset 217 (K); FitzGerald 5988 (K); Menai I., south of Settlement, Stoddart & Poore 1242 (K); Wizard I., central part, Renvoize 1230 (US, K).

BRUGUIERA GYMNORHIZA (L.) Lam.

Menai I., s. 1., Gwynne & Wood 1259 (K, EA); south of Settlement, Stoddart and Poore 1209 (K, US).

CERIOPS TAGAL (Perr.) C. B. Rob.

Menai I., south of Settlement, Stoddart & Poore 1210 (K, US).

RHIZOPHORA MUCRONATA Lam.

Menai I., s. 1., Gwynne & Wood 1261 (K, EA); south of Settlement, Stoddart & Poore 1239 (K).

SONNERATIA ALBA (L.) J. E. Sm.

Menai I., lagoon side, south of Settlement, Stoddart & Poore 1223 (K).

TERMINALIA CATAPPA L.

Menai I., south of Settlement, Stoddart & Poore 1213 (K).

AZIMA TETRACANTHA Lam.

Wizard I., central part, Fosberg 49808 (US, K); Menai I., s. 1., Gwynne & Wood 1243 (EA); south of Settlement, Stoddart & Poore 1237 (K); north end, Fosberg & Grubb 49779 (US, K).

SALVADORA ANGUSTIFOLIA Turr.

S. 1., Dupont 289 (K), 5 (K); Menai I., s. 1., Gwynne & Wood 1247 (K, EA), 1242 (EA); north of Settlement, Stoddart & Poore 1258 (K); Renvoize 1243 (US, K); north end, Fosberg 49784 (US, K), 49785 (US).

PLUMBAGO APHYLLA Boj. ex Boiss.

Wizard I., s. 1., Gwynne & Wood 1227 (EA); central part Fosberg 49809 (US, K); Renvoize 1232 (US, K).

SIDEROXYLON INERME L. subsp. CRYPTOPHLEBIUM (Baker) J. H. Hemsley

Wizard I., central part, Fosberg 49813 (US, K); Menai I., north end, Fosberg & Graham 49782a (US); north of Settlement, Stoddart & Poore 1255 (K), 1256 (K).

CATHARANTHUS ROSEUS (L.) G. Don

Menai I., south of Settlement, Stoddart & Poore 1215 (K).

PLEUROSTELMA CERNUUM (Decne.) Bullock

Wizard I., central part, Fosberg 49801 (US, K); Renvoize 1227 (US, K); Menai I., s. 1., Gwynne & Wood 1234 (K, EA), 1252 (EA); south of Settlement, Stoddart & Poore 1219, 1203, 1204 (K).

SARCOSTEMMA VIMINALE R. Br.

Menai I., s. l., Gwynne & Wood 1239 (EA); north of Settlement, Stoddart & Poore 1253 (K, US); Renvoize 1244 (US, K).

EVOLVULUS ALSINOIDES L.

S. l., Thomasset in 1902 (K); Wizard I., north end, Fosberg & McKenzie 49832 (US); central part, Renvoize 1259 (US, K); south end, Gwynne & Wood 1231 (EA); Menai I., south of settlement, Stoddart & Poore 1229 (K).

IPOMOEA PES-CAPRAE (L.) R. Br.

Wizard I., central part, Fosberg 49790 (US, K); Renvoize 1218 (US, K); Menai I., south of Settlement, Stoddart & Poore 1232 (K).

IPOMOEA TUBA (Schlecht.) Don

Wizard I., central part, Fosberg 49793 (US, K); Renvoize 1223 (US, K).

CORDIA SUBCORDATA Lam.

Wizard I., near south end, Fosberg & Grubb 49821 (US, K); Menai I., south of Settlement, Stoddart & Poore 1236 (K); north end, Fosberg & Grubb 49767 (US).

TOURNEFORTIA ARGENTEA L. f.

Menai I., south of Settlement, Stoddart & Poore 1234 (K); Wizard I., central part, Renvoize 1256 (US, K).

AVICENNIA MARINA (Forsk.) Vierh.

S. l., Fryer 22 (K); Wizard I., near south end, Fosberg & Grubb 49825 (US, K); Menai I., s. l., Gwynne & Wood 1260 (K, EA); north of Settlement, Stoddart & Poore 1259 (K); south of Settlement, Stoddart & Poore 1225 (K).

CLERODENDRUM GLABRUM E. Mey. (*C. minutiflorum* Bak.)

"Dupont records this from Cosmoledo," Hemsley, (1919); s. l., Thomasset in 1902 (K, 2 sheets).

PREMNA OBTUSIFOLIA R. Br.

Menai I., s. l., Gwynne & Wood 1250 (EA); north end, Fosberg & Grubb 49780 (US, K); north of Settlement, Renvoize 1236 (US, K); south of Settlement, Stoddart & Poore 1206 (K), 1226 (K).

SOLANUM ALDABRENSE C. H. Wright

"Dupont records this from ... Cosmoledo", Hemsley (1919).

SOLANUM MELONGENA L.

Menai I., north of Settlement, Stoddart & Poore 1244 (K).

SOLANUM NIGRUM L.

Wizard I., north end, Fosberg & McKenzie 49829 (US); central part, Renvoize 1258 (US, K).

HYPOESTES ALDABRENSIS Baker

Wizard I., s. 1., Gwynne & Wood 1225 (K, EA); near south end, Fosberg & Grubb 49817 (US, K); Menai I., s. 1., Gwynne & Wood 1264 (EA); north of Settlement, Stoddart & Poore 1252 (K).

GUETTARDA SPECIOSA L.

Menai I., s. 1., Vesey-FitzGerald 5987 (K); north of Settlement, Renvoize 1250 (US, K).

POLYSPHAERIA MULTIFLORA Hiern

Menai I., north end, Fosberg & Grubb 49772 (US).

TARENNA TRICHANTHA (Bak.) Brem.

S. 1., Dupont 279 (K).

TRIAINOLEPIS FRYERI (Hemsl.) Brem.

S. 1., Thomasset 242 (K).

SCAEVOLA TACCADA (Gaertn.) Roxb.

Wizard I., near south end, Fosberg & Grubb 49824 (US); Menai I., north of Settlement, Renvoize 1253 (US, K).

LAUNAEA INTYBACEA (Jacq.) Beauv.

Menai I., s. 1., Gwynne & Wood 1253 (EA); north of Settlement, Stoddart & Poore 1262, 1201 (K, US); Renvoize 1247 (US, K).

LAUNAEA SARMENTOSA (Willd.) Alst.

S. 1., Dupont 35 (K); Wizard I., s. 1., Gwynne & Wood 1229 (EA); central part, Fosberg 49791 (US, K); Renvoize 1217 (US, K); Menai I., south of Settlement, Stoddart & Poore 1243 (K, US).

VERNONIA ALDABRENSIS Hemsl.

Menai I., north end of Settlement, Stoddart & Poore 1251 (K); north end, Fosberg & Grubb 49777 (US, K).

7. LAND (INCLUDING SHORE) BIRDS OF COSMOLEDO

C. W. Benson

Introduction

Excepting a brief reference by Abbott to a rail (see below), the earliest reference to birds on Cosmoledo seems to be by Bergne (1901), who had the lease of Aldabra, including also Cosmoledo, at the beginning of the century. Dr D. R. Stoddart has brought to my notice the list of birds made by Bergne, as a result of his visit to Cosmoledo between 9 and 12 October 1901. In addition to five sea birds and a "curlew", it includes four species to be referred to below. Dupont (1907) drew up a fairly comprehensive list of birds as a whole. Fryer (1911, 430) thought that land birds were scarce on Cosmoledo, which was "too broken into small islands to be suitable for a land fauna". Vesey-FitzGerald (1940, 486-488) gives an account of the land, exclusive of shore, birds of the Aldabra archipelago, including Cosmoledo, which he visited in 1937. According to Williams (1953) and Benson (1969) he also collected sunbirds and a white-eye on Menai Island in April 1952. But he has recently explained to me that he only visited Cosmoledo the once, in 1937, and that these specimens were merely collected at his request, and that at the time he was in Africa. Hartman (1958), who spent 10-12 December 1957 on Cosmoledo, visiting Menai and West North Islands, also gives an account of the land birds. H.M.S. Owen called at Menai on 13-15 March 1964, and some observations are given by Bourne (1966). The Bristol Seychelles Expedition, of which R. Gaymer was a member, visited Menai on 9 November 1964, and Gaymer made a further visit to Menai on October 1965. He has kindly made his observations available. I. S. C. Parker collected specimens for the National Museum of Kenya, Nairobi, on Menai on 6 October 1967.

A grant from the Frank M. Chapman Memorial Fund, made at the instance of Dr Dean Amadon, Lamont Curator of Birds in the American Museum of Natural History, enabled me to visit Cosmoledo and Astove myself, on the M.F.R.V. Manihine, during the time that I was working on Aldabra, in January-March 1968. We were on Cosmoledo on 6 March: on Wizard Island from about 0900 to 1300 hours, and on Menai Island from 1600 to 1845 hours. My own observations were augmented by many from A. W. Diamond and P. Grubb. Some additional observations were made on Menai Island by Dr M. E. D. Poore and Dr D. R. Stoddart during a further visit by M.F.R.V. Manihine, on 14 September 1968.

In addition to the generous assistance from the Chapman Fund, I am much indebted to various other persons. Dr R. H. Carcasson, the former Director, and A. D. Forbes-Watson, lent me the specimens collected by Parker for the National Museum of Kenya, and permitted me to make use of them in this paper. They also seconded to me a skinner, Lorian Lokiru, who worked for me throughout my time on Aldabra, and accompanied me to Cosmoledo and Astove. Professor Charles G. Sibley and Mrs Eleanor H. Stickney lent me the material collected by Hartman in the Aldabra archipelago as a whole, in the Peabody Museum of Natural History, Yale University, and which was brought to my notice by R. K. Brooke, of Rhodesia, while on a visit to that Museum. A. M. Hutson, of the Department of Entomology, British Museum (Natural History), has identified the stomach contents of my specimens. Dr D. W. Snow and his staff in the Bird Room, British Museum (Natural History), have given me the necessary facilities for the comparative study of specimens. My own from Cosmoledo and Astove are to be presented to the American Museum of Natural History, while Parker's land birds from these two atolls have recently been donated by the National Museum of Kenya to the British Museum (Natural History). I thank Mr J. A.C. Bergne for the opportunity to make use of unpublished observations made by his father on Cosmoledo in 1901.

Resident true land birds

Dryolimnas cuvieri White-throated Rail
 Abbott (in Ridgway 1895, 529) had it at second-hand that rails "swarm" on Cosmoledo (and Astove), while according to Fryer (1911, 430, under D. abbotti ?), a rail still existed in 1908 on South Island, Cosmoledo. We were unable to land on South Island, which has no human settlement, so that it is possible that this species does still exist there. This is worth further investigation.

Streptopelia picturata Malagasy Turtledove
 This species is listed by Dupont (1907, as Turtur saturatus) for Cosmoledo, and Bergne (1901) mentions a brown "Tourterelle des Iles", but no other reference to its occurrence has been traced. However, one of the labourers on Aldabra, who had previously lived on Cosmoledo for more than ten years, assured me that it still occurs on South Island. Like the case of the rail, this is worth further investigation. A relic population might still survive--in contrast to the situation on Assumption, where extirpation is complete.

Geopelia striata Barred Ground-Dove
 On Menai, I had a quick view of a small long-tailed dove, which I took to be this species, not Oena capensis, which occurs in Malagasy as well as in Africa. I only saw the one bird, which may represent a not very successful artificial introduction. Elsewhere, as in the Seychelles and on Farquhar, this eastern species evidently thrives (Watson et al. 1963, 170, 188; Stoddart and Poore 1970), but there seems to be no previous suggestion of its occurrence in the Aldabra archipelago.

Cisticola cherina

Malagasy Grass-Warbler

Bergne (1901) lists "Allouette", French for a lark. He may well have seen Cisticola cherina, brown above striped blackish, and white below, in general colour resembling a typical lark. It is not mentioned by Dupont (1907), nor by Fryer (1911). It is recorded from Menai by Vesey-FitzGerald (1940, 488), and apparently from both Menai and West North Islands by Hartman (1958). Gaymer found it plentiful on Menai in November 1964 and October 1965, as I and Diamond did on Wizard and Menai. Diamond often heard a "tic" alarm-call, reminiscent of that of a Robin Erithacus rubecula in England. Stoddart and Poore heard this call and saw birds both on the southern dunes on Menai and on the path across champignon north of settlement in September 1968. On Wizard Diamond found a nest containing three eggs, in a bushy Achyranthes 0.6 m above the ground. This is rather high: the greatest height which Rand (1936, 450) gives is 450 mm. The entrance was near the top. Hartman (1958) and Watson et al. (1963, 198) imply that the bird was artificially introduced to Cosmoledo and Astove. This seems most unlikely, and it is virtually certain that colonisation (from Malagasy) was unaided by man. There may be no instance of the successful artificial introduction of an insectivorous warbler in any part of the world.

Vesey-FitzGerald (1940, 488) collected a specimen on Astove. It was sent to the British Museum, but cannot now be found. Hartman collected a male on Menai, Parker three males on Menai and two on Astove. In all, sixteen specimens are available from these two islands and Wizard. Twelve of them are adult, in breeding dress. Their measurements in mm, and of material in this dress from Malagasy, in the British Museum, with the addition of a few in the University Museum of Zoology, Cambridge, are as follows:

	<u>Wing</u>	<u>Tail</u>	<u>Culmen from base</u>
		Malagasy	
19 ♂♂	50 - 52 (50.8)	37 - 42 (39.4)	11.5 - 13 (12.3)
15 ♀♀	45 - 48 (47.1)	36 - 41 (38.9)	11 - 13 (13.0)
		Astove	
3 ♂♂	51 52 53	38 39 40	12.5 13 13
3 ♀♀	47 47 48	34 38 39	12 12.5 12.5
		Cosmoledo: Menai Island	
4 ♂♂	51 52 52 52	37 38 39 42	11.5 11.5 12 12.5
		Cosmoledo: Wizard Island	
2 ♂♂	50 50	38 39	12.5 13
3 juv. ♂♂	47 48 48	40 42 42	12 12 one broken
1 juv. ♀	45	41	11

The juveniles are suffused with rusty above and on the flanks, as described by Lynes (1930, 113) for Malagasy. The juvenile female is also washed with sulphur on the chin, throat and chest. Whereas my adults had the palate wholly black, all four juveniles had black restricted to a small area in the centre, the female without any black

at all. Also, they had irides grey-brown instead of red-brown, and in two at least skull-ossification had barely started. Probably none is more than about two months old (from date of hatching), and they are assumed to be from eggs laid not earlier than December. They are probably fully grown, nevertheless their measurements are kept separate.

The wing-lengths suggest that, while the Astove and Menai birds are similar in size to those from Malagasy, those from Wizard are slightly smaller, particularly if the juveniles are taken into consideration. Weights (in g) also tend to bear this out. Using also data from Parker's specimens as well as my own, the result is as follows:

Astove			
3 ♂	9	10	10.8
3 ♀	8.4	8.5	10.8

(The heaviest female contained an enlarged, yolking egg)

Cosmoledo: Menai Island			
3 ♂	10	10	10

Cosmoledo: Wizard Island			
2 ♂	9.5	9.7	
3 juv. ♂	8	9	9.4
1 juv. ♀	8.2		

It can be seen that the Wizard males are lighter than those from Astove and Menai, the only exception being the Astove male weighing only 9 g. Also, the juvenile female from Wizard is slightly the lightest female. The investigation could be taken further by trapping and weighing of live birds at the same time of day.

As to colour, absolutely no variation could be discerned, and the known range of Cisticola cherina must be extended to include Astove and Cosmoledo. The two atolls may have been colonised quite recently, though in 1937, according to Vesey-FitzGerald, the species was already abundant on Astove. It is a pity that Nicoll (1906, 705) was unable to visit Astove and Cosmoledo, as we could have been reasonably sure from the account that he would have written what the situation was in 1906, and the inference from Bergne that it was already on Cosmoledo in 1901 would have been further illuminated. The fact that neither Dupont nor Fryer mentions it does not necessarily mean that it was absent at the time of their visits. Unlike Nicoll, they were not primarily ornithologists. Nicoll (1906, 686-692) visited Gloriosa in 1906, but makes no mention of C. cherina. It would be interesting to know whether it is there now.

Perhaps in due course Aldabra and Assumption will also be colonised. S. A. Renvoize (personal communication) is unaware of any difference in the species of grasses on the four atolls to account for its presence only on Cosmoledo and Astove. On the other hand, from the physiognomical aspect, on Aldabra there is no habitat comparable to the fairly open plantations with grassy ground cover found on Menai and Astove, or the low scrub on Wizard and Astove.

It would be interesting to ascertain how extensive the breeding season is on Cosmoledo and Astove. Parker's specimens, collected in early October, were already in breeding dress. The differences between breeding (summer) and non-breeding (winter) dress are clearly and correctly given by Lynes (1930, 112). For south-central Africa, Benson, Brooke and Vernon (1964, 83) give 82 egg-laying records for the related C. juncidis, all within the period November-June (only three for November, and a marked fall-off in the last three months). Yet Rand (1936, 449) expresses the opinion that cherina probably breeds throughout the year in Malagasy, and gives several records suggesting egg-laying in August and September (one definitely for the latter month). Nor are specimens in breeding dress on Cosmoledo and Astove in early October in keeping with the data for juncidis. Thus cherina would appear for some reason to be more plastic in its season. As would be expected in juncidis too, breeding was still under way on Cosmoledo and Astove in March. Apart from the nest with eggs found by Diamond, the heavy female collected on Astove held an egg measuring as much as 10 x 15 mm.

In order of predominance (numbers of individual specimens in each group), the stomach-contents of my specimens as a whole, including those from Astove, were:

Hemiptera: Homoptera and Heteroptera, including one Reduviidae nymph

Coleoptera: including Nitidulidae and Curculionidae

Orthoptera: including Tettigonoidea and Acridoida

Diptera: including Fannia sp. larvae (Muscidae), Scenopinidae, and Asilidae

Hymenoptera: winged ants

Neuroptera: Myrmelionidae

Arachnida: small spiders

Corvus albus

Pied Crow

Listed from Cosmoledo by Dupont (1907, as C. scapulatus) and by Bergne (1901, as "Corbeau"). Vesey-FitzGerald (1940, 488) gives it as a visitor only. Hartman (1958) records a pair from West North Island; Bourne (1966) a pair on Menai, "the first for many years". I saw a pair on Menai, but was told that these were the only birds on the atoll as a whole. But Gaymer's information is that there were as many as five on Menai when he was there on 1 October 1965. Two of these he saw.

Zosterops maderaspatana

Malagasy White-eye

Vesey-FitzGerald (1940, 488, as Z. aldabrensis) records it as common on Cosmoledo (no particular island specified), as does Hartman (1958) for Menai. The only other record of white-eyes on Cosmoledo is of one seen by Gaymer on Menai on 1 October 1965. None was seen by any of our party on either Wizard or Menai, though it was seen by Stoddart and Poore on Menai in September 1968.

Three specimens collected on Menai have been studied (Benson 1969), and described as a distinct subspecies, differing from the population of nominate maderaspatana on Astove in being paler green above and paler

yellow on the throat and under tail-coverts. But it has since been ascertained from Vesey-FitzGerald that the specimen collected in his name (on 15 April 1952) was kept in alcohol, probably for several months, before being skinned by J. G. Williams in Nairobi. It is also understood from Mrs Stickney that Hartman's specimens may have been in alcohol for as long as one year. It is possible that the pallor of all three Menai specimens may be due to immersion in alcohol, and the validity of Z. m. menaiensis Benson requires further investigation. The special interest of Hartman's two specimens is however that they are partially grey and partially green above. It is unlikely that this was caused by alcohol. They seem to closely resemble the only known specimen of Z. hovarum Tristram, which probably came from Malagasy. The other specimen is wholly green above.

Nectarinia sovimanga

Souimanga Sunbird

The species is listed from Cosmoledo by Dupont (1907, as Cinnyris abbotti). Fryer (1911, 430) records a Cinnyris; Vesey-FitzGerald (1940, 487) records the species as "especially common" on Menai; Hartman (1958) as "very common" on Menai, "common" on West North Island; and Bourne (1966) "many" Nectarinia sp. on Menai. On Wizard we did not find it to be common. On Menai it was more so, though not as numerous as Cisticola cherina. Vesey-FitzGerald found a nest containing young (he does not say how many) on West North Island on 5 October, and Hartman saw a nest containing two eggs on Menai, during 13-15 December. Gaymer reports that the birds were plentiful on Menai in November 1964 and October 1965. I collected on Wizard two old nests, now in the British Museum (Natural History). Each was about 1 m above the ground, attached to a bush identified by S. A. Renvoize as Azima tetraacantha. This plant is well equipped with large spines, which might help protect the nests and their contents from any enemies. Three juvenile males collected by Parker on Menai on 6 October, the bills of which are recorded as "black with yellow gape", and a juvenile female by Vesey-FitzGerald on 15 April, for further details of all four of which see below, are probably only about one month old from date of hatching, suggesting egg-laying respectively in August and late February or early March. On Aldabra, occupied nests with eggs have been found throughout the period August to March, and presumably this also applies on Cosmoledo. There may even be some breeding throughout the year, as with some Nectarinia spp. in south-central Africa (Benson, Brooke and Vernon 1964, 93-95).

Taking into consideration the material (Benson 1967, 85) in which N. s. buchenorum was represented by only three specimens, all from Menai, and that recently collected, including Hartman's specimens (Astove, 2 ♂♂ 1 ♀; Menai 2 ♂♂ 1 ♀; Assumption 1 ♂ 1 juv. ♀; Aldabra 1 ♂), revised measurements in mm are as follows:

		<u>Wing</u>		<u>Tail</u>	<u>Culmen from base</u>	
				Astove (<u>buchenorum</u>)		
7 ♂♂	54 - 57	(55.1)		39 - 43	(40.6)	17.5 - 20 (19.1)
5 ♀♀	50 - 53	(50.8)		35 - 36	(35.2)	16 - 19 (17.5)
2 juv. ♀♀	49 50			33 35		16.5 19
				Cosmoledo: Wizard (<u>buchenorum</u>)		
1 ♂	55			39.5		20
1 ♀	51			34+		19.5
				Cosmoledo: Menai (<u>buchenorum</u>)		
6 ♂♂	54 - 57	(55.5)		39 - 44	(40.2)	18 - 20 (18.8)
3 juv. ♂♂	52 53 55			34 36 37		17 18 19
2 ♀♀	51 53			33 36		17 18.5
1 juv. ♀	50			31		16
				Assumption (<u>abbotti</u>)		
6 ♂♂	53 - 55	(54.3)		37 - 41	(39.2)	19 - 21 (20.0)
1 ♀	49			34		16+
1 juv. ♀	49			32		18
				Aldabra (<u>aldabrensis</u>)		
20 ♂♂	51 - 55	(52.7)		33 - 40	(37.8)	18 - 21 (19.5)
2 juv. ♂♂	50 51			32 33		19.5 20
12 ♀♀	47 - 50	(48.4)		30 - 35	(32.5)	17 - 19 (18.2)

Specimens not indicated as juvenile are certainly fully grown, and measurements of wing indicate that Astove and Cosmoledo birds are larger than those from Aldabra, with Assumption birds intermediate. Astove and Cosmoledo birds also average larger than those from Malagasy and Gloriosa, see figures for the latter two areas in Benson 1967, 85. They also have proportionately shorter bills than any others.

Of the material now available, much more comprehensive than I had previously, in the first instance adult males may be considered. The existence of an off-season dress was denied (Benson 1967, 88), but it is now evident that, as in some African species (Skead 1967, 20-24), it does exist, at least in aldabrensis and abbotti, and probably in all the subspecies. Ten specimens of aldabrensis are in full metallic (breeding) dress, with the red chest-band fully developed. Most of the remainder (another ten) have this dress only partially developed, with the upper-side largely dull olive, and the lower abdomen always dull olive-yellow instead of dingy white. They appear to represent an off-season dress. In the white of the abdomen, those in breeding dress only differ from specimens of apolis, of dry south-western Malagasy, in that it is less bright, not so pure a white. Three of the males of abbotti, collected by Nicoll on 12-13 March, also appear to be in an off-season dress. The other three differ from males in breeding dress of aldabrensis in having the abdomen mainly black, with a relatively little dingy white on the lower abdomen, while the rump and upper tail-coverts have some metallic green instead of being plain black. All the males from Astove and Cosmoledo (buchenorum) appear to be in breeding dress, with no constant

difference apparent between the two atolls. White on the abdomen has almost disappeared. In some specimens the process is complete, in others some of the feathers of the lower abdomen have whitish fringes. Metallic green on the rump is more extensive than in abbotti, while the lower back is black instead of olive as in abbotti and aldabrensis.

I stated (1967, 84) that buchenorum can also be distinguished by the brownish, less reddish tone of the chest-band. This is not borne out by the relatively long series now available. The colour in the type of buchenorum the only adult male of this subspecies which I had previously seen is almost a brick-red, and is quite accurately reproduced in the colour plate accompanying the original description (Williams 1953). According to the colour-chart of Villalobos-Dominguez and Villalobos (1947), it is nearest to SSO 8°(9). Specimens of nominate sovimanga are about the same, though the band is narrower, as it also is in apolis. In the other males of buchenorum the colour is more scarlet in tone, according to the same colour chart nearest to S 9°(6). Only Hartman's two males from Menai show some tendency to brick-red. In apolis, abbotti and aldabrensis the colour is always scarlet rather than brick-red, and the latter colour is only normal in nominate sovimanga. The type of buchenorum, also two females, one adult, one juvenile, were collected in Vesey-FitzGerald's name on the same day (15 April 1952) on Menai. He has told me that, like the specimen of Zosterops maderaspatana, they were kept in alcohol before being skinned in Nairobi. According to Mrs Stickney, certain of Hartman's specimens were also in alcohol prior to skinning, and this is the cause of the brick-red chest-band in some of the adult males, which are otherwise normal in colour.

Of adult females, Vesey-FitzGerald's specimen does not appear to have been affected by alcohol, but a Hartman specimen from Menai lacks the usual wash of yellow on the underside, and was in alcohol for one year. Material of nominate sovimanga is distinctly washed with olive on the upperside, and a relatively bright yellow below. In buchenorum (disregarding Hartman's female from Menai), abbotti and aldabrensis the upperside is brown with little or no olive wash, and the yellow wash on the underside is much less bright. In these respects these three subspecies from the Aldabra archipelago do not seem distinguishable from one another. Four specimens of apolis are like those from the Aldabra archipelago on the upperside, though perhaps a trifle paler. On the underside they are white with no yellow wash except for a slight sign of it in two from Tabiky. Four of the Astove specimens show a variable degree of orange-red fringing to the feathers of the chest, and the one which has this most pronounced, collected by Parker, also has some metallic bluish-green fringes to the feathers of the crown, nape and mantle. One old specimen of aldabrensis in the British Museum also shows slight signs of this orange-red fringing. M. P. Stuart Irwin has shown me in the National Museum of Rhodesia, Bulawayo, females of two African species, N. bifasciata and mariquensis, the odd individual of which shows the same tendency to red fringing on the chest. Benson and Irwin (1966) also note this in N. bourieri.

Of six specimens whose extreme youth is shown by uniform sooty chin and throat, a male from Aldabra and three collected by Parker on Menai agree with each other in being washed with dull olive above and olive-yellow below. But a juvenile female each from Menai and Assumption, respectively Vesey-FitzGerald and Hartman specimens, lack any olive above or yellow below. This is certainly attributable to immersion in alcohol. Another juvenile male from Aldabra, somewhat older, agrees best in colour and pattern with adult females, though has some olive above. It lacks the sooty chin and throat. The younger of the two Aldabra juvenile males, and one of the three from Menai, have no metallic feathers at all, the others only a few. Two juvenile females from Astove are like adult females but are more olive above.

It may be helpful to give the following summary of the subspecies, based only on males in breeding dress, noting that females of nominate sovimanga are richest in colour, apolis the least so, the other three subspecies rather richer than apolis:

N. s. sovimanga (Gmelin): Abdomen yellow, black restricted to uppermost part. Chest-band brick-red, relatively narrow. Wing 51-56 mm. Gloriosa and Malagasy except the dry southwest.

N. s. apolis (Hartert): Like last, but abdomen white, chest-band scarlet. Dry southwestern Malagasy.

N. s. buchenorum (Williams): Abdomen almost or completely black; chest-band scarlet, and broader. Lower back black instead of olive as in the last two; rump and upper tail-coverts metallic green instead of black. Larger, wing 54-57 mm. Bill proportionately shorter than in all four other subspecies. Astove and Cosmoledo.

N. s. abbotti (Ridgway): Like buchenorum, but some white on lower abdomen, lower back olive, metallic on rump less extensive. Slightly smaller than last, wing 53-55 mm. Assumption.

N. s. aldabrensis (Ridgway): Like abbotti, but lower abdomen wholly dingy white (not so bright as in apolis or nominate sovimanga); rump and upper tail-coverts wholly black, without any metallic. Wing 51-55 mm. Aldabra.

No plausible explanation can be offered for the extensive black in the male of buchenorum, both on the abdomen and on the lower back. If it is the effect of melanism, then it is puzzling that the female shows no richness of colour. It is very like the female of abbotti and aldabrensis, and only slightly richer than in the dry country apolis. The males of apolis and of aldabrensis (in breeding dress) are rather similar. The only colour differences are that apolis has the scarlet chest-band narrower, and the abdomen a brighter white, with the black on the upper abdomen more restricted.

While on Astove, Diamond noted that this species appeared to be larger than on Aldabra, thus agreeing with inference made above from wing-lengths. The following weights in g from specimens collected by me do not support this very well:

				Astove
3	♂♂	6.8	7.6	7.6
2	♀♀	6.0	7.2	

(The heavier female contained an enlarged, yolking egg)

				Wizard
1	♂	7.2		
1	♀	6.9		

				Aldabra
12	♂♂	6.4	- 7.9	(7.1)
6	♀♀	5.7	- 6.8	(6.3)

Nevertheless, trapping and weighing the live birds at the same time of day might well demonstrate a more marked difference.

In adults of buchenorum which I collected on Astove and Wizard, males had the flesh-coloured palate suffused with black, whereas in females there was no such suffusion. The stomach-contents of specimens collected by Parker on Menai consisted of fragments of insects, including some Coleoptera. Those of a male and a female taken by me on Wizard consisted of small Arachnida (spiders) and Homoptera.

Serinus mozambicus Yellow-fronted Serin
Bergne (1901) lists "Sourin", "greyish yellow" in colour. This name may be a corruption of "Serin". S. mozambicus is a common and wide-spread species in southern Africa, and is sometimes kept as a cage bird. It is greyish green above, yellow below. It has been introduced to Desroches, in the Amirantes (Watson et al. 1963, 182), as well as to Mauritius and Reunion (ibid., 148, 159), and an introduction to Cosmoledo would not be surprising. But there is no subsequent record, and so presumably it died out long ago.

Possibly resident shore birds

Ardea cinerea Grey Heron
Listed by Dupont (1907). Between us, Diamond, Grubb and I saw at least five individuals on Wizard, and two more on Menai.

Egretta garzetta Little Egret
Dawson (1966, 7, under E. dimorpha) records that it occurs on Cosmoledo "in large flocks", though we have no evidence of this. There were however at least five birds on Wizard at the time of our visit. I counted three dark phase individuals, one white. On Menai, Diamond counted 13 dark phase birds, four white. Bourne (1966) refers to egrets and herons as abundant on Menai, of which some at least were presumably E. garzetta.

Parker collected a female on Menai, and I collected a female on Wizard. Some particulars for them are:

Locality	Menai	Wizard
Wing	277 mm	287 mm
Culmen from base	90 mm	92 mm
Culmen exposed	88 mm	90 mm
Colour of plumage	bluish grey, chin, throat and outer primary coverts white	similar, but in fresher dress, bluish grey darker
Colour of soft parts	upper mandible blackish, lower blackish at tip; rest pale horn; front of tarsi black, back and toes greenish yellow	bill black; orange- yellow at base and around eye; legs black, feet yellow; irides yellow
Weight	-	540 g

According to me (Benson 1967, 68), E. assumptionis does not seem recognisable, and these two specimens must be assigned to E. g. dimorpha, of Malagasy and the Aldabra archipelago. Their bill-lengths are lower than the minimum given by Grant and Mackworth-Praed (1933, 193) for assumptionis.

Bubulcus ibis

Cattle-Egret

No earlier record has been traced. Inland on Wizard, there were some fifty individuals at least. In the south, Grubb counted 15, about half with buffy breeding plumes. I saw another 34 in the north, including one flock of 19. One bird was seen on Menai. This is not strictly a "shore" bird at all, but is best treated with other Ardeidae spp.

Butorides striatus

Little Green Heron

Listed by Dupont (1907, as B. atricapillus). Only one individual was seen by us on Wizard, and a total of five on Menai. No specimen has been collected, but most likely Cosmoledo birds are B. s. crawfordi, as on Assumption and Aldabra.

Migrants

Unless otherwise indicated, the following records of shore birds are from Diamond, Grubb or myself.

Squatarola squatarola

Grey Plover

Eight on Wizard, also noted on Menai. One on Wizard was mainly in breeding dress.

Charadrius leschenaultii

Great Sand-Plover

Listed by Dupont (1907, as Aegialitis geoffroyi). On Menai and Wizard in small flocks.

- Numenius phaeopus Whimbrel
Listed by Dupont (1907). About 30 on Wizard, some perching on Agave inflorescences or on tops of Tournefortia bushes. Also noted on Menai, where Parker collected one.
- Numenius arquata Curlew
Listed by Dupont (1907), but not seen by us.
- Limosa lapponica Bar-tailed Godwit
About five seen by Diamond on Menai.
- Tringa nebularia Greenshank
Listed by Dupont (1907, as Totanus glottis). One on Wizard, two on Menai.
- Actitis hypoleucos Common Sandpiper
Listed by Dupont (1907), but not seen by us.
- Arenaria interpres Turnstone
Listed by Dupont (1907). Large numbers on Menai (Bourne 1966). At least 100 on Wizard. Also seen on Menai.
- Crocethia alba Sanderling
Seven seen by myself on Wizard, noted by Diamond on Menai.
- Erolia minuta Little Stint
Listed by Dupont (1907), but not seen by us.
- Erolia testacea Curlew-Sandpiper
In small flocks on Menai and Wizard.
- Dromas ardeola Crab-Plover
Listed by Dupont (1907). Bourne (1966) records 20 on Menai. At least 50 on Wizard, over 30 on Menai.

Of true land birds, Vesey-FitzGerald (1940, 488) records a Broad-billed Roller Eurystomus glaucurus on Wizard on 6 October 1937. It was presumably E. g. glaucurus, well known as a migrant from its breeding quarters in Malagasy to Africa. Gaymer also reports one seen on Menai on 9 October 1964 and again on 1 October 1965. He saw a single Blue-cheeked Bee-eater Merops superciliosus on Menai on 1 October 1965. This would be unusually early for the palaeartic M. s. persicus, two of which I definitely saw on Aldabra on 22 March 1968. The earliest arrival date for the subspecies in Zambia is given as late October (Benson and White 1957, 51). Gaymer's record is presumed to refer to M. s. superciliosus, suspected of migrating from breeding quarters in Malagasy to Africa. On Menai, I saw a Red-backed Shrike Lanius collurio, an adult female or an immature bird, perched at the top of a Tournefortia bush. This seems to be the only record of this palaeartic species from the Malagasy Region, and it can only be of a stray individual. Other palaeartic land birds may be expected to occur on Cosmoledo occasionally. The number of such species recorded by now from Aldabra is about 14.

Summary

1. An account is given of the land (including shore) birds of Cosmoledo.

2. Of the resident true land birds:

(a) A rail Dryolimnas cuvieri and a turtledove Streptopelia picturata are said to have existed some 60 years ago, but are now extinct except perhaps on South Island.

(b) A warbler Cisticola cherina may be a recent coloniser from Malagasy, and is undifferentiated from the parent stock, except that specimens from Wizard Island are rather small in size. There is a well-marked subspecies of a sunbird Nectarinia sovimanga, confined to Cosmoledo and Astove. A white-eye Zosterops maderaspatana, only known from Menai Island, may belong to the same subspecies as on Astove. Two out of the three specimens collected are remarkable for being partially grey above. The first two of these species are plentiful, the white-eye less so.

(c) A crow Corvus albus occurs in small numbers. There is one record of a dove Geopelia striata, probably introduced by man. Another such introduction may have been a serin Serinus mozambicus, but it has apparently died out.

3. The number of species of resident true land birds is much less than on Aldabra (see list in Stoddart, Benson and Peak 1970), despite the fact that Cosmoledo is nearer to Malagasy, the principal source of colonisation. But the land area of Cosmoledo is much less.

4. There are four possibly resident herons or egrets (family Ardeidae).

5. Of migrants, eleven species of shore birds which breed in the Palaearctic Region have been recorded; also the Crab Plover Dromas ardeola and three species of true land bird.

References

- Benson, C. W. 1967. The birds of Aldabra and their status. Atoll Res. Bull. 118: 63-111.
- 1969. The white-eye Zosterops maderaspatana (Linn.) of Menai Island, Cosmoledo Atoll. Bull. Brit. Ornithol. Club, 89: 24-27.
- Benson, C. W., Brooke, R. K., and Vernon, C. J. 1964. Bird breeding data from the Rhodesias and Nyasaland. Occas. Papers Nat. Mus. S. Rhodesia, 27B: 30-105.
- Benson, C. W. and Irwin, M. P. Stuart. 1966. The sunbirds Nectarinia bouvieri and batesi. Bull. Brit. Ornithol. Club, 86: 62-65.
- Benson, C. W. and Penny, M. J. In preparation. The land birds of Aldabra.
- Benson, C. W. and White, C. M. N. 1957. Check list of the birds of Northern Rhodesia. Lusaka.

- Bergne, H. A'C. 1901. Rough notes of a voyage to the Aldabra group. Manuscript.
- Bourne, W. R. P. 1966. Observations on islands in the Indian Ocean. Sea Swallow, 18: 40-43.
- Dawson, P. 1966. A survey of the sea birds of the Seychelles Islands. Ool. Rec. 40: 1-11.
- Dupont, R. 1907. Report on a visit of investigation to St Pierre, Astove, Cosmoledo, Assumption and the Aldabra Group. Mahé: Seychelles Government, 1-51.
- Fryer, J. C. F. 1911. The structure and formation of Aldabra and neighbouring islands--with notes on their flora and fauna. Trans. Linn. Soc. London, Ser. 2, Zool., 14: 397-442.
- Gaymer, R. 1967. Observations on the birds of Aldabra in 1964 and 1965. Atoll Res. Bull. 118: 113-125.
- Grant, C. H. B. and Mackworth-Praed, C. W. 1933. On the relationship, status and range of Egretta garzetta, Demigretta gularis, D. schistacea, D. asha, and D. dimorpha, a new subspecies, and the correct type-locality of Egretta garzetta. Bull. Brit. Ornithol. Club, 53: 189-196.
- Hartman, W. D. 1958. Report on some land birds of Farquhar, St Pierre, Astove, Cosmoledo, Assumption and Aldabra. Seychelles Govt. Bull. 21.
- Lynes, H. 1930. Review of the genus Cisticola. Ibis, ser. 12, 6, suppl.
- Nicoll, M. J. 1906. On the birds collected and observed during the voyage of the 'Valhalla', R.Y.S., from November 1905 to May 1906. Ibis, ser. 8, 6: 666-712.
- Rand, A. L. 1936. The distribution and habits of Madagascar birds. Bull. Amer. Mus. Nat. Hist. 72: 143-499.
- Ridgway, R. 1895. On birds collected by Doctor W. L. Abbott in the Seychelles, Amirantes, Gloriosa, Assumption, Aldabra, and adjacent islands, with notes on habits, etc., by the collector. Proc. U.S. Nat. Mus. 18: 509-546 (actual date of publication June 24, 1896).
- Skead, C. J. 1967. The sunbirds of southern Africa. Cape Town.
- Stoddart, D. R., Benson, C. W., and Peake, J. F. 1970. Ecological change and the effects of phosphate mining on Assumption Island. Atoll Res. Bull., this issue.
- Stoddart, D. R. and Poore, M. E. D. 1970. Geography and ecology of Farquhar Atoll. Atoll Res. Bull., this issue.

- Vesey-FitzGerald, L. D. E. F. 1940. The birds of the Seychelles. I. The endemic birds. *Ibis*, ser. 14, 4: 480-489.
- Villalobos-Dominguez, C. and Villalobos, J. 1947. *Atlas de los Colores*. Buenos Aires.
- Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington.
- Williams, J. G. 1953. Revision of *Cinnyris sovimanga*: with description of a new race. *Ibis*, 95: 501-504.

8. GEOGRAPHY AND ECOLOGY OF ASTOVE

C. J. Bayne, B. H. Cogan, A. W. Diamond, J. Frazier, P. Grubb,
A. Hutson, M. E. D. Poore, D. R. Stoddart, J. D. Taylor

Introduction

Astove, 10°6'S, 47°45'E, is an elevated atoll with a nearly continuous land rim, located 35 km south of Cosmoledo Atoll and 145 km south-east of Aldabra. There have been fewer visits by scientists to Astove than to many of the neighbouring islands, and older records are particularly scarce. Fryer called there briefly in 1908 (Fryer 1911), following Dupont in 1906 (Dupont 1907). The main accounts are those by Vesey-FitzGerald (1942), Baker (1963), and Piggott (1961a, 1961b, 1968). Table 8 lists scientific visitors to Astove. This account is based on the literature, and on observations made during two visits by Royal Society Expedition personnel, the first by ten members on 5 March and the second by five on 14 September 1968. Most of these observations were made on the western side of the atoll, though some members visited the northern part of the east side, and Stoddart walked round the whole land rim. The first hydrographic survey of Astove was by H.M.S. Owen in 1964 (Admiralty Chart 718, 1967); Figure 5 is based on small-scale aerial photography carried out in 1960, with details added from Baker (1963) and Piggott (1961b, 1968).

Geomorphology

Astove has maximum surface dimensions of 4.6 x 2.8 km: the land area is 4.25 sq km, that of the lagoon 5 sq km, and the total, including peripheral reef, about 9.5 sq km. It stands on the southernmost of two presumably volcanic peaks which rise from the ocean floor at depths of 4000-4400 m; Cosmoledo stands on the adjacent peak to the north. The atoll lagoon is very shallow, with large areas less than 0.5 m, and it has a restricted tidal range. According to the lessee, the lagoon level gradually falls in the two weeks preceding neaps until a large part of the floor is exposed. Between neap and spring tides the level rises. Thus flow into the lagoon is greater than out of it during spring tides, and vice versa during neaps. The diurnal cycle is damped within the lagoon. The lagoon entrance at the south point is approximately 100 m wide, and also shallow.

Much of the west rim of Astove is formed of elevated reef-rock, which rises to 4-5 m above sea level. In the north the reef-rock is fairly smooth and partly covered with sand, but further south it is

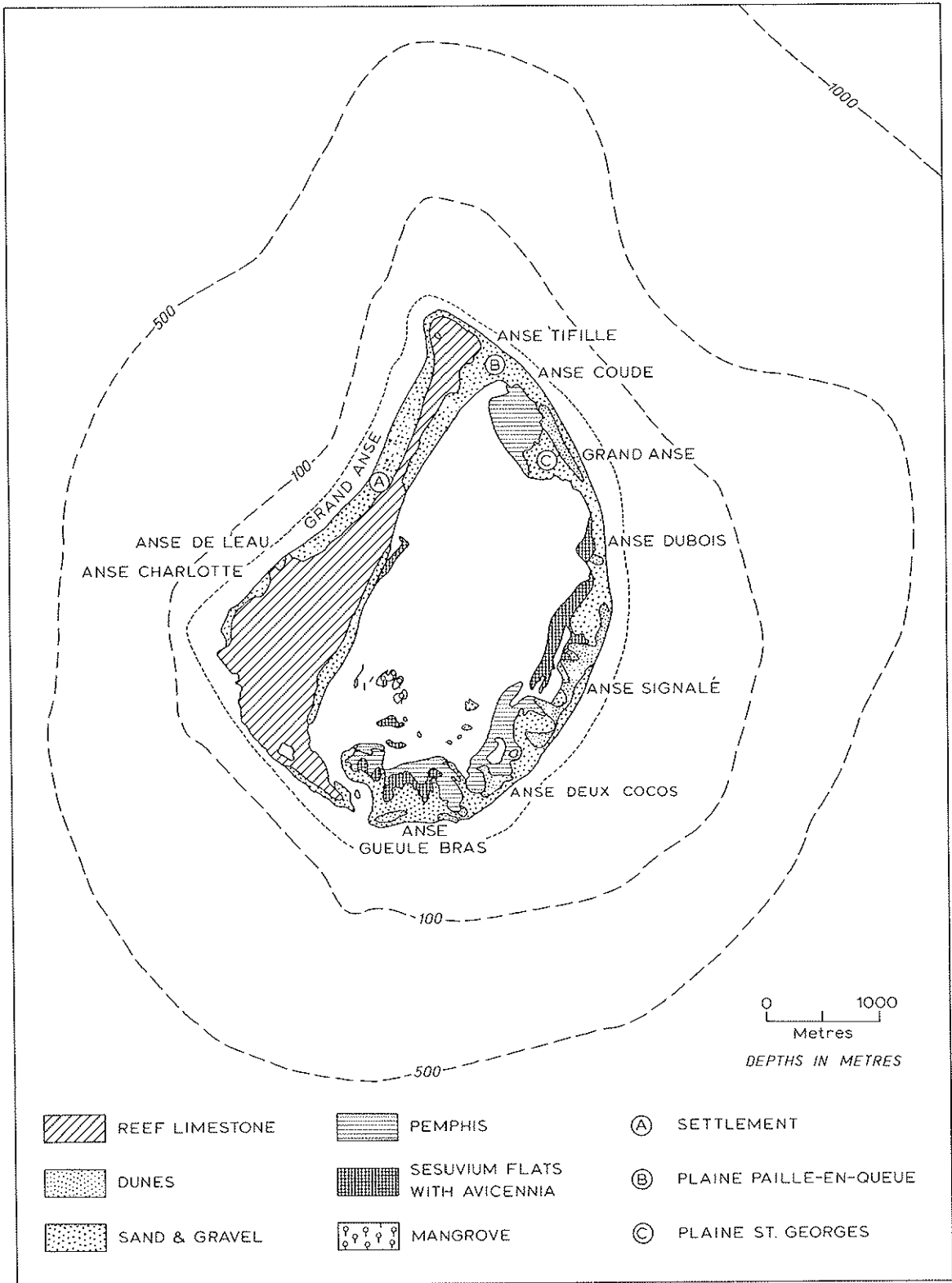


Fig. 5. Astove

Table 8. Scientific Studies at Astove

<u>Date</u>	<u>Study</u>	<u>Reference</u>
1895	S. C. E. Baty, agricultural survey and rudimentary chart	Bergne (1900); Adm.Ch.718(1911)
1901	H. A'C. Bergne, general observations	Bergne (1901)
1906 Sept.10-14	R. Dupont, fauna, flora, agricultural potential	Dupont (1907)
1907	H. L. Thomasset, insects	
1908 Aug.28- Sept.1	J. C. F. Fryer, insects, general observations	Fryer (1908, 1911, 1912); Gardiner (1936)
1910*	R. Dupont, insects, plants	
1937 Oct.	L. D. E. F. Vesey-FitzGerald, vegetation and birds	Vesey-FitzGerald (1940,1941,1942)
1952 Nov.	E. S. Brown, insects	
1956	W. Travis, underwater and general observations	Travis (1959)
1957 Dec.9	W. D. Hartman, land birds	Hartman (1958)
1960 Oct. 6-9	B. H. Baker, C. J. Piggott, geology and soils	Baker (1963); Piggott (1961a, 1961b, 1968)
1964 March 16	H.M.S. <u>Owen</u> , Cmdr D. W. Haslam: survey, birds	Bourne (1966)
1964	R. E. Honegger, reptiles	Honegger (1966)
1967 March 8	J. F. G. Lionnet, H. A. Beamish, insects	Lionnet (1970)
1967 Oct. 7	M. D. Gwynne, D. Wood, I. S. C. Parker, collections of plants and birds	Parker (1970); Gwynne and Wood (1969)
1967-8	Mrs R. M. Veevers-Carter and Miss T. Ridgway, collection of plants	Fosberg and Renvoize (1970)
1968 March 5	C. W. Benson, B. H. Cogan, A. W. Diamond, F. R. Fosberg, J. Frazier, A. Graham, P. Grubb, A. Hutson, K. McKenzie, S. A. Renvoize	This report
1968 Sept. 15	C. J. Bayne, J. C. Gamble, M. E. D. Poore, D. R. Stoddart, T. S. Westoll	This report
1969 June	A. W. Diamond, J. Frazier	This report

* J. A. de Gaye collected Lepidoptera, now in the Rothschild Collection, British Museum (Natural History), on Astove at a date unknown, probably c. 1910.

deeply dissected with large solution holes and is comparable to some of the more extreme Aldabra champignon. The reef-rock is known on Astove as pavé, a name which might be adopted for smoother-surfaced raised limestone which is more irregular than Aldabra platin and stands at a higher level. Baker (1963, 92-97), who calculates the area of raised reef-rock to be 236 ha or nearly 50 per cent of the total land area, has noted that the solution holes are arranged in straight lines in the reef-rock surface.

The reef-rock outcrops to form low cliffs along the southwest coast, but further north there is a seaward sand strip up to 500 m wide (forming Grand Anse) between the sea and the raised limestone. There is also a discontinuous sand strip on the lagoon side of the limestone: it is more complete in the north, where there are vegetated dunes 5-6 m high.

The eastern rim of Astove consists of low sand and gravel spreads overtopped on the seaward coast by active dunes up to 18 m high. These are highest and steepest in the north and become progressively lower and smaller southwards. There is no raised reef-rock outcropping on the surface of the east rim. Much of the seaward coast is rocky, however, though with the appearance of a massive bedded beach conglomerate, with seaward dip, rather than a raised reef-rock. This is a rough-water coast during the Southeast Trades, and because of the narrowness of the reef platform the beaches are formed by gravel, cobbles and rubble as well as sand. Patches of horizontally-bedded sandstone outcrop in places along the lagoon shore, but these may be of recent origin exposed only by the enlargement of the lagoon, and hence do not necessarily result from uplift.

The northern area linking the east and west rims, Plaine Paille-en-Queue, is a largely unvegetated gravel fan that appears to have been recently deposited. It may be either a recent channel fill in a depression formerly separating the two rims, or a cyclone deposit. It is surmounted along the seaward coast by a low sandy beach.

The fringing reef surrounding the land rim is narrow, with an average width of 250 m. On the east side it is an erosional feature, with potholes and deep grooves normal to the shore. The reef front is exceptionally steep, especially on the west side, where the bottom plunges so steeply that ships are unable to anchor and a cable must be taken inshore by small boat and an anchor lodged on the reef flat. A buoy formerly moored outside the reef near the settlement has been washed away.

Fryer (1911) considered that the raised reef-rock indicated a relative uplift of Astove by at least 18 m. The asymmetry of the atoll is striking, with reef-rock confined to the western side, with its straight, vertical (faulted?) coast, and absent from the east side. This suggests tilting rather than simple eustatic emergence of the atoll rim; the asymmetry is also evident in the 100 and 500 m isobaths (Figure 5). No evidence has yet been seen on Astove either of an 8 m ridge or

of a newer limestone at the 4 m level, as on Aldabra, but observations have been rapid and the reef-rock areas have been much altered by phosphate mining in the past.

The usual soil series have been distinguished by Piggott (1961): Desnoeuvs Series on the limestone, now largely removed for phosphate; Farquhar Series on the dunes; and a variable Shioya Series, including gravelly loamy sand and loamy sand.

Vegetation

Previous workers have recorded 58 species of flowering plants from Astove (Dupont 1907, Vesey-FitzGerald 1942). Recent collections have been made by Gwynne and Wood (1969) in 1967, by Veevers-Carter and Ridgway in 1967-68, by Fosberg and Renvoize in March 1968, and by Stoddart and Poore in September 1968. These collections are listed in the following paper (Fosberg and Renvoize 1970). The flora resembles that of Aldabra, though the area of sand is much greater, and there has been more interference by man. The following vegetation types can be distinguished:

1. Pemphis hedge on leeward cliffs.
2. Scaevola hedge on leeward sand beach.
3. Mixed scrub on raised reef-rock.
4. Coconut woodland on leeward sand plains.
5. Coconut woodland on leeward stable dunes.
6. Casuarina woodland on the western rim.
7. Lagoon beach scrub of Scaevola and Pemphis.
8. Scrub of Suriana maritima on high dunes, with ground cover of Fimbristylis cymosa, and with scrub of Tournefortia and Scaevola in protected situations.
9. Grasslands of the exposed sand and gravel plains of the north and east sides.
10. Sesuvium mat of the eastern lagoon shore, with occasional Avicennia.
11. Dwarf mangrove woodland of lagoon islets.

The characteristics of these types can best be described in terms of their distribution round the atoll rim.

West rim

The raised limestone vegetation is similar to that of Aldabra, but more open. Thespesia populneoides (3 m) and Grewia salicifolia are the only common trees, and Pisonia grandis, Euphorbia abbotti and Sideroxylon inerme, all previously recorded, were not seen. The most common shrubs are Vernonia aldabrensis (1-2 m), Colubrina asiatica (2-3 m), Azima tetraantha and Gagnebina pterocarpa. Other characteristic plants are Capparis cartilaginea, Lomatophyllum borbonicum, Cassia occidentalis and Euphorbia hirta. North of the settlement the limestone outcrop is narrower, with fewer and smaller shrubs (mainly Vernonia aldabrensis and Colubrina asiatica) and with a ground cover of Ipomoea tuba, Cassytha filiformis, Plumbago aphylla, Sarcostemma viminale, Launaea intybacea, Boerhavia elegans, Asystasia bojeriana and Vernonia cinerea. This

resembles the vegetation of the more disturbed areas on the limestone near the West Island settlement on Aldabra.

The sand strip south of the raised reef-rock has a seaward hedge of Pemphis acidula 3-4 m tall, then a low dune area under woodland of Cocos and Casuarina. Cordia subcordata is common in the lee of the Pemphis hedge. The ground cover in the woodland consists of grasses (Dactyloctenium aegyptium, Enteropogon sechellensis, Cenchrus echinatus), with Cassytha, Vernonia cinerea and other plants. Gossypium hirsutum, Caesalpinia, and Ricinus communis are common under the coconuts and in the more open areas. There is a large ornamental tree of Tabebuia pallida at a small fishermen's hut in this section.

Further north the lagoonward sand strip has a discontinuous hedge of Suriana maritima and Pemphis acidula, with a woodland of Cocos and Casuarina on low hummocky dunes. Guettarda speciosa is quite common, Tournefortia argentea much less so. The woodland has a low tree storey of Guettarda, and a ground layer of long vines of Ipomoea pes-caprae and I. tuba, with Digitaria horizontalis, Fimbristylis cymosa, Boerhavia repens and Stachytarpheta jamaicensis.

The seaward sand area on the west rim has a littoral hedge of Suriana maritima and Scaevola, with Guettarda; Tournefortia is again uncommon. The coconut woodland is mostly 5-10 m tall, with some Guettarda and Vernonia beneath, but generally there is no shrub layer and only a ground cover of grasses, sedges, vines and herbs. This carpet includes Dactyloctenium aegyptium, Cenchrus echinatus, Sporobolus virginicus, Stachytarpheta jamaicensis, Euphorbia prostrata, Sida parvifolia, Boerhavia, Ipomoea tuba, Achyranthes aspera and Fimbristylis cymosa. Immediately south of the settlement the coconut woodland has a layer of scattered shrubs, with Maytenus, Barleria sp., Grewia salicifolia and Vernonia aldabrensis as well as low trees of Guettarda.

At the settlement there is a grove of tall Casuarina trees, a single Hernandia, and common introduced plants. Catharanthus roseus and Ipomoea pes-caprae are plentiful round the houses, and Agave is cultivated.

East rim

The vegetation of the east rim differs markedly from that of the west, largely in the almost complete absence of trees, except for some small chlorotic coconuts on Plaine St George, in the lee of the highest dunes, but also in the absence of raised limestone and its characteristic plants.

The high northern dunes are covered on their seaward side with a dense scrub of Suriana maritima, overgrown with Cassytha. Bare areas, especially on the tops of the dunes, have clumps of Fimbristylis cymosa, Euphorbia sp., and Boerhavia; and immediately in the lee there is less

luxuriant Suriana, with Scaevola and Tournefortia on more protected sites, and a ground cover of Fimbristylis cymosa and Sporobolus, with Portulaca oleracea, Euphorbia sp., and Sida parvifolia. The gravel and sand plains lack not only trees but also shrubs: the gravel spreads are covered with mats of Plumbago aphylla and Cassytha filiformis, the sand with Dactyloctenium aegyptium, Eragrostis sp. cf. riparia, Sporobolus virginicus, Fimbristylis cymosa, Cleome strigosa, Stachytarpheta jamaicensis and Ipomoea tuba. Much of this ground is burnt over frequently.

The lagoon shore is fringed with a low (1-2 m) scrub of Pemphis acidula or Suriana maritima, which is very difficult to penetrate, and much of which is dead. On the lagoonward side of the Pemphis there is normally a zone of bare silty sand, then a belt of fleshy Sesuvium portulacastrum, extending along most of the lagoon shore, forming a mat up to 80 m wide. There are very occasional stunted trees of Avicennia marina up to 2 m tall in this Sesuvium zone.

The islets near the south end of the lagoon support a dwarf mangrove woodland (1-1.5 m high) of Lumnitzera racemosa and Rhizophora mucronata, the former on the windward eroding shores, the latter (more rarely) on higher drier areas. Suriana and Pemphis are both present on these islets.

The northern gravel spread of Plaine Paille-en-Queue has a very sparse vegetation cover, with a line of windbreak Casuarina at its west end, and a mosaic of Stachytarpheta, Achyranthes, Boerhavia, Plumbago, Dactyloctenium and Fimbristylis. Cassytha is widespread. Pemphis acidula forms a hedge along the lagoon shore.

Fauna other than Birds

Small faunal collections were made by Fryer in 1908: in addition to insects, he collected two spiders (Hirst 1911) and two reptiles (Boulenger 1911). Honegger (1966) collected reptiles more recently, and Legrand (1965) and Lionnet (1970) the Lepidoptera. Further collections were made by the Royal Society party in March 1968.

The littoral fauna and flora resemble those at Aldabra. On the west rim, near the Settlement, the reef flat is sandy and covered with marine grasses, of which Cymodocea predominates toward the seaward edge. Low overhanging cliffs to the north have a fauna which includes the snails Nerita plicata and Nerita undata, the large chiton Acanthopleura brevispinosa, the limpet Cellana cernica, a red xanthid rock crab, and the grapsid Grapsus tenuicrustatus. Echinometra matthai was also collected on the flat. On the east coast, near the high dunes, the cliff is formed by a rough champignon sloping down to an abrasional flat. The cliff lacks the pinnacles and pools of similar cliffs at Cinq Cases, Aldabra, and there is no spray fauna such as that associated with Cinq Cases rock pools. Grapsus tenuicrustatus, Coenobita rugosa and C. perlatus were observed here. Round the lagoon shore there are

wide muddy flats. In the north there are abundant Uca holes in the mud, as well as numerous large elliptical holes occupied by the giant portunid crab Scylla serrata. On the lagoon shore there are many mollusc shells, both of bivalves and Cerithium. Table 9 lists the marine mollusca and Table 10 the Decapod Crustacea collected by P. Grubb in 1968, and identified by J. D. Taylor.

Astove is an important nesting ground for Green Turtle, Chelonia mydas, though on a smaller scale than formerly: Baty in 1895 was told of 150 being taken in a single 24 hour period (Bergne 1900). Hirth (FAO 1967) considers that Astove has the largest Green Turtle rookery in the Aldabra group, though he gives no evidence for this. Hawksbill turtle are said to be rare.

Of the land fauna, Rothschild (1915) records the former existence of the Giant Land Tortoise Geochelone gigantea, now extinct, and Fryer (1911) records the finding of remains in the raised limestone. No historical records of its presence on Astove are known. Three other reptiles are found: Phelsuma astricta astovei FitzSimons (Mertens 1962), a brightly coloured form; Hemidactylus mercatorius (Honegger 1966); and Ablepharus boutonii. All were seen in 1968 in the settlement area, and Ablepharus was also seen on lagoon islets. All three genera are common on southwest Indian Ocean coral islands. Among the land Crustacea, Birgus latro and Cardisoma carnifex are conspicuous.

Table 11 keys the literature on the small recorded insect fauna of Astove found in the Percy Sladen Expedition reports. Collections made by Cogan and Hutson in 1968 will probably increase the known insect fauna from less than 30 to more than 100 species, in spite of only about six hours collecting. The vegetation on Astove, like that on Cosmoledo, is more luxuriant than on Aldabra, and this is reflected in the insect population. This shows a great variety of form, including many of the species found on Aldabra and Cosmoledo, with one or two striking additions. The large dark brown Hemipteran Anoplocnemis curvipes (Fab.) was particularly noticeable, and although this species has been taken in Aldabra in the past it has not been found there during the present expedition. The composition of the insect fauna appears to be very similar to that of the other islands in the Aldabra group. It consists of a large Ethiopian element with strong Malagasy connections, the remainder consisting of cosmopolitan species together with a small number of endemics. These generalisations are based on previously recorded material and a preliminary survey of the 1968 material. So far the 1968 collections have been found to include one Dolichopodid fly of the genus Sciapus endemic to Astove, and a probable new subspecies of the Pierid butterfly Colotis evanthides Holl.

Astove is noted for its Lepidoptera (see also the subsequent paper by Lionnet, 1970), but this is not the result of a very rich fauna, but of favourable conditions for the presence of very large numbers of certain species, such as Acraea ranavalona Boisd. and Junonia clelia epiclelia Boisd. Another Junonia, J. rhadama Boisd., a brilliant blue

Table 9. Mollusca collected on Astove, 1968

Gastropoda

Trochus flammulatus Lamarck	Bursa granularis Röding
Tectus mauritianus (Gould)	Tonna perdix (Linnaeus)
Turbo argyrostomus Linnaeus	Quimalea pomum (Linnaeus)
Nerita albicilla Linnaeus	Drupa margariticola (Broderip)
Nerita plicata Linnaeus	Morula granulata (Duclos)
Nerita polita Linnaeus	Nassa francolina (Bruguère)
Nerita textilis Dillwyn	Engina mendicaria (Linnaeus)
Nerita undata Linnaeus	Nassarius grandiosa (Hinds)
Phasianella aethiopica	Nassarius muricatus (Quoy and Gaim.)
Philippi	Latirus craticulatus (Lamarck)
Philippia hybrida (Linnaeus)	Peristernia nassatula (Lamarck)
Cerithium articulatum Adams	Cantharus undosus (Linnaeus)
and Reeve	Mitra stictica (Link)
Cerithium columna Sowerby	Strigatella litterata (Lamarck)
Cerithium echinatum Lamarck	Chrysame fraga (Quoy and Giamard)
Hipponyx conica Schumacher	Pterygia nucea (Gmelin)
Strombus gibberulus Linnaeus	Vasum turbinellus (Linnaeus)
Strombus mutabilis Swainson	Conus arenatus Hwass
Polynices melanostoma (Gmelin)	Conus coronatus Gmelin
Cypraea annulus Linnaeus	Conus ebraeus Linnaeus
Cypraea carneola Linnaeus	Conus flavians Lamarck
Cypraea erosa Linnaeus	Conus pulicarius Hwass
Cypraea helvola Linnaeus	Conus rattus Hwass
Cypraea histrio Gmelin	Terebra affinis Gray
Cypraea isabella Linnaeus	
Cypraea lynx Linnaeus	<u>Bivalvia</u>
Cypraea moneta Linnaeus	Modiolus auriculatus Krauss
Cypraea vitellus Linnaeus	Septifer bilocularis (Linnaeus)
Phalium achatina Lamarck	Gafrarium pectinatum (Linnaeus)
Cymatium nicobaricum (Röding)	
Cymatium pileane (Linnaeus)	

Collected by P. Grubb; identified by J. D. Taylor; incorporated into the collections of the British Museum (Natural History), accession number 2214.

Table 10. Crustacea (Decapoda) collected on Astove, 1968

Grapsus tenuicrustatus (Herbst): 2♀ 1♂
Metopograpsus messor (Forskål): 2♀ ovig.
Pachygrapsus polyodus (Stebbing): 1♂
Percnon guinotae Crosnier: 1♂
Thalamita prymna (Herbst): 1♂
Charybdis orientalis (Dana): 2♀ ovig.
Actaea ruppelli (Krauss)
Chlorodiella niger (Forskål): 1♂
Phymodius monticulosus (Milne Edwards)
Phymodius unguatus (Milne Edwards): 2♂
Epixanthus frontalis (Milne Edwards): 1♂ 3♀
Xanthias lamarckii (Milne Edwards): 2♂
Liomera monticulosus (Milne Edwards): 1♂
Lachnopodus subacutus (Stimpson): 1♀
Atergatis floridus (Linnaeus): 2♂
Zozimus aeneus (Linnaeus): 1♀
Eriphia laevimanus (Guérin): 1♀
Eriphia scabricula (Dana): 1♀
Lybia tessellata (Latreille): 1♂ 1♀
Madaens granulatus (Haswell): 1♀
Coenobita perlatus (Milne Edwards): 1♀
Coenobita rugosus (Milne Edwards)
Pagurus megistos (Herbst): 1
Pagurus pedunculatus (Herbst): 3
Calcinus elegans (Milne Edwards): 2
Calcinus laevimanus (Randall)
Clibanarius striolatus (Dana)
Clibanarius virescens (Krauss)

Collected by P. Grubb; identified by J. D. Taylor; incorporated into the collections of the British Museum (Natural History).

Table 11. Insects recorded from Astove by the Percy Sladen Expedition

<u>Group</u>	<u>Number of species</u>	<u>Reference</u>
Orthoptera	2	Bolivar (1912, 1924)
Hemiptera	2	Green (1907), Distant (1913), Mamet (1943).
Lepidoptera	5	Fryer (1912)
Coleoptera	7	Champion (1914), Gebien (1922), Schenkling (1922), Scott (1912)
Hymenoptera	6	Burr (1910), Turner (1911)
Diptera	2	Lamb (1912)

Nymphalid, is found on Astove, presumably colonising from Malagasy, but it has progressed no further in the Aldabra group. Unfortunately it appears to be decreasing in numbers and was not seen by the 1968 party. Fryer in 1908 found it not uncommon along the lagoon shore (Fryer 1912).

Another less pleasant part of the insect fauna, very much in evidence, is the mosquito Aedes (Ochlerotatus) fryeri Theo., found in very large numbers. This species breeds in brackish and salt water in the crab-holes along the shore, and the human inhabitants must often sit in clouds of smoke for protection in the evenings.

Birds

The land bird fauna is small and very similar to that of Cosmoledo; it is considered in detail by Benson (1970) in a later paper. Of the six probably resident land birds, two (Dryolimnas cuvieri, Streptopelia picturata) have not been recorded since 1906 and 1908 respectively (Dupont 1907, Fryer 1911) and are certainly extinct. Corvus albus is present in very small numbers. Cisticola cherina is the most abundant land bird, followed by Nectarinia sovimanga; the white-eye Zosterops maderaspatana is not common. In addition to these land birds considered by Benson, Stoddart was informed that pigeons inhabited a large bird box in a tall Casuarina at the settlement, but he did not see the birds, which may have been recently introduced. Benson lists four shore birds as possibly resident: Ardea cinerea, Egretta garzetta, Bubulcus ibis and Butorides striatus. Adults and young of Ardea cinerea were seen in June 1969 by Frazier and Diamond.

The sea bird fauna is unusually impoverished, presumably as a result of the lack of suitable habitat for tree-nesting birds (the absence of mangroves, for example), the degree of human interference, and the continuity of the land rim and resulting lack of isolated refugia. Sea birds have been recorded by Dupont (1907), Vesey-FitzGerald (1941), and Bourne (1966). Diamond made observations on the western rim briefly in March 1968. The only sea birds seen were one or two adult Caspian Terns Hydroprogne caspia and three Crested Terns Thalasseus bergii. The site of a small colony of terns, probably Sooty Terns Sterna fuscata, was found on the islet Petit Astove off the western extremity of the atoll. Frazier saw the Caspian Tern in the lagoon on the same occasion, and Stoddart two of the same species on the eastern rim in September 1968. Frazier also saw the Crested Tern over the lagoon in March.

Previous records are scanty, and often refer to the Aldabra archipelago generally rather than to Astove itself. They may be summarised as follows:

Phaethon lepturus

Recorded from the archipelago by Watson et al. (1963).

Sula sula

Recorded by Watson et al. (1963) as "formerly" occurring. Seen on the west side by Hartman (1958) and by H.M.S. Owen (Bourne 1966).

Fregata arielFregata minor

Both species recorded generally in the archipelago by Dupont (1907).

Hydroprogne caspia

Seen in March by Diamond and Frazier on the west side and in the lagoon; in September by Stoddart on the east side; and in October by Vesey-FitzGerald (1941, 527). Young seen with adults in June 1969 by Frazier and Diamond.

Sterna fuscata?

Colony probably of this species on Petit Astove, noted by Diamond.

Sterna albifrons

Recorded by Dupont (1907), as S. minuta.

Thalasseus bergii

Recorded by Bourne (1966); three seen by Diamond. Young seen with adults in June 1969 by Frazier and Diamond.

Gygis alba

Recorded by Dupont (1907).

Seychellois labourers on Aldabra, who were familiar with Astove, said that both "Diament" (a Creole term covering three species of tern but here most likely to be the Black-naped Tern Sterna sumatrana) and Audubon's Shearwater Puffinus l'herminieri nest on Astove. Even if this were confirmed, Astove would still have the most impoverished sea bird avifauna in the archipelago. In addition to the lack of trees for nesting of such species as Fregata spp., Sula sula and Gygis alba, there are very few of the small islets favoured by Noddy Terns Anous stolidus, Black-naped and Crested Terns, Sterna sumatrana and Thalasseus bergii and Yellow-billed and Red-tailed Tropic Birds Phaethon lepturus and P. rubricauda.

Settlement

Little is known of the early history of Astove. A Portuguese slaver Don Royal is said to have been wrecked there, probably in the eighteenth century, and the survivors to have lived on the atoll for 30-40 years. Other vessels were certainly wrecked, and the remains of some can still be found on the western reefs. Two old graves formerly existed on the west shore. At the time of Sebert Baty's survey in 1895 (Bergne 1900), the atoll was uninhabited, and there were only six coconut palms on the entire island, one of them at the landing place on the west side.

In that year James Spurs left four men there for fishing and built a hut 100 m south of the palm tree on the west shore. Because of lack of rain for six months, water had to be landed for these first settlers. Bergne (1901) found the settlement deserted six years later and the buildings destroyed. Though Baty had forecast that maize would probably be a failure, 150 acres (60 ha) had been cleared for this crop by 1901, a few hundred coconuts had been planted, and tomatoes and pumpkins had been cultivated. Five labourers were left there, and Fryer (1908) found gourds, pumpkins, water melons, maize and tobacco to be cultivated.

No details have been traced of the progress of the guano mining industry on the atoll. According to Baker (1963, 92-97), 72,162 tons of guano were exported between 1927 and 1960, leaving reserves (Baker 1963, 124) of less than 5,000 tons. Baker's analyses of the guano gave a phosphate (total P_2O_5) content of 25-29 per cent.

By 1960 (Piggott 1961) 100 ha were planted to coconut palms, but the yield (15 tons per annum or 7 nuts per tree per year) was very poor, presumably as a result of low rainfall, cyclones, or poor management. Piggott states that the maximum area possible for coconut growing is 240 ha. Since Piggott's survey the lease has changed hands, and the present lessee, Mr R. M. Veevers-Carter, is vigorously developing the plantations with the aid of a tractor and small labour force. Maize has long been grown on the low stable dunes in the wet season. Other crops include sisal, cotton, sweet potatoes. Baty in 1895 had found numerous rats but no goats. Chickens and pigs were introduced at an early stage, and the present lessee has introduced turkeys, ducks and cattle. Giant Tortoises have been introduced from Aldabra, and the lessee hopes to introduce many other animals, and to establish a turtle hatchery. He is at present building a large new house south of the present landing point.

Between 1814, when the administration of Mauritius passed from the French to the English, and 1903, when the new colony of Seychelles was formed, Astove was administered from Mauritius. It now forms part of the Colony of Seychelles, and was not included in the British Indian Ocean Territory in 1965.

Acknowledgements

We thank Mr and Mrs R. M. Veevers-Carter* for their hospitality and kindness during our two visits to the atoll, and Miss T. Ridgway for her

* We regret to announce the untimely death of Mr. Mark Veevers-Carter in Mombasa on March 11, 1970 [Eds.].

assistance. Also Mr Basil Bell, Director, East African Marine Fisheries Research Organization, Zanzibar, and Captain M. Williams and Captain T. Phipps, M.F.R.V. Manihine, for the opportunities for Royal Society parties to visit Astove in March and September 1968; and the Frank M. Chapman Fund, a grant from which to C. W. Benson made the first visit possible. We thank Lady Joan Fryer for the loan of the late Sir John Fryer's manuscript diary of his visit to Astove in 1908, and other material, and Mr J. A'C. Bergne, for the loan of his father's journal of a visit to Astove in 1901, and other papers, and both Lady Fryer and Mr Bergne for permission to quote from these documents.

References

- Baker, B. H. 1963. Geology and mineral resources of the Seychelles Archipelago. Geol. Surv. Kenya Mem. 3: 1-140.
- Benson, C. W. 1970. Land (including shore) birds of Astove. Atoll Res. Bull., this issue.
- Bergne, H. A'C. 1900. Fair record of islands in the Indian Ocean. Manuscript.
- 1901. Rough notes of a voyage to the Aldabra Group. Manuscript.
- Bolivar, I. 1912. Orthoptera: Acrydiidae, Phasgonuridae, Gryllidae. Trans. Linn. Soc. London, ser. 2, Zool., 15: 263-292.
- 1924. Orthoptera Dictyoptera (Blattidae and Mantidae), and supplement to Gryllidae, of the Seychelles and adjacent islands. Ann. Mag. Nat. Hist., ser. 9, 13: 313-359.
- Boulenger, G. A. 1911. List of the Batrachians and Reptiles obtained by Prof. Stanley Gardiner on his second expedition to the Seychelles and Aldabra. Trans. Linn. Soc. London, ser. 2, Zool., 14: 375-378.
- Bourne, W. R. P. 1966. Observations on islands in the Indian Ocean. Sea Swallow, 18: 40-43.
- Burr, M. 1910. Dermaptera. Trans. Linn. Soc. London, ser. 2, Zool., 14: 435-446.
- Champion, G. C. 1914. Coleoptera, Curculionidae. Trans. Linn. Soc. London, ser. 2, Zool., 16: 393-497.
- Distant, W. L. 1913. Rhynchota. Part I: suborder Heteroptera. Trans. Linn. Soc. London, ser. 2, Zool., 16: 139-190.

- FAO. 1967. Report to the Governments of the People's Republic of Southern Yemen and the Seychelles Islands on the Green Turtle resource in South Arabia, and the status of the Green Turtle in the Seychelles Islands. Based on the work of Dr H. Hirth, FAO/TA Marine Turtle Biologist. Rept.FAO/UNDP(TA) 2467: 1-59.
- Fosberg, F. R. and Renvoize, S. A. 1970. Plants of Astove. Atoll Res. Bull., this issue.
- Fryer, J. C. F. 1908. Diary. Manuscript.
- 1911. The structure and formation of Aldabra and neighbouring islands--with notes on their flora and fauna. Trans. Linn. Soc. London, ser. 2, Zool., 14: 397-442.
- 1912. The Lepidoptera of Seychelles and Aldabra, exclusive of the Orneodidae and Pterophoridae and of the Tortricina and Tineina. Trans. Linn. Soc. London, ser. 2, Zool., 15: 1-28.
- Gardiner, J. S. 1936. The reefs of the western Indian Ocean. I. Chagos Archipelago. II. The Mascarene Region. Trans. Linn. Soc. London, ser. 2, Zool., 19: 393-436.
- Gebien, H. 1922. Coleoptera, Heteromera: Tenebrionidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 261-324.
- Green, E. E. 1907. Notes on the Coccidae collected by the Percy Sladen Trust Expedition to the Indian Ocean, supplemented by a collection received from Mr R. Dupont, Director of Agriculture, Seychelles. Trans. Linn. Soc. London, ser. 2, Zool., 12: 197-207.
- Gwynne, M. D., and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M.F.R.V."Manihine", Sept.-Oct. 1967. Atoll Res. Bull. 134: 1-15.
- Hartman, W. D. 1958. Report on some land birds of Farquhar, St Pierre, Astove, Cosmoledo, Assumption and Aldabra. Seychelles Govt. Bull. 21.
- Hirst, S. 1911. The Araneae, Opiliones and Pseudoscorpiones. Trans. Linn. Soc. London, ser. 2, Zool., 14: 379-395.
- Honegger, R. 1966. Beobachtungen an der Herpetofauna der Seychellen. Salamandra, Zeitschr. f. Herpet. u. Terrarienkunde, 2(1-2): 20-36.
- Lamb, C. G. 1912. Diptera: Lonchaeidae, Sapromyzidae, Ephydriidae, Chloropidae, Agromyzidae. Trans. Linn. Soc. London, ser. 2, Zool., 15: 303-348.
- Legrand, H. 1965. Lépidoptères des îles Seychelles et d'Aldabra. Mém. Mus. Nat. Hist. Natur., Sér. A, Zool., 37: 1-210.

- Lionnet, J. F. G. 1970. Note on the Lepidoptera of Astove Atoll. Atoll Res. Bull., this issue.
- Mamet, R. 1943. A revised list of the Coccoidea of the islands of the western Indian Ocean, south of the equator. Mauritius Inst. Bull. 2: 137-170.
- Piggott, C. J. 1961a. A report on a visit to the Outer Islands between October and November 1960. Directorate of Overseas Surveys, Land Resources Division, typescript, 1-71; Chapter 4, Astove, 17-23.
- 1961b. Notes on some of the Seychelles Islands, Indian Ocean. Atoll Res. Bull. 83: 1-10.
- 1968. A soil survey of Seychelles. Directorate of Overseas Surveys, Land Resources Division, Tech. Bull. 2: 1-89.
- Rothschild, W. 1915. On the gigantic land-tortoises of the Seychelles and Aldabra-Madagascar group, with some notes on certain forms of the Mascarene group. Novitates Zool., 22: 418-442.
- Schenkling, S. 1922. Coleoptera: Cleridae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 325-329.
- Scott, H. 1912. Coleoptera, Lamellicornia and Adepaga. Trans. Linn. Soc. London, ser. 2, Zool., 15: 215-262.
- Smith, J. L. B. 1955. The fishes of the family Pomacanthidae in the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 377-384.
- 1955b. The fishes of the family Anthiidae of the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 337-350.
- 1956. The fishes of Aldabra, Part VI. Ann. Mag. Nat. Hist., ser. 12, 9: 817-829.
- Travis, W. 1959. Beyond the reefs. New York: E. P. Dutton (London: Allen and Unwin), 1-221.
- Turner, R. E. 1911. Fossorial Hymenoptera from the Seychelles and other islands in the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 14: 367-374.
- Vesey-FitzGerald, L. D. E. F. 1940. The birds of the Seychelles. I. The endemic birds. Ibis., ser. 14, 4: 480-489.
- 1941. Further contributions to the ornithology of the Seychelles Islands. Ibis, ser. 14, 5: 518-531.
- 1942. Further studies of the vegetation on islands in the Indian Ocean. J. Ecol. 20: 1-16.

Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington: Smithsonian Institution, 1-214.

9. PLANTS OF ASTOVE ISLAND

F. R. Fosberg and S. A. Renvoize

CYMODOCEA [CILIATA]

Seen by Grubb (1968).

CENCHRUS ECHINATUS L.

S. 1., Ridgway 8 (Fo); Veevers-Carter 8 (EA); north of Settlement, Stoddart & Poore 1286 (K); West side, Stoddart & Poore 1279 (K); Grand Anse, Fosberg 49704 (US, K); north of Settlement, Renvoize 1212 (US, K).

DACTYLOCTENIUM AEGYPTIUM (L.) Willd.

S. 1., Gwynne & Wood 1320 (K, EA); Ridgway 31 (Fo); Veevers-Carter 31 (EA); north of Settlement, Stoddart & Poore 1287 (K); East side, Stoddart & Poore 1312 (K); Grand Anse, Fosberg 49691 (US, K); Settlement, Renvoize 1188 (US, K).

DACTYLOCTENIUM PILOSUM Stapf

S. 1., Ridgway 90 (Fo); Veevers-Carter 90 (EA).

DAKNOPHOLIS BOIVINII (Camus) Clayt.

S. 1., Veevers-Carter 29 (EA); Grand Anse, Fosberg 49696 (US, K); north of Settlement, Renvoize 1192 (US, K).

DIGITARIA HORIZONTALIS Willd.

North of Settlement, Stoddart & Poore 1290 (K); Grand Anse, Fosberg 49693 (US, K), 49703 (US, K).

DIGITARIA TIMORENSIS (Kunth) Bal.

S. 1., Gwynne & Wood 1323 (EA); Ridgway 29 (Fo); Veevers-Carter 39 (EA); Settlement, Renvoize 1191 (US, K).

ENTEROPOGON SECHELLENSIS (Baker) Dur. & Schinz

S. 1., Ridgway 30 (Fo); Veevers-Carter 30 (EA); in coconut plantation, Fosberg & Frazier 49747 (US, K); West side, Stoddart & Poore 1278 (K, US); Settlement, Renvoize 1193 (US, K).

ERAGROSTIS sp.

S. 1., Fryer 4 (K), Fryer in 1908 (K); Ridgway 14 (Fo); Veevers-Carter 14 (EA); East side, Stoddart & Poore 1313 (K); Settlement, Renvoize 1200 (US, K).

ERIOCHLOA SUBULIFERA Stapf

Grand Anse, Fosberg 49735 (US, K); north of Settlement, Renvoize 1211 (K).

LEPTURUS REPENS R. Br.

S. 1., Ridgway 98 (Fo); Veevers-Carter 98 (EA); Grand Anse, Fosberg 49694 (US, K); Settlement, Renvoize 1179 (US, K).

PANICUM MAXIMUM Jacq.

S. 1., Ridgway 28 (Fo); Veevers-Carter 28 (EA); north of Settlement, Renvoize 1195 (US, K); Grand Anse, Fosberg 49689 (US).

PANICUM VOELTZKOWII Mez?

S. 1., Ridgway 115 (Fo).

PENNISSETUM POLYSTACHION (L.) Schultes

S. 1., Ridgway 54 (Fo); Veevers-Carter 54 (EA).

SPOROBOLUS VIRGINICUS Kunth

S. 1., Ridgway 2 (Fo); Veevers-Carter 2 (EA); Gwynne & Wood 1310 (EA); north of island, Stoddart & Poore 1288 (K); lagoon shore, back of Grand Anse, Fosberg 49743 (US, K); north of Settlement, Renvoize 1216 (US, K).

STENOTAPHRUM MICRANTHUM (Desv.) Hubb.

S. 1., Ridgway 89 (Fo); Veevers-Carter 89 (EA); Settlement, Renvoize 1208 (US, K).

CYPERUS LIGULARIS L.

S. 1., Ridgway 78 (Fo); Veevers-Carter 78 (EA); East side, Stoddart & Poore 1307 (K).

FIMBRISTYLIS CYMOSA R. Br.

S. 1., Vesey-FitzGerald 5963d (K); Ridgway 33 (Fo); Veevers-Carter 33 (EA); Grand Anse, Fosberg 49695 (US, K); north of Settlement, Stoddart & Poore 1282 (K); Renvoize 1190 (US, K); lagoon beach, Renvoize 1214 (US, K).

COCOS NUCIFERA L.

Seen by Stoddart, 1968, Fosberg, 1968.

ASPARAGUS UMBELLULATUS Sieb.

S. 1., Ridgway 112 (Fo); Veevers-Carter 112 (EA).

DRACAENA REFLEXA Lam.

Dupont records this from Astove acc. Hemsley (1919).

LOMATOPHYLLUM BORBONICUM Willd.

"...On the authority of Dupont, also [on] Astove..." Hemsley (1919).
S. 1., Ridgway 60 (Fo); Veevers-Carter 60 (EA); Grand Anse, Fosberg 49726 (US, K); West side, Stoddart & Poore 1270 (K); Gwynne & Wood 1295 (K, EA).

DIOSCOREA NESIOTIS Hemsl.

S. 1., Ridgway 100 (Fo); Veevers-Carter 100 (EA); Grand Anse, Fosberg 49723 (US, K).

CASUARINA EQUISETIFOLIA L.

"Dupont records this from all the islands in his table..." Hemsley (1919); s. 1., Ridgway 50 (Fo); Veevers-Carter 50 (EA).

FICUS NAUTARUM Baker

"Dupont records this species from all the islands in his tabular view" Hemsley (1919).

FICUS THONNINGII Bl.

"Dupont records this species from Astove..." (as F. aldabrensis) Hemsley (1919); s. 1., Ridgway 117 (Fo), 97a (Fo); Veevers-Carter 58 (EA); Grand Anse, Fosberg 49733 (US, K).

FICUS sp. (aff. F. avi-avi)

S. 1., Ridgway 97b (Fo); Veevers-Carter 97 (EA).

BOERHAVIA ELEGANS Choisy

S. 1., Veevers-Carter 21 (EA); north of Settlement, Stoddart & Poore 1300 (K, US); Renvoize 1187 (US, K).

BOERHAVIA REPENS L.

"Dupont also records this on Astove" Hemsley (1919); s. 1., Fryer 9 (K); Gwynne & Wood 1314 (K, EA); Ridgway 21 (Fo); Grand Anse, Fosberg 49702 (US), 49677 (US, K); north of Settlement, Stoddart & Poore 1294 (K, US).

PISONIA GRANDIS R. Br.

S. 1., Gwynne & Wood 1300 (EA); Ridgway 86 (Fo); Veevers-Carter 86 (EA); Grand Anse, Fosberg 49683 (US, K).

ACHYRANTHES ASPERA L.

S. 1., Gwynne & Wood 1317 (EA); Ridgway 41 (Fo); Veevers-Carter 41 (EA); north of Settlement, Stoddart & Poore 1284 (K); Renvoize 1198 (US, K); Grand Anse, Fosberg & Frazier 49748 (US, K); Fosberg 49707 (US, K), 49727 (US, K).

AMARANTHUS DUBIUS Mart. ex Thell.

S. 1., Ridgway 73 (Fo); Veevers-Carter 73 (EA).

SESUVIUM PORTULACASTRUM (L.) L.

S. 1., Gwynne & Wood 1318 (EA); Ridgway 77 (Fo); Veevers-Carter 77 (EA); lagoon shore back of Grand Anse, Fosberg 49745 (US); East side, Stoddart & Poore 1308 (K, US).

PORTULACA cf. AUSTRALIS Endl.

S. 1., Thomasset 214 (K).

PORTULACA OLERACEA L.

S. 1., Gwynne & Wood 1298 (EA); Ridgway 72 (Fo); Veevers-Carter 72 (EA); lagoon shore back of Grand Anse, Fosberg 49744 (US); in coconut plantation, Fosberg & Frazier 49756 (US); East side, Stoddart & Poore 1317 (K).

CASSYTHA FILIFORMIS L.

S. 1., Ridgway 40 (Fo); Veevers-Carter 40 (EA); Grand Anse, Fosberg 49706 (US, K); north of Settlement, Stoddart & Poore 1289 (K); Renvoize 1186 (US, K).

HERNANDIA SONORA L.

S. 1., Ridgway 82 (Fo); Veevers-Carter 82 (EA); Grand Anse, Fosberg 49686 (US, K).

CAPPARIS CARTILAGINEA Decne.

S. 1., Gwynne & Wood 1291b (K, EA); Fryer 5 (K); Ridgway 53 (Fo); Veevers-Carter 53 (EA); Grand Anse, Fosberg 49718 (US, K); West side, Stoddart & Poore 1272 (K, US).

CLEOME STRIGOSA (Boj.) Oliv.

"Also Astove..." Hemsley (1919); s. 1., Gwynne & Wood 1303 (EA); Fryer 10 (K); Ridgway 19a (Fo), 19b (Fo); Veevers-Carter 19a, b (EA); East side, Stoddart & Poore 1310 (K); Grand Anse, Fosberg 49676 (US, K); north of Settlement, Renvoize 1181 (US, K).

MAERUA TRIPHYLLA var. PUBESCENS (K1.) DeWolf

S. 1., Ridgway 23a (Fo), 23b (Fo), 23c (Fo), 113 (Fo); Veevers-Carter 23 (EA).

MORINGA OLEIFERA Lam.

S. 1., Ridgway 75 (Fo); Veevers-Carter 75 (EA).

CAESALPINIA BONDUC (L.) Roxb.

Grand Anse, Fosberg 49678 (US).

CAESALPINIA MAJOR (Medic.) Dandy & Exell

S. 1., Ridgway 44 (Fo); Veevers-Carter 44 (EA).

CASSIA OCCIDENTALIS L.

S. 1., Ridgway 42 (Fo); Veevers-Carter 42 (EA); in coconut plantation, Fosberg & Frazier 49752 (US, K); West side, Stoddart & Poore 1274 (K, US); north of Settlement, Renvoize 1205 (US, K).

GAGNEBINA PTEROCARPA (Lam.) Baill.

S. 1., Ridgway 12 (Fo); Veevers-Carter 12 (EA); West side, Stoddart & Poore 1268 (K).

SOPHORA TOMENTOSA L.

S. 1., Ridgway 95 (Fo); Veevers-Carter 95 (EA).

TAMARINDUS INDICA L.

S. 1., Ridgway 108 (Fo); Veevers-Carter 108 (EA).

TEPHROSIA PUMILA var. ALDABRENSIS (Drumm. & Hemsl.) Brumm.

S. 1., Ridgway 99a (Fo), 99b (Fo); Veevers-Carter 99a, b (EA).

VIGNA UNGUICULATA subsp. DEKINDTIANA (Harms) Verdc.

S. 1., Ridgway 46 (Fo); Veevers-Carter 46 (EA).

TRIBULUS CISTOIDES L.

S. 1., Ridgway 51 (Fo); Veevers-Carter 51 (EA); Grand Anse, Fosberg 49690 (US, K).

SURIANA MARITIMA L.

S. 1., Ridgway 76 (Fo); Veevers-Carter 76 (EA); lagoon shore back of Grand Anse, Fosberg 49741 (US, K); East side, Stoddart & Poore 1315 (K); north of Settlement, Stoddart & Poore 1292 (K, US); Settlement, Renvoize 1180 (US, K).

ACALYPHA CLAOXYLOIDES Hutch.

S. 1., Thomasset 243 (K); Ridgway 111 (Fo); Veevers-Carter 111 (EA); Grand Anse, Fosberg 49730 (US).

ACALYPHA INDICA L.

S. 1., Ridgway 94 (Fo); Veevers-Carter 94 (EA).

EUPHORBIA ABBOTTII Baker

"Dupont records this from all the islands of the Seychelles region except Gloriosa..." Hemsley (1919).

EUPHORBIA HIRTA L.

S. 1., Ridgway 26 (Fo); Veevers-Carter 26 (EA); West side, Stoddart & Poore 1267 (K); north of Settlement, Renvoize 1197 (US, K).

EUPHORBIA sp. (near E. PROSTRATA Ait.)

S. 1., Thomasset 232 (K); Ridgway 4 (Fo); Veevers-Carter 4, 17 (EA); East side, Stoddart & Poore 1306, 1311, 1319 (K); on coastal windswept sand, Vesey-FitzGerald 5963 (K); Grand Anse, Fosberg 49681 (US, K); north of Settlement, Renvoize 1182 (US, K).

PEDILANTHUS TITHYMALOIDES (L.) Poit.

S. 1., Ridgway 62 (Fo); Veevers-Carter 62 (EA).

PHYLLANTHUS AMARUS Schum. & Thonn.

S. 1., Ridgway 27 (Fo); Grand Anse, Fosberg 49712 (US); north of Settlement, Renvoize 1194 (US, K).

PHYLLANTHUS CHELONIPHORBE Hutchinson

S. 1., Ridgway 58 (Fo); Grand Anse, Fosberg 49715 (US, K).

PHYLLANTHUS sp.

S. 1., Veevers-Carter 27 (EA).

PHYLLANTHUS MADERASPATENSIS L.

S. 1., Gwynne & Wood 1325 (EA); Ridgway 25 (Fo); north of Settlement, Renvoize 1196 (US, K); Grand Anse, Fosberg 49734 (US), 49701 (US, K), 49716 (US, K).

RICINUS COMMUNIS L.

S. 1., Ridgway 81a (Fo), 81b (Fo); Veevers-Carter 81a, b (EA); West side, Stoddart & Poore 1275 (K); Grand Anse, Fosberg 49698 (US, K, Fo, Mo, NY); north of Settlement, Renvoize 1199 (US, K).

MAYTENUS SENEGALENSIS (Lam.) Exell

S. 1., Gwynne & Wood 1302 (K, EA); Ridgway 32 (Fo); Veevers-Carter 32 (EA); lagoon shore back of Grand Anse, Fosberg 49740 (US, K); south of Grand Anse, Fosberg & McKenzie 49762 (US, K).

MYSTROXYLON AETHIOPICUM (Thunb.) Loes.

S. 1., Vesey-FitzGerald 5963d (K); Ridgway 105 (Fo); Veevers-Carter 105 (EA).

ALLOPHYLUS ALDABRICUS Radlk.

S. 1., Ridgway 93 (Fo); Veevers-Carter 25a, b, 93 (EA); north of Settlement, Renvoize 1206 (US, K); Grand Anse, Fosberg & Grubb 49729 (US, K), Fosberg & McKenzie 49761 (US).

COLUBRINA ASIATICA (L.) Brongn.

S. 1., Gwynne & Wood 1308 (K, EA); Ridgway 22 (Fo); Veevers-Carter 22 (EA); north of Settlement, Renvoize 1215 (US, K); Grand Anse, Fosberg 49684 (US, K); West side, Stoddart & Poore 1273 (K, US).

SCUTIA MYRTINA (Burm. f.) Kurz

S. 1., Gwynne & Wood 1294 (EA); Vesey-FitzGerald 5963c (K); Ridgway 16 (Fo), 106 (Fo); Veevers-Carter 106, 16 (EA); Grand Anse, Fosberg 49708 (US).

CORCHORUS AESTUANS L.

S. 1., Ridgway 36 (Fo); Veevers-Carter 36 (EA); Grand Anse, Fosberg 49692 (US), 49728 (US); north of Settlement, Renvoize 1202 (US, K).

GREWIA SALICIFOLIA Schinz

S. 1., Ridgway 15 (Fo); Veevers-Carter 15 (EA); Grand Anse, Fosberg 49751 (US, K).

TRIUMFETTA PROCUMBENS Forst.

S. 1., Ridgway 7 (Fo); Veevers-Carter 7 (EA).

ABUTILON ANGULATUM (G. & P.) Mast.

S. 1., Thomasset 226 (K) "Thomasset's specimens are labelled Astove..." Hemsley (1919); s. 1., Ridgway 56 (Fo); Veevers-Carter 56 (EA); Grand Anse, Fosberg 49737 (K, US).

GOSSYPIUM HIRSUTUM L.

S. 1., Gwynne & Wood 1328 (K, EA); Ridgway 1 (Fo); Veevers-Carter 1 (EA); Grand Anse, Fosberg 49679 (US); West side, Stoddart & Poore 1277 (K, US); north of Settlement, Renvoize 1189 (US, K).

HIBISCUS ABELMOSCHUS L.

S. 1., Ridgway 64 (Fo); Veevers-Carter 64 (EA).

HIBISCUS TILIACEUS L.

S. 1., Ridgway 48 (Fo); Veevers-Carter 48 (EA); Grand Anse, Fosberg 49687 (US, K).

SIDA PARVIFOLIA DC.

S. 1., Gwynne & Wood 1313 (EA); Ridgway 69 (Fo); Veevers-Carter 69 (EA); Grand Anse, Fosberg 49682 (US, K); East side, Stoddart & Poore 1320 (K).

SIDA "VESCOANA Baillon"

S. 1., Vesey-FitzGerald 5962 (K) (probably only a variant of S. parvifolia).

THESPESIA POPULNEOIDES (Roxb.) Kostel.

S. 1., Gwynne & Wood 1297 (EA); Ridgway 74 (Fo); Veevers-Carter 74 (EA); Grand Anse, Fosberg 49717 (US, K); West side, Stoddart & Poore 1269 (K); north of Settlement, Renvoize 1201 (US, K).

FLACOURTIA RAMONTCHII L'Herit.

S. 1., Ridgway 114 (Fo).

TURNERA ULMIFOLIA L.

S. 1., Ridgway 61 (Fo).

PASSIFLORA SUBEROSA L.

S. 1., Ridgway 11 (Fo); Veevers-Carter 11 (EA); Grand Anse, Fosberg 49714 (US).

CUCUMIS PROPHETARUM ssp. DISSECTUS (Naud.) Jeffrey

S. 1., Ridgway 34 (Fo); Veevers-Carter 34 (EA).

PEMPHIS ACIDULA Forst.

"Thomasset notes that this is also common in Astove..." Hemsley (1919); s. 1., Ridgway 68 (Fo); Veevers-Carter 68 (EA); lagoon shore back of Grand Anse, Fosberg 49738 (US, K); East side, Stoddart & Poore 1316 (K); north of Settlement, Stoddart & Poore 1283 (K).

BRUGUIERA GYMNO RHIZA (L.) Lam.

S. 1., Ridgway 102 (Fo); Veevers-Carter 101 (EA).

RHIZOPHORA MUCRONATA Lam.

S. 1., Ridgway 101 (Fo); Veevers-Carter 102 (EA); East side, Stoddart & Poore 1302 (K).

LUMNITZERA RACEMOSA Willd.

S. 1., Ridgway 103 (Fo); Veevers-Carter 103 (EA); East side, Stoddart & Poore 1303 (K).

TERMINALIA CATAPPA L.

S. 1., Ridgway 87 (Fo); Veevers-Carter 87 (EA).

TERMINALIA BOIVINII Tul.

S. 1., Ridgway 107 (Fo); Veevers-Carter 107 (EA).

AZIMA TETRACANTHA Lam.

S. 1., Ridgway 80 (Fo); Veevers-Carter 80 (EA); West side, Stoddart & Poore 1266 (K).

PLUMBAGO APHYLLA Boj. ex Boiss.

S. 1., Gwynne & Wood 1290 (K, EA); Fryer 2 (K); Ridgway 18 (Fo); Veevers-Carter 18 (EA); Grand Anse, Fosberg 49710 (US, K); north of Settlement, Stoddart & Poore 1298 (K).

SIDEROXYLON INERME L. subsp. CRYPTOPHLEBIUM (Baker) J. H. Hemsley

S. 1., Gwynne & Wood 1309 (EA); Ridgway 109 (Fo); Veevers-Carter 109 (EA); Grand Anse, Fosberg 49722 (US).

CATHARANTHUS ROSEUS (L.) Don

S. 1., Gwynne & Wood 1327 (EA); Ridgway 52a (Fo), 52b (Fo); Veevers-Carter 52a, b (EA); Grand Anse, Fosberg 49680 (US, K); West side, Stoddart & Poore 1263 (K, US).

SARCOSTEMMA VIMINALE R. Br.

S. 1., Gwynne & Wood 1293 (EA); Fryer 1 (K); Ridgway 13 (Fo); Veevers-Carter 13 (EA); Grand Anse, Fosberg 49709 (US, K); north of Settlement, Stoddart & Poore 1295 (K).

SECAMONE FRYERI Hems1.

S. 1., Gwynne & Wood 1296 (K, EA); Ridgway 70 (Fo), 116 (Fo); Veevers-Carter 70 (EA); Grand Anse, Fosberg 49721 (US, K).

EVOLVULUS ALSINOIDES L.

S. 1., Fryer 8 (K); Ridgway 3 (Fo); Veevers-Carter 3 (EA); Grand Anse, Fosberg 49731 (US, K).

IPOMOEA BATATAS (L.) Lam.

S. 1., Ridgway 65 (Fo); Veevers-Carter 65 (EA).

IPOMOEA PES-CAPRAE (L.) R. Br. (sens. lat.)

S. 1., Fryer 11 (K); Ridgway 71A (Fo); Veevers-Carter 71A (EA); lagoon shore back of Grand Anse, Fosberg 49739 (US, K); north of Settlement, Stoddart & Poore 1291 (K); Settlement, Renvoize 1178 (US, K).

IPOMOEA TUBA (Schlecht.) Don

S. 1., Ridgway 71b (Fo); Veevers-Carter 71b (EA); lagoon shore back of Grand Anse, Fosberg 49742 (US, K); lagoon coast, Gwynne & Wood 1307 (EA); East side, Stoddart & Poore 1304 (K); north of Settlement, Stoddart & Poore 1285 (K, US); Renvoize 1203 (K).

CORDIA SUBCORDATA Lam.

S. 1., Gwynne & Wood 1301 (K, EA); Ridgway 66 (Fo); Veevers-Carter 66 (EA); West side, Stoddart & Poore 1281 (K, US); north of Settlement, Renvoize 1207 (US, K).

TOURNEFORTIA ARGENTEA L. f.

S. 1., Ridgway 83 (Fo); Veevers-Carter 83 (EA); Grand Anse, Fosberg 49688 (US, K); East side, Stoddart & Poore 1314 (K).

AVICENNIA MARINA (Forsk.) Vierh.

"Dupont records this from Astove..." Hemsley (1919); s. 1., Vesey-FitzGerald 5960 (K); Ridgway 67 (Fo); Veevers-Carter 67 (EA); in coconut plantation, Fosberg & Frazier 49758 (US, K).

CLERODENDRUM GLABRUM E. Mey. (*C. minutiflorum* Bak.)

S. 1., Ridgway 110 (Fo); Veevers-Carter 110 (EA).

NESOGENES DUPONTII Hems1.

S. 1., Ridgway 104 (Fo); Veevers-Carter 104, 5, 113 (EA).

STACHYTARPHETA JAMAICENSIS (L.) Vahl

S. 1., Ridgway 38a (Fo); Veevers-Carter 38 (EA); Grand Anse, Fosberg 49697 (US, K); north of Settlement, Stoddart & Poore 1293 (K); Renvoize 1184 (US, K); East side, Stoddart & Poore 1309 (K).

STACHYTARPHETA URTICIFOLIA Sims

S. 1., Ridgway 38b (Fo); Grand Anse, Fosberg 49700 (US, K).

PREMNA OBTUSIFOLIA R. Br.

Southern part of coconut grove, Fosberg & Graham 49746 (US).

DATURA METEL L.

S. 1., Ridgway 79 (Fo); Veevers-Carter 79 (EA); Grand Anse, Fosberg 49699 (US, K).

SOLANUM ALDABRENSE C. H. Wright

"Dupont records this from...Astove..." Hemsley (1919).

SOLANUM NIGRUM L.

S. 1., Ridgway 49 (Fo); Veevers-Carter 49 (EA).

OCIMUM AMERICANUM L.

S. 1., Dupont 291 (K); Ridgway 43 (Fo); Veevers-Carter 43 (EA).

TABEBUIA PALLIDA (Lindl.) Miers

S. 1., Ridgway 63 (Fo); Veevers-Carter 63 (EA); West side, Stoddart & Poore 1280 (K, US).

ASYSTASIA BOJERIANA Nees

S. 1., Ridgway 5 (Fo), 24 (Fo); Veevers-Carter 24 (EA); Fryer 6 (K, 2 sheets); Gwynne & Wood 1315 (EA), 1324 (EA); north of Settlement, Stoddart & Poore 1296 (K, US); Renvoize 1183 (K, US); Grand Anse, Fosberg 49705 (US, K).

BARLERIA sp. (near B. DECAISNIANA Nees)

Reported from Astove by Hemsley on the basis of a Fryer specimen that cannot now be found at Kew (1919); s. 1., Ridgway 57 (Fo); Veevers-Carter 57 (EA); West side, Stoddart & Poore 1264 (K).

HYPOESTES ALDABRENSIS Baker

S. 1., Fryer 7 (K); Ridgway 91, 20 (Fo); Veevers-Carter 59, 91, 20 (EA); Grand Anse, Fosberg 49713 (US).

GUETTARDA SPECIOSA L.

S. 1., Gwynne & Wood 1321 (K, EA); Ridgway 85 (Fo); Veevers-Carter 85 (EA); Grand Anse, Fosberg 49685 (US, K); West side, Stoddart & Poore 1265 (K).

HEDYOTIS LANCIFOLIA Schum.

S. 1., Ridgway 55 (Fo); Veevers-Carter 55 (EA); Grand Anse, Fosberg 49724 (US, K).

HEDYOTIS sp.

S. 1., Ridgway 6 (Fo); Veevers-Carter 6 (EA); Gwynne & Wood 1326 (EA); Grand Anse, Fosberg 49753 (US, K); north of Settlement, Renvoize 1209 (US, K); sand dunes, Stoddart & Poore 1318 (US, K).

POLYSPHAERIA MULTIFLORA Hiern

S. 1., Ridgway 37 (Fo); Veevers-Carter 37 (EA); Grand Anse, Fosberg 49725 (US, K); south of Grand Anse, Fosberg & McKenzie 49760 (US).

TARENNA TRICHANTHA (Bak.) Brem.

S. 1., Ridgway 92 (Fo); Veevers-Carter 92, 35 (EA); Grand Anse, Fosberg 49720 (US, K); north of Settlement, Renvoize 1204 (US, K).

SCAEVOLA TACCADA (Gaertn.) Roxb.

S. 1., Ridgway 84 (Fo); Veevers-Carter 84 (EA); in coconut plantation, Fosberg & Frazier 49757 (US).

BIDENS PILOSA L.

S. 1., Ridgway 96 (Fo); Veevers-Carter 96 (EA); in coconut plantation, Fosberg & Frazier 49750 (US, K).

LAUNAEA INTYBACEA (Jacq.) P. Beauv.

S. 1., Gwynne & Wood 1316 (K, EA); Ridgway 47 (Fo); Veevers-Carter 47 (EA); in coconut plantation, Fosberg & Frazier 49749 (US); north of Settlement, Stoddart & Poore 1299 (K); Renvoize 1213 (US, K).

LAUNAEA SARMENTOSA (Willd.) Alst.

S. 1., Ridgway 88 (Fo); Veevers-Carter 88 (EA).

VERNONIA ALDABRENSIS Hems1.

S. 1., Vesey-FitzGerald 5963b (K); Gwynne & Wood 1292 (K, EA); Ridgway 9 (Fo); Veevers-Carter 9 (EA); Grand Anse, Fosberg 49719 (US, K); West side, Stoddart & Poore 1271 (K); north of Settlement, Stoddart & Poore 1297 (K); Renvoize 1185 (US, K); East side, Stoddart & Poore 1305 (K).

VERNONIA CINEREA (L.) Less.

S. 1., Ridgway 10 (Fo); Veevers-Carter 10 (EA); in coconut plantation, Fosberg & Frazier 49754 (US, K); south of Grand Anse, Fosberg & McKenzie 49759 (US); West side, Stoddart & Poore 1276 (K, US); north of Settlement, Stoddart & Poore 1301; Renvoize 1210 (US, K).

10. NOTE ON THE LEPIDOPTERA OF ASTOVE ATOLL

J. F. G. Lionnet

Writing in 1911, J. C. F. Fryer, who had visited Astove as a member of the 1908 Percy Sladen Trust Expedition to the Indian Ocean, stated: "The time I spent on Astove was insufficient to properly investigate its structure and therefore the flora and fauna were quite neglected"; and "insects were very numerous and it was a matter of great regret that few could be taken; butterflies were more common than on any other island and comprised one species, the beautiful Precis rhadama, not noted elsewhere".

On 8 March 1967 the writer spent five hours on the west coast of Astove, at Grand Anse, which he devoted to collecting butterflies. These appeared to be as numerous as at the time of Fryer's visit. As, with the exception of Fryer and the writer, none of the collectors who have visited the Aldabra group of islands (Assumption, Cosmoledo and Astove), including W. L. Abbott in 1892, A. Voeltzkow in 1902, E. G. B. Meade-Waldo in 1905, C. Prola in 1953, G. Cherbonnier in 1959 and H. Legrand in 1956 and 1959, visited Astove, it is thought desirable to publish a list of the species already recorded on the atoll. It is, however, hardly necessary to point out that this list could certainly be improved by a more thorough investigation. Thus the Royal Society party which visited Astove in 1968 collected Acraea ranavalona, Acraea terpsichore legrandi, Junonia clelia epiclelia, Colotis evanthides, Syntarucus pirithous (= telicanus) and the hesperiid Pelopidas mathias Fabr., which is a new record for the atoll (pers. comm., Dr T. G. Howarth, British Museum (Natural History) and the account in Bayne and others (1970)).

NOCTUIDAE

<u>Bryophilopsis nesta</u> (Bainbrigge Fletcher)	Collected by Lionnet
<u>Tarache malgassica</u> (Mabille)	Collected by Fryer

PIERIDAE

<u>Belenois aldabrensis</u> (Holland)	Collected by Fryer
<u>Belenois grandidieri</u> form <u>voeltzkowi</u> (Karsch) (see Bernardi 1954)	Collected by Lionnet
<u>Colotis evanthides</u> (Holland)	Collected by Lionnet

DANAIDAE

<u>Danaus chrysippus</u> (Linnaeus)	Collected by Lionnet
-------------------------------------	----------------------

ACRAEIDAE

Acraea ranavalona Boisduval

Collected by Lionnet

Acraea terpsichore legrandi Carcasson

Collected by Lionnet

NYMPHALIDAE

Junonia rhadama (Boisduval)Collected by Fryer and
noted by LionnetJunonia clelia epiclelia (Boisduval)Collected by Fryer and
LionnetPhalanta phalantha aethiopica (Rothschild
and Jordan)

Collected by Lionnet

Fryer also reported that he had noticed Colotis (Teracolus) pernotatus (Butler), a synonym of C. etrida (Boisduval), on Astove. However, since according to Legrand Fryer mistook Colotis evanthides (Holland) on Aldabra for the former species, this record is doubtful.

Acknowledgements

I am greatly indebted to Mr Henry Legrand, Chargé de Mission and Correspondent of the Paris Museum, for kindly undertaking the identification of the specimens captured in 1967, and to Mr Tony Beamish, who assisted in the capture of some of them.

References

- Bayne, C. J., Cogan, B. H., Diamond, A. W., Frazier, J., Grubb, P., Poore, M. E. D., Stoddart, D. R., and Taylor, J. D. 1970. Geography and ecology of Astove. Atoll Res. Bull., this issue.
- Bernardi, G. 1954. Révision des Pierinae de la faune Malgache (Lep. Pieridae). Mém. Inst. Sci. Madagascar, sér. E, 5: 239-375.
- Fryer, J. C. F. 1911. The structure and formation of Aldabra and neighbouring islands--with notes on their flora and fauna. Trans. Linn. Soc. London, ser. 2, Zool., 14: 397-442.
- 1912. The Lepidoptera of Seychelles and Aldabra, exclusive of the Orneodidae and Pterophoridae and of the Tortricina and Tineina. Trans. Linn. Soc. London, ser. 2, Zool., 15: 1-28.
- Le Cerf, F. 1916. Note sur deux Piérides (Lep. Rhopal.) de l'Ile Maurice et de l'Ilot d'Astove. Bull. Soc. Entom. France, 1916: 112-113.
- Legrand, H. 1965. Lépidoptères des îles Seychelles et d'Aldabra. Mém. Mus. Nat. Hist. Natur., sér. A, Zool., 37: 1-210.

11. LAND (INCLUDING SHORE) BIRDS OF ASTOVE

C. W. Benson

Introduction

Much detail concerning the birds of Astove, especially on the systematics of Cisticola cherina and Nectarinia sovimanga, has already been given in the paper on land birds of Cosmoledo (Benson 1970), and need not be repeated. The same acknowledgements and other introductory remarks also apply. Excepting a brief reference by Abbott to a rail (see below), the first mention of birds traced is by Dupont (1907), who drew up a list of species as a whole. Fryer (1911, 428) makes a brief reference, remarking that birds seemed scarce. Vesey-FitzGerald (1940, 486-488) includes Astove in his account of land birds of the Aldabra archipelago, as does Hartman (1958), who spent 9 December 1957 there. H. M. S. Owen called at Astove on 16 March 1964, and a few observations are given by Bourne (1966). I. S. C. Parker collected specimens for the National Museum of Kenya on 7 October 1967, the day after his visit to Menai Island, Cosmoledo. I have had the loan of his specimens, as for Menai. A. W. Diamond, P. Grubb and I were on the western arm of Astove from about 1100 hours until after sunset on 5 March 1968. Their observations, and a few from J. Frazier, have considerably augmented my own. Some further observations were made by M. E. D. Poore and D. R. Stoddart on both the east and west sides of Astove on 15 September 1968.

Resident true land birds

Dryolimnas cuvieri

White-throated Rail

As for Cosmoledo, recorded at second-hand by Abbott (in Ridgway 1895, 529), and listed by Dupont (1907). Fryer (1911, 428, under D. abbotti?) also records it. There is no subsequent record. Due to human activity, it is unlikely that it could still exist there.

Streptopelia picturata

Malagasy Turtledove

This species is listed by Dupont (1907), but no other reference to its occurrence has been traced. As on Cosmoledo (with the possible exception of South Island), it has evidently been extirpated, assuming that it really did formerly occur.

Cisticola cherina

Malagasy Grass-Warbler

Vesey-FitzGerald (1940, 488) found it "abundant", Hartman (1958) "common". Diamond and I also found it common, more so even than the sunbird. Diamond and Stoddart noted the same call as on Cosmoledo.

As already recorded in the Cosmoledo account, a female collected contained a much enlarged egg. Also, as discussed therein, C. cherina appears to be of recent origin on both Cosmoledo and Astove, and except for some tendency to smaller size on Wizard, is still undifferentiated from the Malagasy parent stock.

Corvus albus

Pied Crow

Listed by Dupont (1907, as C. scapulatus), though Vesey-FitzGerald (1940, 488) thought it was only a visitor. Hartman (1958) saw one pair. I saw one couple and one single bird. As on Cosmoledo, the population is evidently extremely small.

Zosterops maderaspatana

Malagasy White-eye

Vesey-FitzGerald (1940, 488) records it as common, though Hartman (1958) did not see it. Diamond saw 15 in all, and I saw a few others. It would appear to be less common than both the grass-warbler and the sunbird. Diamond noted that the call was the same as on Aldabra, though stronger. This is perhaps to be expected, since Astove birds are larger (Benson 1969). A male collected on 5 March 1968 had testes measuring 6 x 4, 7 x 5 mm, a female the same day had a yolking egg of diameter 6 mm. In order of predominance (numbers of individual specimens in each group), the stomach contents of these specimens were:

Lepidoptera: larvae
Hemiptera: Homoptera
Coleoptera: Curculionidae
Arachnida: small spiders
Psocoptera
Hymenoptera: winged ants

In one specimen there were in addition the apparent remains of a seed and some petals.

Astove birds are considered by Benson (1969) inseparable from those of Z. m. maderaspatana from the moister parts of Malagasy, and lack the yellow tone above of Gloriosa birds. The latter can be matched with material of Z. m. maderaspatana from the drier parts of Malagasy, in the southwest and the extreme north. Aldabra (though not Cosmoledo) birds also tend to be yellowish above.

Nectarinia sovimanga

Souimanga Sunbird

This species is listed by Dupont (1907, as Cinnyris abbotti), while Fryer (1911, 428) noted a Cinnyris. It is also recorded by Vesey-FitzGerald (1940, 488) and by Hartman (1958, as Cinnyris comorensis), the latter giving it as "common". Bourne (1966) records "Anjouan Sunbirds" (sic) as "common". We also found it to be common. As already explained in the Cosmoledo account, the population of Astove is inseparable from N. s. buchenorum. The misconception that it might be referable to N. comorensis, of Anjouan, in the Comoros, arose from the male and female collected by Vesey-FitzGerald (1940) and identified in the British Museum as "near Cinnyris comorensis Peters". These specimens cannot now be found, but are virtually certainly N. s. buchenorum. As explained by

Benson (1967, 86), N. comorensis is a distinct species, albeit derived from sovimanga. No reasonable doubt whatever can now remain but that comorensis is endemic to Anjouan.

Vesey-FitzGerald describes a nest, apparently unoccupied, placed 1.3 m above the ground in a bush of Pemphis acidula. I found a similar old nest in a bush of Suriana maritima. It was collected, and is in the British Museum (Natural History). S. A. Renvoize has pointed out that both these plants are spray-zone species. On Aldabra there are some casualties among sunbirds' nests due to spray. There was certainly some breeding on Astove at the time of our visit, since a female collected contained a yolking egg measuring 7 x 8 mm, while three males had enlarged testes, in one case both measuring 7 x 5 mm. A female collected by Parker also had enlarged gonads. One of two females collected by myself, with wing 49, tail 33, culmen from base 16.5 mm, cannot be fully grown (see measurements in the Cosmoledo account, Benson 1970), and is probably only about six weeks old (from date of hatching). It may thus be presumed to have been from an egg laid in January. The stomach-contents of two males and two females collected by Parker were insect fragments, including Coleoptera. In order of predominance (numbers of individual specimens in each group), those of three males and four females collected by myself were:

Arachnida: small spiders
 Hemiptera: Homoptera
 Psocoptera
 Hymenoptera: ants
 Hymenoptera: Parasitica

Diamond heard the same cat-like "miaaw" call as can be heard on Aldabra. Frazier thought that, although the birds were tame, they were less so than on Aldabra. On Astove, in general, they would be more liable to human disturbance.

Possibly resident shore birds

Ardea cinerea

Grey Heron

Listed by Dupont (1907). We saw at least two in the lagoon in March 1968. Adults and young were seen in June 1969 by Diamond and Frazier, so this bird is probably resident.

Egretta garzetta

Little Egret

At least two white and three dark phase birds were seen. Diamond recorded a disused nest in a Bruguiera bush on an island in the entrance to the lagoon. As for Cosmoledo, there is no evidence of the "large flocks" recorded by Dawson (1966, 7).

According to Loustau-Lalanne (1963, 22), "Demiegretta sacra =(asha)" ... "occurs and breeds only on Astove island". On page 13 he also mentions Egretta garzetta as occurring on Astove, stating that it is snow-white. No mention of any colour phase is made, though he states

(page 14) that D. asha is "a dimorphic bird, white or grey in colour". Dawson (1966, 7) goes still further, and apparently considers that there are no fewer than three species of egret on Astove, i.e. E. dimorpha, E. garzetta and D. asha. According to Watson et al. (1963, 101, 106), D. sacra occurs no nearer to Astove than the Cocos-Keeling Islands, and D. asha the Laccadives (merely one record). The latter is placed by Grant and Mackworth-Praed (1933, 194) as a synonym of D. schistacea. This name is a possible source of still further complication. Forbes-Watson (1966) states that he has seen Reef Herons E. schistacea breeding alongside Little Egrets E. garzetta at Tananarive, Malagasy, and gives sight records from the African coast to as far south as Pemba Island. However, White (1965, 25) may be correct in regarding schistacea as a yellow-billed subspecies of E. garzetta, and its breeding range may not extend south of the equator, accordingly excluding any likelihood of it breeding in Malagasy. E. g. schistacea is not mentioned in the comprehensive account of a heronry at Tananarive by Malzy (1967).

Apart from the three species of Ardeidae treated under the headings above and below, there is at present no satisfactory evidence of the occurrence of any species anywhere in the Aldabra archipelago in addition to Egretta garzetta, the subspecies according to Benson (1967, 68) being E. g. dimorpha. Two specimens of this subspecies were recently collected on Cosmoledo. Contrary to Loustau-Lalanne, there are two colour phases. Benson (1967, 96) suggests that E. alba, which breeds in the Comoros, might occasionally occur. But there is still no evidence of this.

Bubulcus ibis

Cattle-Egret

Bourne (1966) records six around the settlement, and six were seen in the settlement itself by Stoddart and Poore in September 1968. Diamond, Frazier and I each saw one bird in March 1968. Frazier's bird was in a coconut tree.

Butorides striatus

Little Green Heron

Listed by Dupont (1907, as B. atricapillus). Diamond saw two in the lagoon, and one in a plantation. On Aldabra, too, this species is not strictly confined to coasts. On Astove as well as on Cosmoledo the subspecies is most likely B. s. crawfordi.

Migrants

Dupont (1907) lists the same eight species from Astove as for Cosmoledo. The only further records are the following, from Diamond, Grubb or myself, from the shore of the lagoon unless otherwise stated (those asterisked are not listed by Dupont): *Squatarola squatarola, three; Charadrius leschenaultii, at least three; Numenius phaeopus, about ten; Arenaria interpres, about 100; *Crocethia alba, two; *Erolia testacea, about 100; Dromas ardeola, at least 30. In addition, Grubb saw what is thought to have been a Charadrius mongolus (Penny, in press).

No true land bird migrants have as yet been recorded from Astove, but as for Cosmoledo there must be occasional occurrences.

Summary

1. An account is given of the land (including shore) birds of Astove.
2. The true land birds are very similar to those of Cosmoledo (Benson 1970), and there is the same paucity of species in comparison to Aldabra. The rail Dryolimnas cuvieri and turtledove Streptopelia picturata, which at one time are said to have occurred, are probably extinct. The warbler Cisticola cherina and sunbird Nectarinia sovimanga, similar to those of Cosmoledo, are plentiful. The white-eye Zosterops maderaspatana, specimens of which are the same as those from the more humid parts of Malagasy, is not so plentiful.
3. Unlike Cosmoledo, there is no evidence that any species has been introduced by man.
4. There are four possibly resident herons or egrets (family Ardeidae), though the status of the Cattle Egret Bubulcus ibis in particular requires further investigation. It has been claimed that the three species Egretta dimorpha, E. garzetta and Demiegretta asha all occur. But probably there is only the one, E. garzetta (subspecies dimorpha), present in a white phase and a dark phase.
5. Of migrants, twelve species of shore birds which breed in the Palaearctic Region have been recorded; also the Crab-Plover Dromas ardeola. No land bird migrants have as yet been recorded.

References

- Benson, C. W. 1967. The birds of Aldabra and their status. Atoll Res. Bull. 118: 63-111.
- 1969. The white-eye Zosterops maderaspatana (Linn.) of Menai Island, Cosmoledo Atoll. Bull. Brit. Ornithol. Club, 89: 24-27.
- 1970. Land (including shore) birds of Cosmoledo. Atoll. Res. Bull. : this issue.
- Bourne, W. R. P. 1966. Observations on islands in the Indian Ocean. Sea Swallow, 18: 40-43.
- Dawson, P. 1966. A survey of the sea birds of the Seychelles Islands. Ool. Rec. 40: 1-11.
- Dupont, R. 1907. Report on a visit of investigation to St Pierre, Astove, Cosmoledo, Assumption and the Aldabra Group. Mahé: Seychelles Government, 1-51.
- Forbes-Watson, A. D. 1966. A further note on Reef Herons in East Africa. J. East Afr. Nat. Hist. Soc. 112: 233.

- Fryer, J. C. F. 1911. The structure and formation of Aldabra and neighbouring islands--with notes on their flora and fauna. Trans. Linn. Soc. London, ser. 2, Zool., 14: 397-442.
- Grant, C. H. B. and Mackworth-Praed, C. W. 1933. On the relationship, status and range of Egretta garzetta, Demigretta gularis, D. schistacea, D. asha and D. dimorpha, a new subspecies, and the correct type-locality of Egretta garzetta. Bull. Brit. Ornithol. Club, 53: 189-196.
- Hartman, W. D. 1958. Report on some land birds of Farquhar, St Pierre, Astove, Cosmoledo, Assumption and Aldabra. Seychelles Govt. Bull. 21.
- Loustau-Lalanne, P. 1963. Sea and shore birds of the Seychelles. Seychelles Soc. Occas. Pub. 2: 1-26.
- Malzy, P. 1967. La héronnière d'Alarobia (Tananarive). Oiseau et Rev. française Ornithol. 37(1-2): 122-142.
- Penny, M. J. In press. Migrant waders at Aldabra, September 1967-March 1968. Phil. Trans. Roy. Soc. B.
- Ridgway, R. 1895. On birds collected by Doctor W. L. Abbott in the Seychelles, Amirantes, Gloriosa, Assumption, Aldabra, and adjacent islands, with notes on habits, etc., by the collector. Proc. U.S. Nat. Mus. 18: 509-546 (actual date of publication June 24, 1896).
- Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington.
- White, C. M. N. 1965. A revised check list of African non-passerine birds. Lusaka.

12. ECOLOGICAL CHANGE AND EFFECTS OF PHOSPHATE MINING ON ASSUMPTION ISLAND

D. R. Stoddart, C. W. Benson, and J. F. Peake

Introduction

Because of their rugged terrain and lack of surface water, elevated reef-limestone islands are often unsuitable for human settlement. As a result of greater environmental diversity and possible greater age than the sand cays of sea-level coral atolls, such islands frequently possess larger and more diverse faunas and floras. Yet because many possess large resources of phosphate derived from bird guano, they have often been subjected to a degree of human interference uncommon on isolated islands before the development of airfields and similar installations. Examples of elevated reef islands where such major modification has taken place include Makatea in the east Pacific, Nauru, Niue and Ocean in the central Pacific, and Christmas in the eastern Indian Ocean.

The results of massive mining disturbance on island ecology are of interest, since they may provide a guide to the results of other kinds of major habitat disturbance, including the construction of airfields and military bases. Such construction work involves the clearing of native vegetation and destruction of habitats, and also the preparation of new habitats for colonisation by introduced plants and animals. We know little of the long-term resilience of indigenous biotas on islands, including those subject to such major interference, except that changes involving extinction are irreversible (Stoddart 1968a, 1968b, MacArthur and Wilson 1967, Mayr 1965).

Assumption Island, 27 km southeast of Aldabra, provides an example of the ecological effects of surface phosphate mining over the last sixty years (Baker 1963). With a fauna and flora similar to those of Aldabra, though smaller, before mining began, it provides data on the capacity of plants and animals to survive vegetation clearance and human settlement, and on the invasions and colonisations which have taken place since settlement began. Assumption was visited by a party from the Royal Society Expedition to Aldabra on 15-16 September 1967, and this paper records the observations made and compares them with previous accounts, mostly from pre-mining times. Familiarity with the fauna and flora of Aldabra meant that maximum advantage could be taken of this short visit.

Apart from hydrographic surveys in 1823 and 1878, Assumption was first visited by W. L. Abbott, who collected birds, plants and insects

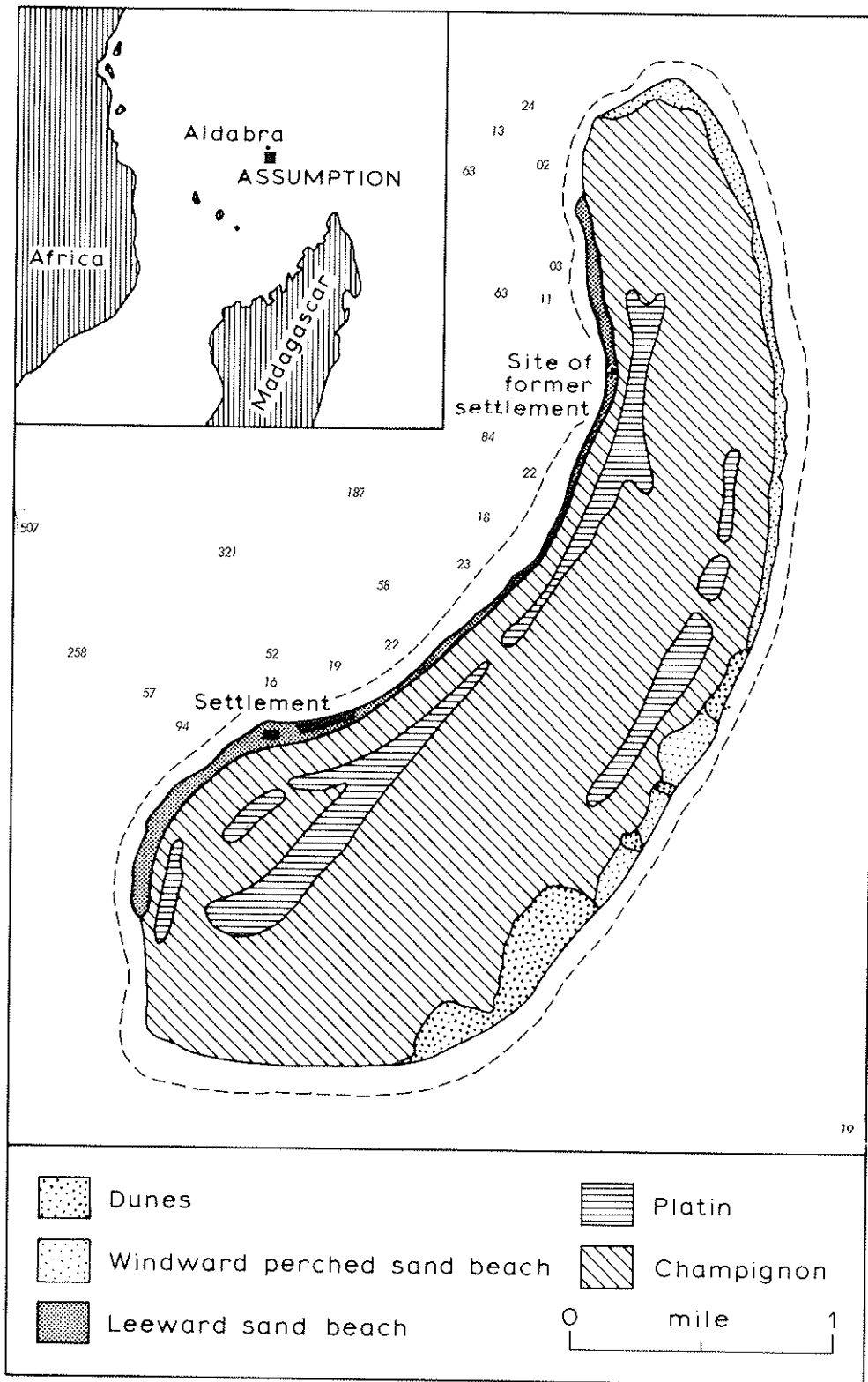


Fig. 6. Assumption

in September 1892. The ornithologist M. J. Nicoll spent 12-13 March there, and was followed by R. Dupont (birds, insects, plants), 19-21 September 1906, and by J. C. F. Fryer (geology, general observations, insects), 6-13 September 1908. The island was uninhabited until June 1908, when a guano-mining settlement was established on the northwest coast: the observations of these earlier workers thus recorded the pre-mining state of the island biota. Table 12 lists these and later

Table 12. Scientific Studies at Assumption Island

<u>Date</u>	<u>Study</u>	<u>Reference</u>
1756 Aug. 15	Nicholas de Morphey, general	Horsburgh (1809)
1823	Richard Owen, hydrographic survey	Adm.Ch.718(1878)
1878	W. J. L. Wharton, hydrographic survey	Adm.Ch.718(1879)
1892 Sept.	W. L. Abbott, birds	Abbott (1893), Ridgway (1895)
1901 Oct. 13	H. A'C. Bergne, general	Bergne (1901)
1906 March 12-13	M. J. Nicoll, birds	Nicoll (1906, 1908)
1906 Sept. 19-21	R. Dupont, birds, insects, plants	Dupont (1907)
1908 Sept. 6-13	J. C. F. Fryer, geology, insects	Fryer (1911)
1910	R. Dupont, insects, plants	
1916	R. Dupont, plants	Hemsley (1919)
1937	L. D. E. F. Vesey-FitzGerald vegetation, birds	Vesey-FitzGerald (1941, 1942)
1956	H. Legrand, Lepidoptera	Legrand (1965)
1956	W. Travis, underwater observations	Travis (1959)
1959	H. Legrand, M. Gerber, Lepidoptera	Legrand (1965)
1960 Oct. 13-16	B. H. Baker (geology) and C. J. Piggott (soils)	Baker (1963), Piggott (1961, 1968)
1964	H.M.S. Owen, Cdr D. W. Haslam: survey, birds	Bourne (1966)
1964	R. E. Honegger, birds, reptiles	Honegger (1966)
1964 Nov. 10	Bristol Seychelles Expedition: M. J. Penny, M. Penny, R. Gaymer and others, birds	This report
1965 Oct. 3	R. Gaymer, birds	This report
1967 March	J. F. G. Lionnet, H. A. Beamish, insects; H. A. Hirth, turtles	
1967 Sept. 15-16	Royal Society party: D. R. Stoddart (geomorphology, plants), C. W. Benson (birds), J. F. Peake (land invertebrates), J. H. Price (marine algae), J. M. Boyd, E. N. Wright (birds)	This report
1967 Oct. 8	M. D. Gwynne, D. Wood, I. S. C. Parker, plants and birds	Fosberg and Renvoize (1970), Parker (1970)
1968 July 31	Royal Society party: J. Frazier R. Hughes, J. Gamble, R. Lowery	

scientific investigations. The Royal Society party in September 1967 consisted of D. R. Stoddart (geomorphology, plants), C. W. Benson (birds), J. F. Peake (land invertebrates), J. H. Price (marine algae), J. Morton Boyd, and E. N. Wright (birds). A further Royal Society party, comprising R. Lowery, J. Gamble, J. Frazier and R. Hughes, made a brief visit on 31 July 1968.

Topography

Assumption (Figure 6) is a raised reef-limestone island, probably similar in origin to Aldabra but without a central lagoon. It is 6 km long, northeast to southwest, and 0.6 to 1.6 km wide, with an area of 10.5 sq km (compare the land area of Aldabra, 155 sq km). The limestone rises to a maximum height of about 6 m above sea-level, and forms cliffs along the northern half of the east coast. As on the south coast of Aldabra, the cliffs are topped by a perched beach up to 1.8 m thick and 18 m wide, which at the head of small coves develops into low dunes 3-4.5 m thick. The perched beach approaches close to the cliff-top along the central part of the coast, but moves inland towards the north, revealing a cliff-top platform of pinnacled limestone. The cliffs are undercut only in coves, and when facing seaward are more ramp-like; they overlook a rock-cut abrasion platform 90-200 m wide (Plates 20 and 21). This platform lacks growing corals, and towards its outer edge has in places mushroom residuals of a surface at least 0.6 m higher (Plate 22). Several high dunes, their steeper slope facing inland, are found along the southeast coast; their heights range from 14-28 m above sea-level. The smaller high dunes have a simple outline, but the larger ones are cut by valleys on their seaward side and may be eroding. Most of the west coast consists of a narrow sand-flat with low dunes, banked against a previously eroded cliff-line. The coast below both the high dunes and the western sand-flat is formed by a wide sand beach.

The main body of the island consists of a deeply-pitted and eroded champignon, with tidal solution holes up to 6 m deep and generally steep-sided. Round the margins of the island there is a higher rim with a less dissected and much smoother surface standing 1.2-1.8 m above the champignon. This surface may be compared to the pavé of Astove, and to the surface of the Aldabra 8 m ridge, where undissected, rather than to typical Aldabra platin. Baker (1963, 101) suggests that the slabby limestone associated with this smoother surface is formed from lithified carbonate sands. Phosphates have accumulated both on the surface, where large quantities have now been scraped away, and in the solution holes, many of which are larger below ground than at the surface. More information on mining activities would be needed before attempting an explanation of the present surface topography on Assumption.

Piggott (1961, 1968) divides the soils of Assumption into three types: phosphatic Desnoeuvs Series on the limestones, now largely dug for phosphate; Farquhar Series on the dunes; and variable Shioya Series especially on the leeward sand flat.

Climate

Rainfall records have been maintained at the Settlement since November 1964. The total fall for 1965 was 813 mm, for 1966 920.5 mm, and for 1967 (to 16 September only) 724.1 mm (Table 13). Rainfall is concentrated from December to March, but is rather variable from year to year. September and October are almost rainless. Several heavy falls have occurred during the period of record: 51.3 mm on 15 April 1965, 105.9 mm on 17 January 1966, 102.6 mm on 5 March 1966, 59.2 mm on 29 April 1966, 113.8 mm on 30 April 1966, and 81.3 mm on 14 December 1966. In 1966 the heavy falls on the four days mentioned accounted for 42 per cent of the total annual rainfall. As at Aldabra the period of the Southeast Trades (June-November) is the dry season, that of the north-westerlies and calms (December-May) the wet season. No temperature records have been kept.

Vegetation

The vegetation of Assumption can be described, based on brief reconnaissance only, in terms of eight communities:

1. perched beach community
2. high dune community
3. Pemphis community of the cliffs
4. west coast sand beach community
5. mixed scrub community of the champignon
6. herbs and grasses community of the pavé or platin
7. solution-hole community
8. settlement vegetation

Perched beach community (Plate 23)

The narrow zone of sand perched on top of the seaward cliffs along the east coast closely resembles that on the south coast of Aldabra, except that the cliff-line is more irregular. The beach is subject to constant spray during the Trades and to wave-swash at exceptional tides. As a result areas on the seaward side of the perched beach lack vegetation cover. The vegetation consists of a mosaic of discrete areas of Sporobolus virginicus and Sclerodactylon macrostachyum, bounded sharply inland by a transition to the rock-surface cover of Sarcostemma viminale and Plumbago aphylla. The dominant Sporobolus turf is much denser and longer (up to 230 mm) than at Aldabra, where it is close-cropped by tortoises. Few other plants are present: small patches of Stenotaphrum clavigerum, inconspicuous individuals of Launaea sarmentosa and Sida parvifolia, and infrequent shrubs only where small dunes have developed.

Table 13. Monthly rainfall at Assumption¹

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1964											26.67	47.75	
1965	151.64	44.96	92.71	170.94	46.48	60.71	31.50	47.50	3.81	6.35	70.61	86.36	813.56
1966	204.72	59.18	192.28	198.88	32.77	20.07	18.29	9.91	13.46	-	19.81	151.13	920.50
1967	136.40	184.91	93.98	136.91	14.61	11.94	46.74	59.20	1.27 ²				

Source: Settlement Manager, Assumption

1. Figures in mm converted from inches and tenths

2. To 16 September only

High dune community (Plates 24-27)

The high dunes of the southeast coast have a comparatively gentle but irregular seaward slope and a steep landward slope. Vegetation on the seaward slope is variable, some areas being dominated by grasses (Sporobolus virginicus and Sclerodactylon macrostachyum), others with shrubs, but the characteristic features of this community are the large areas of bare and sometimes mobile sand. In the areas dominated by grass species the density of the vegetation is frequently so low that large areas of bare sand are visible. The dominant shrubs are low wind-trimmed Scaevola taccada and bushy Suriana maritima, with occasional Tournefortia argentea. The ground under the shrubs, and the walls and floors of the transverse valleys, are largely bare, with clumps of Fimbristylis cymosa and scattered Euphorbia indica 30-60 cm tall. On the crest and backslope of the dunes, Tournefortia is the dominant shrub, with Fimbristylis and patches of Portulaca sp. and Sida parvifolia. At the foot of the high dunes on the seaward side there is a narrow sand flat with Suriana and Tournefortia, and a ground cover of Ipomoea pes-caprae extending onto the beach. In the sheltered area immediately landward of the high dunes there is a fleshy mat of Portulaca oleracea and a narrow belt of stunted Thespesia populneoides woodland. Some of the shrubs on the dunes are overgrown with Cassytha filiformis, and on isolated lower dunes to the north Tournefortia and Scaevola bushes are so heavily overgrown that they are almost invisible.

Cliffs

Cliffs lacking a perched or sea-level sand beach occur at the northern end of the island, where there is a small clump of Pemphis acidula. Thomasset (in Hemsley 1919) noted Pemphis as "common", but Fryer (1911, 433) found only "a few trees...near the west coast...(which) do not unite to form bush". Dupont (1907) mapped Pemphis near its present position. The present distribution is clearly a small relic of a more extensive cover, though with the absence of suitable habitat probably less extensive than on Aldabra.

West coast sand beach community (Plates 28 and 29)

This has certainly been much altered by man, especially on the sites of the present and former settlements. Shrubs are common along this sand strip, species including Scaevola taccada, Suriana maritima and Tournefortia argentea along the shore, and Clerodendron glabrum 3-5 m tall a short distance inland. Sophora tomentosa is present but not common. In the north, near the old settlement, there are some rather bushy trees of Cordia subcordata, which were in flower in September 1967. The ground cover between the shrubs largely consists of a thick carpet of Cassytha filiformis, with Pennisetum polystachion, Amaranthus viridis and Melanthera biflora. Canavalia rosea is an escape from cultivation near the former settlement. The sand-strip vegetation thus consists of a mixture of native and introduced species.

Mixed scrub community

The mixed scrub on the elevated limestone has clearly been much altered by man, and now presents such a diverse form that any generalisations are difficult to make. Before mining began it was probably comparable to the more open mixed scrub areas of Aldabra. Abbott (1893, 763) noted that the surface was "not so densely covered with scrub as Aldabra", while Nicoll (1908, 107) found it "less thickly covered than Gloriosa. The central part is almost bare of vegetation, the only growth being a few low bushes (hibiscus [Thespesia?]), and a thin wiry grass which springs from the cracks and fissures in the coral". Fryer (1911, 433) stated that "the vegetation over the majority of the island consists of a tangled network of Plumbago (P. aphylla sp.), Astephanus (A. arenarius sp.) and numerous low bushes not identified. Small trees such as Euphorbia Abbotti, banyan (Ficus sp.) were not uncommon, while Dracaena (D. reflexa sp.) occurred in guano-filled pits".

From the floristic records of Dupont (1907) and Hemsley (1919), it appears that the scrub consisted of Thespesia populneoides, Guettarda speciosa, Pisonia grandis, Euphorbia abbottii, Ficus nautarum, Ficus aldabrensis and Dracaena reflexa, with a ground cover of Colubrina asiatica, Lomatophyllum borbonicum, Solanum aldabrense, Capparis cartilaginea, grasses, sedges and herbs. A number of common characteristic trees or shrubs of the Aldabra mixed scrub have, however, not been recorded on Assumption, and were not seen in 1967: these include the trees Grewia salicifolia, Ochna ciliata, Vernonia aldabrensis, Terminalia boivinii, and Tricalysia cuneifolia, and the shrubs Myrtroxylon aethiopicum, Sideroxylon inerme, Maytenus senegalensis, Tarenna supra-axillaris, Apodytes dimidiata and Ehretia cymosa. Some may have been present in former times but were not collected and are perhaps now extinct on Assumption.

Guano-mining led to large-scale vegetation clearance. Vesey-FitzGerald reported in 1937 that "the central area ... has been largely cleared of vegetation. ... A thick secondary mat of Plumbago now covers the whole of this country" (Vesey-FitzGerald 1942, 12). There are now very few trees or tall shrubs on the champignon. In the south there are small trees of Euphorbia abbottii, and in holes some bushy Ficus nautarum, but few other shrubs are taller than 2 m, and then only towards the south. Between the settlement and the high dunes the central part of the island is dominated by Gossypium hirsutum with a thick ground cover of Plumbago aphylla and Sarcostemma viminale. Shrubs collected in this sector include Clerodendrum glabrum (1.6 m), Acalypha claoxyloides (1-1.3 m), Abutilon fruticosum (1 m), Secamone fryeri (0.6-1 m), and Capparis cartilaginea. Ficus aldabrensis and Guettarda speciosa, noted by Dupont, were not seen in 1967, and the latter may be extinct on the island; only one almost leafless Pisonia grandis was seen near the northwest coast (Plate 30).

In contrast to the poverty of the shrub layer, the ground vegetation is diverse, but patchy. Apart from Plumbago, Sarcostemma and Cassytha, it includes the grasses Dactyloctenium pilosum, Enteropogon sechellensis and Eriochloa meyeriana, and such weedy plants as Achyranthes aspera, Boerhavia elegans, Euphorbia hirta, Ipomoea tuba, Nesogenes dupontii, Passiflora foetida, Passiflora suberosa, and Tribulus cistoides. Momordica charantia is an escape from cultivation. Solanum aldabrense and the introduced grass Panicum maximum were not seen in 1967, and both Capparis and Lomatophyllum are uncommon. Close to the settlement the mixed scrub is being invaded by such common weeds as Stachytarpheta jamaicensis and Catharanthus roseus. Dried Nostoc commune was taken from bare rock pavement in the centre of the island. In general the vegetation is so low over the southern part of Assumption that visibility is limited more by the irregularity of the ground than by the height of shrubs and trees.

The patchiness of the vegetation needs to be stressed, as a result of the colonisation of workings of different ages. There is a mosaic of plant communities varying in their structure, age and species composition; these differences can possibly be associated with periods of human activity. Shrubs are usually found on the small areas that have escaped such activity, on in areas of older workings.

Pavé or platin community (Plate 31)

The northern part of the island has a much less dissected surface and lacks shrubby growth. Along the seaward side it is covered with a dense mat of Plumbago and Sarcostemma, but further inland and towards the north large areas of ground are bare, except for scattered grasses and sedges (Dactyloctenium, Fimbristylis), weeds such as Achyranthes, and long trailers of orange vine Cassytha filiformis. In crevices and holes it is possible to find a few flowering Hedyotis sp. and Sida parvifolia, characteristic on Aldabra of the most exposed and almost unvegetated champignon of the southeast coast. This area has probably been worked over for phosphate, and the vegetation may be a pioneer one of the bare rock pavement which has resulted.

Solution-hole community

Solution holes in the champignon now contain the largest trees on Assumption, apart from coconuts and Casuarina. In the centre and south of the island Ficus nautarum is characteristic of solution holes, as on Aldabra: Dracaena reflexa, said to occur in holes by Fryer, was not seen by us. No ferns have previously been recorded from Assumption, though Acrostichum aureum is common in shallow holes at the east end of Aldabra. Shrivelled Acrostichum was found in several holes at the north end of Assumption in 1967, together with, in one case, a fern not then recorded but since found on Aldabra, Nephrolepis biserrata (Plate 32).

One hole near the north point also contains several tall trees of Cerriops tagal, though no mangroves have been previously recorded from Assumption and they do not occur on the coast. Local informants stated that this was the only solution hole with mangroves. In Fryer's manuscript journal (Fryer 1908), however, he records several such pits with mature mangroves up to 12 m tall, mostly Bruguiera though in one case with Cerriops. He was unable to understand how mangroves came to colonise such inland holes, at least half a mile from the sea, and thought they were formerly more extensive. Most of these inland mangroves have probably disappeared through being cut for timber since 1908. One hole north of the settlement is now used as a pool for keeping captive turtles.

Settlement vegetation

Before permanent settlement there were "a few casuarina trees, and in one spot on the shore three coconut palms" on the west coast (Nicoll 1908, 107); Sebert Baty in 1895 had found a total of six coconut palms (Bergne 1900). At the site of the first settlement (Plate 33), northern part of the west shore, there is a clump of tall Casuarina, a coconut, two massive trees of Terminalia catappa, a patch of Caesalpinia bonduc, and spreading out over the bare plain behind the beach a conspicuous area of Agave. At the present settlement there is a woodland of mature Casuarina near the manager's house, with, to the south, a coconut plantation of several hundred trees. At the settlement itself there are cultivated trees (Moringa oleifera, Carica papaya) and other plants (Catharanthus roseus, Datura metel, Gossypium hirsutum, Ipomoea batatas, Leonotis nepetifolia, Momordica charantia, Pedilanthus tithymaloides, Solanum lycopersicum and Solanum nigrum), together with weeds (Achyranthes aspera, Boerhavia elegans, Cleome strigosa, Dactyloctenium aegyptium, Enteropogon sechellensis, Hypoestes aldabrensis, Stachytarpheta jamaicensis, Vernonia cinerea). Between the settlement and the sea there is a narrow hedge of Scaevola taccada, with some Tournefortia argentea and Suriana maritima, and a ground cover of Canavalia rosea. Two introductions mentioned by Dupont in 1907 were not seen in 1967: Abrus precatorius and Albizia fastigiata.

Flora

The flora of Assumption has never been properly worked up from the earlier collections, though Dupont (1907) published a list of species in his table of island plants, and Hemsley (1919) included species collected by Fryer, Fox, Dupont and Thomasset in his "Flora of Aldabra". Gwynne and Wood (1969) record 8 species, four of them sight records. A list of plants collected in 1967 is given in a later paper by Fosberg and Renvoize (1970), and the flora is being included in the revision of the Aldabra flora now being undertaken.

The publications of Dupont and Hemsley list about 63 species from Assumption; with the collections made in 1967, this is increased to about 100, or roughly half the number of species found on Aldabra. Among the species conspicuously absent from the earlier records are the mangroves (species of Avicennia, Bruguiera, Rhizophora, Lumnitzera, Sonneratia, Ceriops and Xylocarpus, all found on Aldabra), Pandanus, and the ferns; one mangrove and two ferns have since been collected. Of the additional species collected in 1967, perhaps 16 represent indigenous species present but uncollected at the time of the earlier visits (e.g. species of Acalypha, Acrostichum, Boerhavia, Ceriops, Dactyloctenium, Euphorbia, Ipomoea, Launaea, Nephrolepis, Nostoc, Pennisetum, Portulaca, Sida, Sophora, Sclerodactylon). At least 19 species collected in 1967, or one-fifth of the known flora, represent deliberate introductions or weeds which have probably arrived since settlement began in 1908; six of these have also appeared at Aldabra. These introduced plants include species of Agave, Carica, Catharanthus, Datura, Ipomoea, Leonotis, Momordica, Moringa, Solanum and Terminalia.

Some idea of the contrast between the floras of Aldabra and Assumption, and the greater changes in the latter, can be obtained by comparing the collections made sixty years ago on each with those made in 1966-67 (this comparison includes only Stoddart's collections and not the more extensive collections made on Aldabra by Fosberg and Renvoize):

	<u>Aldabra</u>	<u>Assumption</u>
Per cent total flora recorded by Hemsley and earlier workers	46	28
Per cent recorded by both Hemsley and in present collection	38	35
Per cent recorded only in present collection (new records)	16	36
Total number of species	c.200	c.100

The comparison is only approximate, for the Assumption flora is still to be properly collected and the Aldabra collections of 1966-67 were small and preliminary, but it is clear that considerable changes have taken place in the flora as well as in the vegetation of Assumption since settlement began.

Of the species listed by Hemsley (1919), three have been described as endemic (Panicum assumptionis Stapf, Eriochloa subulifera Stapf, Stenotaphrum clavigerum Stapf), and twenty could be classed as "regional endemics". Since the new records are mainly cosmopolitan weeds and cultivated plants, the flora is changing from one typical of the elevated reef islands of the southwest Indian Ocean to one dominated by common tropical species of no particular regional affinity.

Marine fauna

The Green Turtle Chelonia mydas was formerly abundant on Assumption. Baty (in Bergne 1900) and Nicoll (1908) reported them in great numbers close to the shore, and also nesting. Fryer found them plentiful, but said that it was no longer possible to take up to two hundred in a night as had once been the practice (Fryer 1910, 263). Numbers have declined catastrophically, and though turtle still come ashore at one or two places on the east coast to lay, for several years it has had to be prohibited to take them or their eggs anywhere on Assumption. There has, however, been no means of enforcing this prohibition among the island's labourers. Little else is known of the marine fauna; J. L. B. Smith collected fish at Assumption in 1954, and a few records have appeared in his revisions of the Indian Ocean fish fauna (Smith 1955a, 1955b, 1956a, 1956b).

Land fauna other than birds

The only indigenous mammal at Assumption is an insectivorous bat Taphozous mauritianus collected by Fryer in October 1908 (Scott 1914, 163). The fruit-bat Pteropus, found on Aldabra, is absent. The indigenous land reptiles formerly included the Giant Land Tortoise Geochelone sp., which, however, became extinct before ever being recorded alive, as far as can be ascertained. Fryer found the remains of two in a solution hole in 1908, and Honegger found eggs in a guano pit on 1964. The geckos Phelsuma abboti abboti and Hemidactylus mercatorius, and the skink Ablepharus boutonii, are also indigenous (Boulenger 1911); both Hemidactylus and Ablepharus were collected on the high dunes in 1967. All three species are found on Aldabra. The land Crustacea include Birgus latro, very common in 1906 (Nicoll 1908, 112) and still existing. 65 species of insects have been recorded, mainly collected by Fryer and Dupont, and the literature on these earlier collections is keyed in Table 14. There was no opportunity to collect insects in 1967, though members of the Odonata were conspicuous. Blackman and Pinhey (1967) review this group on western Indian Ocean islands, with mention of Assumption.

Land (including shore) birds

Birds form the best known element in the Assumption land fauna, and are also the group apparently most affected by guano mining. In connection with the following account, we are grateful to Professor Charles G. Sibley and Mrs Eleanor H. Stickney for the loan from the Peabody Museum of Natural History, Yale University, of material collected by Hartman in 1957.

Table 14. Insects recorded from Assumption
by the Percy Sladen Expedition

<u>Group</u>	<u>Number of species</u>	<u>Reference</u>
Orthoptera	10	Bolivar (1912, 1924)
Dermaptera	1	Burr (1910)
Hemiptera	4	Distant (1913, 1917)
Lepidoptera	22	Fletcher (1910), Fryer (1912), Hampson (1908)
Coleoptera	8	Aurivillius (1922), Champion (1914), Gebien 1922, Scott (1912, 1926)
Hymenoptera	8	Cockerell (1912), Morley (1912), Turner (1911)
Diptera	3	Lamb (1922, 1914), Scott (1914)
Odonata	6	Campion (1913)

Residents

There are five land birds which breed (or did so formerly) on Assumption, with four more which may do so. These are:

<u>Dryolimnas cuvieri</u>	White-throated Rail
<u>Streptopelia picturata</u>	Malagasy Turtledove
<u>Centropus toulou</u>	Malagasy Coucal
<u>Nectarinia sovimanga</u>	Souimanga Sunbird
<u>Corvus albus</u>	Pied Crow

plus

<u>Ardea cinerea</u>	Grey Heron
<u>Egretta garzetta</u>	Little Egret
<u>Bubulcus ibis</u>	Cattle Egret
<u>Butorides striatus</u>	Little Green Heron

All of these species also breed on Aldabra, which has at least seventeen breeding land birds. The following breeding Aldabra land birds have never been recorded on Assumption:

<u>Threskiornis aethiopica</u>	Sacred Ibis
<u>Falco newtoni</u>	Malagasy Kestrel
<u>Alectroenas sganzeni</u>	Comoro Blue Pigeon
<u>Caprimulgus madagascariensis</u>	Malagasy Nightjar
<u>Hypsipetes madagascariensis</u>	Malagasy Bulbul
<u>Nesillas aldabranus</u>	Aldabra Tsikurity
<u>Dicrurus aldabranus</u>	Aldabra Drongo
<u>Zosterops maderaspatana</u>	Malagasy White-eye
<u>Foudia eminentissima</u>	Red-headed Forest Fody

Nor has the Barn Owl Tyto alba been recorded from Assumption. It certainly occurred (and probably bred) in the past on Aldabra, but appears no longer to exist there. The Malagasy Cisticola cherina, which Benson found plentiful on Menai and Wizard Islands (Cosmoledo Atoll) and on Astove in March 1968, is unknown on Assumption or Aldabra.

The Assumption subspecies of the White-throated Rail was discovered by Abbott in 1892 and named Dryolimnas abbotti by Ridgway (1894a, 74). Fryer (in MS) in 1908 found "plenty of the Rail D. abbotti which was very tame and very common". Both Abbott in 1892 and Nicoll in 1906 found it abundant. "They were found on all parts of the island, except on the summit of the sandy hill on the windward side" (Nicoll 1908, 109). In spite of the large numbers, Nicoll feared that introduced rats might lead to its extinction by predation of eggs (1908, 111). It did duly become extinct some time between the establishment of the settlement in 1908 and Vesey-FitzGerald's visit in 1937, undoubtedly as a result of catching for food, destruction of habitat, and predation by introduced cats and rats. It was conspecific with Dryolimnas c. cuvieri, of Malagasy, as is the Aldabra form. It appears not to have lost the power of flight so completely as D. c. aldabranus: see the wing-lengths in Benson (1967, 74).

The turtledove Streptopelia picturata was not definitely recorded by Abbott in 1892 (see Ridgway 1895, 522, under Turtur aldabranus), but was so by Nicoll (1906, 693; 1908, 109, under T. assumptionis). It was "quite common" and "extraordinarily tame" at the time of Nicoll's visit, when it nested in the branches of Hibiscus (?) bushes. It was mentioned by Fryer in 1908, but not by Vesey-FitzGerald in 1937, and has not been seen since. It was probably extirpated by the labourers, again for food. It seems to have only differed from the Aldabra population in being a little larger (Benson 1967, 75-79). This is supported by wing-lengths of recent Aldabra material, four males measuring 166, 167, 169, 170, and six females 155, 157, 158, 160, 160, 163 mm.

The coucal Centropus toulou was collected by Abbott (C. insularis in Ridgway 1895, 522-523), and was noted as common and tame by Nicoll (1906, 494, as C. assumptionis) and by Fryer (in MS). Vesey-FitzGerald (1940, 487) saw one in 1937. But it is not mentioned by Hartman (1958), neither did Gaymer see it in 1964 or 1965, nor Benson in 1967, nor Frazier in 1968. Wright in 1967 thought he saw one but was not sure. It may also be extinct, extirpated by the labourers for food. According to Benson (1967, 80-81), it is (or was) only possibly distinguishable from C. t. insularis of Aldabra by its slightly shorter tail. The following are measurements in mm of further adult Aldabra specimens:

	Wing	Tail
♂	149 150	232 243
♀	165	250

The smaller male tail-length indicates an overlap in figures for insularis and assumptionis, and the latter name is really no longer worth maintaining.

The sunbird Nectarinia sovimanga is still relatively flourishing, in no apparent immediate danger of extinction, even though its numbers have probably been greatly reduced by destruction of the original habitat. On the morning of 16 September Benson counted eight males, four females and six unsexed birds on the south-east side of the island, in the mixed scrub community, and in the afternoon 43 males and 26 females in the west coast sand beach community, also a few in Casuarina trees at the site of the old settlement near the northwest corner of the island. Frazier found sunbirds singing in the trees at the present settlement. All males observed appeared to be in full breeding dress. Feeding was noticed at flowers of Agave and Tournefortia argentea. Although Vesey-FitzGerald (1940, 487) reported it as rare, Hartman (1958) found it common, and it is the most plentiful true land bird on Aldabra. It is possible that competition from Nectarinia has excluded the white-eye Zosterops maderaspatana from Assumption, which, unlike Aldabra, may not be large enough for both (Serventy 1951). Nevertheless both have been recorded from other small islands--Gloriosa, Astove, and Menai Island in Cosmoledo. N. s. abbotti is a valid subspecies, endemic to Assumption (Benson 1967, 84-86). This is confirmed by further material from Aldabra, Assumption, Cosmoledo and Astove, the subspecies on both the latter two islands being N. s. buchenorum.

The crow Corvus albus was collected by Abbott in 1892 (Ridgway 1895, 532, under C. scapulatus). Nicoll (1906, 693; 1908, 109) recorded small numbers, and found several empty nests "built at the tops of the tallest trees on the island". He also noted it as "extremely wild". Vesey-FitzGerald (1940, 588), however, considered it was only a visitor. "About 25" were seen in 1964 (Bourne 1966); and Gaymer recorded about "two dozen" in the same year. Benson saw 10 on 15 September 1967 and Morton Boyd a total of 15 on the same day: it was seen at the settlement, in Casuarina trees at the old settlement site, and over the southeast dunes. Frazier saw none in 1968. Probably it does still breed on Assumption, as recently definitely established for Aldabra. Breeding may take place only at infrequent intervals, and so can be easily overlooked.

Of the possibly breeding shore birds, Ardea cinerea and Egretta garzetta, both collected by Nicoll (1906, 695-696, the latter under Demiegretta sacra), have not otherwise been recorded, except that Dupont (1907) lists the former. Possibly they no longer exist on Assumption, though it is unlikely that they have been molested to the same extent (except at possible breeding sites) as the turtledove and coucal discussed above. Bubulcus ibis was seen by Gaymer in 1964, and there was a flock of about 60 inland, just south of the settlement, in 1967. Its status on Assumption is quite uncertain.

Butorides striatus, recorded by Nicoll (1906, 696, under B. crawfordi), and listed by Dupont (1907, under B. atricapillus), was seen by Gaymer in 1964, by Benson on the southeast shore at low water (three adults, one immature) and inland (three adults) in 1967, and by Frazier on the southwest coast in 1968. Assumption is the type-locality of

Nicoll's B. s. crawfordi, only otherwise recorded from Aldabra (Benson (1967, 67)). Additional material, now in the British Museum (Natural History), is available from Aldabra, and A. D. Forbes-Watson has kindly donated on behalf of the National Museum of Kenya, Nairobi, a specimen collected by I. S. C. Parker in the Amirante Islands, on the reef between Darros and St Joseph (5°25'S, 53°18'E), on 23 September 1967. Wing-lengths in mm of this material are:

Aldabra	♂♂	159	165	
	♀♀	156	158	162
Amirante Islands	♀	169		

One male and one female from Aldabra have the sides of the neck, chest and abdomen washed with brown, but the other specimens lack this wash. It may be that only the latter are completely adult, the difference thus being due to age rather than sex, contra Benson (1967, 68). It is impossible to separate the Amirante specimen from those from Aldabra on colour, and on present evidence crawfordi must be regarded as extending north to the Amirantes. Possibly Amirante birds are a little larger, see also further figures in Benson (1967). This is also suggested by weights, the Amirante specimen being the heaviest. Those whose wing-lengths were given above weighed respectively 164, 158, 168, 163, 177, 180 g. This recent Aldabra material, collected in 1968, is not markedly paler grey below than in any specimen of B. s. rhizophorae, whether collected a decade or a century ago, and the two subspecies may only be distinguishable on size. It would seem that the type of crawfordi and the adult male from Aldabra examined by Benson (1967, 67), so pale grey below, are exceptional individuals.

Migrants

The following are recorded from Assumption:

Ardeola idae

One seen by Benson to fly onto the island, from the direction of Aldabra, at 0800 hours on 16 September 1967. It was thought to be this species, now known to occur on Aldabra, whereas A. ralloides is not.

Squatarola squatarola

Two seen on the southeast coast in 1967.

Charadrius leschenaultii

Listed by Dupont (1907, under Aegialitis geoffroyi); three seen in 1967.

Numenius phaeopus

Listed by Dupont (1907); two seen in 1967.

Numenius arquata

Listed by Dupont (1907).

Tringa nebularia

Listed by Dupont (1907, under Totanus glottis); two seen in 1967.

Actitis hypoleucos

Listed by Dupont (1907).

Arenaria interpres

Listed by Dupont (1907); 100 seen in March 1964 (Bourne 1966); five seen in 1967.

Crocethia alba

One seen in 1967.

Erolia minuta

Listed by Dupont (1907).

Dromas ardeola

Listed by Dupont (1907); 40 seen in March 1964 (Bourne 1966); one seen on the southeast shore in 1967.

Hirundo rustica

On 13 December 1957 Hartman (1958) saw "an unidentified swallow, black above, white below, and with a long, forked tail", "in flight over the sand dunes". It was very probably this species, for which Benson (1967, 95) quotes one sighting for Malagasy in January, while a number were seen on Aldabra in March 1968.

Other migrants must occur occasionally on Assumption. Thus among shore birds, Erolia testacea is plentiful on Aldabra, and some 14 species of palaeartic true land birds have by now been found there.

Sea birds

Sea birds were not common in 1967, and have certainly greatly decreased in numbers during the last sixty years. It is probable that few now nest on Assumption. The following species have been recorded:

Phaethon rubricauda

Collected by Abbott (Ridgway 1895, 522), who found it breeding in dense thickets or under a bush, and by Nicoll (1906, 693). Not seen in 1967. Loustau-Lalanne (1963, 21, 23) considers it confined to Assumption, but this is not correct. Thus Benson (1967, 99) quotes records from Aldabra, where it breeds. P. lepturus has never been recorded from Assumption.

Sula abbotti

Collected by Abbott (Ridgway 1893, 599; 1895, 520-522), who stated that "a few" breed. According to Fryer (1911, 433) it "inhabits the large dune, never descending to low parts of the island." It has not been recorded since, and Vesey-FitzGerald (1941, 52) says it was extirpated in 1926; the species now only breeds on Christmas Island (Indian Ocean). Gibson-Hill (1950) has very fully discussed uncertainties in the earlier records. The two specimens collected by Fryer on Assumption, and examined by Gibson-Hill, are still extant in the University Museum of Zoology, Cambridge. The statement by Loustau-Lalanne (1963, 23) in regard to the Red-footed Booby Sula sula is presumed to be really intended to apply to S. abbotti, though unfortunately it is more than "very near extinction" on Assumption.

Sula dactylatra (syn. S. cyanops)

Noted by Abbott (Ridgway 1895, 520) to breed on bare ground on the sand dunes; collected by Nicoll (1906, 697). Probably no longer breeding in 1937 (Vesey-FitzGerald 1941, 521) but "a few" seen in 1964

(Bourne 1966). Not seen in 1967. Sebert Baty in 1895 found a "camp of boobies", species not specified, on guano 600 yards northeast of the big dune, and boobies in trees (Sula sula ?) all over the island (Bergne 1900).

Sula sula

Recorded breeding by Nicoll (1906, 697). Four seen in 1967.

Fregata minor (syn. F. aquila)

Recorded by Nicoll (1906, 692) and listed by Dupont (1907).

Not seen in 1967, but R. Hughes saw a female in March 1968.

Fregata ariel

A group of four males and seven females, all apparently adult, seen soaring over the southeast coast in 1967.

Sterna fuscata

15-20 seen by J. Frazier off the west coast in March 1968.

Sterna albifrons

Listed by Dupont (1907, under both S. minuta and S. balaenarum).

About thirty probably this species seen in March 1964 (Bourne 1966).

Sterna sumatrana

Three recorded in March 1964 (Bourne 1966), and one flock of ten, another of four, on the southeast coast in 1967.

Thalasseus bergii

Listed by Dupont (1907, under both "Sterna Bersteini" and "Sterna Bergi").

Anous stolidus

Listed by Dupont (1907).

Gygis alba

Collected by Nicoll (1906, 696), listed by Dupont (1907). One seen in March 1964 (Bourne 1966). On 16 September 1967 Benson saw one lot of ten, four each of two, and one single bird, and E. Wright a total of about 20. J. F. Peake found three probably breeding in a solution hole. Frazier saw 4-5 off the west coast on 31 July 1968.

Introduced animals

Rats were abundant by the time of Nicoll's visit (before settlement began), and were already destroying birds' eggs. Goats were introduced "many years" before Abbott's visit in 1893, according to him from Europa Island in the Mozambique Channel (Abbott 1893, 763). According to Bergne (1901) goats were introduced by H.M.S. Wasp, Captain Bidenfield, in 1867, a crew member on that occasion living on Astove when Bergne visited it in 1901. Sebert Baty gave the number of goats as 300-400 in 1895 (Bergne 1900). Dupont (1907, 12) gave the date of introduction as c. 1887 and the number in 1906 as "several thousands". Nicoll (1908, 112) found twenty, very wild, near the foot of the dunes. Vesey-FitzGerald (1942) did not mention them and Gaymer thought they were extinct in 1964. We saw none in 1967, though we were told that some still existed in the north. Dupont was so impressed by the goats as a food resource that he suggested the introduction of rabbits and hares (Dupont 1907, 13). Dogs, cats and chickens were seen in 1967.

Settlement and Exploitation

Settlement began in June 1908, and by Fryer's arrival in September tracks had been cut through the bush in several directions. The first settlement was in the northern part of the west bay, and large rainwater tanks were constructed there in 1910. Both contained excellent water in 1967. At a date unknown the settlement was transferred to the south end of the bay, where there is now a manager's house and garden, and a line of labourers' huts (Plate 34). There is a short jetty, a boat house, and to the north a small cemetery. On the east coast there are two small fishing shacks on the dunes.

Between 1926 and 1945, 161,000 tons of guano were exported, together with an unknown amount before 1926. After 1945 the lease lapsed and exploitation ceased in 1948; but with the renewal of the lease in 1955 mining began again. A mechanical crusher and light railway (Plate 35) have been installed. Baker (1963) estimated reserves at 160,000 tons following his survey in 1960, mostly in solution holes. Because of the sharp decline in the price of guano, production was at a standstill in 1967, and mounds of guano stood at the settlement unable to be shipped. Assumption is leased jointly with Aldabra and Cosmoledo by Mr H. Savy of Mahé, for thirty years from 1955 (Stoddart and Wright 1967, 48-50). Unlike Aldabra, it still forms part of the Colony of Seychelles, and has not been incorporated in the British Indian Ocean Territory.

Summary and Conclusions

After sixty years of intensive exploitation and a previous century of more casual interference, Assumption has now lost many of the faunal and floral elements which formerly characterised the elevated reef islands of the southwest Indian Ocean. There is no doubt that at the time of settlement in 1908 a number of irreversible changes had taken place, particularly the disappearance of the Giant Land Tortoise. The Tortoise population on so small an island must clearly have been more vulnerable to cropping for food during the late eighteenth and early nineteenth centuries than on the much larger island of Aldabra. The presence of introduced goats must have initiated vegetation changes, and early reports mention the wide distribution of Plumbago.

Major vegetation and floristic changes, however, followed the beginning of phosphate mining, in which vegetation was removed and the phosphate scraped from the surface of the ground, leaving a sterile rock surface for new colonisation. Many of the species common in Mixed Scrub on Aldabra and possibly formerly present on Assumption appear now to be absent on the latter, and their place has been taken by weeds such as Plumbago, Sarcostemma and Cassytha, and escapes such as Gossypium. All of these species are rare on Aldabra except close to the settlement where man has actively interfered with indigenous vegetation. The only areas apparently unaffected by these changes on Assumption are the high

dunes and the windward perched beach, with their typical vegetation of Sporobolus, Sclerodactylon, Scaevola, Suriana and Tournefortia, all characteristic of similar habitats on Aldabra. Lack of active disturbance and the extreme environmental conditions have probably restricted invasions in these habitats. In the flora as a whole, indigenous elements are possibly being replaced by common weeds, many of pan-tropical distribution, and cultivated plants, but further data on these processes are required.

With major vegetation changes and probable continuous predation, the bird fauna has changed considerably since 1908. The endemic rail Dryolimnas cuvieri abbotti has certainly become extinct, the local population of the turtledove Streptopelia picturata possibly so too. Of the shore birds, Ardea cinerea and Egretta garzetta may no longer occur. Changes in the sea bird population have been considerable. Though a few Sula sula and S. dactylatra have been seen in recent years, the booby breeding colonies over the northern half of the island have disappeared. Abbott's Booby Sula abbotti is now extinct on Assumption, and breeds only on faraway Christmas Island. None of the other eight recorded species of sea bird is now definitely known to breed, though Gygis alba probably does so. On the other hand, the endemic sunbird Nectarinia sovimanga abbotti, the crow Corvus albus, and migrants generally, are probably little affected by changes on the island.

Since settlement began the large breeding grounds on Assumption of the Green Turtle have been largely abandoned, and though this decline appears to be common throughout the southwest Indian Ocean it has been especially catastrophic on Assumption.

Assumption thus provides an extreme example of ecological change brought about by human settlement and exploitation. Since exploitation depends on the maintenance of an economic price for phosphate, it is possible that the venture will become uneconomic and the settlement could be abandoned. If this occurs it will be useful to observe the progress of ecological change in the future, as part of the Royal Society's continuing programme at Aldabra.

References

- Abbott, W. L. 1893. Notes on the natural history of Aldabra, Assumption and Gloriosa Islands, Indian Ocean. Proc. U.S. Nat. Mus. 16: 759-764.
- Aurivillius, C. 1922. Coleoptera (Cerambycidae) from the Seychelles Islands, Aldabra, and Rodriguez. Ann. Mag. Nat. Hist., ser. 9, 10: 421-443.
- Baker, B. H. 1963. Geology and mineral resources of the Seychelles archipelago. Geol. Surv. Kenya Mem. 3: 1-140.

- Benson, C. W. 1967. The birds of Aldabra and their status. Atoll Res. Bull. 118: 63-111.
- Benson, C. W. and Penny, M. J. 1968. A new species of warbler from the Aldabra Atoll. Bull. Brit. Ornith. Club, 88: 102-108.
- In preparation. The land birds of Aldabra. Phil. Trans. Roy. Soc. B.
- Bergne, H. A'C. 1900. Fair record of islands in the Indian Ocean. Manuscript.
- 1901. Rough notes of a voyage to the Aldabra group. Manuscript.
- Blackman, R. A. A. and Pinhey, E. C. G. 1967. Odonata of the Seychelles and other Indian Ocean islands groups, based primarily on the Bristol University Expedition of 1964-1965. Arnoldia, 3(12): 1-38.
- Bolivar, I. 1912. Orthoptera: Acrydiidae, Phasgonuridae, Gryllidae. Trans. Linn. Soc. London, ser. 2, Zool., 15: 263-292.
- 1924. Orthoptera Dictyoptera (Blattidae and Mantidae), and supplement to Gryllidae, of the Seychelles and adjacent islands. Ann. Mag. Nat. Hist., ser. 9, 13: 313-359.
- Boulenger, G. A. 1911. List of the Batrachians and Reptiles obtained by Prof. Stanley Gardiner on his second expedition to the Seychelles and Aldabra. Trans. Linn. Soc. London, ser. 2, Zool., 14: 375-378.
- Bourne, W. R. P. 1966. Observations on islands in the Indian Ocean. Sea Swallow, 18: 40-43.
- Burr, M. 1910. Dermaptera. Trans. Linn. Soc. London, ser. 2, Zool., 14: 123-133.
- Campion, H. 1913. Odonata. Trans. Linn. Soc. London, ser. 2, Zool., 15: 435-446.
- Champion, G. C. 1914. Coleoptera, Curculionidae. Trans. Linn. Soc. London, ser. 2., Zool., 16: 393-497.
- Cockerell, T. D. A. 1912. Hymenoptera, Apoidea. Trans. Linn. Soc. London, ser. 2, Zool., 15: 29-41.
- Distant, W. L. 1913. Rhynchota. Part I: suborder Heteroptera. Trans. Linn. Soc. London, ser. 2, Zool., 16: 139-190.
- 1917. Rhynchota. Part II: suborder Homoptera. Trans. Linn. Soc. London, ser. 2, Zool., 17: 273-322.

- Dupont, R. P. 1907. Report on a visit of investigation to St Pierre, Astove, Cosmoledo, Assumption and the Aldabra group. Mahé: Government Printing Office, 1-51.
- Fletcher, T. B. 1910. Lepidoptera, exclusive of the Tortricidae and Tineidae, with some remarks on their distribution and means of dispersal amongst the islands of the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 13: 265-323.
- Fosberg, F. R. and Renvoize, S. A. 1970. Plants of Assumption Island. Atoll Res. Bull., this issue.
- Fryer, J. C. F. 1908. Diary. Manuscript.
- 1910. The South-west Indian Ocean (being an account of Aldabra and certain neighbouring islands, which were not explored by Prof. J. Stanley Gardiner in H.M.S. "Sealark"). Geog. J. 37: 249-268.
- 1911. The structure and formation of Aldabra and neighbouring islands--with notes on their fauna and flora. Trans. Linn. Soc. London, ser. 2, Zool., 14: 397-442.
- 1912. The Lepidoptera of Seychelles and Aldabra, exclusive of the Orneodidae and Pterophoridae and of the Tortricina and Tineina. Trans. Linn. Soc. London, ser. 2, Zool., 15: 1-28.
- Gebien, H. 1922. Coleoptera, Heteromera: Tenebrionidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 261-324.
- Gibson-Hill, C. A. 1950. Notes on Abbott's Booby. Bull. Raffles Mus. 23: 65-76.
- Gwynne, M. D. and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M.F.R.V. "Manihine", Sept.-Oct. 1967. Atoll Res. Bull. 134: 1-15.
- Hampson, G. F. 1908. On the moths collected during the cruise of the "Valhalla" during the winter 1905-6 by Mr E. G. B. Meade-Waldo. Ann. Mag. Nat. Hist. ser. 8, 1: 474-492.
- Hartman, W. D. 1958. Report on some land birds of Farquhar, St Pierre, Astove, Cosmoledo, Assumption and Aldabra. Seychelles Govt. Bull. 21.
- Hemsley, W. B. 1919. Flora of Aldabra: with notes on the flora of the neighbouring islands. Bull. Misc. Inform. Roy. Botanic Gards. Kew, 1919: 108-153.

- Honegger, R. 1966. Beobachtungen an der Herpetofauna der Seychellen. Salamandra, Zeitschr. f. Herpetol. u. Terrarienkunde, 2(1-2): 20-36.
- Unpublished. Some notes and observations on Giant Tortoises Testudo gigantea Schweigger living and extinct of the Indian Ocean islands. World Wildlife Fund Project No. 28. Typescript.
- Horsburgh, J. 1809. Directions for sailing to and from the East Indies, China, New Holland, Cape of Good Hope, and the interjacent points. Part first. London: Black, Parry and Kingsbury, 1-397.
- Lamb, C. G. 1914. Diptera: Heteroneuridae, Ortalidae, Trypetidae, Sepsidae, Micropezidae, Drosophilidae, Geomyzidae, Milichidae. Trans. Linn. Soc. London, ser. 2, Zool., 16: 307-372.
- 1922. Diptera: Asilidae, Scenopinidae, Dolichopodidae, Pipunculidae, Syrphidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 361-416.
- Legrand, H. 1965. Lépidoptères des îles Seychelles et d'Aldabra. Mém. Mus. Nat. Hist. Natur. A, Zool., 37: 1-210.
- Loustau-Lalanne, P. 1963. Sea and shore birds of the Seychelles. Seychelles Soc. Occas. Papers, 2: 1-26.
- MacArthur, R. H. and Wilson, E. O. 1967. The theory of island biogeography. Princeton: University Press, 1-203.
- Mamet, R. 1943. A revised list of the Coccoidea of the islands of the western Indian Ocean, south of the equator. Mauritius Inst. Bull. 2: 137-170.
- Mayr, E. 1965. Avifauna: turnover in islands. Science, 150: 1587-1588.
- Morley, C. 1912. Hymenoptera, Ichneumonidae. Trans. Linn. Soc. London, ser. 2, Zool., 15: 169-179.
- Nicoll, M. J. 1906. On the birds collected and observed during the voyage of the "Valhalla", R.Y.S., from November 1905 to May 1906. Ibis, ser. 8, 6: 666-712.
- 1908. Three voyages of a naturalist, being an account of many little-known islands in three oceans visited by the "Valhalla", R.Y.S. London: Witherby, 1-246.
- Parker, I. S. C. 1970. Some ornithological observations from the western Indian Ocean. Atoll Res. Bull., this issue.
- Piggott, C. J. 1961. A report on a visit to the Outer Islands between October and November 1960. Directorate of Overseas Surveys, Land Resources Division, typescript, 1-71.

- Piggott, C. J. 1968. A soil survey of Seychelles. Directorate of Overseas Surveys, Land Resources Division, Tech. Bull. 2: 1-89.
- Regan, C. T. 1912. New fishes from Aldabra and Assumption, collected by Mr J. C. F. Fryer. Trans. Linn. Soc. London, ser. 2, Zool., 15: 301-302.
- Ridgway, R. 1893. Descriptions of some new birds collected on the islands of Aldabra and Assumption, northwest of Madagascar, by Dr W. L. Abbott. Proc. U.S. Nat. Mus. 16: 597-600.
- 1894a. Note on Rougetius aldabranus. Auk, 11: 74.
- 1894b. Descriptions of some new birds from Aldabra, Assumption and Gloriosa Islands, collected by Dr W. L. Abbott. Proc. U.S. Nat. Mus. 17: 371-373.
- 1895. On birds collected by Doctor W. L. Abbott on the Seychelles, Amirantes, Gloriosa, Assumption, Aldabra and adjacent islands, with notes on habits, etc., by the collector. Proc. U.S. Nat. Mus. 18: 509-546 (actual date of publication June 24, 1896).
- Scott, H. 1912. Coleoptera, Lamellicornia and Adephaga. Trans. Linn. Soc. London, ser. 2, Zool., 15: 215-262.
- 1914. Mallophaga, Aphaniptera, and Diptera Pupipara. Trans. Linn. Soc. London, ser. 2, Zool., 17: 161-167.
- 1926. Coleoptera from the Seychelles and adjacent islands: Carabidae (supplement), Cryptophagidae (supplement), Dermestidae, Lymexylonidae, Rhipiceridae, Sphindidae, Throscidae, Brenthidae. Ann. Mag. Nat. Hist. ser. 9, 18: 50-76.
- Serventy, D. L. 1951. Interspecific competition on small islands. Western Austr. Nat. 3(3): 59-60.
- Smith, J. L. B. 1955a. The fishes of the family Anthiidae of the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 337-350.
- 1955b. The fishes of the family Pomacanthidae in the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 337-384.
- 1956a. The fishes of Aldabra, Part V. Ann. Mag. Nat. Hist. ser. 12, 9: 721-729.
- 1956b. The fishes of Aldabra, Part VI. Ann. Mag. Nat. Hist. ser. 12, 9: 817-829.
- Stoddart, D. R. editor. 1967. Ecology of Aldabra Atoll, Indian Ocean. Atoll Res. Bull. 118: 1-141.

- Stoddart, D. R. 1968a. Catastrophic human interference with coral atoll ecosystems. *Geography*, 53: 25-40.
- 1968b. Isolated island communities. *Science J.* 4(4): 32-38.
- Stoddart, D. R. and Wright, C. A. 1967. Geography and ecology of Aldabra Atoll. *Atoll Res. Bull.* 118: 11-52.
- Travis, W. 1959. *Beyond the reefs*. New York: E. P. Dutton (London: Allen and Unwin), 1-221.
- Turner, R. E. 1911. Fossorial Hymenoptera from the Seychelles and other islands in the Indian Ocean. *Trans. Linn. Soc. London, ser. 2, Zool.*, 14: 367-374.
- Vesey-FitzGerald, L. D. E. F. 1941. Further contributions to the ornithology of the Seychelles Islands. *Ibis, ser. 14, 5*: 518-521.
- 1942. Further studies of the vegetation on islands in the Indian Ocean. *J. Ecol.* 30: 1-16.

ASSUMPTION ISLAND



18. Low champignon cliffs and perched beach, east coast, view towards the south



19. Pocket beach in the champignon cliffs, continuous with the higher perched beach; north of the high dunes, east coast



20. Eroded inner edge of the reef flat where it passes beneath the beach at the foot of the high dunes, east coast



21. Transverse erosional grooves in the reef flat, backed by a rocky erosion ramp, beach, and high dunes; east coast



22. Outer edge of the reef flat near the high dunes, east coast



23. Small dunes on the perched beach, which is densely covered with grasses; east coast, looking north



24. Clumps of Suriana maritima and scattered Fimbristylis on the eroding seaward face of the highest dune



25. Scaevola and Fimbristylis on the high dunes



26. View from the summit of the highest dune, with Tournefortia scrub, across the low mixed scrub of the centre of Assumption. The line of Casuarina trees on the west shore marks the Settlement



27. The lee slope of the highest dune, with Tournefortia and Scaevola



28. Tournefortia and Suriana forming the littoral hedge on the prograding west coast, view north from Settlement



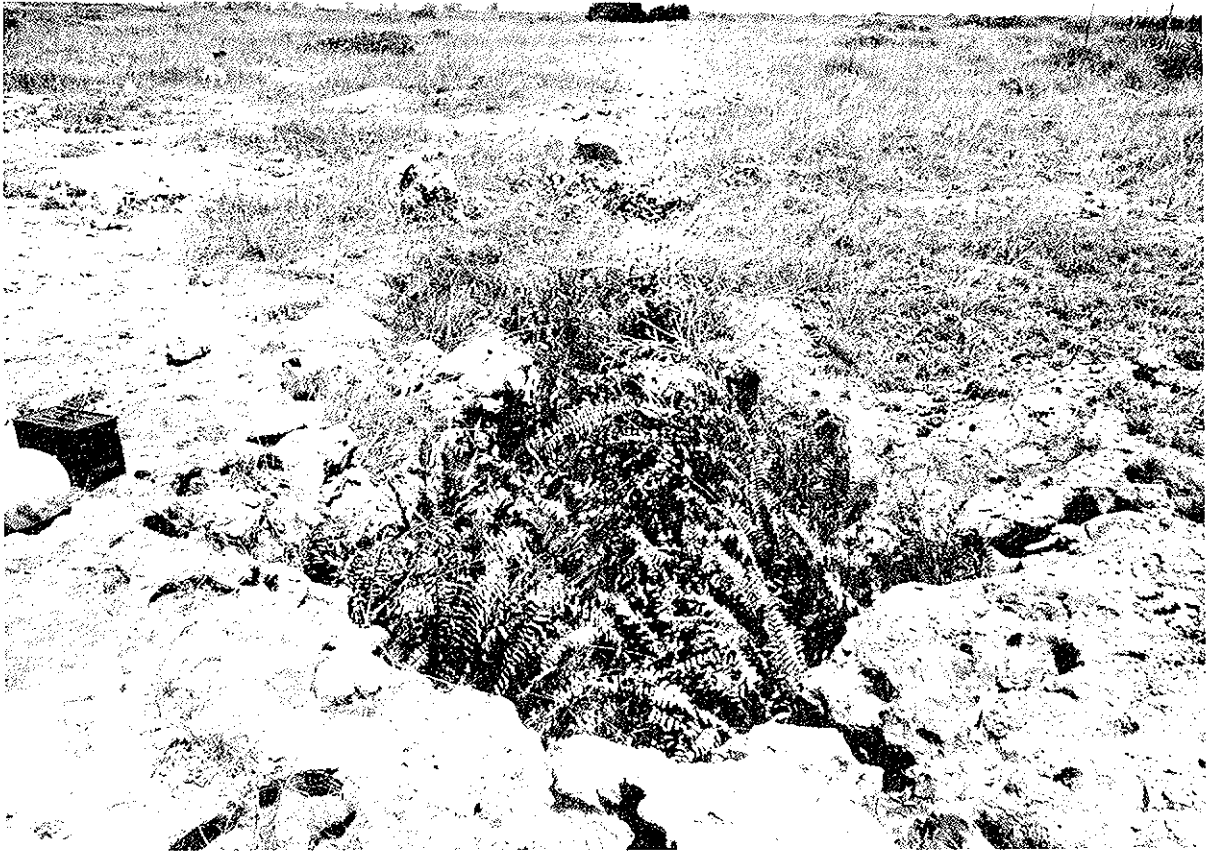
29. Suriana and Pemphis forming the littoral hedge near the northern end of the west coast



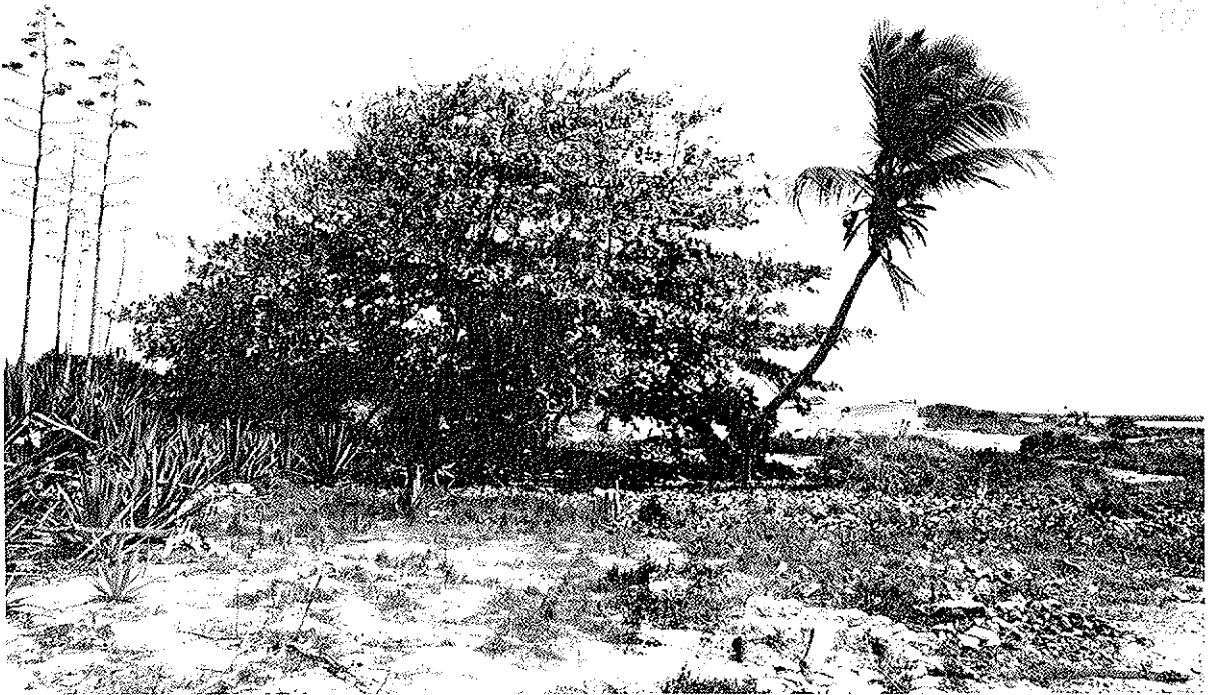
30. Leafless Pisonia in the low mixed scrub in the centre of the island



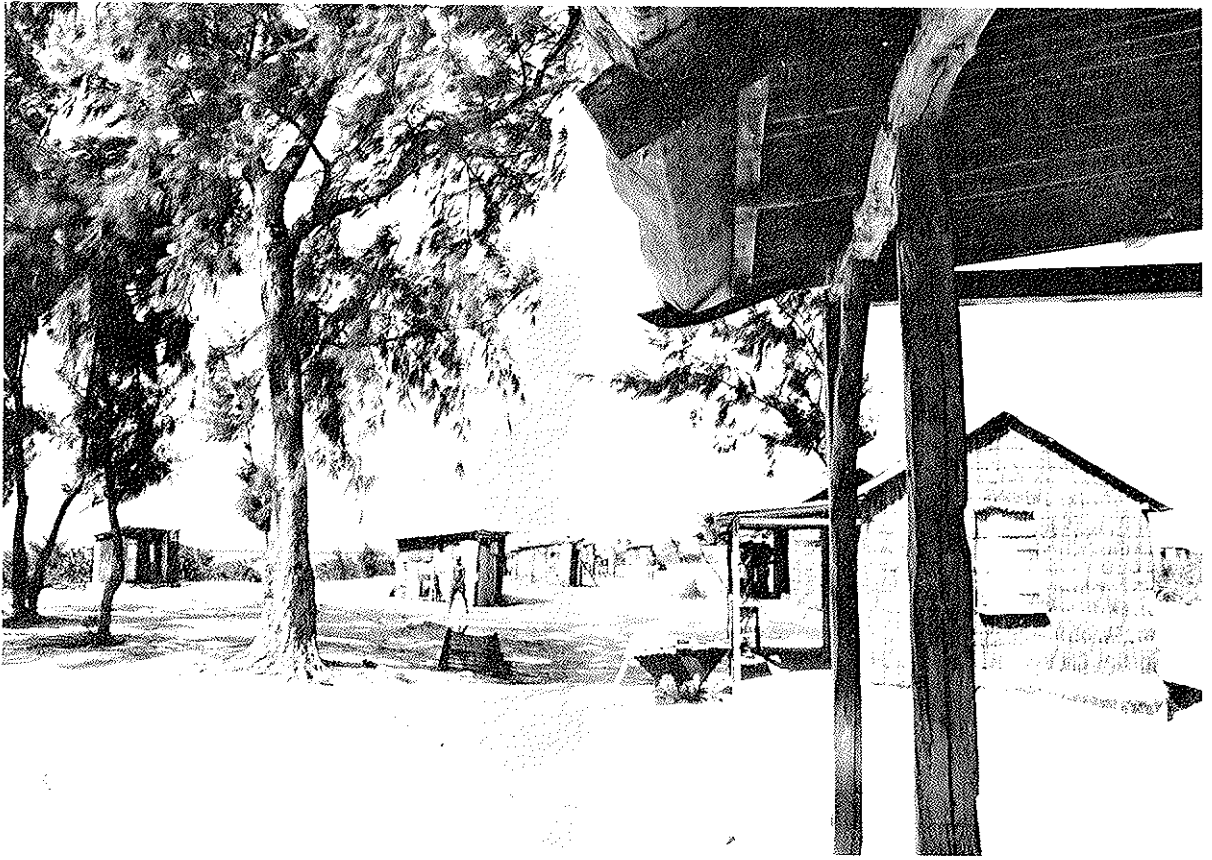
31. Flat plain almost devoid of soil and vegetation, northern end of the island; Ficus in the foreground



32. Nephrolepis biserrata in a solution hole, north end



33. Agave, massive Terminalia, and Cocos at the site of the old settlement; note the water tank behind the coconut



34. Labourers' huts at Settlement; compare with the illustration given of similar quarters in Fryer (1910)



35. Guano railway and sheds at Settlement

13. PLANTS OF ASSUMPTION ISLAND

F. R. Fosberg and S. A. Renvoize

NOSTOC COMMUNE L.

Seen by Stoddart, 1967.

ACROSTICHUM AUREUM L.

S. 1., Stoddart 1096 (K).

NEPHROLEPIS BISERRATA (Sw.) Schott

Near North Point, Stoddart 1097 (K).

DACTYLOCTENIUM AEGYPTIUM (L.) Willd.

S. 1., Stoddart 1042 (K).

DACTYLOCTENIUM PILOSUM Stapf

S. 1., Fox [=Dupont] 254 (K) (not seen); Stoddart 1072 (K).

ENTEROPOGON SEHELLENSIS (Bak.) Dur. & Schinz

S. 1., Stoddart 1065 (K), 1109 (K), 1073 (K); Price in 1967 (BM);
Dupont 238 (K), 257 (K); Settlement, Stoddart 1043 (K); West side,
Frazier 17 (K).

ERAGROSTIS sp.

S. 1., Dupont 109 (K), 237 (K), 252 (K).

ERIOCHLOA MEYERIANA (Nees) Pilg.

S. 1., Stoddart 1063 (K); Dupont 75 (K).

ERIOCHLOA SUBULIFERA Stapf

S. 1., Fox [Dupont] 258, 261 (K).

PANICUM ASSUMPTIONIS Stapf

S. 1., Dupont 110 (K, type).

PENNISSETUM POLYSTACHION (L.) Schult.

Southern part of West shore, Stoddart 1100 (K).

SCLERODACTYLON MACROSTACHYUM (Benth.) Camus

S. 1., Gwynne & Wood 1335 (EA); Parts of east dunes, Stoddart 1088
(K).

SPOROBOLUS VIRGINICUS L.

Along N. E. Coast, Stoddart 1093 (K).

STENOTAPHRUM CLAVIGERUM Stapf

East dune 3 mi. from north point, Stoddart 1090 (K).

FIMBRISTYLIS CYMOSA R. Br.

East dunes, Stoddart 1084 (K); West side, Frazier 21 (K, US).

COCOS NUCIFERA L.

Seen by Stoddart, 1967.

COMMELINA BENGHALENSIS L.

S. 1., Dupont 253 (K).

AGAVE SISALANA Perr.

Seen by Stoddart, 1967.

ASPARAGUS UMBELLULATUS Lieb.

Reported by Hemsley (1919) on authority of Dupont.

LOMATOPHYLLUM BORBONICUM Willd.

Settlement, Stoddart 1041 (K, US).

DIOSCOREA NESIOTIS Hems1.

S. 1., Dupont 118 (K), 274 (K).

CASUARINA EQUISETIFOLIA L.

Seen by Stoddart, 1967.

FICUS NAUTARUM Bak.

S. 1., Stoddart 1078 (K); West side, Frazier 10 (K).

BOERHAVIA ELEGANS Choisy

S. 1., Stoddart 1081 (K); Settlement, Stoddart 1062 (K).

BOERHAVIA REPENS L.

S. 1., Gwynne & Wood 1330 (EA).

PISONIA GRANDIS R. Br.

Seen and photographed by Stoddart.

ACHYRANTHES ASPERA L.

S. 1., Stoddart 1048 (K); West side, Frazier 20 (K).

AMARANTHUS DUBIUS Mart. ex Thel.

East shore N. of Settlement, Stoddart 1106 (K); West side, Frazier 1 (K, US).

AMARANTHUS VIRIDIS L.

Settlement, Stoddart 1056bis (K).

LAGREZIA MADAGASCARIENSIS (Poir.) Moq.

S. 1., Dupont 248 (K); south of island, Dupont 113 (K).

PORTULACA cf. AUSTRALIS Endl.

S. 1., Dupont 216 (K), 114 (K); Stoddart 1092 (K); Thomasset 214 (K); West side, Frazier 3 (K). This is the plant commonly referred to P. quadrifida, which it does not resemble.

PORTULACA OLERACEA L.

S. 1., Stoddart 1083 (K); West side, Frazier 27 (K, US).

CISSAMPELOS PAREIRA var. HIRSUTA (Buch. ex DC.) Forman

Guano pits, Dupont 104 (K, 2 sheets), 104 (K); Dupont 263 (K).

CASSYTHA FILIFORMIS L.

S. 1., Stoddart 1074 (K).

CAPPARIS CARTILAGINEA Decne.

Seen and photographed by Stoddart, 1967.

CLEOME STRIGOSA (Boj.) Oliv.

Settlement, Stoddart 1059 (K); West side, Frazier 23 (K).

MAERUA TRIPHYLLA var. PUBESCENS (Kl.) De Wolf

S. 1., Stoddart 1085 (K); Dupont 270 (K), 260 (K); West side, Frazier 11 (K, US).

MORINGA OLEIFERA Lam.

Village, Stoddart 1107 (K).

CAESALPINIA BONDUC (L.) Roxb.

S. 1., Stoddart 1101 (K).

CANAVALIA ROSEA (Sw.) DC.

S. 1., Frazier 33 (K); Settlement, Stoddart 1046 (K); Dupont 29 (K); West side, Frazier 25 (K).

SOPHORA TOMENTOSA L.

S. 1., Stoddart 1104 (K); Dupont 262 (K).

TRIBULUS CISTOIDES L.

S. 1., Stoddart 1080 (K).

SURIANA MARITIMA L.

S. 1., Dupont 107 (K); Settlement, Stoddart 1057 (K).

ACALYPHA CLAOXYLOIDES Hutch.

West side, Frazier 29 (K, US).

ACALYPHA INDICA L.

West side, Frazier 30 (K).

EUPHORBIA ABBOTTII Baker

"Dupont records this from all the islands of the Seychelles region except Gloriosa..." Hemsley (1919). S. 1., Fryer 52 (K); West side, Frazier 32 (K).

EUPHORBIA HIRTA L.

Settlement, Stoddart 1056 (K); West side, Frazier 31 (K).

EUPHORBIA INDICA Lam.

S. 1., Stoddart 1089 (K); Dupont 292 (K).

EUPHORBIA PROSTRATA Ait.

West side, Frazier 2 (K, US).

PEDILANTHUS TITHYMALOIDES (L.) Poit.

Settlement, Stoddart 1038 (K).

PHYLLANTHUS AMARUS Sch. & Thonn.

West side, Frazier 4 (K, US).

ABUTILON FRUTICOSUM Guill.

S. 1., Stoddart 1068 (K); West side, Frazier 26 (K, US).

GOSSYPIUM HIRSUTUM L.

Settlement, Stoddart 1058 (K); West side, Frazier 19 (K, US).

SIDA "DIFFUSA" HBK.

S. 1., Dupont 111 (K).

SIDA PARVIFOLIA DC.

S. 1., Stoddart 1094 (K); Dupont 264 (K).

THESPESIA POPULNEOIDES (Roxb.) Kostel.

S. 1., Stoddart 1082 (K).

PASSIFLORA FOETIDA var. HISPIDA (DC.) Killip

S. 1., Gwynne & Wood 1332 (EA); Stoddart 1076 (K).

PASSIFLORA SUBEROSA L.

S. 1., Stoddart 1067 (K).

CARICA PAPAYA L.

Seen by Stoddart, 1967.

MOMORDICA CHARANTIA L.

S. 1., Stoddart 1077 (K); Manager's garden, Stoddart 1108 (K).

PEMPHIS ACIDULA Forst.

S. 1., Stoddart 1091 (K).

CERIOPS TAGAL (Perr.) C. B. Rob.

In deep hole inland, Stoddart 1098 (K).

TERMINALIA CATAPPA L.

Northern part of West shore, abandoned Settlement, Stoddart 1102 (K, US).

TERMINALIA BOIVINII Tul.

S. 1., Dupont 272 (K).

AZIMA TETRACANTHA Lam.

West side, Frazier 12 (K); Settlement, Stoddart 1055 (K).

PLUMBAGO APHYLLA Boj. ex Boiss.

S. 1., Vesey-FitzGerald 6008 (K); Gwynne & Wood 1334 (EA); Settlement, Stoddart 1052 (K); West side, Frazier 15 (K).

CATHARANTHUS ROSEUS (L.) G. Don

Settlement, Stoddart 1061 (K); West side, Frazier 9 (K).

PLEUROSTELMA CERNUUM (Decne) Bullock

S. 1., Dupont 249 (K); West side, Frazier 16 (K).

SARCOSTEMMA VIMINALE R. Br.

S. 1., Stoddart 1075 (K); West side, Frazier 14 (K).

SECAMONE FRYERI Hems1.

S. 1., Gwynne & Wood 1333 (EA); Stoddart 1066 (K); Dupont 115 (K).

Unidentified Asclepiadaceae

S. 1., Frazier 34 (K).

EVOLVULUS ALSINOIDES L.

S. 1., Gwynne & Wood 1331 (EA); West side, Frazier 28 (K).

IPOMOEA BATATAS (L.) Lam.

S. 1., Stoddart 1079 (K), 1047 (K); West side, Frazier 8 (K).

IPOMOEA PES-CAPRAE (L.) R. Br.

Eastern windward beach crest, Stoddart 1087 (K); West side, Frazier 18 (K).

IPOMOEA TUBA (Schlecht) G. Don

S. 1., Stoddart 1079 (K).

CORDIA SUBCORDATA Lam.

Northern part of west shore, Stoddart 1099 (K).

TOURNEFORTIA ARGENTEA L. f.

Settlement, Stoddart 1050 (K).

CLERODENDRUM GLABRUM E. Mey. (C. minutiflorum Baker).

S. 1., Stoddart 1069 (K); West sandy shore, Stoddart 1103 (K); in guano pits, Dupont 105 (K).

NESOGENES DUPONTII Hems1.

S. 1., Dupont 250 (K), 106 (K, type?); Stoddart 1064 (K).

PREMNA OBTUSIFOLIA R. Br.

S. 1., Dupont 247 (K).

STACHYTARPHETA JAMAICENSIS (L.) Vahl

S. 1., Stoddart 1054 (K); West side, Frazier 5 (K).

DATURA METEL L.

Settlement, Stoddart 1045 (K); West side, Frazier 13 (K).

SOLANUM LYCOPERSICUM L.

Settlement, Stoddart 1044 (K).

SOLANUM NIGRUM L.

Settlement, Stoddart 1053 (K); West side, Frazier 22 (K).

LEONOTIS NEPETIFOLIA (L.) R. Br.

Settlement, Stoddart 1039 (K).

HYPOESTES ALDABRENSIS Bak.

S. 1., Dupont 101 (K), 251 (K); Gwynne & Wood 1329; Settlement, Stoddart 1049 (K); West side, Frazier 6 (K).

HEDYOTIS sp.

S. 1., Dupont 108 (K), 108bis (K); near South Point, Stoddart 1095 (US, K).

TARENNA TRICHANTHA (Bak.) Brem.

S. 1., Dupont 116 (K).

TRIAINOLEPIS FRYERI (Hems1.) Brem.

S. 1., Dupont 259 (K).

SCAEVOLA TACCADA (Gaertn.) Roxb.

S. 1., Stoddart 1051 (K).

LAUNAEA SARMENTOSA (Willd.) Alst.

S. 1., Stoddart 1086 (K); Dupont 112 (K).

MELANTHERA BIFLORA (L.) H. Wild (Wedelia biflora (L.) DC.)

S. 1., Stoddart 1105 (K); Settlement, Stoddart 1060 (K).

VERNONIA CINEREA (L.) Less.

S. 1., Stoddart 1040 (K); West side, Frazier 24 (K, US, EA).

14. GEOGRAPHY AND ECOLOGY OF DESROCHES

D. R. Stoddart and M. E. D. Poore

Introduction

Desroches is a sand island on the windward rim of a slightly submerged atoll located 16 km east of the main Amirante Ridge. The atoll is 19-21 km in diameter; its rim has depths of 2-9 m on the north, east and south sides, and of 15-18 m on the west side. The lagoon is 18-31 m deep. There is a sounding of 1598 m between the atoll and the Amirante Ridge. Desroches island, which has been described by Baker (1963, 60-63), is elongate, 5.25 km long and 0.4-1.1 km wide, with an approximate area of 324 ha. Figure 7 is based on aerial photographs flown in 1960; there is no detailed land survey. Nothing is known of the condition of the peripheral reef of the atoll rim, and whether coral is active on it. Gardiner (1936, 435) drew attention to the absence of patch reefs and knolls within the lagoon.

The island is formed mainly of sand, and has a main elevation of 2-3 m. There is very little surface relief. The south coast especially is irregular, with deep bays surrounded by steep beaches of sand with cobbles (Plate 37 and 38). Beachrock outcrops patchily on the south coast (Plate 39). Beach erosion is taking place at the east and especially the western points; at the latter there is a small peninsula formed by layers of massive beachrock (Plate 40). No elevated reef-rock was seen. Piggott (1968) maps most of the island as Shioya Sand and Loamy Sand, with scattered patches of Jemo Series soils. The latter occur as rounded lumps of phosphate-cemented sand scattered over the surface.

Table 15 lists previous scientific work on Desroches. Coppinger (1883) contributed an important descriptive account following the visit of the Alert; Gardiner spent two days there during the Percy Sladen Expedition (Gardiner and Cooper 1907); but otherwise the most important systematic accounts are the recent ones by Baker (1963) and Piggott (1961, 43-47; 1968, 56).

Vegetation

By the time of Coppinger's visit in 1882, the vegetation was dominated by "several large groves of tall Casuarina trees, many...one hundred and eleven feet [34 m] in height". Coconuts had been planted

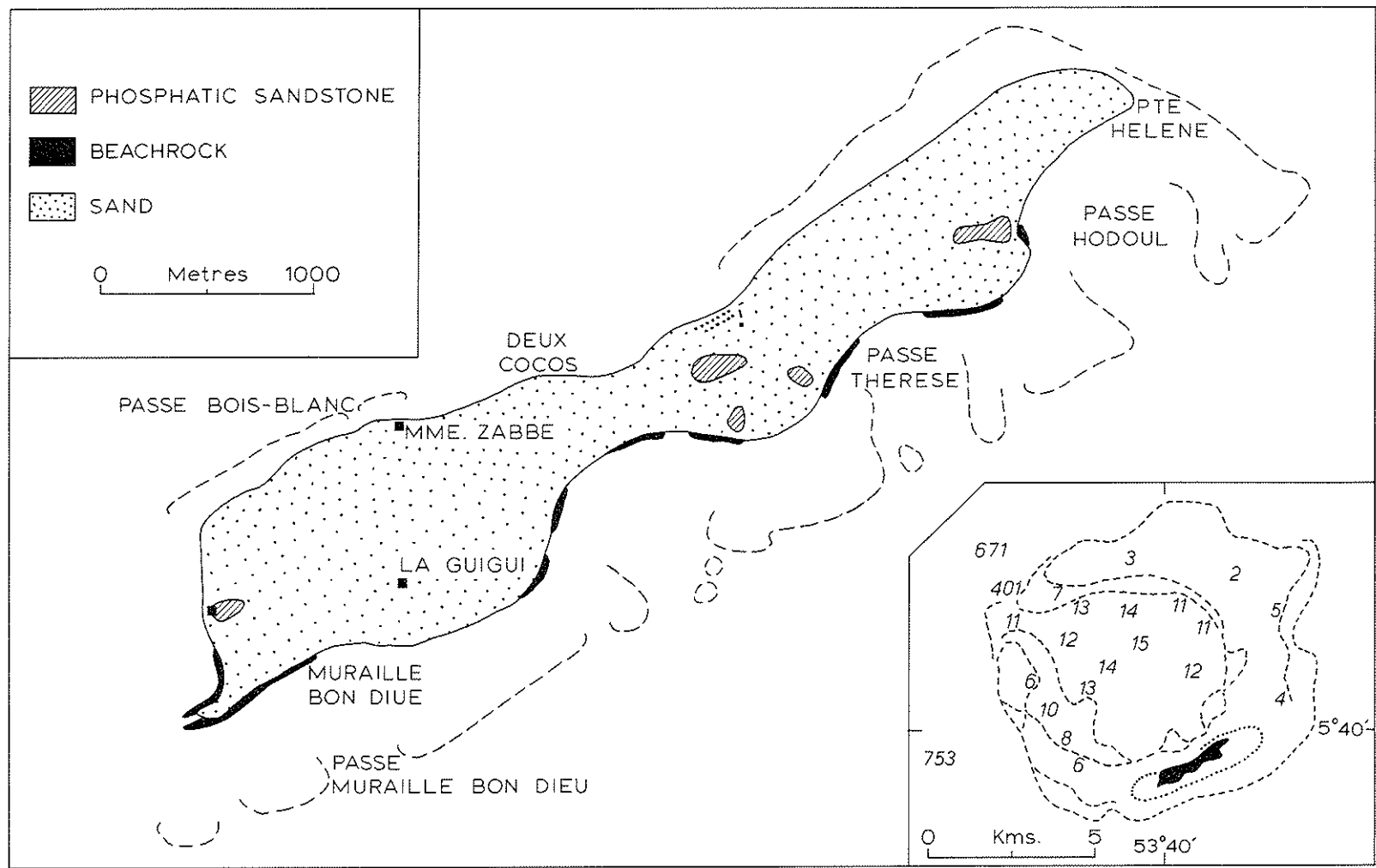


Fig. 7. Desroches

Table 15. Scientific studies at Desroches

<u>Date</u>	<u>Study</u>	<u>Reference</u>
1770	M. du Roslan: first recorded visit	Findlay (1882)
c. 1837	H. Dufo: mollusca	Dufo (1840)
1882 March 25-29	H.M.S. <u>Alert</u> , Dr R. Coppinger: Collections of birds and marine fauna. Hydrographic survey by Capt. J. P. Maclear	Coppinger (1883); Coppinger et al. (1884); Admiralty Chart 724
1892 Aug. 26	W. L. Abbott: birds	Ridgway (1895)
1905 Oct. 14-15	H.M.S. <u>Sealark</u> : J. S. Gardiner and Percy Sladen Expedition party	Gardiner and Cooper (1907), Gardiner (1936)
1960 Nov. 2-4	B. H. Baker, C. J. Piggott: geology, soils	Piggott (1961, 43-47; 1968, 56) Baker (1963)
1965 March 5	W.H.T. Tams and I.W.B. Nye: insects	
1967 Sept. 24	M. D. Gwynne, D. Wood, I. S. C. Parker: plants, birds	Parker (1970); Gwynne and Wood (1969)
1968 Sept. 21	M. E. D. Poore, D. R. Stoddart: General observations; collection of plants	This report; Fosberg and Renvoize (1970)

extensively, though few were old enough to bear, and at the time of this visit vanilla was being planted round the bases of the Casuarina trees. Coppinger noted that the flora was "more extensive than that of the other islands"; he recorded Scaevola taccada, a Ficus (possibly introduced), the only fern he saw in the Amirantes (Nephrolepis), and "herbaceous plants of the families Malvaceae, Solanaceae, Cinchonaceae, and Convolvulaceae" (Coppinger 1883, 223).

Gardiner and Cooper (1907, 155) state that the Casuarina was planted about 1835, and though the island was abandoned the tree rapidly spread over it. A new settlement was established about 1880, when coconuts were planted. At the time of the Percy Sladen visit in 1905 the Casuarina was being cut and coconuts were being encouraged. At that time there was an enormous clump of Casuarina at the west end, more along the south side to the village, and clumps at the east end. Gardiner commented on the lack of ground vegetation beneath these trees.

Thus the vegetation of Desroches, which has been continuously managed since 1905, has a long history of human interference. It is now actively managed as a copra island, with labourers clearing undergrowth and preventing the establishment of shrubs, as well as planting coconuts. With the exception of littoral Scaevola, Piggott (1961, 45) found "no evidence of the original vegetation. In other ways the flora is very

poor; the number of species is extremely limited and is diminishing under the existing system of nearly clean cultivation". This is somewhat exaggerated, for though vegetation growth is controlled there is a fairly complete ground cover, and our collections in 1968 totalled some 60 species (Fosberg and Renvoize 1970). There are no rainfall records for Desroches, but data for Darros and Alphonse in the Amirantes suggest an annual total of about 1500 mm, substantially more than occurs on the islands immediately north of Madagascar.

Undisturbed vegetation is now limited to nearshore areas. On the south coast Scaevola taccada is dominant, forming a tall hedge, with occasional Suriana maritima and Tournefortia argentea (Plates 37 and 38). Guettarda speciosa is commonly found fringing the Scaevola hedge on its landward side. On the north coast Scaevola is again dominant (Plate 41), forming taller and more open shrubs, with scattered tall trees of Ochrosia oppositifolia, Guettarda speciosa, Pipturus argenteus and Cordia subcordata. These species are presumably indicative of the original tree flora of the island. Elsewhere the vegetation is completely dominated by tall Casuarina equisetifolia and planted coconuts (Plate 42). A few other trees are occasionally found in the centre of the island, especially at the southwest end (Guettarda speciosa, Morinda citrifolia, large Ficus, Terminalia catappa), but otherwise the only trees on the island are huge specimens of Hernandia sonora forming an avenue at the settlement. Gardiner and Cooper (1907, 155) recorded these, together with Barringtonia asiatica. We did not see the latter, but did record Calophyllum inophyllum, also at the settlement. Decorative trees such as Delonix regia and Tamarindus indicus and economic trees such as Carica papaya are found at the main settlement and at smaller settlements around the island. A single bryophyte, Calymperes sanctae-mariae Besch. (det. C. C. Townsend), was taken on a rotten Casuarina trunk; this species has also been collected at Aldabra and Diego Garcia.

A shrub or tall herb layer is almost absent under the coconuts, apart from some Gossypium hirsutum and tall Alocasia near the main settlement. The tallest plants of the ground layer are Kalanchoe pinnata, Stachytarpheta jamaicensis and Turnera ulmifolia, but especially near the settlement the vegetation is kept closely cropped and these plants are not important. Grasses collected include species of Eragrostis, Stenotaphrum micranthum, Cynodon dactylon, Dactyloctenium aegyptium, Eleusine indica, and taller Digitaria horizontalis and Enteropogon sechellensis; the sedges Cyperus dubius, Cyperus ligularis and Fimbristylis cymosa are all common. The fern Nephrolepis biserrata is widespread, especially towards the northeast end of the island. The remaining species of the ground layer form a diverse assemblage of flowering plants, comprising:

<u>Bidens pilosa</u>	<u>Phyllanthus amarus</u>
<u>Euphorbia hirta</u>	<u>Phyllanthus maderaspatensis</u>
<u>Euphorbia prostrata</u>	<u>Sida parvifolia</u>
<u>Gynandropsis gynandra</u>	<u>Striga asiatica</u>
<u>Lippia nodiflora</u>	<u>Tridax procumbens</u>
<u>Passiflora suberosa</u>	<u>Vernonia cinerea</u>

Cassytha filiformis is very widespread, especially on open ground between the seaward Scaevola hedge and the coconut woodland. Ipomoea is very uncommon: I. pes-caprae was only found in one place on the lagoon beach crest. A single specimen of Euphorbia cyathophora was found at the settlement cemetery.

The settlement itself (Plates 43 and 44) has the usual assemblage of decorative and economic plants, apart from the trees already mentioned. The decoratives include species of Gaillardia, Catharanthus roseus, Tagetes patula, Pedilanthus tithymaloides and Mirabilis jalapa; the economic plants Moringa oleifera, Ricinus communis, Agave, Musa, and maize. Caesalpinia sp. is also present.

The combination of Casuarina and Cocos forms a most attractive woodland, and Piggott (1961, 44) noted that "palm yields tend to be much higher when next to a large Casuarina and their leaves are rich dark green". Nevertheless he later (1968, 56) stated that Casuarina "is notorious for the way it reduces fertility. Nothing grows underneath. Some still remain and, other than those necessary as windbreaks, should be cut down as soon as possible". We feel that more consideration should be given to this question before the trees are cut.

Fauna other than Birds

Apart from the birds very little indeed is known of the fauna of Desroches. Small collections of marine fauna were made by the Alert expedition: they include 8 species of marine Mollusca (Smith 1884), one echinoderm (Bell 1884), and either 4 or 8 species (locations are doubtful) of Crustacea (Miers 1884). The Percy Sladen party apparently completely neglected the marine fauna and flora during their visit.

Of the terrestrial fauna, a single reptile Hemidactylus brookii was recorded by Boulenger (1909), two spiders by Hirst (1911), and three species of terrestrial isopods by Budde-Lund (1912). About forty species of insects were collected by the Percy Sladen party, and the references to the determinations are given in Table 16.

Birds

Land birds

The following are recorded from Desroches:

Streptopelia sp.

According to Coppinger: "I saw only once. But one of the Creoles living on the island told me that it was an indigenous species, and was quite distinct from the domestic pigeons which roost about and restrict their range to the houses and trees about the settlement" (1884, 225). There is no later record of either; Benson (1970) discusses Streptopelia in the Amirantes.

Table 16. Insects recorded from Desroches
by the Percy Sladen Expedition

<u>Group</u>	<u>Number of species</u>	<u>Reference</u>
Orthoptera	10	Bolivar (1912, 1924)
Dermaptera	1	Burr (1910)
Hemiptera	4	Green (1907), Distant (1909)
Lepidoptera	9	Fletcher (1910)
Coleoptera	7	Champion (1914), Scott (1912, 1926), Arrow (1922)
Hymenoptera	6	Cameron (1907), Forel (1907, 1912), Meade-Waldo (1912)
Diptera	1	Theobald (1912)

Passer domesticus

Reported (as P. indicus) by Abbott in Ridgway (1895), and included by Watson et al. (1963). Common at the Settlement in 1968.

Foudia madagascariensis

Collected by Abbott on 26 August 1892 (Ridgway 1895), and "with great difficulty" by Coppinger (1884, 224) "in the large Casuarina grove, near the western end of the island"; "the females were nesting". Fairly common at the settlement in 1968 but only infrequently seen elsewhere. Status unknown according to Watson et al. (1963).

Francolinus pondicerianus

Coppinger (1884, 224) noted a "red-legged partridge", Abbott in Ridgway (1895) a partridge, and Gardiner and Cooper (1907, 156) a wild partridge. Seen in 1968 on the seaward side near the cemetery.

Estrilda astrild

Coppinger (1884, 224) noted "a very small bird which was to be seen every now and then flitting in large flocks among the maize plants and low bushes". He thought it a waxbill and it may have been this species. There is no later record.

Serinus mozambicus

Collected by Coppinger, recorded as Crithagra chrysopyga in Sharpe (1884). Coppinger states: "The yellow-breasted finch is gregarious, and mostly frequents the tops of the cocoa-nut trees and the upper branches of the tall Casuarinas" (1884, 224). One specimen collected on 26 August 1892 by Abbott (Ridgway 1895, as Serinus icterus). Introduced, according to Gardiner and Cooper (1907, 106).

In addition to these records, Coppinger also noted a brown finch "not abundant", which "seemed to confine its range to the plantations of young coconuts, where it was continually shifting its perch" (1884, 224).

Shore birds

Bubulcus ibis

Recorded as Bubulcus bubulcus by Abbott in Ridgway (1895) and in Watson et al. (1963). Not seen in 1968.

Butorides striatus

Recorded as Butorides atricapilla by Abbott in Ridgway (1895) and in Watson et al. (1963). Seen inland in 1968.

Migrants

Numenius phaeopus

Recorded by Abbott in Ridgway (1895). Quite common and vocal in woodland in 1968.

Actitis hypoleucos

Sight record, September 1968.

Arenaria interpres

Listed generally by Parker (1970) after his visit in 1967.

Sea birds

Puffinus pacificus

Seen at sea between Desroches and Mahé by Parker (1970).

Puffinus l'herminieri

Seen at sea between Desroches and Mahé by Parker (1970).

Sterna fuscata

Seen by Parker in September 1967 and by Poore and Stoddart in September 1968.

Anous stolidus

Seen by Parker in September 1967 and by Poore and Stoddart in September 1968.

Gygis alba

"Very common" according to Parker in 1967, but not seen by Poore and Stoddart in September 1968.

Other species of shore birds, migrants and sea birds are likely to occur on Desroches in view of the list for the Amirantes in Watson et al. (1963, 179-182).

History and Settlement

Desroches was discovered by Europeans later than most of the islands immediately north of Madagascar. The island is said to be identical with the "Ile du Berger" discovered by Du Roslan in 1770, when "good water" was found. But Du Roslan described the Ile du Berger as consisting of two separate islands with a channel passable at low water between them (Findlay 1882, 128). Such a description would fit Poivre rather than Desroches, but Du Roslan's navigation then becomes difficult to follow. Ile du Berger was named after his ship Heure du Berger, and Desroches after the Chevalier Desroches, Governor General of the Ile de France and Bourbon.

Casuarina trees were planted during a brief settlement in 1835. A new settlement was established in 1875-1880, and coconut planting was begun. Since that time the island has been continuously inhabited, and Casuarinas have been cut and coconuts planted at intervals. The manager's house, offices and plantation works were laid out between 1910 and 1920 (Plates 43 and 44). By 1882 there were already pigs and poultry on the island, and fruit and vegetables were grown (Coppinger 1884, 223). Cats and rabbits were noted in 1905 (Gardiner and Cooper 1907, 156), but there is no further reference to rabbits and the reference may be mistaken. There are now pigs and poultry on Desroches, together with about seventy semi-feral donkeys formerly used in the coconut mills. The manager has a lorry and there is a network of motorable roads. In 1967 copra production was 179 tons.

Desroches has clearly changed so much in the last hundred years that little evidence of its original biota remains. The vegetation is dominated by a man-induced woodland, with a characteristic assemblage of wide-ranging species beneath the coconuts and Casuarina. There are no certain references to breeding land birds, and the only common species in 1968 (the house sparrow and the Madagascar Fody) are both introduced. The extent of human disturbance may likewise account for the paucity of records of shore birds and sea birds: it is unlikely that any of the species noted now nests on Desroches. No collections of the terrestrial invertebrates have been made since Gardiner's in 1905, but it is probable, that like the plants, many of the species now there represent deliberate or accidental introductions.

Desroches was administered as a dependency of Seychelles between 1903 and 1965, when it was incorporated in the British Indian Ocean Territory.

References

- Arrow, G. J. 1922. Coleoptera, Erotylidae and Endomychidae, from the Seychelles, Chagos, and Amirantes Islands. *Ann. Mag. Nat. Hist.*, ser. 9, 10: 73-83.

- Baker, B. H. 1963. Geology and mineral resources of the Seychelles Archipelago. Mem. Geol. Surv. Kenya, 3: 1-140.
- Bell, F. J. 1884. Echinodermata. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 509-512.
- Benson, C. W. 1970. An introduction of Streptopelia picturata into the Amirantes. Atoll Res. Bull., this issue.
- Bolivar, I. 1912. Orthoptera: Acrydiidae, Phasgonuridae, Gryllidae. Trans. Linn. Soc. London, ser. 2, Zool., 15: 263-292.
- 1924. Orthoptera Dictyoptera (Blattidae and Mantidae), and supplement to Gryllidae, of the Seychelles and adjacent islands. Ann. Mag. Nat. Hist., ser. 9, 13: 313-359.
- Boulenger, G. A. 1909. A list of the freshwater fishes, batrachians and reptiles obtained by Mr J. Stanley Gardiner's expedition to the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 12: 291-300.
- Budde-Lund, G. 1912. Terrestrial Isopoda, particularly considered in relation to the distribution of the southern Indo-Pacific species. Trans. Linn. Soc. London, ser. 2, Zool., 15: 367-394.
- Burr, M. 1910. Dermaptera. Trans. Linn. Soc. London, ser. 2, Zool., 14: 123-133.
- Cameron, P. 1907. Hymenoptera. Trans. Linn. Soc. London, ser. 2, Zool., 12: 69-86.
- Champion, G. C. 1914. Coleoptera, Curculionidae. Trans. Linn. Soc. London, ser. 2, Zool., 16: 393-497.
- Coppinger, R. W. 1883. Cruise of the "Alert". Four years in Patagonian, Polynesian, and Mascarene water (1878-82). London: W. Swan Sonnenschein.
- [Coppinger, R. W., and others.] 1884. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2. London: British Museum (Natural History).
- Distant, W. L. 1909. "Sealark" Rhynchota. Trans. Linn. Soc. London, ser. 2, Zool., 13: 29-48.
- Dufo, H. 1840. Observations sur les Mollusques marins, terrestres et fluviatiles des îles Séchelles et des Amirantes. Ann. Sci. Nat., ser. 2, Zool., 14: 45-80, 166-221.

- Findlay, A. G. 1882. A directory for the navigation of the Indian Ocean, with descriptions of its coasts, islands, etc. London: R. H. Laurie, 4th edition, 1-1304.
- Fletcher, T. B. 1910. Lepidoptera, exclusive of the Tortricidae and Tineidae, with some remarks on their distribution and means of dispersal amongst the islands of the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 13: 265-323.
- Forel, A. 1907. Fourmis des Seychelles, Amirantes, Farquhar et Chagos. Trans. Linn. Soc. London, ser. 2, Zool., 12: 91-94.
- 1912. Fourmis des Seychelles, et des Aldabras, reçues de M. Hugh Scott. Trans. Linn. Soc. London, ser. 2, Zool., 15: 159-167.
- Fosberg, F. R. and Renvoize, S. A. 1970. Plants of Desroches. Atoll Res. Bull., this issue.
- Gardiner, J. S. 1936. The reefs of the western Indian Ocean. I. Chagos Archipelago. II. The Mascarene Region. Trans. Linn. Soc. London, ser. 2, Zool., 19: 393-436.
- Gardiner, J. S. and Cooper, C. F. 1907. Description of the Expedition, II. Trans. Linn. Soc. London, ser. 2, Zool., 12: 111-175.
- Gebien, H. 1922. Coleoptera, Heteromera: Tenebrionidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 261-324.
- Green, E. E. 1907. Notes on the Coccidae collected by the Percy Sladen Trust Expedition to the Indian Ocean, supplemented by a collection received from Mr R. Dupont, Director of Agriculture, Seychelles. Trans. Linn. Soc. London, ser. 2, Zool., 12: 197-207.
- Gwynne, M. D. and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M.F.R.V. "Manihine", Sept.-Oct. 1967. Atoll Res. Bull. 134: 1-15.
- Hirst, S. 1911. The Araneae, Opiliones and Pseudoscorpiones. Trans. Linn. Soc. London, ser. 2, Zool., 14: 375-395.
- Lamb, C. G. 1922. Diptera: Asilidae, Scenopinidae, Dolichopodidae, Pipunculidae, Syrphidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 361-416.
- Meade-Waldo, G. 1912. Hymenoptera, Diploptera. Trans. Linn. Soc. London, ser. 2, Zool., 15: 43-44.
- Miers, E. J. 1884. Crustacea. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of the H.M.S. "Alert" 1881-2 (London: British Museum), 513-575.

- Parker, I. S. C. 1970. Some ornithological observations from the Western Indian Ocean. *Atoll. Res. Bull.*, this issue.
- Piggott, C. J. 1961. A report on a visit to the Outer Islands between October and November 1960. Directorate of Overseas Surveys, Land Resources Division, typescript, 1-71.
- 1968. A soil survey of Seychelles. Directorate of Overseas Surveys, Land Resources Division, *Tech. Bull.* 2: 1-89.
- Ridgway, R. 1895. On birds collected by Doctor W. L. Abbott on the Seychelles, Amirantes, Gloriosa, Assumption, Aldabra and adjacent islands, with notes on habits, etc., by the collector. *Proc. U.S. Nat. Mus.*, 18: 509-546 (actual date of publication June 24, 1896).
- Scott, H. 1912. Coleoptera, Lamellicornia and Adephaga. *Trans. Linn. Soc. London*, ser. 2, *Zool.*, 15: 215-262.
- 1926. Coleoptera from the Seychelles and adjacent islands: Carabidae (supplement), Cryptophagidae (supplement), Dermestidae, Lymexylonidae, Rhipiceridae, Sphindidae, Throscidae, Brenthidae. *Ann. Mag. Nat. Hist.*, ser. 9, 18: 50-76.
- Smith, E. A. 1884. Mollusca. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of the H.M.S. "Alert" 1881-2 (London: British Museum), 487-508.
- Theobald, F. V. 1912. Diptera, Culicidae. *Trans. Linn. Soc. London*, ser. 2, *Zool.*, 15: 81-94.
- Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington: Smithsonian Institution.

DESROCHES



36. Scaevola and Casuarina on the south coast near Pointe Helene



37. Suriana on the south coast near Muraille Bon Dieu



38. Massive beachrock near the centre of the south coast



39. Massive beachrock at the southwest point



40. Scaevola and Cocos on the lagoon shore at Settlement



41. Mixed Cocos and Casuarina woodland near La Guigui



42. Labourers' quarters at Settlement, the path flanked by Cocos and Hymenocallis



43. Labourer's quarters at Settlement

15. PLANTS OF DESROCHES ISLAND

F. R. Fosberg and S. A. Renvoize

- CALYMPERES SANCTAE-MARIAE Besch.
Stoddart & Poore s. n. (Det. C. C. Townsend).
- NEPHROLEPIS BISERRATA (Sw.) Schott
Stoddart & Poore 1419 (K, US).
- CYMODOCEA CILIATA Ehrenb. ex Aschers.
Gwynne & Wood 1031a (K, EA).
- CYNODON DACTYLON (L.) Pers.
Stoddart & Poore 1390 (K, US)
- DACTYLOCTENIUM AEGYPTIUM (L.) Willd.
Gwynne & Wood 1039 (EA) (small plant with 1-2 spikes about 1 cm long, possibly not this species); Stoddart & Poore 1413 (K).
- DIGITARIA HORIZONTALIS Willd.
Gwynne & Wood 1034 (K, EA); Stoddart & Poore 1414 (K, US).
- ELEUSINE INDICA (L.) Gaertn.
Gwynne & Wood 1045 (EA); Stoddart & Poore 1405 (K).
- ENTEROPOGON SECHELLENSIS (Baker) Dur. & Schinz
Stoddart & Poore 1417 (K, US); Gwynne & Wood 1044 (EA).
- ERAGROSTIS TENELLA (L.) Beauv.
Gwynne & Wood 1033 (EA); Stoddart & Poore 1404 (K), 1423 (K, US).
- ERAGROSTIS sp.
Stoddart & Poore 1393 (K); Gwynne & Wood 1043 (EA).
- STENOTAPHRUM MICRANTHUM (Desv.) Hubb.
Stoddart & Poore 1391 (K, US).
- ZEA MAYS L.
Seen by Stoddart (1968).
- CYPERUS DUBIUS Rottb.
Gwynne & Wood 1048 (EA), 1036 (EA); Stoddart & Poore 1428 (K).

CYPERUS LIGULARIS L.

Stoddart & Poore 1412 (K, US).

FIMBRISTYLIS CYMOSA R. Br.

Gwynne & Wood 1032 (EA); Stoddart & Poore 1410 (K).

COCOS NUCIFERA L.

Seen by Stoddart (1968).

ALOCASIA?

Seen by Stoddart (1968).

AGAVE SISALANA Perr.?

Seen by Stoddart (1968).

MUSA SAPIENTUM L.

Seen by Stoddart (1968).

CASUARINA EQUISETIFOLIA L.

Seen by Stoddart (1968).

FICUS sp.

Seen by Stoddart (1968).

PIPTURUS ARGENTEUS Gaud. ex Wedd.

Stoddart & Poore 1399 (K, P, EA, US).

MIRABILIS JALAPA L.

Stoddart & Poore 1398 (K).

CASSYTHA FILIFORMIS L.

Stoddart & Poore 1418 (K).

HERNANDIA SONORA L.

Gwynne & Wood 1041 (EA); Stoddart & Poore 1388 (K, US).

GYNANDROPSIS GYNANDRA (L.) Briq.

Stoddart & Poore 1400 (K).

MORINGA OLEIFERA Lam.

Seen by Stoddart (1968).

KALANCHOE PINNATA (Lam.) Pers.

Stoddart & Poore 1408 (K, US).

CAESALPINIA sp.

Seen by Stoddart (1968).

DELONIX REGIA (Boj.) Raf.

Seen by Stoddart (1968).

- TAMARINDUS INDICA L.
Stoddart & Poore 1402 (K).
- SURIANA MARITIMA L.
Gwynne & Wood 1037 (K, EA); Stoddart & Poore 1420 (K, US).
- EUPHORBIA CYATHOPHORA Murr.
Stoddart & Poore 1389 (K).
- EUPHORBIA HIRTA L.
Stoddart & Poore 1396 (K, US).
- EUPHORBIA PROSTRATA Ait.
Gwynne & Wood 1046 (EA) (no fruit); Stoddart & Poore 1415 (K, US).
- PEDILANTHUS TITHYMALOIDES (L.) Poit.
Seen by Stoddart (1968).
- PHYLLANTHUS AMARUS Schum. & Thonn.
Stoddart & Poore 1406 (K).
- PHYLLANTHUS MADERASPATENSIS L.
Gwynne & Wood 1050 (EA), 1040 (EA); Stoddart & Poore 1416 (K, US).
- RICINUS COMMUNIS L.
Seen by Stoddart (1968).
- GOSSYPIUM HIRSUTUM L.
Seen by Stoddart (1968).
- SIDA PARVIFOLIA DC.
Gwynne & Wood 1035 (EA); Stoddart & Poore 1422 (K).
- CALOPHYLLUM INOPHYLLUM L.
Coppinger in 1822, label mounted "specimen not laid in" (K). Seen
by Stoddart (1968).
- TURNERA ULMIFOLIA L.
Stoddart & Poore 1425 (K, US).
- PASSIFLORA SUBEROSA L.
Stoddart & Poore 1403 (K, US).
- CARICA PAPAYA L.
Seen by Stoddart (1968).
- BARRINGTONIA ASIATICA (L.) Kurz
Reported by Gardiner & Cooper (1907), not seen during present
survey.

TERMINALIA CATAPPA L.

Seen by Stoddart (1968).

CATHARANTHUS ROSEUS (L.) G. Don

Stoddart & Poore 1395 (K).

OCHROSIA OPPOSITIFOLIA (Lam.) K. Schum.

Stoddart & Poore 1401 (K, US).

IPOMOEA PES-CAPRAE (L.) R. Br.

Stoddart & Poore 1329 (K, US).

CORDIA SUBCORDATA Lam.

Seen by Stoddart (1968).

TOURNEFORTIA ARGENTEA L. f.

Seen by Stoddart (1968).

LIPPIA NODIFLORA L.

Stoddart & Poore 1427 (K).

STACHYTARPHETA JAMAICENSIS (L.) Vahl

Stoddart & Poore 1424 (K).

STRIGA ASIATICA (L.) O. Ktze.

Stoddart & Poore 1409 (K).

GUETTARDA SPECIOSA L.

Gwynne & Wood 1038 (K, EA); Stoddart & Poore 1421 (K).

MORINDA CITRIFOLIA L.

Stoddart & Poore 1407 (K, US).

SCAEVOLA TACCADA (Gaertn.) Roxb.

Seen by Stoddart (1968).

BIDENS PILOSA L.

Stoddart & Poore 1394 (K, US).

GAILLARDIA LANCEOLATA Michx?

Seen by Stoddart (1968).

TAGETES PATULA L.

Stoddart & Poore 1397 (K).

TRIDAX PROCUMBENS L.

Stoddart & Poore 1426 (K).

VERNONIA CINEREA (L.) Less.

Coppinger, label mounted "specimen not laid in" (K); Gwynne & Wood 1047 (EA); Stoddart & Poore 1411 (K).

16. GEOGRAPHY AND ECOLOGY OF REMIRE

D. R. Stoddart and M. E. D. Poore

Introduction

Remire or Eagle Island is a small oval-shaped island, 0.8 km in diameter and with an area of 80 hectares. It stands at the south end of a long north-south trending reef, but is detached from it. Remire itself stands on a small reef flat which extends from the shore for 140-370 m on the northwest and southeast sides (Figure 8). Surrounding water depths are generally less than 35 m (Baker 1963, 51-54).

The island is mainly sandy, with littoral beachrock on the south and east shores. Much of the interior, however, has been converted into a phosphatic rock, with horizontal pitted and irregular surface, covered with loose cobble-size fragments. This plate of phosphate rock, at least 1.5 m thick, outcrops at the southeast corner to form a steep cliff 3-4 m high on the shore. The phosphate surface is rather higher than that of unconsolidated sand, but it has been much modified by mining. Braithwaite (1968) has discussed the formation of the phosphate rock. Piggott (1968, 60-61) distinguishes the soil of the phosphate areas as Jemo Series.

As in the case of Desroches, Remire was briefly visited by the Alert and Percy Sladen Expeditions in 1882 and 1905. Table 17 lists other scientific visitors. The following account is based on a short visit on 26 September 1968.

Vegetation

The vegetation of Remire has changed considerably since it was first discovered. Horsburgh (1852, 182) referred to it as "covered with shrubs" and Coppinger (1883, 220) as "covered with a thick growth of stunted bushes". Gardiner and Cooper (1907, 157) stated that "there are as yet no high trees and the shrubs are as small and stunted as at Cargados. A few coconuts have been planted to the north in the last ten years. But it is only recently that the last of the guano has been removed and the island let for cultivation. A clump of screw-pines (Pandanus Balfouri) in the centre of the island was an unusual feature".

The island is now covered with a dense coconut-dominated woodland on the sand areas, and a more open vegetation, with trees but without

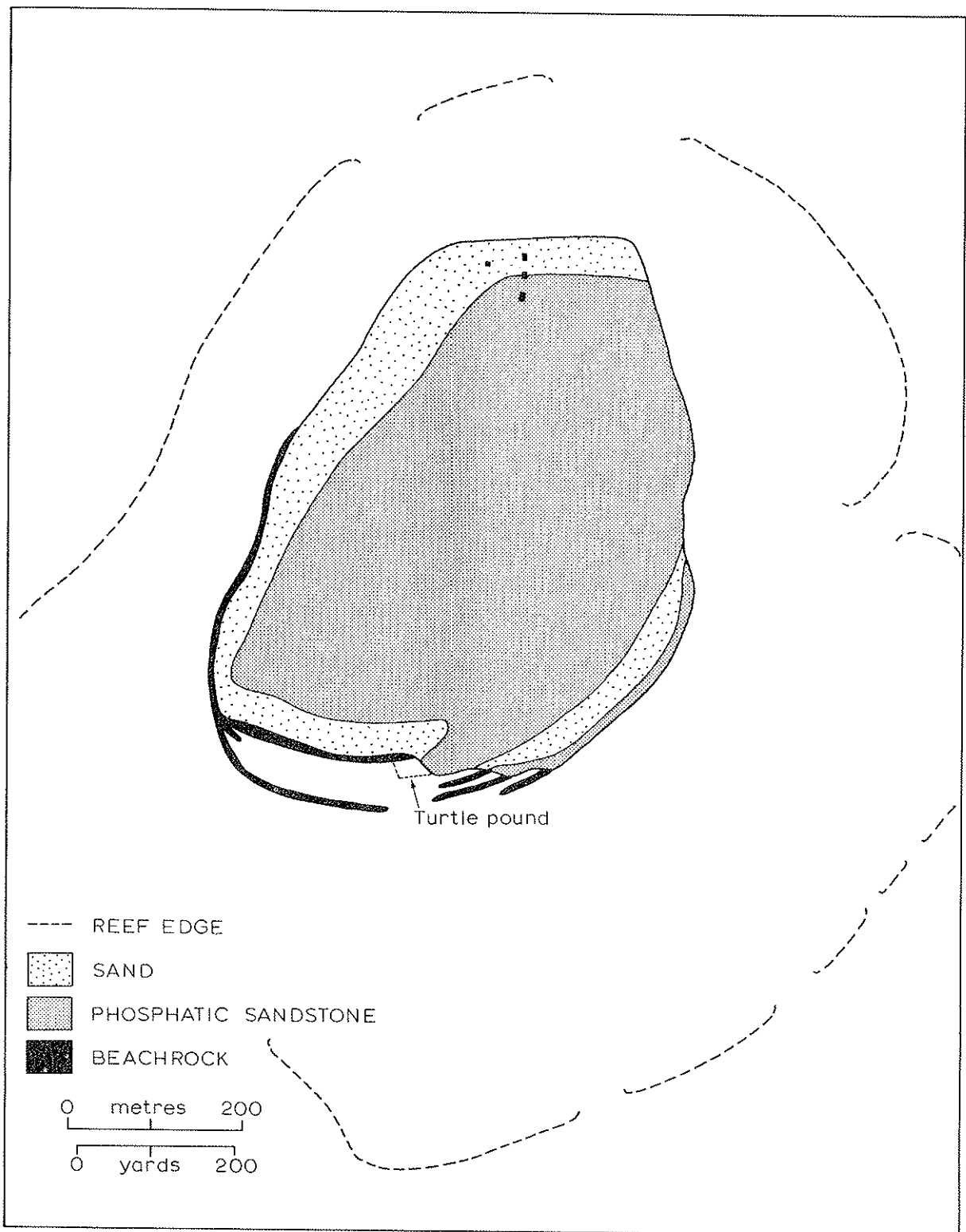


Fig. 8. Remire (after Baker 1963, Fig. 10)

Table 17. Scientific studies at Remire

<u>Date</u>	<u>Study</u>	<u>Reference</u>
1770	Explored by Du Roslan	
1771	Explored by M. de la Biollière, in the Eagle	Horsburgh (1852)
1882 March 19-20	H.M.S. <u>Alert</u> , R. W. Coppinger: general observations, bird collecting; Hydrographic survey by Capt. J. P. Maclear	Coppinger (1883), Coppinger et al. (1884), Admiralty Chart 724
1901	Visit by G. Naylor for Baty, Bergne and Co.	Bergne (1900)
1905 Oct. 17	Percy Sladen Expedition, H.M.S. <u>Sealark</u> : J. S. Gardiner, land collections, mainly insects	Gardiner and Cooper (1907), Gardiner (1936)
1955 July 5, Aug. 16	Viscount Ridley, Lord Richard Percy: birds	Ridley and Percy (1958)
1960 Nov. 2	B. H. Baker, C. J. Piggott: geology, soils	Baker (1963), Piggott (1961, 66-67; 1968, 60-61)
1965	C. J. R. Braithwaite, B. R. Rosen: geology of phosphate deposits, modern corals	Braithwaite (1968)
1967 Sept. 21-22	M. D. Gwynne, D. Wood, I. S. C. Parker: plants, birds	Parker (1970), Gwynne and Wood (1969)
1968 Sept. 26	M. E. D. Poore, D. R. Stoddart: plants, general observations	This report; Fosberg and Renvoize (1970)

coconuts, on the phosphate areas. A third vegetation type consists of a littoral hedge surrounding the island, dominated by Scaevola taccada, with Suriana maritima and Tournefortia argentea, with trees on its inner edge of Cordia subcordata and Guettarda speciosa.

The coconut woodland includes much Casuarina equisetifolia, and occasional Ficus nautarum, Thespesia populneoides, Terminalia catappa and other trees. The settlement area on the west coast is surrounded by a row, clearly planted, of tall Ochrosia oppositifolia, and at the settlement there are tall trees of Hernandia sonora and Calophyllum inophyllum. The ground layer in the coconut woodland consists of the following common species: together with grasses (Cenchrus echinatus, Stenotaphrum micranthum) and sedges (Cyperus dubius),

<u>Acalypha indica</u>	<u>Euphorbia hirta</u>
<u>Achyranthes aspera</u>	<u>Lippia nodiflora</u>
<u>Boerhavia repens</u>	<u>Phyllanthus maderaspatensis</u>
<u>Bidens pilosa</u>	<u>Sida parvifolia</u>
<u>Cassia occidentalis</u>	<u>Solanum nigrum</u>
<u>Cassytha filiformis</u>	<u>Stachytarpheta jamaicensis</u>
<u>Cleome viscosa</u>	<u>Turnera ulmifolia</u>

The vegetation of the phosphate area is highly variable. Two tree-dominated communities can be distinguished: one with a dense growth of Leucaena leucocephala about 5 m tall, the other a more open community of Carica papaya with a ground cover on a very irregular surface of Ipomoea pes-caprae and subsidiary Boerhavia repens, Bidens pilosa and Stenotaphrum micranthum. On the east side of the island, trees on the phosphate are rare, and much of the irregular surface is again covered with a thick mat of Ipomoea pes-caprae. Where the surface is smooth, probably because of superficial quarrying, the dominance of Ipomoea is reduced and other species, such as Tridax procumbens and Cyperus ligularis, appear. Weeds on this treeless phosphate are common along paths, where they include Eragrostis sp., Dactyloctenium aegyptium, Stachytarpheta jamaicensis, Cassytha filiformis and Portulaca oleracea.

The settlement has a number of decoratives (Catharanthus roseus, Datura metel) and other cultivated plants (Moringa oleifera, Capsicum frutescens, Agave, Carica papaya, a large cucurbit).

The contrast between the present wooded island and that described before 1905 is striking. Remire is at present uninhabited, no clearing of ground vegetation takes place, and the growth in many places is very dense.

Fauna other than Birds

The Alert expedition made small collections, mostly of marine fauna, including 9 species of marine molluscs (Smith 1884), one sponge (Ridley 1884), and either 1 or 6 (location uncertain) crabs (Miers 1884). Coppinger (1883) recorded a Coenobita as being particularly common. The Percy Sladen Expedition made almost no collections of marine fauna and flora in 1905. Both the Alert and the Percy Sladen collected a single gecko Hemidactylus frenatus (Gunther 1884, Boulenger 1909). Ridley and Percy (1958, 43) record in addition Mabuia sechellensis. No lizards were seen in 1968. Some 35 species of insects were recorded by the Percy Sladen team, in addition to three beetles collected by Coppinger (Waterhouse 1884): the references to the Percy Sladen insects are tabulated in Table 18.

Birds

The bird fauna of Remire shows interesting contrasts with that of the neighbouring larger island of Desroches. Neither has any native land birds, though more have been introduced to the larger island. Few migrants have been recorded on either island, though this largely reflects lack of observation. Remire has a much more diverse sea bird fauna, dominated by terns, especially Sterna fuscata, Gygis alba and Anous tenuirostris. The island was probably a more important sea bird breeding ground in the past, before mining began, and sea bird populations

Table 18. Insects recorded from Remire
by the Percy Sladen Expedition

<u>Group</u>	<u>Number of species</u>	<u>Reference</u>
Orthoptera	5	Bolivar (1912, 1924)
Dermaptera	1	Burr (1910)
Hemiptera	2	Green (1907), Distant (1909)
Lepidoptera	8	Fletcher (1910)
Coleoptera	15	Aurivillius (1922), Champion (1914), Gebien (1922), Schenkling (1922), Scott (1912, 1917, 1926), Fleutiaux (1923)
Hymenoptera	3	Cameron (1907), Forel (1907), Meade-Waldo (1912)
Diptera	3	Lamb (1912, 1914, 1922)

may have affected the vegetation and restricted it to shrubs. Ridley and Percy (1958) considered the Sooty Tern population to be in danger of extinction, and pointed out that the export of eggs had declined from 300 cases (210 000 eggs) in 1931 to 105 cases (73 500 eggs) in 1954. At the time of our visit there were no more than a few hundred terns, mainly in tall Casuarina on the southwest coast. The absence of boobies is striking.

Land birds

There are no native land birds on Remire. Four species of introduced land birds have been recorded from time to time:

Francolinus pondicerianus

Coppinger (1883, 220) found "a small red-legged partridge, which was very abundant, and afforded us some good shooting"; a specimen was collected (Bowdler-Sharpe 1884). Not recorded since.

Gallus gallus

Coppinger (1883, 220) noted domestic fowl gone wild, with chickens which "on being disturbed, rose and took to flight like pheasants". Not recorded since.

Cisticola cherina

A small active warbler, possibly this species, was seen in coastal Scaevola by Poore and Stoddart in 1968. It had the same metallic tic-tic-tic call as the Astove and Cosmoledo Cisticola. Not previously recorded.

Foudia madagascariensis

First recorded, ♂ collected, by Parker, 22 September 1967.

Shore birdsArdea cinerea

Three seen by Parker, 22 September 1967.

MigrantsSquatarola squatarola

Seen by Parker, 22 September 1967.

Charadrius leschenaultii

♀ collected by Parker, 22 September 1967.

Numenius phaeopus

Seen and recorded as common by Parker in 1967, seen by Poore and Stoddart in September 1968.

Arenaria interpres

Seen by Parker 22 September 1967.

Crocethia alba

Seen by Parker 22 September 1967.

Sea birdsPuffinus sp.

Coppinger (1883) recorded a "night petrel in burrows". There is no other record.

Phaethon lepturus

Four seen by Parker, 1967.

Fregata minor

"Frigate birds" common, roosting in coconuts (Ridley and Percy 1958, 18). Seen by Parker, 1967, and by Poore and Stoddart (probably this species) in September 1968.

Fregata ariel

Seen by Parker, September 1967.

Sterna anaethetus

♂ ♀♀♀ collected by Parker, 22 September 1967.

Sterna fuscata

Reported by Vesey-FitzGerald (1941) to breed, but population reduced and spasmodic. Ridley and Percy (1958) found 3200 pairs in two separate colonies and considered that the population could be in

danger of extinction because of excessive egg-collecting. ♂ collected by Parker, 22 September 1967. A few hundred seen by Poore and Stoddart, September 1968.

Thalasseus bergii

♂♂♀ collected by Parker, 22 September 1967, who saw about 200. seen also by Poore and Stoddart in September 1968.

Anous stolidus

♂ ♀♀ collected by Parker, 22 September 1967, and seen by Poore and Stoddart in September 1968.

Anous tenuirostris

8 ♀♀ collected by Parker on 22 September 1967. Parker reported it to be by far the most common bird on Remire, though he did not see it on the other islands he visited (these did not include African Banks). Seen also by Poore and Stoddart in September 1968.

Gygis alba

Found nesting by Vesey-FitzGerald (1941). Noted as "very common" by Parker, who collected ♂ ♀♀ on 22 September 1967. Seen by Poore and Stoddart in September 1968.

More species of shore birds, migrants and sea birds will probably be recorded, in view of the list for the Amirantes in Watson et al. (1963, 179-182).

History and Settlement

Remire was still apparently uninhabited in 1882, though discovered in 1770. Coppinger (1883), however, reports finding the ruins of a solidly built stone house in the centre of the island. Guano-mining was carried on for some years after Coppinger's visit, and was extensive in 1900 when visited by H. A'C. Bergne. Huts and a shed were built during this period (Bergne 1900). Mining was reported to be complete by 1905, according to Gardiner and Cooper (1907). The island has been visited regularly during this century for birds' eggs, but it is not known how continuous human settlement has been. In 1898 about one third of the island had been planted with about 1750 coconuts, which were doing well, together with maize and pumpkins (Bergne 1900). Messrs Baty, Bergne and Co. held the lease of Remire until 1926. In 1901 there were guano sheds and a tramway for the export of guano, and other installations included an iron house, a boat house, a store and other sheds. Of these there is now no trace. In the last few years, while the lease was held for a period by R. M. Veevers-Carter, several new buildings were erected, including a large house in Moorish style, reservoir, copra drier, and turtle pen; but when Mr Veevers-Carter moved to Astove the Seychelles Development Corporation employed only a caretaker on Remire, which was uninhabited in September 1968.

Rats have been introduced, but apart from the birds we saw no other exotic animals in 1968.

Remire has been administered as a dependency of Seychelles since 1903, and was not included in the British Indian Ocean Territory in 1965.

References

- Aurivillius, C. 1922. Coleoptera (Cerambycidae) from the Seychelles Islands, Aldabra, and Rodriguez. *Ann. Mag. Nat. Hist.*, ser. 9, 10: 421-443.
- Baker, B. H. 1963. Geology and mineral resources of the Seychelles Archipelago. *Mem. Geol. Surv. Kenya*, 3: 1-140.
- Bergne, H. A'C. 1900. Fair record of islands in the Indian Ocean. Manuscript.
- Bolivar, I. 1912. Orthoptera: Acrydiidae, Phasgonuridae, Gryllidae. *Trans. Linn. Soc. London*, ser. 2, Zool., 15: 263-292.
- 1924. Orthoptera Dictyoptera (Blattidae and Mantidae), and supplement to Gryllidae, of the Seychelles and adjacent islands. *Ann. Mag. Nat. Hist.*, ser. 9, 13: 313-359.
- Boulenger, G. A. 1909. A list of the freshwater fishes, batrachians and reptiles obtained by Mr J. Stanley Gardiner's expedition to the Indian Ocean. *Trans. Linn. Soc. London*, ser. 2, Zool., 12: 291-300.
- Bowdler-Sharpe, R. 1884. Birds. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 483-485.
- Braithwaite, C. J. R. 1968. Diagenesis of phosphatic carbonate rocks on Remire, Amirantes, Indian Ocean. *J. Sedimen. Petrol.* 38: 1194-1212.
- Budde-Lund, G. 1912. Terrestrial Isopoda, particularly considered in relation to the distribution of the southern Indo-Pacific species. *Trans. Linn. Soc. London*, ser. 2, Zool., 15: 367-394.
- Burr, M. 1910. Dermaptera. *Trans. Linn. Soc. London*, ser. 2, Zool., 14: 123-133.
- Cameron, P. 1907. Hymenoptera. *Trans. Linn. Soc. London*, ser. 2, Zool., 12: 69-86.
- Champion, G. C. 1914. Coleoptera, Curculionidae. *Trans. Linn. Soc. London*, ser. 2, Zool., 16: 393-497.

- Coppinger, R. W. 1883. Cruise of the "Alert". Four years in Patagonian, Polynesian and Mascarene waters (1878-82). London: W. Swan Sonnenschein.
- Distant, W. L. 1909. "Sealark" Rhynchota. Trans. Linn. Soc. London, ser. 2, Zool., 13: 29-48.
- Fletcher, T. B. 1910. Lepidoptera, exclusive of the Tortricidae and Tineidae, with some remarks on their distribution and means of dispersal amongst the islands of the Indian Ocean. Trans. Linn. Soc. London, ser. 2, Zool., 13: 265-323.
- Fleutiaux, E. 1923. Coleoptera: Melasidae et Elateridae des Séchelles et des îles voisines. Trans. Entom. Soc. London, 1922: 398-436.
- Forel, A. 1907. Fourmis des Seychelles, Amirantes, Farquhar et Chagos. Trans. Linn. Soc. London, ser. 2, Zool., 12: 91-94.
- Gardiner, J. S. and Cooper, C. F. 1907. Description of the Expedition, II. Trans. Linn. Soc. London, ser. 2, Zool., 12: 111-175.
- Gebien, H. 1922. Coleoptera, Heteromera: Tenebrionidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 261-324.
- Green, E. E. 1907. Notes on the Coccidae collected by the Percy Sladen Trust Expedition to the Indian Ocean, supplemented by a collection received from Mr R. Dupont, Director of Agriculture, Seychelles. Trans. Linn. Soc. London, ser. 2, Zool., 12: 197-207.
- Günther, A. 1884. Reptilia. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 486.
- Gwynne, M. D. and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M.F.R.V. "Manihine", Sept.-Oct. 1967. Atoll Res. Bull. 134: 1-15.
- Horsburgh, J. 1852. The India Directory, or, Directions of sailing to and from the East Indies, China, Australia, and the interjacent ports of Africa and South America: originally compiled from journals of the Honourable Company's Ships, and from observations and remarks, resulting from the experience of twentyone years in the navigation of these seas. London: W. H. Allen, 6th edition, 2 vols.: 1-650, 1-890.
- Lamb, C. G. 1912. Diptera: Lonchaeidae, Sapromyzidae, Ephydriidae, Chloropidae, Agromyzidae. Trans. Linn. Soc. London, ser. 2, Zool., 15: 303-348.

- Lamb, C. G. 1914. Diptera: Heteroneuridae, Ortalidae, Trypetidae, Sepsidae, Micropezidae, Drosophilidae, Geomyzidae, Milichidae. Trans. Linn. Soc. London, ser. 2, Zool., 16: 307-372.
- 1922. Diptera: Asilidae, Scenopinidae, Dolichopodidae, Pipunculidae, Syrphidae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 361-416.
- Meade-Waldo, G. 1912. Hymenoptera, Diploptera. Trans. Linn. Soc. London, ser. 2, Zool., 15: 43-44.
- Miers, E. J. 1884. Crustacea. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 513-575.
- Piggott, C. J. 1961. A report on a visit to the Outer Islands between October and November 1960. Directorate of Overseas Surveys, Land Resources Division, typescript, 1-71.
- 1968. A soil survey of Seychelles. Directorate of Overseas Surveys, Land Resources Division, Tech. Bull. 2: 1-89.
- Ridley, S. O. 1884. Spongiida. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 582-630.
- Ridley, M. W. and Percy, R. 1958. The exploitation of sea birds in the Seychelles. Colonial Res. Studies, 25.
- Schenkling, S. 1922. Coleoptera: Cleridae. Trans. Linn. Soc. London, ser. 2, Zool., 18: 325-329.
- Scott, H. 1912. Coleoptera, Lamellicornia and Adephaga. Trans. Linn. Soc. London, ser. 2, Zool., 15: 215-262.
- 1917. Corylophidae (Coleoptera) from the Seychelles and Rangoon. Ann. Mag. Nat. Hist., ser. 8, 19: 1-33.
- 1926. Coleoptera from the Seychelles and adjacent islands: Carabidae (supplement), Cryptophagidae (supplement), Dermestidae, Lymexylonidae, Rhipiceridae, Sphindidae, Throscidae, Brenthidae. Ann. Mag. Nat. Hist., ser. 9, 18: 50-76.
- Smith, E. A. 1884. Mollusca. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 487-508.
- Vesey-FitzGerald, L. D. E. F. 1941. Further contributions to the ornithology of the Seychelles Islands. Ibis, ser. 14, 5: 518-531.

Waterhouse, C. O. 1884. Coleoptera. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 576.

Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington: Smithsonian Institution.

17. PLANTS OF REMIRE (EAGLE) ISLAND, AMIRANTES

F. R. Fosberg and S. A. Renvoize

NEPHROLEPIS BISERRATA (Sw.) Schott
Gwynne & Wood 890 (EA).

CYMODOECA CILIATA Ehrenb. ex Aschers.
"4 m. s.w. of island" Gwynne & Wood 918 (EA); Gwynne & Wood 898 (K, EA).

CENCHRUS ECHINATUS L.
Stoddart & Poore 1453 (K, US); Gwynne & Wood 872 (EA, K).

DACTYLOCTENIUM AEGYPTIUM (L.) Willd.
Stoddart & Poore 1458 (K, US); Gwynne & Wood 884 (EA).

ERAGROSTIS sp.
Stoddart & Poore 1448 (K, US); Gwynne & Wood 883 (K, EA), 858 (EA).

LEPTURUS REPENS R. Br.
Gwynne & Wood 888 (EA).

STENOTAPHRUM MICRANTHUM (Desv.) C. E. Hubbard
Stoddart & Poore 1454 (K, US); 1470 (K); Gwynne & Wood 871 (K, EA).

CYPERUS AROMATICUS (Ridl.) Mattf. et Kük.
Gwynne & Wood 879 (EA), 892 (EA).

CYPERUS DUBIUS Rottb.
Gwynne & Wood 900, 885 (EA); Stoddart & Poore 1456 (K).

CYPERUS LIGULARIS L.
Stoddart & Poore 1456 (K).

FIMBRISTYLIS CYMOSA R. Br.
Gwynne & Wood 873 (EA).

COCOS NUCIFERA L.
Seen by Stoddart, 1968.

COMMELINA cf. DIFFUSA Burm. f.
Gwynne & Wood 896 (EA).

- AGAVE SISALANA Perr.
Seen by Stoddart, 1968.
- CASUARINA EQUISETIFOLIA L.
Gwynne & Wood 891 (K, EA).
- LAPORTEA AESTUANS (Gaud.) Chew
Gwynne & Wood 906 (K, EA).
- FICUS NAUTARUM Baker
Stoddart & Poore 1455 (K, US).
- BOERHAVIA DIFFUSA L.
Gwynne & Wood 877 (K, EA), 886 (EA) (both very young).
- BOERHAVIA REPENS L.
Stoddart & Poore 1452, 1474 (K).
- ACHYRANTHES ASPERA L.
Stoddart & Poore 1460 (K, US).
- AMARANTHUS DUBIUS Mart. ex. Thell.
Gwynne & Wood 860 (K, EA).
- PORTULACA OLERACEA L.
Gwynne & Wood 901 (EA); Stoddart & Poore 1471 (K).
- CASSYTHA FILIFORMIS L.
Gwynne & Wood 899 (EA).
- HERNANDIA SONORA L.
Stoddart & Poore 1445 (K, US).
- CLEOME VISCOSA L.
Gwynne & Wood 859 (K, EA); Stoddart & Poore 1442 (K, US).
- MORINGA OLEIFERA Lam.
Seen by Stoddart, 1968.
- CAESALPINIA BONDUC (L.) Roxb.?
Gwynne & Wood 864 (EA) (only distal part of leaf).
- CASSIA OCCIDENTALIS L.
Gwynne & Wood 863 (K, EA); Stoddart & Poore 1462 (K, US).
- LEUCAENA LEUCOCEPHALA (Lam.) de Wit
Stoddart & Poore 1446, 1457 (K, US); Gwynne & Wood 888 (K, EA).
- SURIANA MARITIMA L.
Seen by Stoddart, 1968.

- ACALYPHA INDICA L.
Stoddart & Poore 1459 (K, US); Gwynne & Wood 874 (K, EA).
- EUPHORBIA HIRTA L.
Gwynne & Wood 856 (K, EA); Stoddart & Poore 1463 (K).
- EUPHORBIA PROSTRATA Ait.
Gwynne & Wood 861 (EA).
- PEDILANTHUS TITHYMALOIDES (L.) Poit.
Gwynne & Wood 905 (EA) (hedge plant).
- PHYLLANTHUS AMARUS Sch. & Thonn.
Gwynne & Wood 887 (K, EA).
- PHYLLANTHUS MADERASPATENSIS L.
Gwynne & Wood 881 (K, EA); Stoddart & Poore 1468 (K, US).
- ABUTILON MAURITIANUM (Jacq.) Medic.
Gwynne & Wood 870 (EA) (so det. but sterile, could as well be
A. indicum).
- SIDA PARVIFOLIA DC.
Gwynne & Wood 855 (K, EA); Stoddart & Poore 1451 (K).
- THESPESIA POPULNEA (L.) Sol. ex Correa
Stoddart & Poore 1447 (K, US, EA); Gwynne & Wood 868 (K, EA).
- CALOPHYLLUM INOPHYLLUM L.
Stoddart & Poore 1444 (K, US); Gwynne & Wood 866 (K, EA).
- TURNERA ULMIFOLIA L.
Gwynne & Wood 897 (K, EA); Stoddart & Poore 1464 (K, US).
- PASSIFLORA SUBEROSA L.
Gwynne & Wood 876 (K, EA).
- CARICA PAPAYA L.
Seen by Stoddart, 1968.
- Unidentified Cucurbitaceae
Seen by Stoddart, 1968.
- TERMINALIA CATAPPA L.
Gwynne & Wood 907 (EA).
- CATHARANTHUS ROSEUS (L.) Don
Gwynne & Wood 857 (K, EA); Stoddart & Poore 1467 (K).

- OCHROSIA OPPOSITIFOLIA (Lam.) K. Schum.
Gwynne & Wood 893 (K, EA); Stoddart & Poore 1472 (K, US).
- IPOMOEA PES-CAPRAE (L.) R. Br.
Gwynne & Wood 894 (K, EA); Stoddart & Poore 1450 (K, US).
- CORDIA SUBCORDATA Lam.
Gwynne & Wood 867 (K, EA), 904 (EA).
- TOURNEFORTIA ARGENTEA L. f.
Gwynne & Wood 903 (K, EA).
- LIPPIA NODIFLORA (L.) Michx.
Gwynne & Wood 878 (K, EA); Stoddart & Poore 1469 (K, US).
- STACHYTARPHETA JAMAICENSIS (L.) Vahl
Stoddart & Poore 1461 (K, US); Gwynne & Wood 862 (K, EA).
- CAPSICUM FRUTESCENS L.
Stoddart & Poore 1466 (K).
- DATURA METEL L.
Gwynne & Wood 882 (EA); Stoddart & Poore 1441 (K, US).
- SOLANUM NIGRUM L.
Gwynne & Wood 879 (EA), 875 (K, EA); Stoddart & Poore 1443 (K, US).
- GUETTARDA SPECIOSA L.
Gwynne & Wood 869 (K, EA).
- SCAEVOLA TACCADA (Gaertn.) Roxb.
Gwynne & Wood 865 (EA, K) (glabrous).
- BIDENS PILOSA L.
Stoddart & Poore 1449 (K, US).
- TRIDAX PROCUMBENS L.
Gwynne & Wood 889 (K, EA); Stoddart & Poore 1473 (K, US).

18. GEOGRAPHY AND ECOLOGY OF AFRICAN BANKS

D. R. Stoddart and M. E. D. Poore

Introduction

The two small islands of African Banks are the most northerly of the Amirantes, and are situated on the eastern side of the Amirante Ridge (Baker 1963, 48-51). The ridge surface to the west carries 18-37 m of water. North Island, the larger of the two African Banks, is 275 m long and 45-90 m wide; South Island is 230 m long and 70 m wide. The islands are 2.9 km apart, and only South Island could be visited in 1968. The reef edge lies 450-800 m east of the cays; to the south and west there is a wide area of shoal water with reef patches.

The islands are much smaller, and presumably less stable, than others in the western Indian Ocean that have been considered in these reports. Horsburgh (1809, 127) reported that "they are almost overflowed at high water spring tides", and Coppinger (1883, 219) described one of them (?North Island) as a low flat elliptical cay, built of foraminiferal sand, with "upraised coral sandstone" at its northern end, "grooved and honeycombed into various fantastic shapes". Baker (1963, 50) mentions relict beachrock extending up to 1.1 km north of South Island, indicating considerable shifting of position.

Table 19 lists scientific visitors to the cays. Apart from H.M.S. Alert, all have been concerned with the bird fauna. The Percy Sladen Expedition did not call there.

Vegetation

The vegetation of South Island consists of scattered bushes of Tournefortia argentea, Suriana maritima and Scaevola taccada, all less than 2 m tall, with a single coconut and some gnarled trees of Tournefortia and a sparse and patchy ground cover of grasses, sedges, herbs and vines. Large areas of the ground are quite bare. On the seaward beach crest, which is subject to overtopping by waves, there is a patch of Paspalum distichum. The ground cover over the rest of the island consists of patches of two species of Portulaca (a small form, P. cf. australis, and a much larger fleshy form), Boerhavia repens, Tribulus cistoides, Achyranthes aspera, Sida parvifolia, the sedge Cyperus ligularis, and the grasses Dactyloctenium aegyptium and Lepturus

Table 19. Scientific studies at African Banks

<u>Date</u>	<u>Study</u>	<u>Reference</u>
1771	Survey by M. de la Biollière*	
1801	Wreck of H.M.S. <u>Spitfire</u>	
1821	Visit by H.M.S. <u>Menai</u> , Lt. Hay, to North Island	
1882	H.M.S. <u>Alert</u> , R. Coppinger, North Island: birds, general observations	Coppinger (1883); Coppinger and others (1884)
1937 Sept. 8, Nov.	D. Vesey-FitzGerald: sea birds	Vesey-FitzGerald (1941)
1955 July 5, Aug. 17	Viscount Ridley and Lord Richard Percy: sea birds	Ridley and Percy (1958)
1968 Sept. 26	M. E. D. Poore and D. R. Stoddart general observations, plant collection on South Island	This report

*Lionnet (this issue, Appendix) dates their discovery as 1797.

repens. Cassytha filiformis is widespread, and completely smothers some moribund Scaevola bushes at the southern end. The absence of Stachytarpheta may be remarked.

Coppinger (1883, 219), on the island he visited, mentions "scrubby grass and low bushes of the same character as those at Bird Island i.e. Tournefortia", with some juvenile Barringtonia but no other tree species.

Fauna other than Birds

The fauna of African Banks is dominated by birds and marine life; the islands are too small and ephemeral for any large land fauna to have established itself. The Alert collected 11 species of marine Mollusca (Smith 1884), two species of sponge (Ridley 1884), and two crabs, including Coenobita (Miers 1884). Horsburgh (1809, 127) said that African Banks "abound with turtle and aquatic birds, but are destitute of fresh water". Coppinger (1883, 219) found turtle nests but saw no turtle. He also mentions Ocypode. Rothschild (1915) stated that the Giant Land Tortoise was found on African Banks in the seventeenth and eighteenth centuries, but this is certainly an error, unless it refers to an occasional specimen landed from a passing ship.

Birds

The bird fauna is dominated by breeding colonies of terns, particularly Sooty Terns and Noddies.

Shore birdsArdea cinerea

Two nests in coconuts recorded on North Island by Ridley and Percy (1958, 17).

MigrantsArenaria interpres

Seen on South Island by Poore and Stoddart, September 1968.

Dromas ardeola

Seen on South Island by Poore and Stoddart, September 1968.

Sea birdsPhaethon aethereus

Sighted from ship off South Island by Poore and Stoddart, September 1968.

Sula sula

Unfledged gannets recorded by Coppinger (1883) and immature wanderers by Vesey-FitzGerald (1941) on 8 September 1937. Booby population said to be negligible by Ridley and Percy (1958).

Sterna dougallii

Breeds on North Island (Ridley and Percy 1958).

Sterna sumatrana

Collected by Coppinger in 1882 (Bowdler-Sharpe 1884, as S. melanauchen). Recorded as nesting on South Island (Vesey-FitzGerald 1941), and as breeding on North Island with a few pairs on South Island by Ridley and Percy (1958). Seen on South Island by Poore and Stoddart in 1968.

Sterna fuscata

Recorded as breeding by Vesey-FitzGerald (1941), and as breeding on North but no longer on South Island by Ridley and Percy (1958), who reported a total population of 43,300 in 1955. Breeding on South Island in large numbers in September 1968.

Sterna albifrons

Recorded by Vesey-FitzGerald (1941).

Thalasseus bergii

Breeding in November on North Island (Vesey-FitzGerald 1941), and again recorded as breeding on North Island by Ridley and Percy (1958). Present on South Island in September 1968.

Anous stolidus

Breeds on the ground with the Sooty Tern (Vesey-FitzGerald 1941). Breeds mainly on North Island, according to Ridley and Percy (1958), but 70 pairs of noddies nesting in bushes on South Island, total population 5900 in 1955. Present in large numbers on South Island in September 1968, mainly in trees and bushes, in contrast to the Sooty Tern which was mainly on the ground.

Anous tenuirostris

Breeding on South Island in September 1968, identified by head colour and by egg pattern, though difficult to distinguish when on the wing from A. stolidus. Nesting in a Scaevola bush.

Gygis alba

Seen at sea near South Island, probably a stray from Remire.

The sea bird colonies have been much affected by their proximity to Mahé, and the population has seriously declined in recent years. Ridley and Percy (1958) state that the egg export in 1931 was 2000 cases (1.4 million eggs), but that it had fallen by 1954 to 108 cases (75, 600 eggs). The egg industry is now controlled by legislation in the Seychelles.

History and Settlement

The northern islands of the Amirantes were first surveyed in 1771 by M. de la Biollière. H.M.S. Spitfire was wrecked on South Island on 21 August 1801, and Lieut. Campbell went in a small boat to Mahé to seek help. He arrived there on 2 September, and the Spitfire's crew was rescued by H.M.S. Sybille.

It is unlikely that there has been any permanent settlement on either island. There is a small hut on South Island, used by fishermen and egg collectors, but no-one was living there in September 1968.

African Banks have formed part of the Colony of Seychelles since 1903, and were previously under the administration of Maritius.

References

- Baker, B. H. 1963. Geology and mineral resources of the Seychelles Archipelago. Mem. Geol. Surv. Kenya, 3: 1-140.
- Bowdler-Sharpe, R. 1884. Birds. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 483-485.
- Coppinger, R. W. 1883. Cruise of the "Alert". Four years in Patagonian, Polynesian, and Mascarene waters (1878-82). London: W. Swan Sonnenschein.

- [Coppinger, R. W., and others.] 1884. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2. London: British Museum (Natural History).
- Horsburgh, J. 1809. Directions for sailing to and from the East Indies, China, New Holland, Cape of Good Hope, and the interjacent points. Part first. London: Black, Parry and Kingsbury, 1-397.
- Miers, E. J. 1884. Crustacea. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 513-575.
- Ridley, S. O. 1884. Spongiida. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 582-630.
- Ridley, M. W. and Percy, R. 1958. The exploitation of sea birds in the Seychelles. Colonial Res. Studies, 25.
- Rothschild, W. 1915. On the gigantic land-tortoises of the Seychelles and Aldabra-Madagascar group, with some notes on certain forms of the Mascarene group. Novitates Zool. 22: 418-442.
- Smith, E. A. 1884. Mollusca. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881-2 (London: British Museum), 487-508.
- Vesey-FitzGerald, L. D. E. F. 1941. Further contributions to the ornithology of the Seychelles Islands. Ibis, ser. 14, 5: 518-531.

19. PLANTS OF AFRICAN BANKS (ILES AFRICAINES)

F. R. Fosberg and S. A. Renvoize

- DACTYLOCTENIUM AEGYPTIUM (L.) Willd.
Southern I., Stoddart & Poore 1434 (K, US).
- LEPTURUS REPENS R. Br.
Southern I., Stoddart & Poore 1438 (K).
- PASPALUM DISTICHUM L.
Southern I., Stoddart & Poore 1435 (K).
- CYPERUS LIGULARIS L.
Southern I., Stoddart & Poore 1432 (K).
- COCOS NUCIFERA L.
Seen by Stoddart, 1968.
- BOERHAVIA REPENS L.
Southern I., Stoddart & Poore 1431 (K, US).
- ACHYRANTHES ASPERA L.
Southern I., Stoddart & Poore 1437 (K, US).
- PORTULACA cf. AUSTRALIS Endl.
Southern I., Stoddart & Poore 1439 (K).
- PORTULACA cf. OLERACEA L.
Seen by Stoddart, 1968.
- CASSYTHA FILIFORMIS L.
Seen by Stoddart, 1968.
- TRIBULUS CISTOIDES L.
Southern I., Stoddart & Poore 1436 (K, US).
- SURIANA MARITIMA L.
Southern I., Stoddart & Poore 1433 (K, US).
- SIDA PARVIFOLIA DC.
Southern I., Stoddart & Poore 1440 (K).

194

TOURNEFORTIA ARGENTEA L. f.
Seen by Stoddart, 1968.

SCAEVOLA TACCADA (Gaertn.) Roxb.
Seen by Stoddart, 1968.

20. AN INTRODUCTION OF STREPTOPELIA PICTURATA
INTO THE AMIRANTES

C. W. Benson

On 23 September 1967 I. S. C. Parker collected for the National Museum of Kenya, Nairobi, two specimens of the Malagasy Turtledove Streptopelia picturata on St Joseph Atoll, in the Amirantes (see map in Watson et al. 1963, 179). Thanks to R. H. Carcasson and A. D. Forbes-Watson, I have had the loan of them, and they have been donated to the British Museum (Natural History).

Both are sexed as females. They have been compared with material of the grey-headed S. p. picturata (Temminck), of Malagasy, in the British Museum (Natural History), from which in colour they do not differ. But in wing-length (144, 154 mm) they are smaller, Benson (1967, 79) giving a range of 158-170 (mean 166.7) mm for 14 Malagasy females, 165-177 (mean 172.5)mm for 12 Malagasy males. They appear to represent a recent introduction--more likely artificial than natural--from the Seychelles. S. p. picturata was artificially introduced into the Seychelles in the nineteenth century, as recently discussed by Penny (1968, 271). It has there hybridised extensively with the endemic S. p. rostrata (Bonaparte), which in addition to colour-differences, including a vinous head, is smaller. Thus Benson (1967, 79) gives the wing-length of two females as 146, 147 mm only. Those of Parker's two specimens suggest that they do not represent true S. p. picturata but are the result of some hybridisation with rostrata. Some further particulars of them are as follows:

	Larger specimen (wing 154 mm)	Smaller specimen (wing 144 mm)
Weight	135 g	110 g
Irides	pale brown	pale brown
Skin around eye	maroon	-
Bill	horn-grey, base deep maroon	pale horn-grey, soft parts tinged maroon
Feet	dull maroon	dull maroon

Information is very desirable on the extent of this introduction into the Amirantes, where there is an endemic, vinous-headed, subspecies, S. p. saturata (Ridgway), discussed by Benson (1967, 76). Parker had informed me that one of the specimens he collected was with a vinous-headed bird. He was on St Joseph Atoll for less than a day, and so

cannot provide any information on the extent of the introduction of S. p. picturata. There is no information about saturata beyond that provided from specimens. W. L. Abbott collected it in 1892 on Ile Poivre, slightly to the south of St Joseph, and on Alphonse, 47 miles (76 km) south of the Amirantes proper (Ridgway 1895, 517).

References

- Benson, C. W. 1967. The birds of Aldabra and their status. Atoll Res. Bull. 118: 63-111.
- Penny, M. 1968. Endemic birds of the Seychelles. Oryx, 9: 267-275.
- Ridgway, R. 1895. On birds collected by Doctor W. L. Abbott in the Seychelles, Amirantes, Gloriosa, Assumption, Aldabra, and adjacent islands, with notes on habits, etc., by the collector. Proc. U.S. Nat. Mus. 18: 509-546 (actual date of publication June 24, 1896).
- Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington: Smithsonian Institution.

21. GEOGRAPHY AND ECOLOGY OF TROMELIN ISLAND

France Staub

Introduction

Location

Tromelin Island, a dependency of Réunion Island, is located at 15°52' South and 54°25' East, 390 km east of Antongil Bay, Madagascar, and 480 km north-northwest of Mauritius. Cargados Carajos shoals are about 480 km due east.

Topography

The pear-shaped island measures 1750 meters in length and about three quarters of this distance at its greatest width (Paulian 1955). It consists of coral sand piled up on a coral reef substratum rising to an approximate height of six metres above the high water mark in the northwestern region. The whole structure crowns an abruptly rising submarine cone towering from abyssal depths of about 2500 fathoms. The island profile slopes gently from the highest point in the north-west to the south-east. To the west, a band of raised reef of the "platin" type, met with in some of the Cargados Carajos islets, fringes the beach, passing to the south-east into a belt of coral blocks piled up by the action of heavy swell and breakers driven by the trade winds. On the lee side, sandy beaches occur with formation of small sand dunes. Reefs girdle the island at about 150 metres from the coast and are interrupted by a pass opposite the north-western coast. Access however to the islet is rather difficult and the landing of material for the construction of the meteorological station proved a hazardous operation. The airstrip runs along the long axis of the island.

History

Tromelin Island was first sighted by Captain Briand de la Feuillée on board the Diane in 1722 and was called Sandy Island (Bourde 1934). On the 21st of November, 1776, the Chevalier de Tromelin sailing in La Dauphine and returning from a voyage of exploration to Madagascar rediscovered the island to which he gave his name. He managed to pick up the seven women survivors from the ship L'Utile, wrecked in the vicinity fifteen years before and brought them safely back to Mauritius (Gardiner and Cooper 1907).

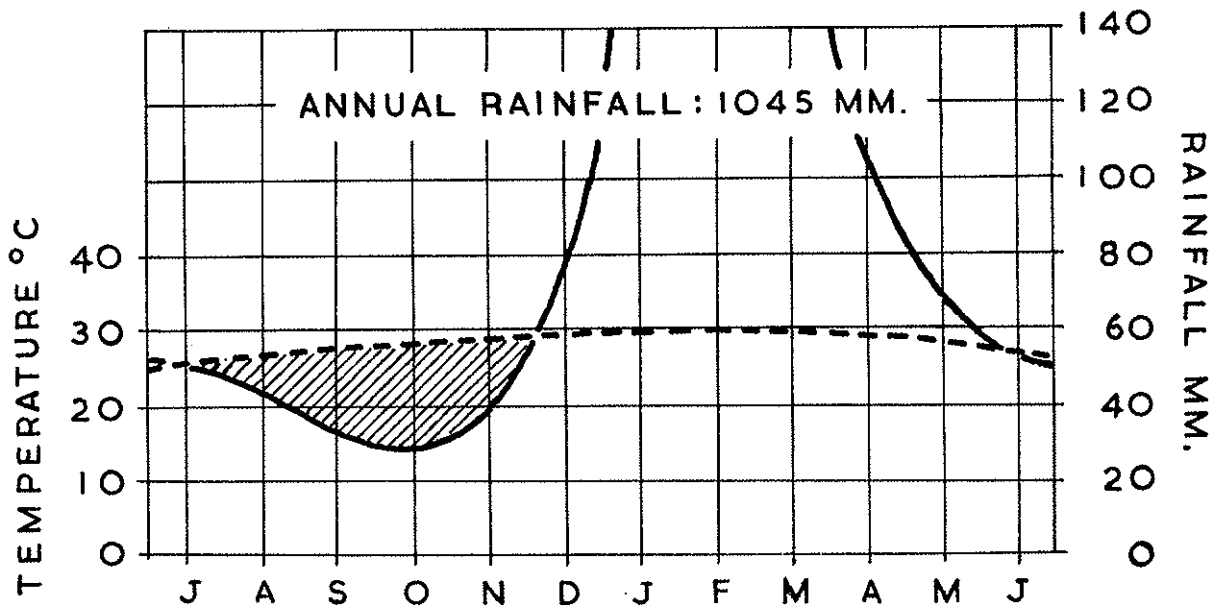


Fig. 9. Ombrothermic diagram for Tromelin

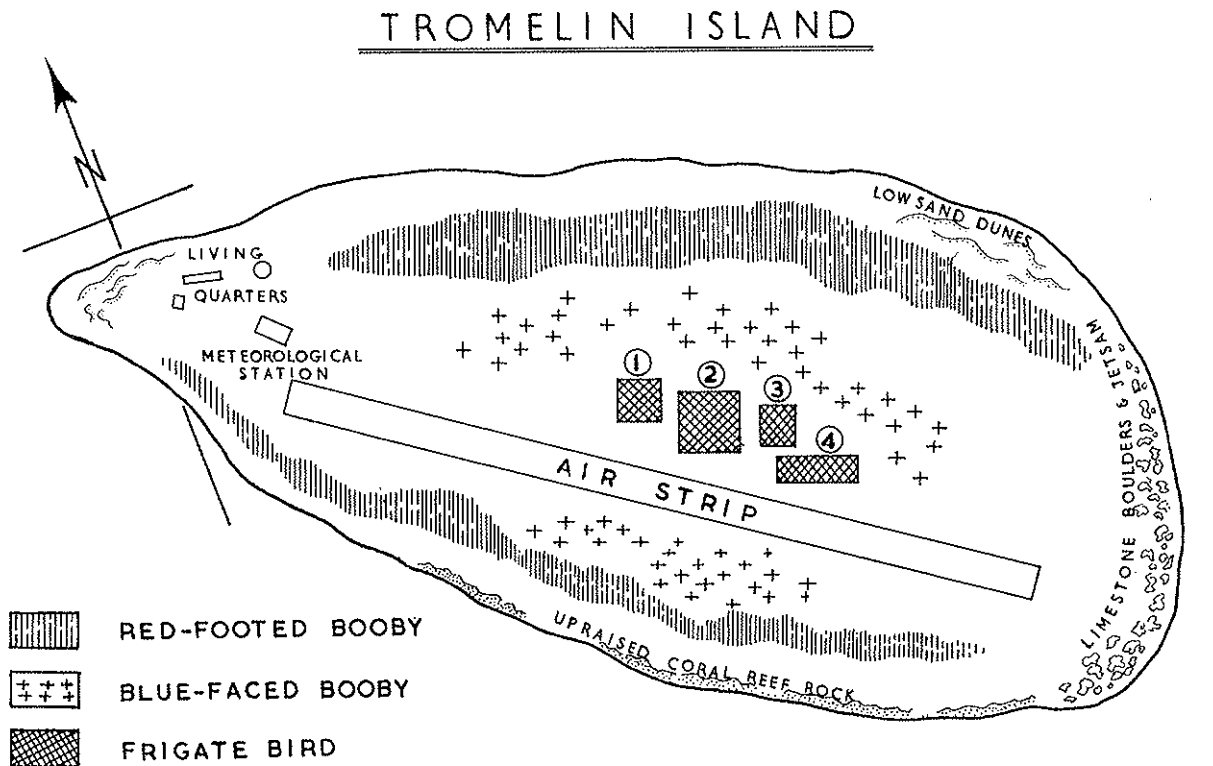
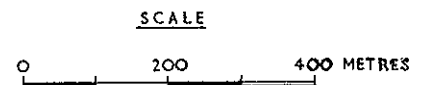


Fig. 10. Tromelin, showing distribution of breeding bird colonies



Climate

In May 1954, a meteorological station was built on Tromelin Island (Platon 1956, Pretceille 1955). It was enlarged later. It is important for the air and sea traffic in this southern part of the Indian Ocean because it is situated in the cyclone zone of the Agalega-Cargados Carajos region where the tracks of cyclones often assume their southern curvature.

The following weather data for the period 1955-1968, obtained from the Meteorological Department, Réunion, through the kindness of Mr. E. Davy, Director of the Meteorological Department, Mauritius, is given in Table 20. An ombrothermic diagram (Fig. 9) is also included interpreting these figures following the method advocated by Bagnouls and Gaussen (1953). A dry cool season extending from July to mid-November prevails, followed by unstable weather with high precipitation during the cyclonic season when the rainfall may exceed 190 mm.

Objectives and description of visit

The aims of the visit were mainly to study, within the limits of the very short time available, the avifauna and vegetation of the islet and to obtain plant material for the Mauritius Herbarium.

We landed from the military plane, which links up Tromelin once every two months with Réunion Island, on the 29th of August 1968 at about 9.30 a.m. and left the next day at 2.15 p.m. having enjoyed the hospitality and comfortable quarters of the meteorological station. In spite of occasional showers passing over with the southeast trade winds, about fifteen hours field work were accomplished. A short 8 mm film on Kodachrome II was made of the nesting bird colonies and a fair amount of photographs both in colour and in black and white were obtained. Ornithological observations and collection of plant specimens were made, with special reference to studies by previous visitors.

Previous studies at Tromelin Island

In November 1953, R. Paulian visited the island, together with a party from Madagascar who came to study the possibilities of building a weather station there. During his two-day visit, he studied the entomological fauna and listed 28 insect species (Paulian 1955). Following the erection of the present station in May 1954, E. Brygoo accompanied the first relieving party in November of the same year. He ringed a hundred Red-footed Boobies and later published his observations on the avifauna (Brygoo 1955). On the 23rd February, 1962, R. O. Morris on board H.M.S. Owen paid a brief visit to the island and subsequently published a report about its avifauna (Morris 1964).

Table 20. Meteorological data, mean monthly figures 1955-1968, Tromelin

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.
Rainfall, mm	175.8	146.0	193.3	109.3	68.0	53.3	61.8	46.8	33.2	29.2	50.3	78.1
Number of rainy days per month	12	14	15	12	10	11	12	12	9	7	6	10
Maximum temperature °C	30.0	30.0	29.9	29.3	28.2	26.9	25.9	25.8	26.4	27.3	28.3	29.7
Minimum temperature °C	25.0	25.3	25.1	24.7	23.5	22.1	21.1	20.8	21.3	22.2	23.6	24.8
Pressure at sea level (millibars)	1010.4	1009.5	1010.7	1012.0	1014.5	1016.8	1017.7	1018.1	1017.6	1016.7	1014.4	1012.3
Humidity %	82	82	83	82	80	82	82	82	82	81	82	81
Insolation (hours) (period 1960-1968)	254.5	235.6	244.2	244.4	247.2	234.4	228.7	233.6	250.1	268.5	272.2	292.0

Vegetation

The vegetation consists mainly of two communities as shown in Plate 45. These are: (1) A Tournefortia argentea L. f. shrubbery, one half to one metre high, extending around the island but becoming more scattered towards the centre, that is, along both sides of the airstrip. Towards the north-western end, some Tournefortia trees may reach two and a half metres, (2) an herb-mat consisting mostly of Boerhavia diffusa L. along with scattered colonies of Sida cf. grewioides Guill. et. Perr., with occasional clumps of Portulaca oleracea L. The first plant to colonise the airstrip after weeding is usually the species of Sida mentioned above.

R. Paulian noted the rare occurrence of Achyranthes aspera L. and Ipomoea pes-caprae L. but we did not find the two plants during our short visit. The presence of rabbits recently introduced and now feral, may account for the absence or rarity of these species which are very common on Cargados Carajos 480 km due East, from where birds, wind, and currents could probably transport to Tromelin a supply of seeds or torn strands. About a dozen coconut trees have been introduced and planted along the track to the meteorological station.

Marine fauna

In the short time available, it was not possible to study in any detail the marine fauna. However, tracks left by turtles coming to lay their eggs were quite frequent on the northern beaches and these were said to be mostly green turtles (Chelonia mydas L.) by the staff members. The Hawksbill or Caret (Eretmochelys imbricata L.) was reported to be scarcer. The capture of a Jackfish (Caranx sp.) on hook and line was witnessed on the east coast of the island. The small extent of the lagoon and the rapid deepening of the waters outside the reef would possibly not sustain a richly varied marine life. Pelagic fish would probably be more often encountered.

Fauna other than birds

A few rats were seen hiding in the shade of the Tournefortia bushes during the day. R. Paulian notes that rats (Rattus norvegicus L.) and mice (Mus musculus L.) were swarming in the southern part of the island in 1953. We found that their number seemed to have been very much reduced, probably due to pest control. There were however quite a number of rabbits all over the island, congregating on the more protected northern side.

Great numbers of hermit-crabs, housed mostly in the shells of Turbo argyrostomus L. were observed at dusk climbing the Tournefortia shrubs. They preyed upon the caterpillars of an insect, Utetheisa pulchelloides Hampson (sensu Jordan 1938), which were themselves actively feeding on leaves of the latter plants.

Insects of Tromelin

The following list records the insects known from the islet and was kindly compiled by Mr. Raymond Mamet, Sugar Industry Research Institute, Mauritius:

Collembola

One undetermined species.

Thysanura

One undetermined species

Orthoptera

Periplaneta americana L. (cosmopolitan)

Blatta orientalis L. (tropicopolitan)

Symploie sp.

Embioptera

Oligotoma saundersi Westw. under bark of Tournefortia (cosmopolitan)

Isoptera

Cryptotermes domesticus Hav. (Ceylon, Eastern Indian Ocean and Pacific Ocean up to Panama)

Psocoptera

One undetermined species.

Hemiptera

Creontiades pallidus Ramb. (Continental Africa, Arabia, Madagascar, Mediterranean region)

Stenarus leucochilus Reuter on Tournefortia (East Africa, Pemba Islands, Madagascar, Mauritius)

Geocoris insularis China (endemic)

Pictinus pauliani China on Tournefortia (endemic)

Homoptera

Igerna bimaculicollis Stål on Tournefortia (South Africa, Kilimandjaro, Madagascar)

Pulvinaria tromelini Mamet on Achyranthes aspera (endemic)

Coleoptera

Cratopus adpersus Wat. on Tournefortia (Amirantes, Chagos, Coetivy, Seychelles, Farquhar, Cargados Carajos, Aldabra, Astove, Cosmoledo, Assumption, Maldives)

Dryotribus mimeticus Horn on dead wood of Tournefortia (Florida, West Indies, Galapagos, Hawaii, Adèle and Nyew Tyew Islands, North Western Australia, Chekiang)

Stephanoderes vulgaris Schauf. on dead wood of Tournefortia (Madagascar)

HymenopteraPheidole megacephala F. (wide distribution)Apanteles sp. near sphingivorus Granger. A parasite of Utetheisa (Lepid.) (Madagascar)LepidopteraUtetheisa pulchelloides Hampson (sensu Jordan 1938) on Tournefortia (Africa, throughout Indian Ocean up to Gilbert Isls.)Loxostege coelatalis Walk. (Ceylon)DipteraSichopogon reginaldi Séguy (endemic)Ornithoctona plicililis van Olfers. Host: probably frigate birds (Mauritius, Philippines, New Hebrides, Samoa, Comoros, Madagascar)Sarcophaga spinosa Villn. (Mediterranean region)Sarcophaga sp.Acanthonotiphila scotti Séguy on inflorescences of Tournefortia (endemic)Hippelates longiseta Lamb. on inflorescences of Tournefortia (Seychelles, Amirantes, Cargados Carajos)Siphunculina signata Woll. (Madeira, Cargados Carajos).Birds

At our time of visit, the bird population of Tromelin Island comprised the following nesting species: the Red-footed Booby, the Masked or Blue-faced Booby and the Great Frigate Bird.

Sula sula rubripes

Red-footed Booby

In 1954, E. Brygoo noted about 200 nesting pairs scattered on the Tournefortia bushes, some nesting alongside the Frigates. Of 100 nests inspected, two thirds were occupied by the "white" form, the rest by the "brown and white" form. R. O. Morris in February counted from 150 to 300 individuals. In August 1968, our estimates for the northern half of the island as assessed by the census of occupied nests along 100 x 5 metres of the Tournefortia belt were about 300 pairs, compared with 200 pairs for the southern half (Fig. 10). About one third of the observed birds were of the "brown and white" form. It is interesting to note that R. Newton (1958) found about 4 per cent nesting "brown" forms on Ile Albatros at Cargados Carajos in January 1956, in an overall population of three hundred. It is a pity he did not describe this form, as Red-footed Boobies have now disappeared there probably through the depredations of feral cats. Our discovery of a pair of the "white" form roosting on South Island of the Cargados Carajos, in April 1968 might suggest the possibility of recolonisation from Tromelin Island.

As to their nesting habits, the Red-footed Boobies of Tromelin build on top the Tournefortia bushes. Nests are two thirds to one metre apart and made up of Boerhavia strands with a lining of Tournefortia leaves on which the egg is deposited. Brygoo in 1954 found the lining

to have been of Ipomoea pes-caprae leaves. A few egg measurements were taken. In spite of the meagre data obtained, the eggs from the "brown and white" form do appear more slender as shown by the figures given below:

<u>Eggs under "brown and white" form</u>			<u>Eggs under "white" form</u>		
cm			cm		
5.4	x	3.7	6.3	x	4.2
5.2	x	3.7	5.9	x	3.8
5.2	x	3.7	6.2	x	3.7
5.9	x	3.8	6.0	x	4.0
5.9	x	3.8	6.3	x	3.9
5.4	x	3.7			

Colour variation

All the forms of the versatile Red-footed Booby were observed, from naked or fluffy chick that looked as big as its parent, to the two adult forms. It might prove useful to describe its morphology in the light of previous studies made on this same species by Nelson (1968) as occurring in the Galapagos on Tower Island. There they nest, about two metres distant from one another, on the Cryptocarpus shrubs.

At Tromelin the following variations in plumage occur as follows:
 Chick: naked, later covered with fluffy white down.
 Juvenile: has fledged to chocolate brown form. Bill black, feet dark khaki, eyes clear yellow.
 First adult form: Golden brown above, light brown beneath, back streaked with white to all degrees. Rump, tail and underpart of tail pure white. Bill now turned blue. The fleshy part of the head deep pink. Eyes dark brown. The head is tinted a golden hue. The feet now bright red. The gular spot is black.
 Second adult form: All white plumage with black primaries. Head suffused with yellow. Fleshy part of the head, bill and feet as of first adult form. The gular spot is velvety black.

The species at Tromelin as described above seems very much like its Galapagos counterpart. It is only in the first adult form that differences occur as to plumage colouration, the Tower Island first adult form being basically brown sometimes with white scapular markings (Nelson 1968). The question whether the first "brown" adult form completes its change to the second "white" adult form is still uncertain. This would require continuous observation of ringed birds in the field for a number of years (Plate 44).

Skins from a "juvenile brown" and a "brown and white" form were prepared and later presented to the Mauritius Institute, Port Louis. Their measurements are given below:

	♀ "juvenile brown" cm	♀ "brown and white" cm
Culmen	8.6	8.7
Tail	20.0	20.0
Wing	37.0	38.6
Tarsus	4.6	4.7
Weight (g)	900	900

Feeding

We noted that the chicks and juveniles regurgitated mainly flying fish when disturbed just as they did at the Galapagos as noted by Nelson. Rich fishing grounds in the vicinity of Tromelin Island exist for these birds and R. O. Morris noticed that they were very active only twenty miles away.

Sula dactylatra melanops

"Blue-faced Booby"

This species occupied about fifty nest sites scattered along both the north and south of the airstrip near the central part of the island as shown in Fig. 10. Few eggs were seen, two in a nest being more common than one. About fifteen chicks, just hatched or with down, were being attended by a parent. They were obviously half way through the off period season when breeding is at its lowest. No juveniles were observed and the majority of the colony was apparently keeping to the high seas feeding. As at the Cargados Carajos the peak period of reproduction is probably from November to March as reported by previous visitors.

The "meeting ceremony" of the male relieving a female with chick was filmed while they jabbed at each other before assuming the "parallel standing" illustrated and described by Nelson at the Galapagos. Like the Red-footed Boobies, they were attacked and robbed of their food bolus by the Frigate Birds.

Fregata minor

"Great Frigate Bird"

Although both species of the often associated Frigate birds, F. minor and F. ariel iredalei, have been noted flying over Tromelin Island by R. O. Morris in February 1962, only one species, F. minor was noticed just starting its nesting season. On this late August visit in 1968, the males had an extended gular pouch, a few eggs had already been laid.

In the Cargados Carajos F. ariel iredalei was observed starting its nesting in late April (Staub and Guého 1968) at the onset of the dry cool season. F. minor starts probably later there. The juveniles of both species were nearly all gone from the breeding grounds by April-May the following year. It is surprising that living in identical climates, the F. ariel iredalei of Tromelin Island had not set to breeding by late

Table 22. Breeding birds and occasional visitors, Tromelin

	E. Brygoo Nov. 1954	R.O.Morris Feb. 1962	F. Staub Aug.1968
<u>Breeding Birds</u>			
Fregatidae			
<u>Fregata ariel iredalei</u> Lesser Frigate bird	X ?	X	
<u>Fregata minor</u> Great Frigate bird	X ?	X	X
Sulidae			
<u>Sula dactylatra melanops</u> Blue-faced Booby	X	X	X
<u>Sula sula rubripes</u> Red-footed Booby	X	X	X
<u>Migrants and occasional visitors</u>			
Laridae			
<u>Sterna dougalli</u> Roseate Tern	X ?		
<u>Erolia testacea</u> Curlew Sand-Piper	X ?		
<u>Numenius phaeopus</u> Whimbrel			X
Phoenicopteridae			
<u>Phoenicopteros</u> sp. Flamingo	X		

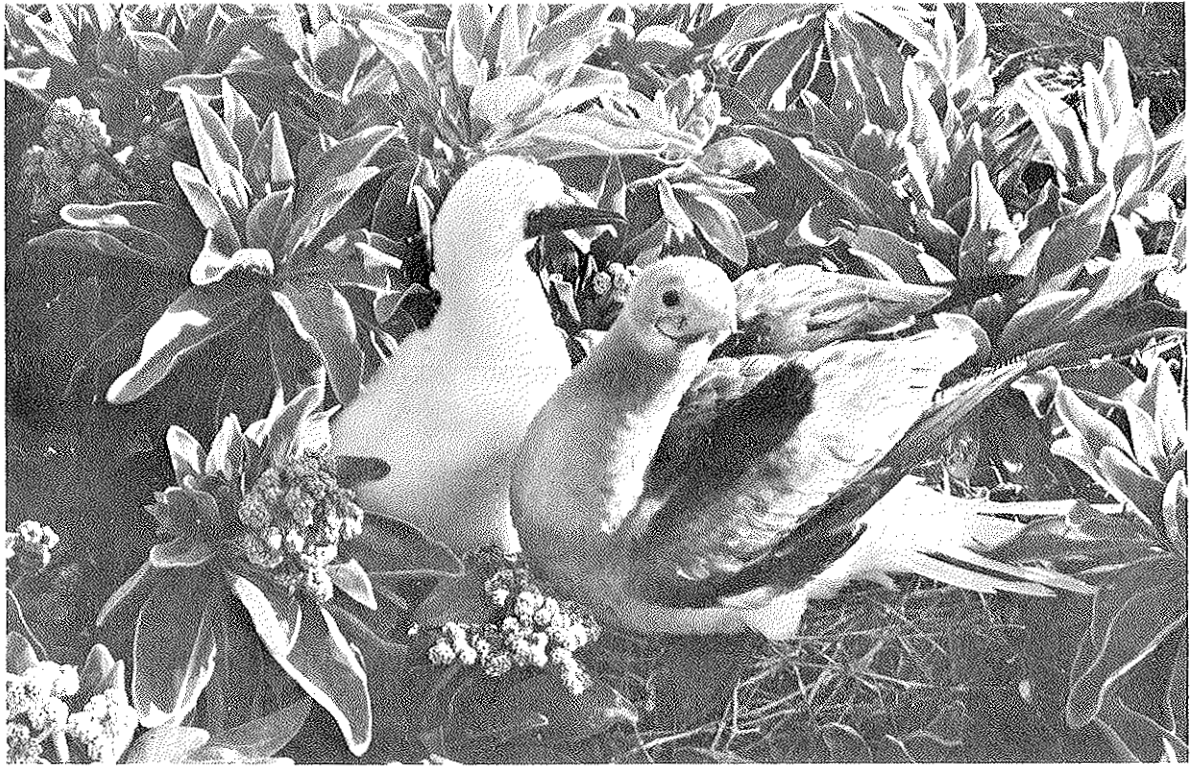
N.B. X identified species
X ? unidentified species

Acknowledgments

We are grateful to Mr. Edwin Davy, director of the Meteorological Services, Mauritius, whose help made the visit possible, to Mr. Trendel, Director of the Réunion Meteorological Services and to Mr. Malik, assistant-director, who made arrangements for the journey. Our thanks are due to Dr. R. E. Vaughan, Curator of the Mauritius Herbarium for helpful suggestions, to Mr. R. Mamet from the Mauritius Sugar Research Institute who compiled the list of insects and to Mr. J. Guého who has kindly plotted the ombrothermic curve from the meteorological data and drawn the sketch map.

References

- Alexander, W. B. 1928. Birds of the ocean. A handbook for voyagers. London.
- Bagnouls, F. and Gaussen, H. 1953. Saison sèche et indice xérothermique. Bull. Soc. Hist. Nat. Toulouse 88: 193-239.
- Bourde de la Rogerie, H. 1934. Les Bretons aux Iles de France et de Bourbon au XVII^{ème} et au XVIII^{ème} siècles. Rennes, Imp. Oberthur.
- Brygoo, E. 1955. Observations sur les oiseaux de Tromelin. Le Naturaliste Malgache, 7 (2): 209-214.
- China, W. E. 1955. Hemiptera of the Island of Tromelin. Le Naturaliste Malgache, 7: 13-18.
- Gardiner, J. S. and Cooper, C. F. 1907. Description of the Expedition, II. Trans. Linn. Soc. London, ser. 2, Zool., 12: 111-175 (foot-note p. 127, by Abbé Rochon).
- Mamet, J. R. 1956. Miscellaneous Coccid studies (Homoptera). 3. A new species of Coccoidea from Tromelin Island. Le Naturaliste Malgache, 8: 138-140.
- Morris, R. O. 1964. Sea Swallow 16: 76-77.
- Nelson, B. 1968. Galapagos, islands of birds. Longmans, London.
- Newton, R. 1958. Ornithological notes on Mauritius and the Cargados Carajos Archipelago. Proc. R. Soc. Arts. Sci. Maurit. 2: 39-71.
- Paulian, R. 1955. Observations sur la faune terrestre de l'Ile Tromelin. Le Naturaliste Malgache, 7 (1): 1-18.
- Platon, P. 1956. A l'Ile Tromelin. Rev. Madagascar, 26: 46-58.
- Pocklington, R. 1965. Birds seen on Coco Island, Cargados Carajos Shoals, Indian Ocean. The Ibis, 107: 387.
- Pretceille, M. 1955. Petites îles qui deviennent grandes. Geographia, 48: 33-36.
- Séguy, E. 1955. Diptères de l'Ile Tromelin. Le Naturaliste Malgache, 7: 8-12.
- Staub, F. and Guého, J. 1968. The Cargados Carajos Shoals or St. Brandon: Resources, avifauna and vegetation. Proc. R. Soc. Arts. Sci. Maurit. 3(1): 7-46.



44. Sula sula rubripes: chick with "brown and white" parents



45. Sula sula rubripes: chick nearly fledged to "brown" juvenile form



46. Sula sula rubripes: "brown" juvenile



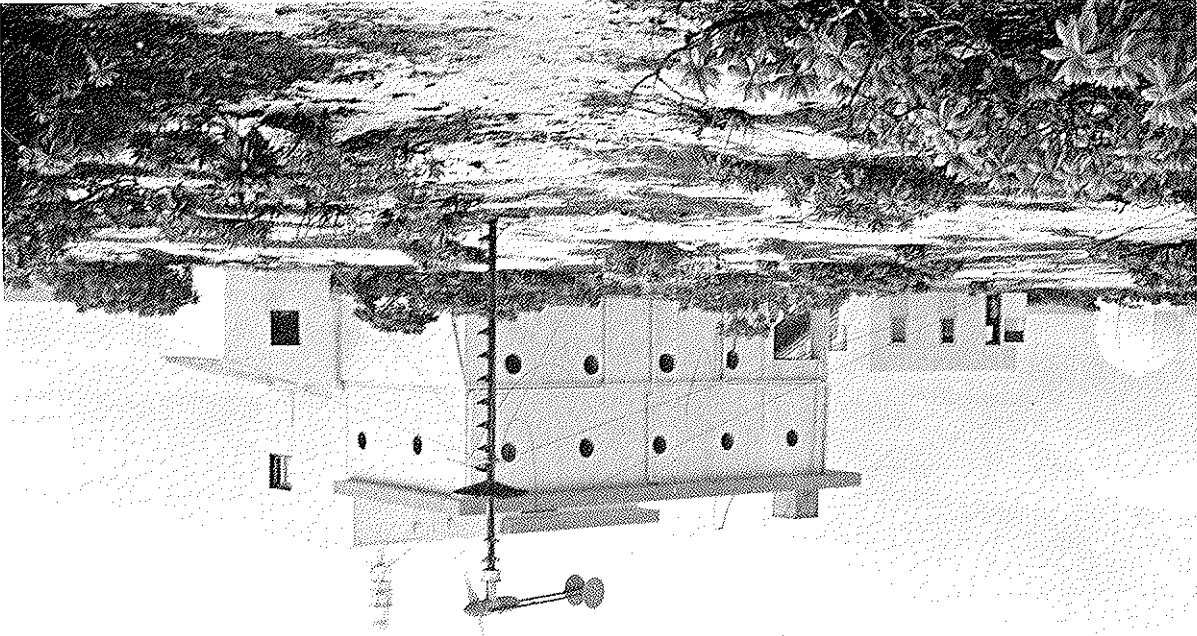
47. Sula sula rubripes: adult "brown and white" form with few white scapular markings.



48. Sula sula rubripes: adult "brown and white" form with back nearly white

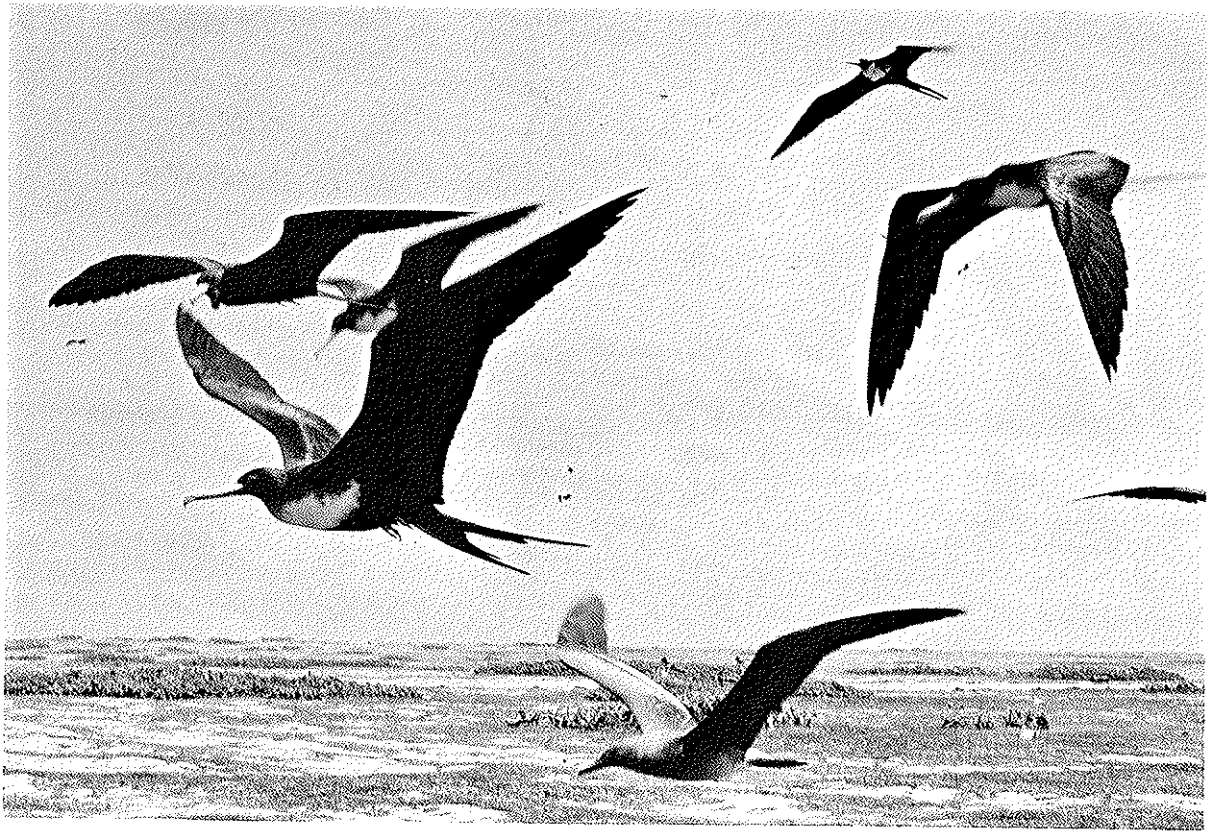


49. Sula sula rubripes: adult "white" form



50. Sula dactylatra melanops: parents with chick





52. Male and four females of Fregata minor with Red-footed Booby in flight



53. Nesting colony of Fregata minor and Sula sula rubripes near airstrip, with Tournefortia thickets and herb-mat vegetation

22. SOME ORNITHOLOGICAL OBSERVATIONS
FROM THE WESTERN INDIAN OCEAN

I. S. C. Parker

Introduction

These records were obtained while making a collection of oceanic birds for the National Museum of Kenya (formerly the Coryndon Museum). They were made in September and October 1967 when I accompanied the East African Marine Fisheries Research Organization's vessel Manihine on routine cruise no. 270. This proceeded more or less directly between the points listed below:

	<u>Depart</u>		<u>Arrive</u>
September	14 Mombasa	September	21 Remire (Amirantes)
	22 Remire		22 D'Arros (Amirantes)
	23 D'Arros to St Joseph (Amirantes)		to D'Arros (Amirantes)
	24 D'Arros	September	24 Desroches
	26 Desroches		26 Mahé (Seychelles)
	28 Mahé		28 Coetivy
	29 Coetivy	October	2 Farquhar
October	3 Farquhar		5 Cosmoledo
	6 Cosmoledo		7 Astove
	8 Astove		8 Assumption and Aldabra
	9 Aldabra		12 Latham Island, off the East African coast 97 km south of Zanzibar

Methods

While at sea a discontinuous watch was kept for birds and this covered most daylight hours. Where possible, specimens that came close to the ship were collected. The opportunity was also taken to collect birds on the islands visited, though the time spent was too short to permit more than cursory records to be made. Once a bird had been collected, it was labelled, sealed in a polythene tube, and deep-frozen. The collection was kept in this state until arrival at Nairobi, where specimens were thawed and skinned.

Nomenclature follows Watson et al. (1963).

List of species seen and/or collectedOceanites oceanicus (Kuhl)

Two sightings, one at lat. 05°0'S, long. 48°30'E on 19 September 1967, and the other at 04°40'S, 54°20'E, were believed to be this species.

Puffinus pacificus Gmel.

A total of 13 were seen at sea between 4°02'S, 47°40'E and 05°0'S, 52°50'E, but none were seen in the immediate vicinity of Remire Island. They were numerous around D'Arros and St Joseph Atoll and breeding on Fouquet Island of the latter group. They were seen frequently at sea between Desroches and Mahé and between Mahé and Coetivy. They became progressively less numerous en route from Coetivy to Farquhar, and the last was seen at approximately 09°50'S, 51°35'E. Three specimens were obtained at St Joseph, comprising one male and two females. Both females were taken from nesting burrows. Of these, one had recently laid, the egg being collected, but the other did not appear to be in breeding condition, the ovaries being very small. This suggests that non-breeding birds also frequent the nesting grounds. The male collected had enlarged gonads. The nesting ground visited on Fouquet was situated in the midst of a coconut plantation and covered the greater part of the island. Burrows were seldom more than 4 ft (1.3 m) in length or 1 ft (0.3 m) in depth at the deepest point. They were so close together that walking across the colony was rendered difficult. For the greater part, burrow entrances were in the open, but some were concealed under fallen palm fronds or piles of coconut husks. The island's human inhabitants stated that the breeding season was October to December and that annually at least 600 nestlings were taken as rations. They also stated that the continued existence of the nesting colony was entirely due to the complete absence of rats on this particular island. When caught the two specimens taken from burrows made a goatlike bleat. Stomach contents of one comprised a few cephalopod beaks, the second contained a few fish bones, while the third was empty.

Puffinus lherminieri Less.

Several were seen on 23 September 1.6 km north of D'Arros, and a few were seen at sea between Desroches and Mahé. Some 24 were seen south of Mahé within 65 km of the island.

Phaethon lepturus Lacép. and Daudin

A mature male in non-breeding condition was taken at 4°0'S, 44°40'E. Another was seen at 4°25'S, 48°0'E, and two were seen at 4°35'E, 50°0'E. All these birds seen at sea were flying in an easterly direction. On land four were recorded on Remire island, and six on Resource Island of St Joseph Atoll on 23 September. Several were seen at Aldabra. The stomach contents of the one collected were both fish and cephalopod remains.

Sula leucogaster Bodd.

One specimen was secured on Cosmoledo and another on Latham Island. Small numbers were seen off Farquhar, Cosmoledo and Aldabra atolls and around Astove. They were numerous at Latham Island where a small number were nesting. Young were present in all stages from newly hatched to fully fledged. Some birds were brooding. Both specimens taken were females in nonbreeding condition. The stomach of one was full of gastropods.

Sula sula (Linn.)

This species was common around Cosmoledo, Astove, Assumption and Aldabra where it was by far the most numerous booby. It was also recorded at sea at approximately 4°25'S, 49°0'E, in company with Sooty Terns Sterna fuscata. One immature was collected at the latter position, two more at sea off Farquhar Atoll, and two mature males were taken at Cosmoledo. One of the latter was in breeding condition. Both mature birds had empty stomachs, but all three immatures contained fish remains.

Sula dactylatra Less.

Several immatures were seen at sea at approximately 04°25'S, 50°20'E, of which one was collected. Several mature birds were also seen at sea at 4°40'S, 51°30'E, of which one was also collected. On both occasions they were accompanied by many Sterna fuscata. Off Astove Island three matures were seen and they were very numerous around and on Latham Island. As with Sula leucogaster they were breeding, and in all stages from newly laid eggs to fully fledged young. This was the most numerous of the two boobies. Nests of both species were intermixed. The mature male taken at Latham Island had enlarged gonads, another two collected at sea were not in breeding condition. The stomach of the Latham Island specimen contained some twenty cephalopod beaks, one of the other had cephalopod beaks and fish bones, while the third was empty.

Fregata minor Gmel.

This species was seen on all islands visited except Mahé. Single birds were occasionally seen at sea between 4°0'S, 44°40'E and Remire Island. A mature male in full breeding condition was taken 320 km west of Remire. An immature was taken on St Joseph. Stomachs of both were empty.

Fregata ariel (Gray)

Seen on all islands except Mahé with F. minor. None were seen at sea, but this might be due to misidentification with the latter.

Ardea cinerea Linn.

A total of three were seen at Remire Island, 15 on St Joseph Atoll, one on Goelette Island, Farquhar Atoll, three at Astove, of which two were recently fledged, and they were numerous at Cosmoledo and Aldabra.

(1968) makes a similar observation on Desnoeufs Island, Amirantes. There were fewer immature noddies on the ground, but they outnumbered Sterna fuscata in the air. Both species were very tame. The Farquhar islanders take at least 1000 eggs annually from this ternery and probably many more. Another large colony was recorded on Wizard Island, Cosmoledo Atoll. Here all had fledged, and there were very few young about. There was little evidence of the massive mortality recorded from Farquhar. A total of four specimens were taken, one from Remire and three from Farquhar. None were in breeding condition. All stomach contents were fish remains.

Sterna anaethetus Scop.

This species was very numerous on Remire Island, Amirantes, and was seen on D'Arros and St Joseph, Amirantes. It was not recorded elsewhere. A total of four was obtained on Remire. Of these one had slightly enlarged testes, the others were inactive. Stomach contents were entirely fish remains.

Sterna sumatrana Raffles

One specimen was seen on Resource Island, St Joseph Atoll, and 50 were seen on Goelette, Farquhar Atoll. Two specimens were collected on Goelette, one of which, a female, was in breeding condition. Stomach contents were entirely fish remains.

Gygis alba (Sparrm.)

Recorded as very common on Remire, D'Arros, St Joseph and Desroches (Amirantes) as well as on Cosmoledo, Astove and Aldabra. A number were seen 65 km out to sea between Mahé and Coetivy. All four specimens were taken on Remire. All were in breeding condition. Stomach contents of all were fish remains in which a Sardinella sp. was recognised.

Anous stolidus (Linn.)

This species was recorded from every island visited, and was often seen up to 65 km from land. It was particularly numerous around the Amirantes and was breeding on Goelette Island, Farquhar, as described in the section on Sterna fuscata above. All three specimens were taken at Remire. One was a male and two were females, none obviously in breeding condition. In two the stomachs were empty and one contained small fish.

Anous tenuirostris (Temm.)

Only recorded from Remire Island, where it was by far the most common bird. On the western side of the island it was present in such numbers that the eight specimens were taken with a shot intended for one. It is of interest that all eight were females with very small ovaries. Though more likely coincidence, it is possible that the species exhibits some segregation of sexes when not breeding. The stomachs of all but one contained small fish.

Streptopelia picturata (Temm.)

Some were seen on D'Arros and St Joseph (Amirantes) but were nowhere numerous. The majority of those seen were associated with the small patches of native vegetation. Two females were taken. These are discussed by Benson (1970a).

Geopelia striata (Linn.)

This species is common on North Island, Farquhar Atoll. One male was collected in breeding condition.

Foudia madagascariensis (Linn.)

This species was the only passerine seen on Remire Island, and was numerous on D'Arros, Resource and St Joseph Atoll. One taken on Remire was in non-breeding dress with only a few red feathers on the head, and one from St Joseph was in breeding plumage with a little olive on the nape.

Passer domesticus (Linn.)

This introduced species is very common on D'Arros, Resource and St Joseph Atoll. A female was collected at the latter locality.

Cisticola cherina (Smith)

This species was numerous on Menai Island, Cosmoledo Atoll, and on Astove. Three males were collected on Menai Island, and two males on Astove. For a full discussion of specimens of this and the next two species, see Benson (1970b).

Nectarinia sovimanga (Gmel.)

The one species was recorded on Menai Island of Cosmoledo Atoll, Astove, Assumption and Aldabra, and appeared to be the only Nectarinia species on these islands. Ten specimens of N. s. buchenorum (Williams) were collected on Menai Island and Astove.

Zosterops maderaspatana (Linn.)

This species was observed on Astove (only six specimens seen) and on Aldabra, where it appeared numerous. The two specimens collected were obtained on Astove.

Corvus albus Muller

No attempt was made to secure specimens of this species. However a pair was recorded on Menai Island, Cosmoledo, another on Astove, six individuals were seen on Assumption, and at least 24 during the short stay on Aldabra.

Weights

When it did not interfere with other scientists' activities specimens were weighed before freezing. It was not possible to weigh every specimen, but the following table gives the records made; weights

References

- Bailey, R. S. 1968. The pelagic distribution of sea-birds in the western Indian Ocean. *Ibis*, 110: 493-519.
- Benson, C. W. 1970a. An introduction of Streptopelia picturata into the Amirantes. *Atoll Res. Bull.*, this issue.
- 1970b. Land (including shore) birds of Cosmoledo. *Atoll Res. Bull.*, this issue.
- Moreau, R. E. 1940. Contribution to the ornithology of the East African islands. *Ibis*, ser. 14, 4: 48-91.
- Watson, G. E., Zusi, R. L., and Storer, R. E. 1963. Preliminary field guide to the birds of the Indian Ocean. Washington: Smithsonian Institution.

APPENDIX: NAMES OF THE ISLANDS

J. F. G. Lionnet

The coral islands of the western Indian Ocean are nearly all dependencies of the Seychelles. Among the exceptions are Agalega, which belongs to Mauritius, the Gloriosa Islands, which belong to the Malagasy Republic, and the islands of the British Indian Ocean Territory. Of these latter, Desroches, Farquhar and Aldabra were until 1965 part of the Seychelles, and the Chagos Archipelago was formerly administered by Mauritius. As the islands have generally been named after their discoverers or early explorers, their names recall the early history of the Indian Ocean.

Denis and Bird Islands

Denis Island bears the name of Denis de Trobriand, who took possession of it in the name of the King of France in 1777, while in command of the flute L'Etoile. Bird Island, better known in the Seychelles as Ile aux Vaches, has been named after the numerous sea birds, mainly Sooty Terns, which breed upon it. Its alternative name refers to the vaches marines, or dugongs, which were formerly found there.

Platte, Coetivy and Agalega

Platte (the correct orthography should be Plate) owes its French name to its topography. It is indeed so flat and low that it is difficult to locate, especially during rough weather. It was discovered and named by Lieutenant de Lamperiere, of the goelette La Curieuse, in 1769.

Coëtivy bears the name of the Chevalier de Coëtivy, who sighted it on 3 July 1771, while in command of the flute Ile de France. Agalega or Galega derives, according to E. de Froberville, from Portuguese words meaning "the Galician". This island is therefore reported to have been named after the Galician navigator João de Nova, who is believed to have discovered it in 1501.

The Amirantes

The Amirantes, which figured on early Portuguese charts as the Ilhas do Almirante, or Admiral's Islands, are believed to have been named after Vasco da Gama, the celebrated Portuguese navigator, who is

believed to have sighted them in 1502, soon after acceding to the rank of Admiral, during his second voyage in the Indian Ocean. They were explored in 1771, the southern islands in January of that year by the Chevalier du Roslan of the corvette L'Heure du Berger, and by the Chevalier d'Hercé of the corvette L'Etoile du Matin; the northern islands by the Chevalier de la Biollière, also of the corvette L'Etoile du Matin, in November of the same year. They were formally taken possession of, in the name of France, on 7 September and 5 October 1802, by the Sieur Blin, who sailed from the Seychelles on the goelette La Rosalie for that purpose.

The origin of the name of the African Banks or Bancs Africains is not known. They were discovered and named Ilots Africains in 1797 by Admiral Willaumez, then a Capitaine de Vaisseau in command of the frigate La Régénérée.

Eagle Island, known in Seychelles as Rémire, bears the name of an English ship which visited it in 1771. The origin of its French name is not known. Eagle was visited by the Chevalier de la Biollière in 1771.

Daros bears the name of the Baron d'Arros, Marine Commandant at the Ile de France (Mauritius) from 1770 to 1771.

Poivre bears the name of Pierre Poivre, the famous "Peter Pepper" and Intendant of the Ile de France (Mauritius) and Bourbon (Réunion) from 1769 to 1772. It was visited by the Chevalier du Roslan, but was named by the Chevalier de la Biollière, in 1771.

Boudeuse and Etoile are believed to have been named after the two ships of Bougainville's famous voyage round the world, from 1766 to 1769. They were explored and named by the Chevalier du Roslan in 1771.

Marie Louise was visited and named by the Chevalier du Roslan in 1771. It was the fourth island located by that explorer in the course of his voyage in the Amirantes. The origin of the name is not known.

Desnoeufs, or Desneuf, which means "one of the nine", is believed to owe its name to the fact that it is one of the nine main islands of the Amirantes. It was, however, only the fifth island located by the Chevalier du Roslan, during his voyage in the Amirantes, in 1771, and who named it Ile des Neufs. On the other hand, according to E. de Froberville, the name should be "des Noeuds"; the origin of this latter name is not known.

Desroches has been named after the Chevalier des Roches, the Governor of the Ile de France (now Mauritius) and Bourbon (now Réunion) from 1767 to 1772. It was explored by the Chevalier de la Biollière in 1771.

Alphonse, St François and Bijoutier

Alphonse bears the name of its discoverer, the Chevalier Alphonse de Pontevez, of the frigate Le Lys, who visited it on 28 January 1730.

St François, which was discovered on the same occasion, was named presumably after the religious feast of 29 January, which is that of St François de Sales.

The origin of the name of the third island of the group, Bijoutier, is not known.

St Pierre, Providence and Farquhar

St Pierre bears the name of a ship, that of Captain Dechemin, who visited the island on 6 June 1732.

Providence was named "La Providence" by the crew of a French frigate, L'Heureuse, which was wrecked on a neighbouring bank in 1769, and who managed to reach the island.

The Farquhar Islands were formerly called Juan de Nova (or Jean de Nova), after João de Nova, the Galician navigator. Their names were changed in or about 1810, when they were renamed after the first British Governor of Mauritius, Sir Robert Townsend Farquhar. The islands were visited by the Chevalier de Pontevez in 1730.

The Aldabra Group

Cosmoledo, according to d'Avezac, bears the name of an unknown Portuguese navigator. The two main islands of the group, Menai and Wizard, have been named after two ships of Captain Moresby, who visited them in 1822. The group was sighted by Captain Nicolas Morphey, of the frigate Le Cerf, on 13 August 1756.

The name Astove, according to d'Avezac, derives from the Portuguese words "As Doze Ilhas", meaning the twelve islands, which he claims was originally the name of the Farquhar islands but which was transferred in error to Astove. Astove was visited by Captain Lazare Picault, of the tartane L'Elisabeth, and Captain Jean Grossin, of the boat Le Charles, in 1742, during their exploration of the Seychelles.

Assumption Island (Assomption in French) was discovered by Captain Nicolas Morphey on 14 August 1756, and named presumably after the religious feast of the next day.

The origin of the name Aldabra is uncertain. It has been said to derive from the Arabic "al-Kadhra", meaning "the green", and also from "Aldaraba", a type of door knocker the same shape as the atoll. According to d'Avezac the atoll should be named Ilha da Area, meaning

Sand Island, though this hardly seems appropriate. C. Elgood (Seychelles Bulletin, 6 April 1967) claimed that Aldabra could derive from the Arabic "al-Dabaran", which means the five stars in Taurus, more particularly the brightest of the group. If the first of these derivations is accepted, it could be attributed to the fact that the large lagoon on Aldabra produces a green reflection in the sky above the atoll, which can be seen for miles out at sea. Aldabra was sighted by Captain Lazare Picault and Captain Jean Grossin in 1742.

References

- Bradley, J. T. 1940. History of Seychelles. Vol. 1. Mahé, Seychelles.
- Bulpin, T. V. 1960. Islands in the forgotten sea. Cape Town.
- Coppinger, R. W. 1883. Cruise of the Alert. London.
- Fauvel, A. A. 1909. Unpublished documents on the history of the Seychelles prior to 1810. Mahé, Seychelles.
- Fröberville, E. de. 1848. Iles de l'Afrique. In L'Univers (ed. M. d'Avezac), Vol. 6, part 3. Paris.
- McEwen, A. C. 1961. Fragments of early Seychelles history. J. Seychelles Soc. 1: 22-31.