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ATOLL RESEARCH BULLETIN

149. Geography and Ecology of Diego Garcia Atoll, Chagos Archipelago

Edited by D. R. Stoddart and J. D. Taylor

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

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"I make it my province to dwell in this preliminary discourse on those objects only, which most excited my attention. Among the number of these I reckon, for instance, the harbour of Diego Garcia, and the prospect of the island itself is pleasant. We judged to have twelve leagues in circumference. Its form resembles a horse shoe. Its greatest breadth is not above a quarter of a league; the ground is however sufficiently elevated to serve as a fence and shelter to a vast reservoir of sand, which affords spacious room to the most numerous fleets. This level is four leagues long, and its main breadth is about one league. Its excellent harbour has two entrances to the north. The roads are extremely fine. Its situation I ascertain it to be in the 7 deg. 14 min. South Latitude, and in the 68 degree east longitude from the meridian of Paris."

ABBÉ ROCHON (1793, 48-49)

"This Island is one of the wonderful phaenomena of this globe."

JAMES HORSBURGH (1809, 131)

Contributors

W. R. P. Bourne
62 Vicarage Road, Watford, England

A. A. Bullock
Royal Botanic Gardens, Kew, Richmond, Surrey, England (retired)

A. M. Clark
Department of Zoology, British Museum (Natural History), London, S.W.7., England

F. R. Fosberg
Smithsonian Institution, National Museum of Natural History, Washington, D.C. 20560, U.S.A.

J. F. Peake
Department of Zoology, British Museum (Natural History), London, S.W.7., England

C. F. Rhyne
Department of Botany, University of North Carolina, Chapel Hill, N.C. 27514, U.S.A. (formerly Smithsonian Institution, Washington, D.C. 20560, U.S.A.)

B. R. Rosen
School of Physics, The University, Newcastle-on-Tyne, England (formerly Department of Geology, University College of Wales, Aberystwyth, Wales)

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

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

D. R. Stoddart
Department of Geography, University of Cambridge, England

J. D. Taylor
Department of Zoology, British Museum (Natural History) London, S.W.7., England

C. C. Townsend
c/o Royal Botanic Gardens, Kew, Richmond, Surrey, England

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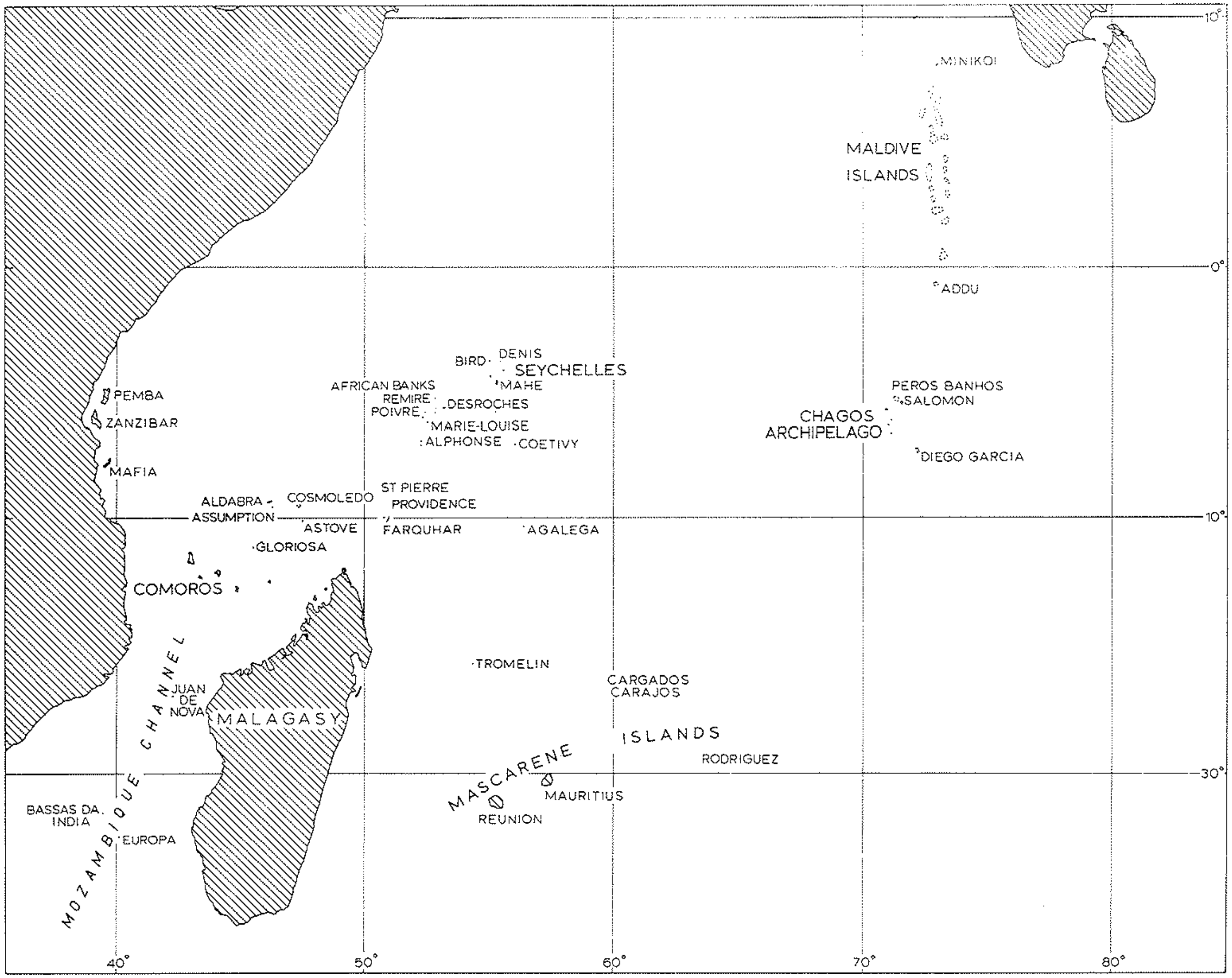

Fig. 1. The western Indian Ocean, showing the location of Diego Garcia.

1. SCIENTIFIC STUDIES AT DIEGO GARCIA ATOLL

D. R. Stoddart

Introduction

The islands of the Chagos Archipelago (Fig. 1) are of interest for several reasons. First, they are the wettest coral islands in the Indian Ocean, with mean annual rainfalls of up to more than 3700 mm: one would thus expect marked ecological differences between these islands and the much drier ones in the western Indian Ocean. Second, the Chagos islands are situated in the centre of the Indian Ocean and form the termini of sequences of islands (the Maldives and Laccadives in linear array to the north, and the more scattered array of islands in the western Indian Ocean) which display marked differences in distance from continental land, in area, climate, and habitat diversity. Any analysis of Indian Ocean island biotas must thus take into account the status of the islands of the Chagos Archipelago. And finally, in common with areas on the Mid-Ocean Ridge, the present dry-land areas of the Chagos represent only a minute proportion of the total land area exposed during the last Pleistocene low stand of the sea. It is probable that 17,000 years ago Great Chagos Bank had a dry land area of 13,500 sq km, with other large land areas in Speaker's Bank and Pill Bank and smaller ones in the present atolls of Peros Banhos, Salomon and Diego Garcia. The flora and fauna present on such areas would be potentially much larger than on the present islands, and it would be at least theoretically possible that some elements of this larger biota survived during the Holocene transgression of the sea. In the event, no such survivals have been found, at least on Diego Garcia: all the plants and animals, other than deliberate introductions, have probably reached the Chagos by trans-oceanic dispersal in Holocene times.

The opportunity to visit Diego Garcia Atoll during a hydrographic survey by H.M.S. Vidal in 1967 was therefore a most welcome one. In recent years there has been renewed interest in Indian Ocean coral islands, taking up many of the problems explored by J. Stanley Gardiner and R. B. Seymour Sewell 30-70 years ago. These recent studies have concerned both reef and shoreline ecology (Stoddart and Yonge, eds., 1971)* and the terrestrial ecology of islands, in the Maldives (Stoddart,

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* References cited in Chapters 1, 2, 3, 11, 14 and 18 are grouped in Chapter 19 of this report; in other chapters the references are grouped at the end of the chapter.

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ed., 1966), at Aldabra (Stoddart, ed., 1967), and at other western Indian Ocean islands (Stoddart, ed., 1970). A general picture of variation in Indian Ocean coral islands, and of the factors contributing to it, is now emerging (Stoddart 1969, Peake 1971), based partly on the recent studies but also to a considerable extent on the records contained in a voluminous literature resulting from earlier expeditionary work. The present study of Diego Garcia Atoll adds to this body of knowledge: with the exception of a short visit by the Yale Seychelles Expedition to Peros Banhos Atoll in 1957 (Kohn 1964) it represents the first modern study of any of the Chagos group of atolls.

Previous Work

There have been three main scientific investigations on Diego Garcia in the past: by G. C. Bourne from September 1885 to January 1886; by the Deutsche Tiefsee-Expedition in the *Valdivia*, in February 1899; and by the Percy Sladen Trust Expedition, with J. Stanley Gardiner, C. Forster Cooper and T. Bainbrigge Fletcher, from 7 to 13 July 1905. Collections were also made by J. Morin in July 1937, and an excellent but unpublished general account was written by P. O. Wiehe following a visit in May-June 1939. Wiehe made further small collections in September 1961. Each of these, except for G. C. Bourne and the *Valdivia* Expedition, also visited Peros Banhos, Egmont and Salomon Atolls.

Table 1 briefly lists the main scientific visitors to Diego Garcia since 1884, with their fields of interest and the general publications resulting from their work. The earlier history of the atoll, including hydrographic surveys made before 1884, is outlined in Chapter 18 of this volume, and more extensive references to the earlier scientific work are given in several later chapters but particularly in Chapter 14. A full bibliography of the atoll is given in Chapter 19.

Early general accounts of Diego Garcia are those by Moresby (1844, Anon. 1845), Pridham (1846) and Finsch (1887). G. C. Bourne, after four months' fieldwork, published a general paper (1886a) and papers on the geomorphology (1888a, 1888b); his plants were worked up by Hemsley (1887) and his birds by Saunders (1886). Chun (1903) published a long general account of the atoll, with the first published photographs, after the *Valdivia* Expedition, and references to collections made there are scattered through the Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition: on birds (Reichenow 1900, Vanhoffen 1901), marine algae (Reinbold 1904), echinoderms (Döderlein 1906, Hertz 1927, Heding 1940), Crustacea (Balss 1912, Doflein 1904, Doflein and Balss 1913), Mollusca (von Martens 1904, Thiele and Jaeckel 1931), and Phytoplankton (Karsten 1907). The most substantial accounts are, however, those resulting from the week's visit of H.M.S. *Sealark* with the Percy Sladen Trust Expedition in July 1905. During this time Gardiner with Fletcher worked mainly on the land and Cooper in the lagoon. General descriptions were published by Gardiner and Cooper (1907) and by Gardiner

Table 1. Scientific studies at Diego Garcia

Date	Investigator	Field of study	References
1883	A. Hume, H.M.S. Moorhen	Plants	Hemsley 1884
1884 July 9	O. Finsch	Birds	Finsch 1887; Finsch and Blasius 1887
1885	Cdr F.C.P. Vereker H.M.S. Rambler	Hydrographic survey	Admiralty chart 920
1885 Sept. 15- 1886 Jan.	G. C. Bourne	General, geology, birds, plants	Bourne 1886a, 1886b, 1888a, 1888b
1889	R. F. M. Wilson	Lichens	Wilson 1889
1899 Feb.	Deutsche Tiefsee-Expedition, Valdivia	General, marine fauna, birds	Chun 1903
1905 July 7-13	Percy Sladen Trust Expedition, H.M.S. Sealark	Geomorphology, marine fauna, terrestrial fauna and flora	Gardiner 1903, 1905, 1906, 1936; Gardiner and Cooper 1907
1936	J. Morin	Mollusca, Crustacea	Madge 1946; Viader 1937; Ward 1942
1937 July	J. Morin	Plants	
1938	J. Closel	Mollusca	
1939 May-June	P. O. Wiehe	General, plants, insects	Wiehe 1939
1941-2	H.M.I.S. Clive, Cdrs J. W. Jefford and R. R. Caws	Hydrographic survey	Admiralty chart 920
1948	Mauritius-Seychelles Fisheries Survey: J.F.G. Wheeler and F. D. Ommanney	Fish	Ommanney 1952
1960 Nov.-Dec.	P. Loustau-Lalanne	Birds	Loustau-Lalanne 1962
1961	P. O. Wiehe	Plants	
1961	Vitiaz	Beach fauna	Bezrunov 1963
1964 July-Aug.	Lt P.G. Odling-Smee	Birds	Bourne 1966
1967	Vitiaz	Geomorphology	Dolotov 1968; Leont'yev 1969
1967 June-July	H.M.S. Vidal, Capt. C.R.K. Roe	Hydrographic survey	
1967 June-July	H.A. Fehlmann, C. F. Rhyne, D.R. Stoddart, J.D. Taylor	Geography and ecology, marine and terrestrial	This volume; Ripley 1969; Benson 1970

(1936, 416-420, also 1931). Table 2 lists papers resulting from the Percy Sladen Trust Expedition dealing with marine fauna and flora; Table 8 in Chapter 14 lists the many papers dealing with insects. Willis and Gardiner (1931) list the land flora. Most of the Percy Sladen collections are in the British Museum (Natural History), except for the plants, which are at the Royal Botanic Gardens, Kew.

After the Percy Sladen Trust Expedition, no further collections appear to have been made until J. Morin's visit. Morin was a museum assistant in Mauritius and his zoological collections are in the Maritius Institute, Port Louis. Crustacea collected by him at Diego Garcia, Peros Banhos and Salomon in 1936 were described by Ward (1942), his land Mollusca by Madge (1946), and his marine Mollusca by Viader (1937) (but without localities). The Mauritius Herbarium at Réduit also contains a number of sheets of plants from Diego Garcia, dated June-August 1937: it is not known whether Morin made two visits to the archipelago, or whether some mislabelling has occurred. Further marine mollusca in the Mauritius Institute from Diego Garcia were collected by J. Closel in 1938. Wiehe's visit in 1939 resulted in a large collection of plants, now in the Mauritius Herbarium (Wiehe 1939), not only from Diego Garcia but also from Salomon and Peros Banhos, together with some insects (Mamet 1941, 1943). More plants in the Herbarium were collected on these three atolls and also on Egmont in 1961, again by Wiehe.

Subsequent visits have resulted mainly in sight records, particularly of birds, and Loustau-Lalanne (1962) has contributed a general account of the birds of the Chagos Archipelago following a visit in 1960. For other recent visits, see Table 1.

Present Investigation

The present investigation was carried out during June and July 1967 by four scientists attached to a British Ministry of Defence hydrographic survey carried out by H.M.S. Vidal. These were Dr. H. A. Fehlmann, Smithsonian Oceanographic Sorting Center, and Mr. C. F. Rhyne, Smithsonian Institution and now, the University of North Carolina, both nominated by the Smithsonian Institution; and Dr D. R. Stoddart, Cambridge University, and Dr J. D. Taylor, British Museum (Natural History), both nominated by The Royal Society. Stoddart and Taylor were on Diego Garcia from 1-29 July, Rhyne and Fehlmann from 10 June to 29 July. The purpose of the scientific party was to make a survey of the present status of the geography and ecology of the atoll and if necessary to make conservation recommendations.

Responsibilities were divided as follows. Fehlmann made large collections of fish, which are being distributed by the Smithsonian Oceanographic Sorting Center; he also made smaller collections of other marine groups; of birds, particularly the Little Green Heron (Ripley

Table 2. Studies of marine biota by the Percy Sladen Trust Expedition

MARINE ALGAE
- Foslie 1907
- Gepp and Gepp 1909
- Weber-van Bosse 1913, 1914

PORIFERA
- Dendy 1913, 1916, 1922

COELENTERATA
- Browne, 1916, 1926
- Cooper 1909
- Gardiner 1909
- Hickson and England 1909
- Horst 1922, 1926
- Jarvis 1922
- Matthai 1914, 1928
- Thomson and Mackinnon 1910

BRYOZOA
- Thornely 1912

ANNELIDA
- Potts 1910

ECHINODERMATA
- Bell 1909

ARTHROPODA
- Borradaile 1907b, 1910, 1917
- Coutière 1921
- Laurie 1926
- Rathbun 1911

MOLLUSCA
- Eliot 1910
- Melvill 1909

VERTEBRATA
- Regan 1908

1969) and the Turtledove (Benson 1970); of reptiles; and of insects. Rhyne specialised on marine algae, and also collected land plants. Stoddart studied geomorphology and sedimentology, including lagoon floor sediments, and also collected land plants. Taylor concentrated on intertidal ecology and on the lagoon reefs, collecting corals, Mollusca and Crustacea; he also made some terrestrial collections, notably of land Mollusca and of earthworms. Most of these collections are reported in this volume. The main group very inadequately represented in the 1967 collections was the insects, and it is hoped that some work can be done on these in the near future.

Acknowledgements

We thank particularly the Hydrographer, Ministry of Defence (Navy) and Captain C. R. K. Roe, D.S.C., R.N., and the officers and men of H.M.S. *Vidal* for making this investigation possible. We are grateful to Lt Cdr D.P.D. Scott, R.N., for his help with practical details. We also thank the leader of the United States survey party, Lt. G. Robinson, and the Manager of the Atoll for their aid with transport and accommodation. The participation of Stoddart and Taylor was made possible by the Royal Society, London, and the Ministry of Defence, and that of Fehlmann and Rhyne by the Smithsonian Institution, Washington, and the Department of Defense. The Ministry of Defence also kindly made available to us the chart of Diego Garcia made in 1967 and tidal information collected by H.M.S. *Vidal*, and loaned us aerial photographs of the atoll flown in 1967. We are also grateful to all those who have worked on collections made during this expedition, and who have contributed to this volume, and to Mr. E. G. Davey, Meteorological Department, Mauritius, for climatic information. Most of the illustrations have been drawn by Mr. M. Young, Mr. M. Ampleford, and Mr. C. Lewis of the Department of Geography, Cambridge, and the photographic work is by Mr. R. Coe of that Department. We thank Mr. R. Balmforth for xerox work in connection with this project.

Stoddart also thanks the Southern Zone Research Committee of the Royal Society for the opportunity to visit Mauritius in July 1969, to see collections in the Mauritius Institute, Port Louis, and the Mauritius Herbarium, Reduit; he thanks Dr. R. E. Vaughan and many others for their great assistance during that visit.

Finally, we are grateful to the then Commissioner of the British Indian Ocean Territory, Sir Hugh Norman-Walker, and to the Administrator, Mr. J. Todd, for their interest in this work and for their hospitality in the Seychelles.

2. GEOMORPHOLOGY OF DIEGO GARCIA ATOLL

D. R. Stoddart

Diego Garcia Atoll (Fig. 2), Chagos Archipelago, has a total area of 170 sq km, of which the lagoon occupies 124 sq km and the peripheral reef (including the land rim) 47 sq km. Diego Garcia has one of the most continuous land rims of all coral atolls, and the land itself covers 30 sq km, or rather more than one-sixth of the total atoll area.

A. Structure and regional relationships

The atoll (Fig. 3) lies 55 km south of the Great Chagos Bank, a largely submerged platform of drowned atoll form, approximately 13,500 sq km in area, with maximum depths of 70-80 m and a broad rim at 7-17 m. The Bank is separated from the Maldives and Laccadives plateaux by a channel 500 km wide and 2200-3300 m deep. Both the Great Chagos Bank and the Maldives-Laccadives plateau are outlined bathymetrically by the 2000 m isobath, and together they form a major topographic lineament extending in a north-south direction across the Indian Ocean for 3000 km. The Chagos Bank lies adjacent to the Mid-Ocean Ridge close to its ENE-WSW intersection by the Vema Trench. The Mid-Ocean Ridge is a complex structure in this area, and is adjoined to the west by the Mascarene Plateau, the part granitic, part basaltic coral-capped arc extending from the Seychelles to the Mascarenes (Fisher, Johnson and Heezen 1967, 1261). Unlike the Maldive-Chagos plateaux, the Mascarene Plateau is apparently interrupted by ENE-WSW displacements.

In contrast to the extensive geophysical work in the northwest Indian Ocean, the structure of the Maldives and Chagos has been relatively neglected, and little is known in detail of the relationship between these features, the Indian sub-continent and the Mid-Ocean Ridge. Geophysical work on the Seychelles Bank and Cargados Carajos indicates a granitic basement covered with coral limestone (Matthews and Davies 1966), and on Saya de Malha a basaltic basement, also covered with coral (Shor and Pollard 1963); the inferred thicknesses of the coral in these cases range from 0.5 to 1.5 km. Seismic refraction profiles in the Maldives indicate a volcanic layer 4-5 km thick, capped with coral (Francis and Shor 1966, 431); Glennie (1936) observed large negative gravity anomalies throughout the Maldives, and large magnetic anomalies have also been reported. A seismic refraction profile is described by Francis and Shor (1966) near the Great Chagos Bank south of Peros Banhos and Salomon Atolls. This shows a layer 0.6-1.7 km thick with velocity 3.01 km/sec, interpreted as coral, over-

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lying 3.6-5 km of volcanic rock (velocity 4.76 km/sec) and basic crustal material (velocity 6.79 km/sec). Water depth in this area averaged about 1000 m. Presumably over the shallow Chagos Bank, and over Diego Garcia, the coral and possibly the volcanic layers are thicker.

The Maldives and Chagos plateaux lack the characteristic features of the deeper (c. 3 km) Mid-Ocean Ridge, i.e. high heat flow, seismicity and volcanicity. The plateaux are notably aseismic (Stover 1966). Francis and Shor (1966) suggest that, on the analogy with many Pacific linear volcanic belts, the Maldives-Chagos vulcanism began in the south and moved northwards, culminating in the outpouring of the Eocene Deccan Traps. This would imply that subsidence of reef foundations has been greatest and most prolonged in the south. It is possible that the Chagos and Maldives volcanic belt represents the track of drift of the Indian sub-continent to the north during the late Mesozoic and early Tertiary disruption of Gondwanaland (Le Pichon and Heirtzler 1968, 2115), though this interpretation remains speculative.

Little is known of the ocean floor to the east of the Chagos, where depths are generally 3.5-4.5 km. A north-south trending trench, the Chagos Trench, with depths greater than 5 km, has been identified along the east side of the Chagos Plateau (Francis and Shor 1966, 428).

The relationship of Diego Garcia itself to the Great Chagos Bank remains unclear. There are soundings of 1-1.3 km between the two. Similar depths are found to the north, between the Bank and Peros Banhos and Salomon Atolls, where Francis and Shor (1966) shot their refraction profile. Depths of less than 1.8 km extend for 130 km southwest of Diego Garcia, but for only 30 km to the east. No geophysical work has been done on Diego Garcia itself, which from the regional situation can be inferred to be a typical mid-ocean atoll, with a reef limestone cap 1.5 km or more in thickness resting on a subsiding volcanic basement.

B. Geomorphology of the land rim

The geomorphology of Diego Garcia has been briefly described by Bourne (1888a, 1888b) and Gardiner and Cooper (1907). The atoll is unusual in the length and continuity of its land rim, which extends round 90 per cent of the atoll circumference. Because of the narrowness of the rim, however, land covers only 18 per cent of the total area of the atoll.

Because of its length and continuity, the land rim is difficult to describe. It varies in width, height and surface features from place to place, and some sectors are clearly older and more stable than others. The nature of both the lagoon and seaward coasts varies with differences in exposure and sediment supply. For convenience the continuous rim is divided into three main types: normal rim, barachois rim, and narrow rim (Fig. 2). The terminal ends of the rim represent a fourth type, and the lagoon-mouth islets a fifth.

1. Normal rim

The term "normal rim" is applied to those sectors with a mean width of about 0.5 km, possessing a prominent seaward ridge, a less pronounced lagoon ridge, and either a gentle slope between the two or an interior depression. This type of rim has been described from many other atolls.

Between Cust Point and East Point, a distance of 7 km, the rim is 0.4-0.6 km wide, reaching 1 km at East Point. Figure 4a shows a levelled section north of East Point. The seaward ridge is topped by a belt of low dunes 120 m wide, rising to 5 m above low water level (Plates 5-6). The lagoon ridge is less pronounced, rising to little more than 2 m above low water. Apart from a central depression most of the rim surface is horizontal or falls gently lagoonward, with an elevation of only 1-2 m. The central depression is close to or slightly below the level of high water springs. The beaches and rim surface consist of fine to coarse sand, with organic debris forming a black deposit in the depression. After heavy rain the depression holds standing water several decimeters deep for some days.

The rim northwest of Pointe Marianne is very similar, being 8 km long and 0.4-0.75 km wide. The seaward ridge (Plate 8) is higher here than on the east rim, and the levelled transect at Pointe Marianne (Fig. 4b) reaches almost 7 m above low water springs in the seaward dunes. Inland from the dunes there is a horizontal surface at 3 m, formed by a gravel spread on which the dunes stand. The lagoon ridge here is low and insignificant.

Part of the southeast rim also falls into this category. From some 4 km northeast of Barachois Sylvain the rim has a width of 0.4-0.9 km. A transect on this coast (Fig. 4c) shows a rather lower seaward ridge (3-4 m above low water springs), with a gentle slope from the seaward beach crest to the lagoon. This sector is entirely built of sand.

Rims of this type have presumably formed by the gradual accretion of sand on the face of seaward beaches, with occasional washovers of sand and gravel raising the rim surface inland during storms. Lower beach ridges on the lagoon coast also grow by accretion. Where the rim is wide or sediment supply deficient, the two ridges may be separated by a depression, but generally there is a continuous gentle surface slope over bedded sands and gravels, part wind-blown and part washover. The width of these sectors implies formation over a considerable period of time, and they probably represent the oldest and most stable portions of the land rim. Two of the sectors described trend NNE-SSW, and the other at right-angles, NW-SE.

2. Barachois rim

In places the lagoon shore of the land rim is highly crenulate, with deep indentations enclosing areas of intertidal sands and gravels. These indentations are surrounded by the normal sandy island surface, and the seaward shore is formed by a normal beach ridge, in places topped by dunes. These indentations are known as barachois (Plate 12). The two main barachois systems are those at the South Point (Barachois Sylvain, 2 km long and 1.5 km wide) and at Horsburgh Point (Barachois Maurice, 4 km long, 0.9-1.4 km wide). In the case of Barachois Sylvain the seaward beach ridge is low and narrow, but at Maurice it has its usual high and wide development. In each case the lagoon beach ridge is weakly developed and is actively retreating, exposing a low cliff of consolidated cay sandstone at its foot. This sandstone is massive and lacks the strong seaward dip of true beachrock. It is not only exposed along the lagoon shore near the mouths of barachois, but also within the mouths and round the margins of the indentations.

Gardiner and Cooper (1907, 47) give a useful description of the barachois:

> "Their entrances are all relatively small, but inside they open out with horns branching off in every direction; the whole is fringed with tall coco-palms. At high water all parts are covered, but at low tide they form vast expanses of glaring white sand or mud, with perhaps shallow streams in their centres. They are evidently growing, dead and falling coconuts fringing their sides, soon to be buried by the Cardisoma crabs, whose immense holes and heaps of soil give a rough appearance to the ground. On the flats, too, which are regularly covered by the tide, any coral-mass or stone is as quickly buried by Uca."

The main features of barachois may be seen in the maps compiled from air photographs in Figures 5 and 6. Figure 7 gives a series of sections surveyed across one arm of Barachois Maurice, and shows the vertical separation of the Cardisoma and Uca zones. In the former the surface is formed of algal-blackened coral sticks and gravel, overlying sandy and silty deposits. Segregation of the coarse sediments is clearly caused by crab activity. The burrowing crabs bring unblackened sediments to the surface to form white conical mounds up to 0.3 m high; these are very conspicuous against the grey surface. Much of the surface is underlain by burrows, and collapses when walked over (Plate 13). This zone is probably only infrequently flooded. Toward the centre of the barachois it often passes into a pavement of cemented sandstone, and may be separated from the lower Uca zone by a low sandstone cliff which marks the upper limit of ordinary high tides (Plate 29). The Uca zone consists of sandy and silty deposits penetrated by large numbers of Uca burrows. Slightly more elevated areas are vegetated with a sward of a sterile grass similar to Paspalum, which may be regarded as the first stage in salt-marsh development (Plate 14). At lower levels the Uca zone is intersected by meandering creeks, in which deeper pools and abandoned arms contain very fine silty sediments. Uca is absent from these lower levels (Plate 15).

Gardiner interpreted the barachois as largely erosional, and the evidence of undercut sandstone cliffs round their margins and of dying coconuts standing in brackish water supports his argument. Bourne (1888b, 457) considered that the lagoon could be raised to abnormally high levels by northwesterly winds, and high salinity of the flood waters killing land vegetation, and scouring and deepening of the barachois occurring as soon as a channel is opened through the lagoon beach ridge. Not all barachois are growing, however. Air photographs show several small barachois on the coast between Sylvain and Maurice which are now dry and being colonised by vegetation. Between Maurice and Carcasse, another such barachois is being filled by fans of storm gravels washed over the lagoon beach ridge, and this too is being vegetated.

Barachois may thus represent an early stage in land rim formation, rather than, as Gardiner (1936, 418) thought, a late stage in land rim destruction. The main barachois occur on a lagoon coast where the dominant winds are from the south, i.e. offshore. Sediment movement on both the east and west sides of the lagoon is clearly northward, and the south side lies in an area of sediment deficit, with no sediment source except for material from the seaward reef carried over the seaward beach ridge, and lagoon floor sediment transported onshore during storms. Such supplies are necessarily limited: material from the seaward side will decrease in quantity as the rim becomes higher and wider, and living reefs are not well represented in the southern lagoon. In this interpretation, spits and projections on the inner margins of the barachois are probably original depositional features, probably washover deposits, stabilised by subsurface cementation and slightly modified by subsequent marginal erosion. Spits and recurves at the mouths of barachois are formed by small-scale longshore sand movement on the lagoon coast after the lagoon beach ridge has been breached; these features, like the original beach ridge, are subject to subsurface cementation and erosional modification.

It is difficult to estimate long-term trends in the barachois. It is possible that they are in approximate equilibrium, with the deposition of fine sediments and of new biogenic material, mainly crustacean and molluscan, balancing any loss by tidal flushing. The fact that no conspicuous changes have occurred since the first maps of the atoll were made in 1824 probably is the result of the absence of a mangrove swamp or salt marsh flora: mangroves or even a cover of Sesuvium or Arthrocnemum would certainly promote sedimentation and transition to a dry land vegetation at the higher levels. Colonisation by such vegetation is at present certainly prevented by the extreme environmental conditions, particularly of salinity and insolation, experienced on the flats, and by continuous reworking of the sediments by crabs.

The more remote arms of several barachois, especially Maurice, stand at a high level and are occupied by brackish standing water, as noted by Gardiner and Cooper (1907, 48). Gardiner considered these to be the advancing arms of enlarging barachois, with the rising water level killing the coconuts. There is no doubt that coconuts are being killed in these situations today, and their trunks stand or lie in brackish water. At Barachois Maurice the water surface in one such arm was shown by levelling to stand at the same elevation as the main *Cardisoma* flat and well above the *Uca* zone and the active creek system. It is possible that waterlogging has occurred as a result of the formation of a cemented horizon below the *Cardisoma* zone: this horizon outcrops in a cliff between the *Cardisoma* and *Uca* zones, and the perched pool is drained by a spillway over the edge of the cliff. Erosion in this spillway is not significant, and the marginal pool has clearly not been flooded as a result of backward erosion from the main barachois. These data suggest that Gardiner's explanation of the phenomenon may not be correct.

3. Narrow rim

Two distinct types of narrow rim are found. The first and most simple extends from Barton Point to Cust Point on the northeast side, a distance of 9 km. The width here varies from 45 to 250 m. The seaward ridge is low, generally less than 3 m, and lacks dunes; the lagoon ridge is in places higher and may be topped by low dunes (Plate 10). Along this sector the seaward beach is retreating and the lagoon beach stable or aggrading. The section surveyed at Cust Point (Fig. 8) represents a very narrow section; where the rim is broader incipient interior depressions are found. Because of the narrowness of the rim in this sector, breaches and washovers from sea to lagoon are not uncommon: Bourne found recent cuts in 1883 (1888b, 457-458). As both Bourne (1888b, 442) and Gardiner and Cooper (1907, 46) recognised, this sector of narrow rim is a recent and unstable link between the more permanent land areas at Observatory Point and south of Cust Point.

The second type of narrow rim is more complex. Between Pointe Marianne and Barachois Sylvain, a distance of 14 km, the rim varies in width from 100 to 500 m. The seaward beach ridge is similar to such ridges elsewhere round the atoll; it is lower in the south, where the beach is retreating, and higher in the north where dunes are building. At one point 4 km south of Pointe Marianne the sandy seaward beach-ridge is topped by a spread of gravel and cobbles, probably of storm origin. The lagoon shore is of diverse character. In the south it is lined by an intertidal rock platform up to 30 m wide (Plate 11), the inner 7-10 m being covered by wave-tossed loose blackened coral boulders. The beach is low and less than 1 m in thickness; it is usually only 5-10 m wide; and it is only intermittently attached to the main land area of the rim. The ridge thus effectively encloses small barachois at a higher level than the main southern barachois, lying mostly in the *Cardisoma* zone. Sediment transport is from south to north, and the lagoon beach thus forms a series of en echelon spits and headlands, each enclosing small barachois-like depressions. The headlands have been stabilised by intertidal cementation, and are made conspicuous by their tall clumps of Hernandia and Ficus. The low beach ridges south of each headland, enclosing the Barachois, are often breached, but the main entrance to each barachois is normally to the northwest of the headlands.

The largest of these barachois is at Mamzelle Adélie. Unfortunately this could not be visited, but air photographs show a well-developed creek system in a surface covered with what is probably a Paspalum turf. A larger indentation of a different type is found at Pointe Marianne itself, where the trend of the lagoon coast changes from N-S to NW-SE. Here the lagoon beach ridge encloses a large expanse of standing water (Plates 16-17), densely vegetated with the pondweed Bacopa monnieri. The inner margins of this pool are lined with dead and dying coconuts and Casuarina trees (Plates 18-19), and several islets also bear dead and decapitated coconuts. Gardiner and Cooper (1907, 417) reported a similar situation, and gave the maximum depth of water as 4-5 ft (1.2-1.5 m). It is similar in size to the large southern barachois, but does not dry at low water. The pool can only have been formed by the growth across a former arm of the lagoon of a sand spit where the coastline changes trend; it has remained open because of deficient sediment supply and because of its exceptional size, suggesting that here the reef itself was unusually wide. How coconuts formerly grew in now waterlogged conditions presents a major problem. Gardiner's account suggests little change during the last sixty years; it has already been shown in the discussion of the main barachois that Gardiner's views that "more barachois have formed" and "all have enlarged" since Moresby's 1837 survey (Gardiner 1931, 140) are not supported bv the 1824 charts, and that waterlogging in the southern barachois may have a different explanation.

4. Rim ends

At both its northeast and especially its northwest terminations, the land rim widens. Seaward and lagoon beaches diverge, without marked change of character, and the low-lying interior contains marshy areas with sedges and standing water. At the northwest point the area of standing water is large and surrounded by dense coconut thicket; unfortunately it was not possible to visit it in 1967. Both points have considerable dune fields, described in Section B.6, p. 15. At northeast point the dunes are being eroded, and there are vertical sand cliffs up to 3 m high at Observatory Point. Gardiner (1931, 139) observed these in 1905. At Barton Point, at the entrance to the lagoon, the reef flat is covered with boulders 0.5-1 m in diameter for a distance of several hundred meters (Plates 3-4). This is unusual on Diego Garcia reef flats, and may have resulted from the effects of a single major storm.

5. Lagoon-mouth islands

There are three small islets at the entrance to the atoll lagoon. West Island stands at the end of a spit-like reef extending 1.4 km from Eclipse Point; Middle Island stands at the northeastern point of an isolated reef 1.7 km long and 1.0-1.3 km broad; and East Island stands on a much smaller isolated reef only slightly larger than the island itself. West Island (Fig. 9) is a narrow strip of sand and cobbles 450 m long and 75 m wide standing on a rock platform which dries at low water springs; the area of the islet itself is 3.4 ha and of the islet and platform together 5.4 ha. Middle Island (Fig. 10) has a total area of about 6 ha, but a large area enclosed by a shingle rampart on the south side consists of standing water. East Island (Fig. 11) is the largest of the three, 800 m long and 200 m wide, and has an area of 11.75 ha.

Middle Island is the least interesting physiographically. It is built of cobbles and gravel at the windward edge of Spur Reef, and has maximum dimensions of 340 x 230 m. An intertidal tail of rubble more than 0.5 km long, with occasional sandbores, extends southwards from the cay across the reef surface. Rubble forms a subtidal carpet round the island shores. The shingle rampart enclosing the pools is largely unvegetated: spread of sand and gravel in the pools show that the rampart is often overtopped or breached by storm waves.

West and East Islands, though very different in size, are similar morphologically and of considerable interest. In each case bedded cemented sands outcrop to form horizontal or slightly dipping platforms along the north and east shores of the islands ("promenades"). At East Island (Plates 31-34) these bedded calcarenites rise at the east point to 3 m above the surrounding reef flat, decreasing in height towards the southwest. The deposits show cross-bedding, with dominant dip away from the island. The platform formed by the calcarenite increases in width to nearly 90 m near the east point; it is surrounded by a platform with similar width at about the level of low water neaps. The junction between the two is formed by a cliff, generally 1-2 m high and slightly undercut. The surface of the calcarenite above is rough and pitted, and the cliff is retreating by fracturing and detachment of quadrangular blocks. The lower outer surface is smoother, coated with algae, and marked by deep round potholes and by trenches presumably eroded along vertical joints. Its outer edge is straight and steep, with a coating of encrusting calcareous algae. Stacks and residuals of calcarenite rise at intervals from the lower platform, demonstrating its erosional origin. Blocks detached from the calcarenite platform during storms, which may reach several meters in length, form a massively imbricated sediment overlying the platform at the east end of East Island, bringing the total height above low water springs to 5.6 m. The island beaches of gravel and cobbles are perched on the conglomerate platform; the island sediments are 2-3 m thick.

The calcarenites are considered further in section C. 4, and the vegetation of the islands is described in Chapter 11, p. 127.

6. Sand dunes on aggrading coasts

While most of the seaward and lagoonward coasts of Diego Garcia are slightly retreating, as shown by the presence of erosion ramps and cliffing, sectors totalling about 17 km possess coastal dune belts. The two main dune areas both face the southwesterlies and trend NW-SE: one, from Simpson Point to Pointe Marianne, is a seaward coast; the other, from Observatory Point to Cust Point, is a lagoon coast. Both lie to the north of slightly retreating sectors of coast, and the direction of sediment movement in each case is clearly from south to north. A third dune sector lies on the eastern seaward coast between East Point and Cust Point: again this lies to the north of a retreating sector, and the sediment supply is from the south.

In all of these sectors, dune accumulation takes the form of a single ridge of varying width rather than of discrete dunes. Vegetation cover is usually so dense that the dune ridge often only becomes apparent when the vegetation is cleared (Plate 10). At the northeast point the dune ridge widens and covers much of the end of the land rim, with a rolling but subdued topography. Generally the ridge is 40-150 m wide. According to Bourne the highest point on Diego Garcia is 30 ft (9 m) high (1888b, 441) and the dunes reach 25 ft (7.5 m) (1886, 385). Gardiner first stated that dunes at Northeast Point varied up to 30 or 40 ft (9-12 m) in height (Gardiner and Cooper, 1907, 46), but he later said that there was "no evidence that they ever reached more than 20 to 30 ft [6-9 m] above sea level" (1936, 417). In places the dunes are being eroded, as at Observatory Point (Dolotov, 1968), but generally they overlook a wide sand beach.

It is interesting that dunes are not developed on the southeast coast, facing prevailing winds. It is probable that, with little lateral sand movement on this coast, sand supply across the reef is inadequate for dune building, and that intermittent storm action is mainly destructive. The main dunes only form where alongshore sand movement from the south provides a supply. In the field it is noticeable that even slight changes in beach orientation can lead to changes in sand accumulation and dune formation on the berm.

7. Land sediments

Land sediment samples were collected at several stations round the atoll rim (Fig. 16): no attempt was made to secure uniformity of coverage, but the samples were chosen to illustrate the sedimentary characteristics of particular environments. Coarse sediments (cobbles and larger particles) were not sampled. Table 3 lists Folk and Ward parameters for mean size, sorting, skewness and kurtosis (M_Z, σ_I, SK_I,

Table 3. Characteristics of some beach, dune and barachois sediments at Diego Garcia (ϕ units)

Environment	Sample number	D_{50}	M_z	σ_I	Sk_I	K_G
Lagoon beach	DG 2	2.05	2.05	1.46	-0.34	2.79
	DG 3	1.78	1.80	0.45	-0.01	1.19
	DG 4	1.95	1.68	1.09	-0.46	0.80
	DG 5	1.43	1.48	0.25	+0.39	1.93
	DG10	0.54	0.41	1.09	-0.29	1.06
Seaward beach	DG 6	-0.16	-0.25	0.70	-0.22	1.51
	DG11	1.62	1.61	0.61	-0.07	1.02
	DG12	1.70	1.69	0.45	-0.05	1.00
	DG16	1.40	1.17	0.94	-0.46	1.48
	DG19	0.30	0.23	1.15	-0.33	1.65
Dune	DG14	2.01	2.03	0.42	+0.01	0.89
	DG15	2.40	2.40	0.33	0	1.29
	DG21	1.72	1.75	0.48	+0.03	1.01
Barachois	DG 9	1.30	1.46	1.66	+0.17	1.06
	DG13	-0.52	-0.54	0.96	+0.02	1.31
	DG17	1.52	1.50	1.33	+0.02	1.17
	DG22	0.80	1.09	1.67	+0.24	1.14
	DG24	0.94	0.94	1.13	+0.04	0.96

and K_G)* for samples from seaward beach, lagoon beach, dune and barachois environments, and cumulative frequency curves for these samples are given in Figure 17.

Beach samples are generally moderately well to well sorted, with negative skewness. Seaward beach samples are coarser than lagoon beach samples. Lagoon beach samples are either well sorted if homogeneous or less well sorted if more than one kind of sediment is represented, particularly in quiet water environments. The beach samples do not differ in any major way from those of other atolls, such as those of Addu Atoll previously reported (Stoddart, Davies and Keith, 1966), except that seaward beach sediments on Diego Garcia are generally of finer calibre than those of other, especially Trade Wind, atolls.

Dune sediments are well sorted and show no marked skewness. The mean grain size of about +2ϕ is smaller than that of seaward beach sediments, and would closely approach that of lagoon beach sediments were it not that the mean size of the latter is often increased by the inclusion of coarse material in the sample.

* For definitions of these parameters, see R. L. Folk, Sedimentology 6: 73-93, 1966.

Barachois sediments show greatest diversity. Whereas both beach and dune sediments are formed by an active sorting process, either by waves or wind, in the barachois the sediments have complex origins. Partly they are transported and deposited by tidal currents, though this is probably of minor importance; partly they result from the in situ deposition and disintegration of organic skeletons. As a result the sediments are poorly sorted (σ_I equal to or greater than 1.0). Most have a fine fraction (smaller than +3.4ϕ) of about 10 per cent, whereas such fine sediments are rare or non-existent in other land environments. Barachois sediments are subject to continuous post-depositional disturbance by the activities of Cardisoma, Uca and other organisms, which themselves add material in the form of skeletons and faeces to the sediments.

Diego Garcia terrestrial sediments are entirely composed of calcium carbonate, except for fragments of stranded pumice. These are fairly plentiful on the berms of aggrading beaches on seaward coasts, for example on the east coast between East Point and Minni Minni. Most of the fragments are less than 5 cm in diameter, a few reach 20 cm. Finsch (1887, 42) and Wilson (1889, 144) noted large amounts of pumice on the atoll, but their visits took place in 1884, the year following the great explosion of Krakatau. Earlier observations of pumice in the Chagos Archipelago had been made by Moresby (1844, 309). Pumice now forms a quantitatively insignificant proportion of the land sediments, though often local concentrations are formed by the practice of piling pumice fragments around newly planted coconuts. No other non-calcareous material was seen on the atoll.

C. Beach conglomerates and beach rocks

Most of the seaward beaches of the atoll are lined with some form of lithified reef-derived sediments; the total outcrop is greater than on any other Indian Ocean atoll visited by the writer. Rock outcrops are found more intermittently round the lagoon shores, and on the lagoon-mouth islets. The origin and relationship to sea level of these rocks is important in interpreting atoll history, particularly in view of the references made to sea-level change by Gardiner.

Categories of lithified sediments were first recognised at Diego Garcia by Bourne (1888b, 443), who distinguished four types:

1. reef rock, of compacted coral debris with horizontal stratification, formed under the sea or intertidally;
2. boulder rock, formed above high tide by salt spray, outcropping as a low rampart with seaward dip;
3. shingle rock, which is either (a) horizontally stratified but finer in calibre than reef rock, formed under the sea or intertidally, and including corals in the position of growth in sheltered parts of the lagoon; and (b) a seaward-dipping rock, similar in features and origin to boulder rock, but of finer calibre;

4. sand rock, formed from sediment accumulated above water level by wind action and cemented by spray, the outcrops possessing seaward dip.

These categories are not mutually exclusive, and Bourne's use of both morphologic and genetic criteria leads to confusion, but it is clear that considerable differences do exist in the form, composition and origin of the coastal rock.

1. Seaward coast erosion ramp and beach rock

Rocks on the seaward coast are of similar form round the whole atoll rim, though in general they are not well exposed on aggrading coasts with dune development (e.g. East Point to Cust Point; Pointe Marianne to Simpson Point). Typically the base of the beach is formed by an erosion ramp or low-angle surface bevelling a coral conglomerate (Plate 23). Where wave action is considerable the surface of the ramp may be highly polished, but it is generally smooth, with rounded erosion furrows oriented normal to the beach (Plate 28). The surface of the ramp clearly truncates corals embedded in the conglomerate. In many places (e.g. southeast of Barton Point, northwest of Horsburgh Point, northeast of South Point) the ramp surface passes smoothly, without visible break, into the bevelled horizontal surface of the inner reef flat, suggesting that the underlying rocks are continuous and that the difference in form results from erosion. Between East Point and Horsburgh Point, this is further suggested by the continuity of erosion furrows of the rock surface between reef flat and ramp. The ramp rock is often a conglomerate filled with corals, particularly *Pocillopora*, also suggesting that this may be an elevated reef rock much modified by erosion during the formation of the present reef flat surface.

Elsewhere round the atoll the erosion ramp outcrops only intermittently across the lower beach: the middle part of the beach consists of sand or cobbles, and on the upper beach there is a vertical or overhanging clifflet cut into the conglomerate rock (Plates 25-26). The rock surface above the cliff is horizontal or rises slightly inland, and is overlain with sand or humic soil. Where the cliff is cut in conglomerate similar to that of the planed *Pocillopora* ramp, the corals can be seen to be wave-tossed and not in the position of growth. This can also occasionally be seen lower on the beach when vertical sections are revealed on the ramp by spalling of slabs. Near East Point there is a section showing on the lower beach a cemented conglomerate of jumbled coral colonies, and on the upper beach a wave-eroded cliff in unconsolidated sediments consisting mainly of coral colonies of the same size and type as those in the conglomerate (Plates 20-22). The only apparent difference is that the unconsolidated deposits contain more rounded cobbles than the conglomerate. No case was seen anywhere on the seaward coast where corals in the position of growth in the conglomerate indicated emergence. In many places, of course, the rock is a calcarenite (e.g. in the upper beach clifflets near South Point) and corals are completely absent.

The relationship of the erosion ramp and upper beach clifflet to tidal levels is of interest. The erosion ramp lies between approximate low water springs and mean sea level. The highest parts of the ramp and of the upper beach clifflet may lie above the still-water level of high water spring tides, but are within the range of swash. Thus, if the cementation process is intertidal (Stoddart and Cann 1965), all the rocks on the seaward coasts could be formed at their present elevation by cementation of clastic deposits and subsequent erosional modification. The East Point section indicates that some of the ramp rocks closely resemble contemporary beach sediments in composition. This interpretation would suggest that the erosion ramp rocks are similar in origin to ordinary beach rocks. The absence of normal morphologic features of beach rock and the continuity of ramp and reef flat in many places, on the other hand, suggest that the comparison with normal beach rock is an over-simplification.

Special attention was given in the field to observing whether beach-foot rock exposure possessed any morphological features of beach-rock, such as seaward dip, land-facing scarp, and undercut along stratification lines, to determine whether the smooth erosion ramps could be degraded beach rock. The results were ambiguous. In some places smooth erosion ramp passes into true beach rock with characteristic seaward dip; the beachrock features then disappear further along the beach and the ramp again becomes continuous with the reef flat. Northeast of South Point "morphologic beach rock" of sandy composition overlies conglomeratic ramp rock, and slabs of the beach rock are being peeled from the underlying ramp (Plate 24). But laterally this clear distinction fades, and becomes difficult to make as the beach rock often contains much coral debris. Sandy beach rock is found near Simpson Point, but again its relationship to the erosion ramp elsewhere is not clear. No relict beach rock was seen on the reef flats seaward of the present beaches anywhere round the atoll.

Provisionally, all the rocks seen on the seaward coast are interpreted as formed at present sea-level by cementation of beach deposits, and subsequently much modified by erosion. There is no clear evidence of elevation or relative sea level movement in any of these rocks.

2. Lagoon coast beach rock

"Morphologic beach rock" with seaward dip, at low intertidal levels, following the trend of the beach, and of clearly recent origin, is uncommon on Diego Garcia beaches. The best exposure is found in the wide sandy bay between Barton Point and Observatory Point at the lagoon entrance. Elsewhere beach rock is generally found slightly offshore on slowly retreating sandy coasts: for example between Observatory and Cust Points (30-40 m offshore), between East Point and Carcasse, and between Eclipse Point and Pointe Marianne (up to 30 m offshore). In the southern half of the lagoon, beaches with plentiful sand supply are absent, and normal beach rock is not found on the slightly cliffed shores. All the beach rocks seen on the lagoon coast are clearly related to the present sea-level stand.

3. Barachois rock

The massive calcarenitic ledges at the mouths and round part of the margins of the large southern barachois (Plates 29-30) have already been described (Section B.2). Gardiner, who figured "overhanging cliffs" of rock in one of the barachois (1906, 459), believed that it indicated a relative change in sea level. The rock at the mouth of Barachois Maurice was "such as might have been formed in the elevation of an encircling reef" (Gardiner 1936, 419). South of East Point the rock "was sometimes of coral in its growth position bedded by sand, not algae; it must have been of lagoon formation and its present position can only have been due to a fall in the water level of the lagoon" (Gardiner 1936, 419).

No trace was seen in 1967, at Barachois Maurice or elsewhere, of corals in the position of growth in this barachois rock. The rocks are fine-grained calcarenites formed from clastic sediments, generally massive and without marked bedding, but in places with a slight lagoonward dip resulting in the formation on the upper surface of the rock of small-scale cuestas which are, however, distinct from those of normal beach rock. The cementation is firm but superficial, and at Barachois Maurice decreases inland away from the lagoon until it becomes only a thin superficial crust.

The origin of the barachois rock is clearly linked to that of the barachois. It must be stressed, however, that all the outcrops seen are intertidal: Gardiner's photograph of "overhanging cliffs" was clearly taken at low water spring tide, and at high water springs almost all the barachois rock is submerged, with the sea reaching beaches perched on the rock surface. No evidence was found to support Gardiner's hypothesis of recent emergence.

The cemented pavements of the smaller barachois on the narrow western rim lack the cliffed form of the southern outcrops, but their surfaces lie at high intertidal levels, and they probably have a similar origin.

These rocks most resemble the cay sandstones outcropping on retreating sandy shores of Caribbean atolls (Stoddart 1962, plate 1; 1963, 108-109) and ascribed to ground-water cementation. The barachois rocks may have similar origin.

4. Island "promenades"

The outcrops of bedded calcarenites on the windward sides of East and West Islands have been described in Section B.5. They extend to about 3 m above low water spring tide level, and thus are clearly higher than intertidal. Bourne (1888b, 446-447) described this rock from East Island, and argued that it indicated a slight elevation. He described well sections on the island, showing 2.5 ft (0.8 m) of thick horizontal "shingle rock" with some corals, over 1.5 ft (0.46 m) of loose sand, over 3 ft (0.9 m) of coral rock, over more sand, over a basement of solid reef rock. Bourne thought that the alternation of sand and rock represented an alternation of coral growth and sedimentation under lagoon floor conditions. The upper rock surface he estimated to be 4 ft (1.2 m) above high springs, thus giving a minimum estimate of the amount of elevation. Gardiner (1931, 35) also briefly mentioned stratified rock forming cliffs 10 ft (3 m) high on the islands.

It is difficult to see how these bedded sands could be formed at their present elevation under present conditions. They probably indicate emergence of a few metres, following accumulation on the lagoon floor under conditions of active water movement. Strongly bedded sands of very similar form, though with a large terrigenous element, have been found in the Gulf of Mannar, South India, and undoubtedly originated as nearshore bay-floor sediments subsequently elevated (Stoddart and Pillai, in preparation). The restriction of these rocks on Diego Garcia to the two lagoon-mouth islets presents a considerable problem if they do indicate emergence. They could indicate that some at least of the seaward coast ramp rocks were also formed by the same elevation movement. The island promenades thus form a crucial problem in the recent geomorphic history of the atoll, and merit further study.

D. Seaward reefs

The seaward reef flats of Diego Garcia are remarkably uniform around the atoll. They vary in width from a minimum of 50 m to a maximum of 250 m, but are usually about 150 m wide. They also vary slightly in height: most of the flats remain slightly submerged even at low water spring tides, though some sections (e.g. at the South Point) dry. These characteristics differ from those of Addu in the southern Maldives, where the seaward reef flat varies in width from 50 to 750 m (the total width is from 1 to 2 km) and much of the flat dries completely at low spring tides.

The surface of the flat is rocky, with thin patches of rippled sand, gravel and boulders. Corals are generally rare, and the main organisms are *Cymodocea* (=*Thalassodendron*), benthic algae, and a crust-forming bivalve *Modiolus*. Boulders are in many cases scattered over the whole flat and there is no well-marked boulder zone. Local exceptions are, however, found, for example at Barton Point, where the inner flat is covered with large boulders (Plate 3). Where bare rock is exposed it is often polished, especially near the shore where it passes either beneath the beach or into an erosion ramp. The surface is intersected by long straight cracks with variable orientation. Toward the seaward side it may be dissected by erosional channels normal to the reef edge. The seaward edge is intermittently marked by an algal ridge forming a slight topographic feature. This is best developed on the west coast near Pointe Marianne (Plates 1 and 2), where, however, it extends for only a few hundred metres.

Surge channels through the ridge are found here but were not seen well developed elsewhere; the reef edge on the southeast coast could not be properly inspected because of surf. In general the algal ridge is less well developed at Diego Garcia than at Addu Atoll in the Maldives. Small and scattered coral colonies are found in places on the reef flats, particularly species of Pocillopora, Platygyra and Porites, and of Acropora near the edge, but these contribute little to the morphology of a mainly erosional landform. There is no evidence at all that "the reef is growing seawards on all sides and the gain of the island to seaward exceeds its loss", as Gardiner (1936, 416) supposed.

We have no data, apart from aerial photography, on the seaward reef slopes around the atoll, except outside the lagoon entrances on the north side where H.M.S. Vidal carried the 1967 survey to depths of 300-400 m. Figure 12 shows 8 profiles in this area from the 1967 chart. The mean slope of the outer reef to a depth of 25 m is 6°30'; the slope then steepens to 17° down to 50 m and to 48° down to 230 m, before declining to 20° between 230 and 410 m. Aerial photographs suggest a similar low-angle shelf, 200-300 m wide, outside the breakers round much of the atoll. We have no information at all on reef communities on these outer slopes.

E. Lagoon

1. Topography

The lagoon of Diego Garcia is large, shallow, and almost completely enclosed by land. It has a total area of 124 sq km, and a maximum depth of 31 m. It was first charted by R. Moresby in 1837, and the northern half was charted in great detail by F. C. P. Vereker in 1885. A detailed survey of the whole lagoon was made by Capt C. R. K. Roe, H.M.S. Vidal, in 1967. Diego Garcia lagoon is thus topographically one of the best known atoll lagoons in the world. Sounding density in the 1967 survey ranged from 100 to 200 soundings per sq km, giving a total number of soundings on the 1:25,000 chart of about 18,000. This sounding density is rather less than those for Addu and Eniwetok, but substantially greater than that of any other atoll.

The main features of the lagoon floor are given in Figure 13, reduced from the 1967 chart, and in the profiles from the same source in Figure 14. The lagoon consists of three main basins: a large northern basin with its floor at 25-30 m depth; a central basin with its floor at 16-20 m depth; and a southern basin with more intricate topography, isolated by a ridge with depths of only 2-4 m extending entirely across the lagoon. For an atoll of this size the lagoon is unusually shallow. Most of the Maldive atolls have depths of 40-70 m, and the southernmost, Addu, has a maximum depth of 78.6 m. Peros Banhos in the Chagos has a maximum depth of 75 m, and though Salomon has the same maximum as Diego Garcia it is a much smaller atoll (overall 36 sq km).

Hypsometric curves have been drawn for the Chagos (Fig. 15) and Maldive atolls, and hypsometric integrals* calculated. Diego Garcia has the highest hypsometric integral of all of these atolls, 51.0, indicating the least-basined form, compared with 48.7 for Peros Banhos and 38.4 for Salomon. Most Maldive atolls have values ranging from 25-30, and a few from 38-44 (Stoddart, in preparation). Median depths of the Chagos atolls read from hypsometric curves are: Diego Garcia 17 m; Salomon 21 m; and Peros Banhos 40 m. The hypsometric curve for Diego Garcia was constructed from a subjectively-generalized contour map of the lagoon floor based on the 1967 chart: it thus excludes the many knolls and irregularities and represents gross topography only.

2. Knolls

The extremely detailed sounding in 1967 clearly demonstrated the irregularity of the lagoon floor and the presence of large numbers of knolls. It is however remarkable, as Gardiner (1936, 419-420) pointed out, that outside the 10 m line virtually none of these knolls reaches the surface: Diego Garcia must be almost unique among atolls in the absence of surface patch reefs in the lagoon.

In the main northern basin of the lagoon, with its floor at 25-30 m, large numbers of knolls rise to 15-18 m depth, but only five reach 2-5 m. Knolls are especially concentrated in the north, near the lagoon entrances, where the basin-like form of the lagoon floor is in places almost obscured. In the central basin, with its floor at 18-20 m, the knoll summits are shoaler, many reaching 5-8 m and some even 3 m depth. The small southern basin is so encumbered with winding ridges and knolls mostly reaching 7-9 m but some reaching 2-4 m depth, that the intervening floor at 16-20 m is almost obscured. The variation of lagoon and knoll characteristics from north to south forms a problem second only to that of the absence of surface reefs in the Diego Garcia lagoon.

Knolls in atoll lagoons may be either contemporary growth features or karst-eroded limestone hillocks formed during periods of low sea-level. The fact that most of the Diego Garcia knolls fail to reach the surface and are apparently not actively growing suggests the latter explanation. Conversely the great concentration of knolls near the lagoon entrances suggests that coral growth may be restricted to this area and inhibited elsewhere in the lagoon by low water circulation, resulting from encirclement by land. There are problems in this explanation, however, for the shoalest knolls, with actively growing corals,

* This measure is defined and measurement procedures are described by A. N. Strahler, Bull. Geol. Soc. Am. 63: 1117-1142, 1963.

are in fact found in the southernmost part of the lagoon, where water circulation is probably minimal. The problem of knolls and lagoon reef growth forms one of the most intriguing problems for future research at Diego Garcia.

3. Entrances

The unusual degree of enclosure of the lagoon has already been mentioned. There are three gaps, all in the north, and all shallow. Main Pass, the westernmost, is 1.6 km wide and about 10 m deep. Middle Pass is 0.6 km wide and 6-7.5 m deep, except for a narrow steep-walled trough more than 30 m deep cutting back into it. Barton Pass is 1 km wide, and again only 6.5-7.5 m deep.

The volume of the Diego Garcia lagoon is of the order of 1900 x 10^6 cubic meters. With a comparatively small tidal range, such shallow passes, and no possibility of water entering or leaving across reef flats as is usual in other atolls, the residence-time of water in the lagoon must be considerable and exchange with the open ocean much inhibited. The effects of this on the physical and biological characteristics of the lagoon require study. The Diego Garcia lagoon contrasts with those of many other landlocked atolls, which have very shallow and often hypersaline lagoons.

4. Lagoon sediments

Fifty-one lagoon-floor sediment samples were taken in 1967: their location is shown in Figure 16. Folk and Ward characteristics for some of these samples are given in Table 4, and cumulative curves for certain samples in Figure 18. These sediments will be reported in greater detail elsewhere. They fall into two groups: first, sediments with size and sorting characteristics similar to those of lagoon beach sediments, with mean size about 2ϕ and moderate sorting. These sand-size sediments are clearly subject to wave-sorting processes; they are found in shallow nearshore areas and adjacent to some knolls. Second, there is a group of sediments with a wide range of mean sizes, poor sorting, and a high proportion (50-90%) finer than +3.5ϕ. These fine sand and silt size sediments with occasional coarse skeletal fragments are found in the deep northern basin, especially towards the east side, in depths of 15-30 m. A sample of this "coral mud" was collected by Gardiner and was described by Murray (1910, 390). Electron micrographs of this fine fraction show that the material is largely of detrital origin. Similar fine sediments in other lagoons are not often found in such shallow depths (at Addu they are restricted to the deepest part of the lagoon) and their occurrence at Diego Garcia probably results from the encirclement and restricted movement of lagoon waters.

Table 4. Characteristics of some lagoon sediments at Diego Garcia (ø units)

Environment	Sample number	D_{50}	M_z	σ_I	Sk_I	K_G
LAGOON FLOOR	B 8	1.10	1.28	0.94	+0.30	0.94
	B 9	1.72	1.91	1.02	+0.20	0.93
	B10	1.55	1.59	1.00	+0.04	1.18
	B20	1.67	1.71	0.89	+0.06	0.97
	B24	1.08	1.15	0.83	+0.11	0.96
	B25	2.21	2.17	0.60	-0.09	0.96
	B28	1.24	1.20	1.49	-0.16	1.00
	B36	1.80	1.71	1.01	-0.17	0.95
	B39	1.44	1.30	1.06	-0.28	1.23
	B51	1.76	1.74	0.91	+0.01	1.00
	B52	2.23	2.16	1.05	-0.07	0.85

5. Lagoon changes

The availability of hydrographic charts made in 1837 and 1885 suggested to Gardiner (1931, 139-141; 1936, 419-420) the possibility of demonstrating topographic changes resulting from either solution or infilling over this 48 year period. Comparison of the charts of the northern lagoon basin led him to conclude that the total area had increased from 19.31 to 21.75 sq miles, and of the basin below 5 fathoms from 16.5 to 17.42 sq miles. He concluded that the lagoon was expanding by solution at the same rate as the outer reef was growing outwards, so that there was no change in gross form of the atoll. The detail of the earlier charts, however, was not sufficient to show the complexity of the lagoon floor topography revealed by the 1967 survey. The bottom variability is such that no inferences concerning changes in depth can be made from the data on earlier charts. Gardiner's calculations were made at the time when Daly (e.g. 1934, 221) was even using the Diego Garcia lagoon as one of his examples of lagoons with smooth horizontal floors. These interpretations are clearly untenable with present knowledge.

F. Conclusion

The main problems raised by this outline of the geomorphology of Diego Garcia concern (a) the origin of the various lithified sediments and their relationships to sea-level change, and (b) the status and origins of knolls and other lagoon floor features, and their relationship to sea-level changes. We have, however, no data from Diego Garcia from which an absolute chronology of sea-level change could be established. Many of the features of the atoll must remain unexplained until such a chronology is available. Except in the case of the calcarenites at East and West Islands, the evidence of lithified sediments for recent sea level change is equivocal. On the other hand many features of the land rim might more easily be explained if recent sea-level change were admitted. These include the formation of barachois and the general occurrence of beach retreat. Documentary evidence of the form of the atoll, going back to 1824, suggests, however that changes since that time have been minor. Future geomorphological research at Diego Garcia might concentrate on the problem of sea-level change, since this probably forms a key to most of the outstanding problems of the atoll geomorphology.

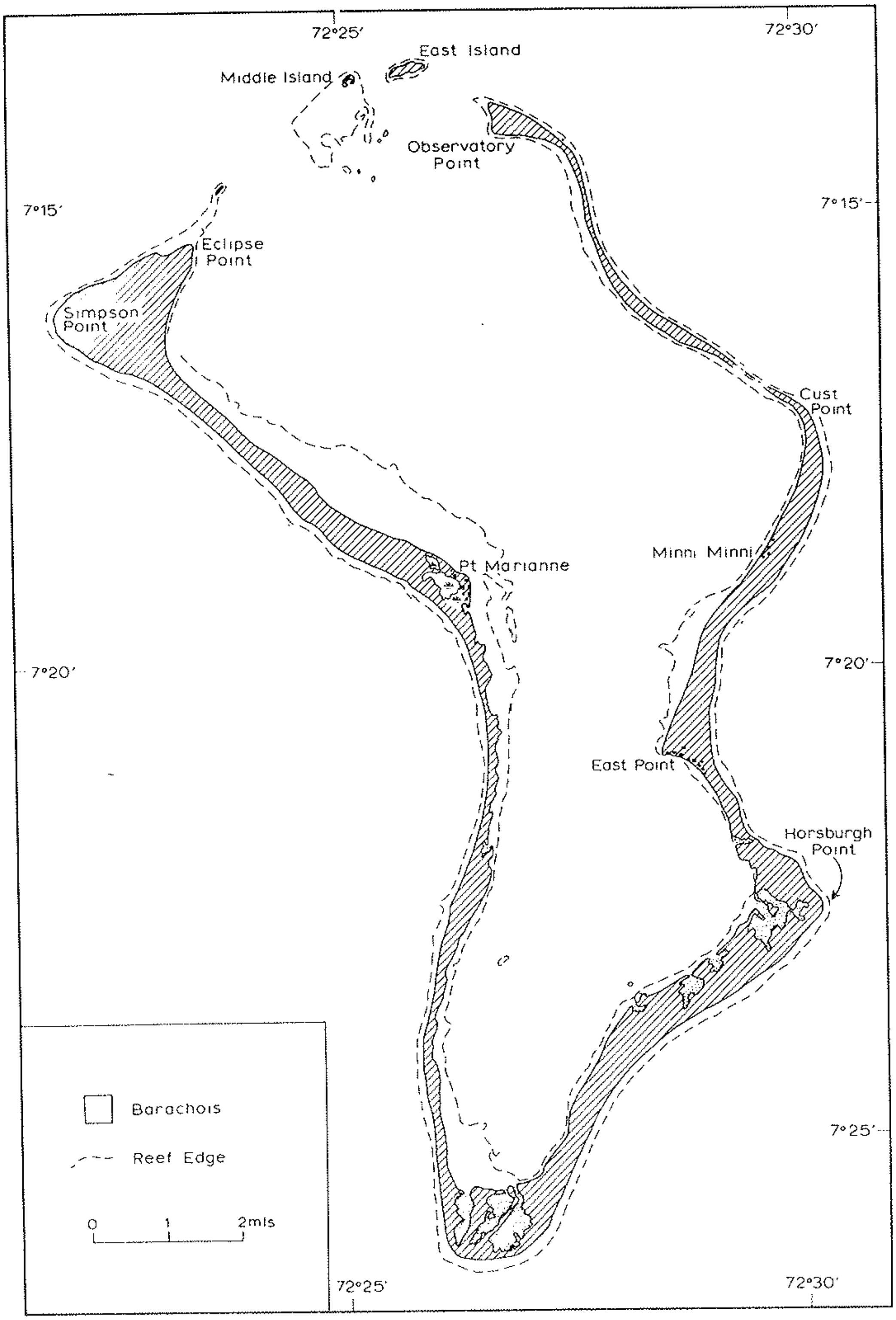


Fig. 2. Diego Garcia Atoll. From a survey by HMS Vidal 1967 and reproduced with the sanction of the Controller, Her Majesty's Stationery Office and of the Hydrographer of the Navy.

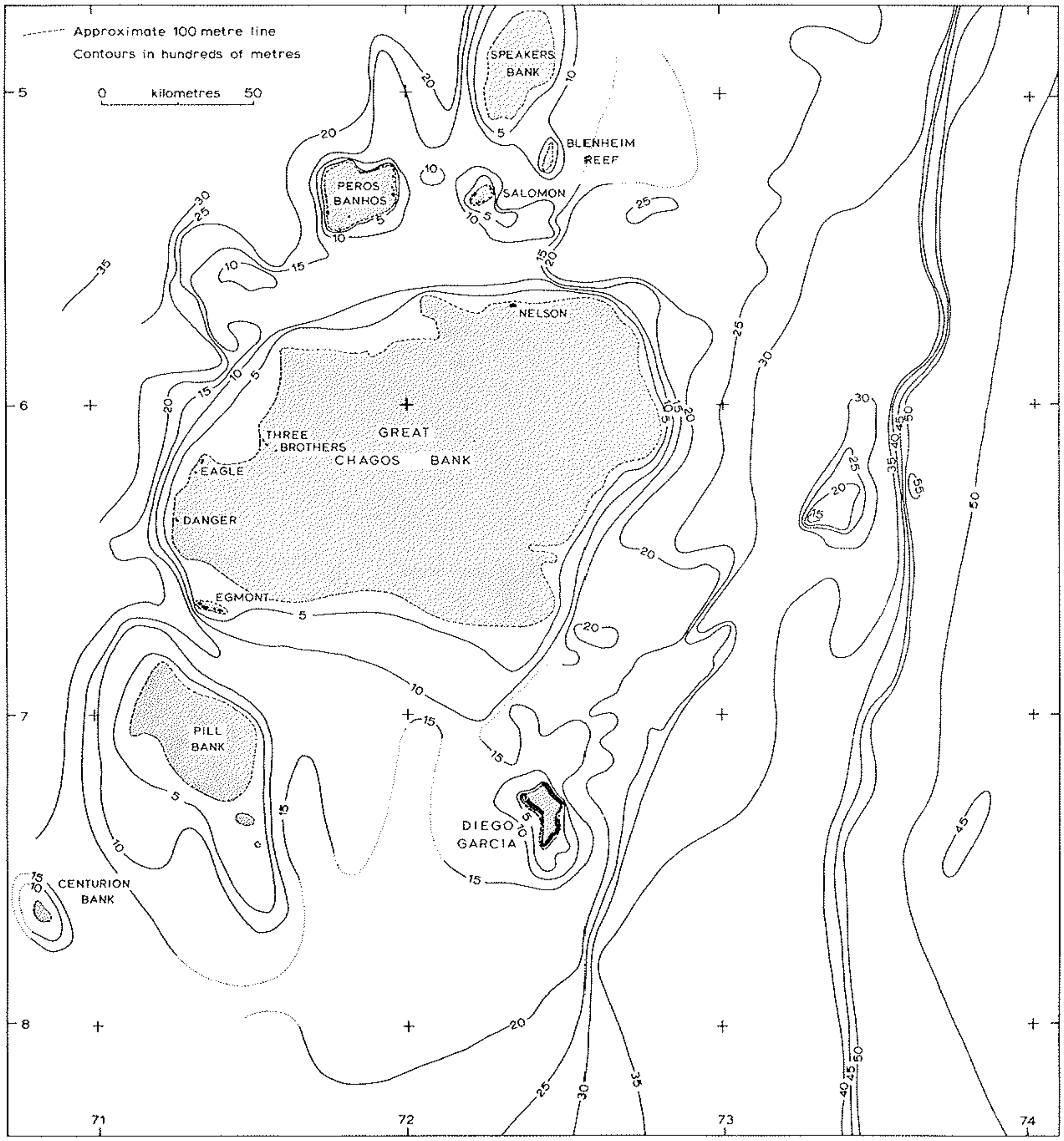


Fig. 3. Bathymetry of the Chagos Archipelago. From Admiralty Charts and Ocean Plotting Sheets and reproduced with the sanction of the Controller, H.M. Stationery Office and of the Hydrographer of the Navy.

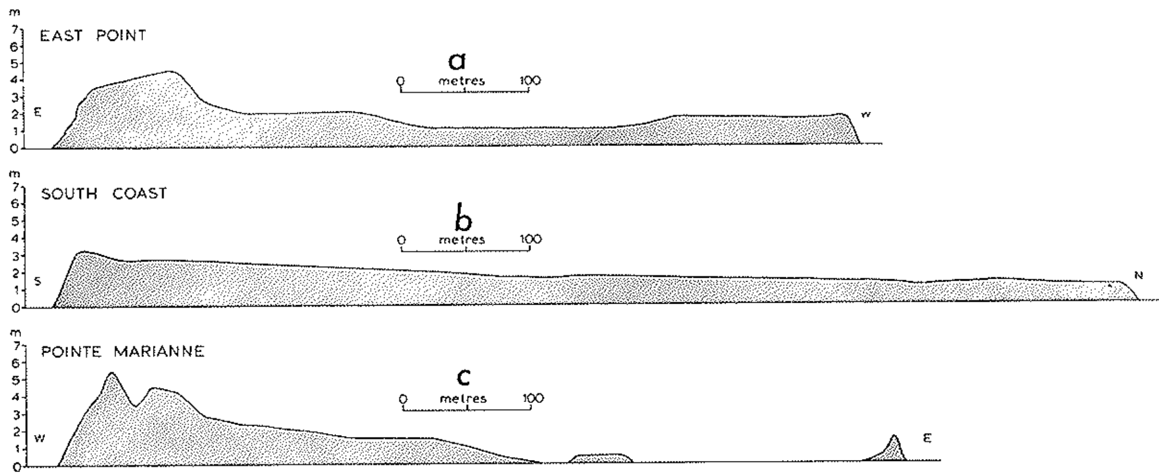


Fig. 4. Profiles of the land rim of Diego Garcia: (a) East Point, (b) Pointe Marianne and (c) South rim.

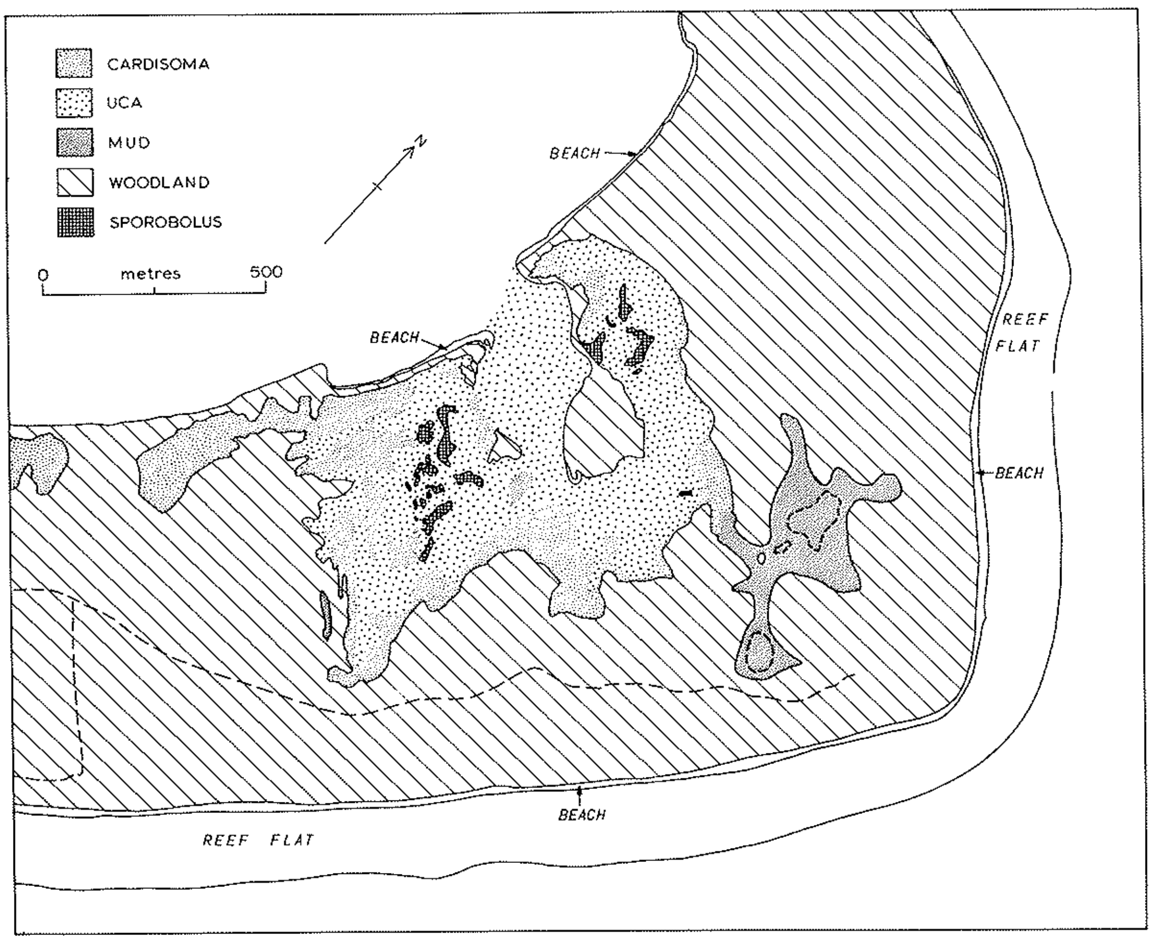


Fig. 5. Barachois Maurice. Based on Crown Copyright air photographs.

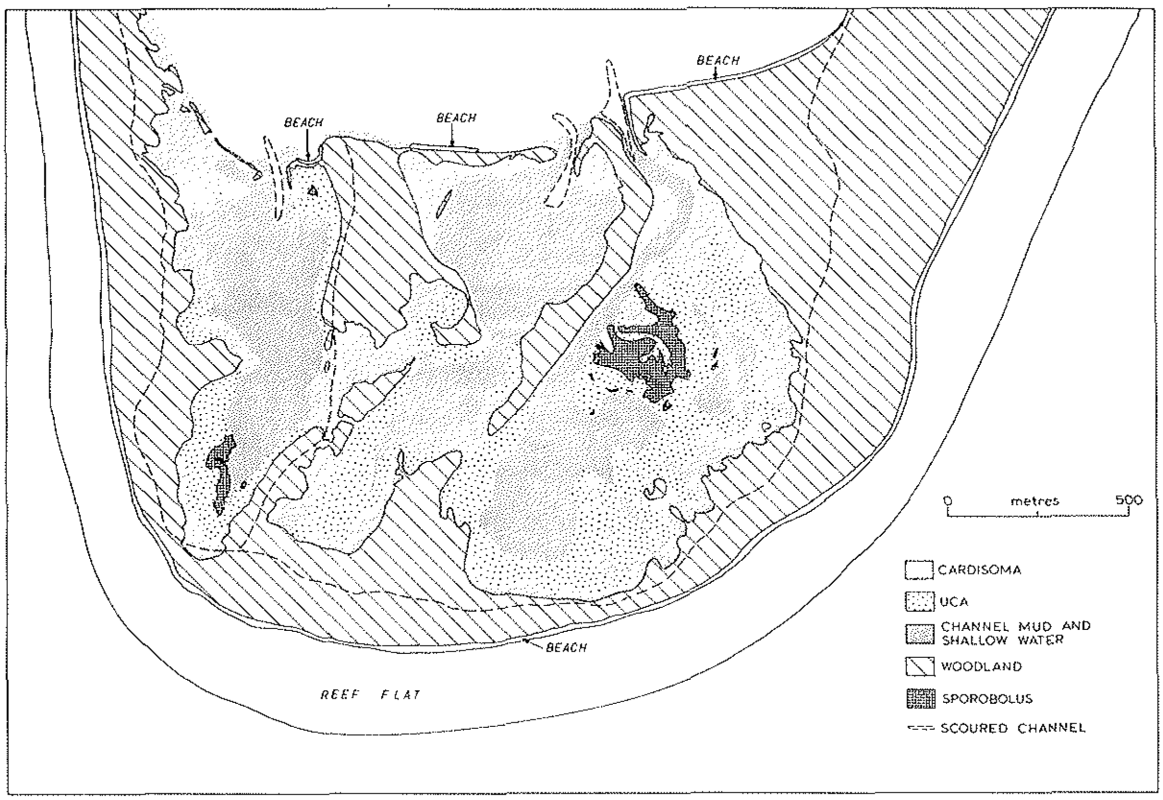


Fig. 6. Barachois Sylvain. Based on Crown Copyright air photographs.

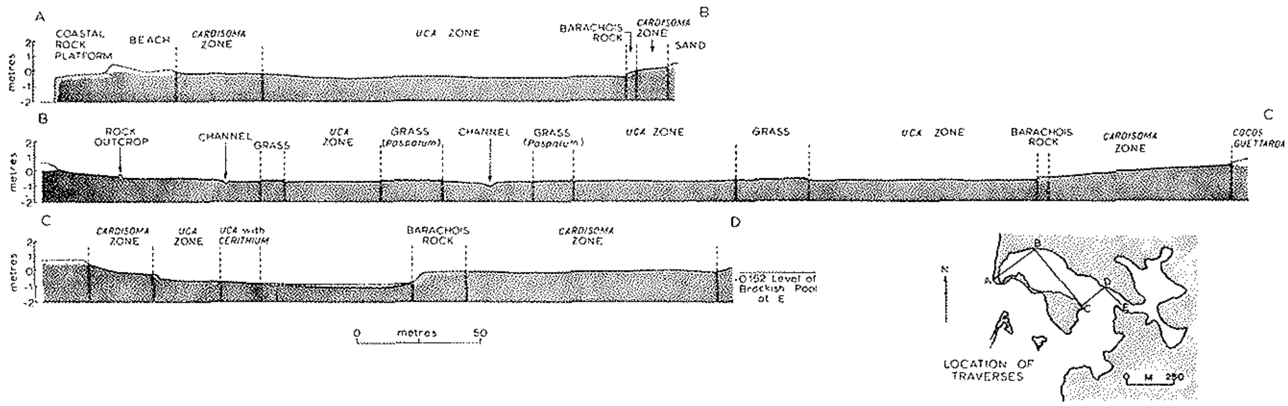


Fig. 7. Prcfiles in Barachois Maurice.

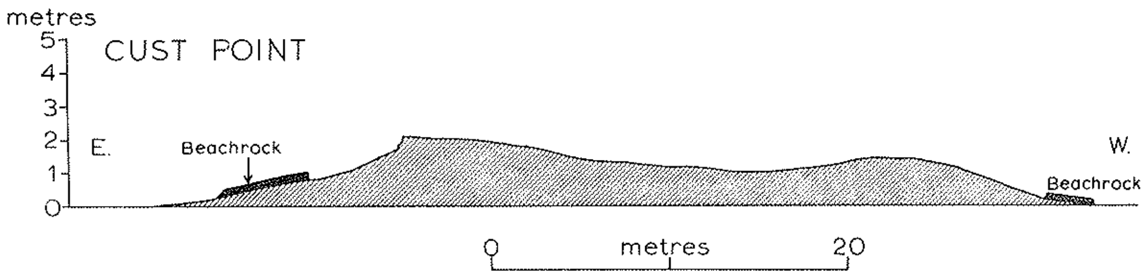


Fig. 8. Profile of the land rim at Cust Point.

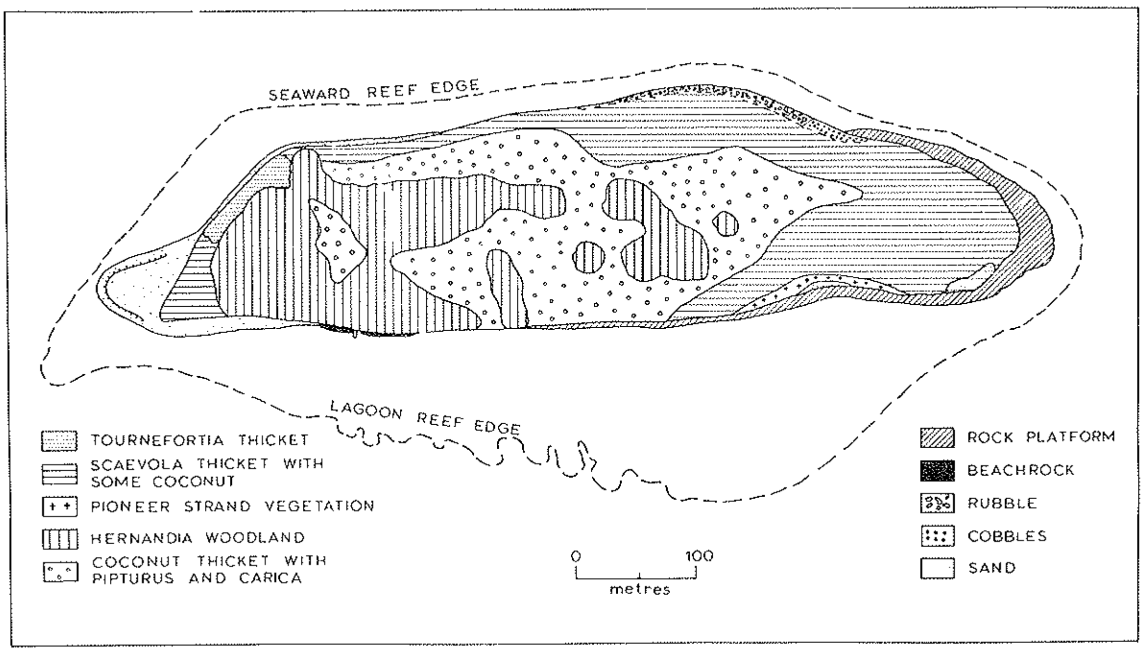


Fig. 9. West Island.

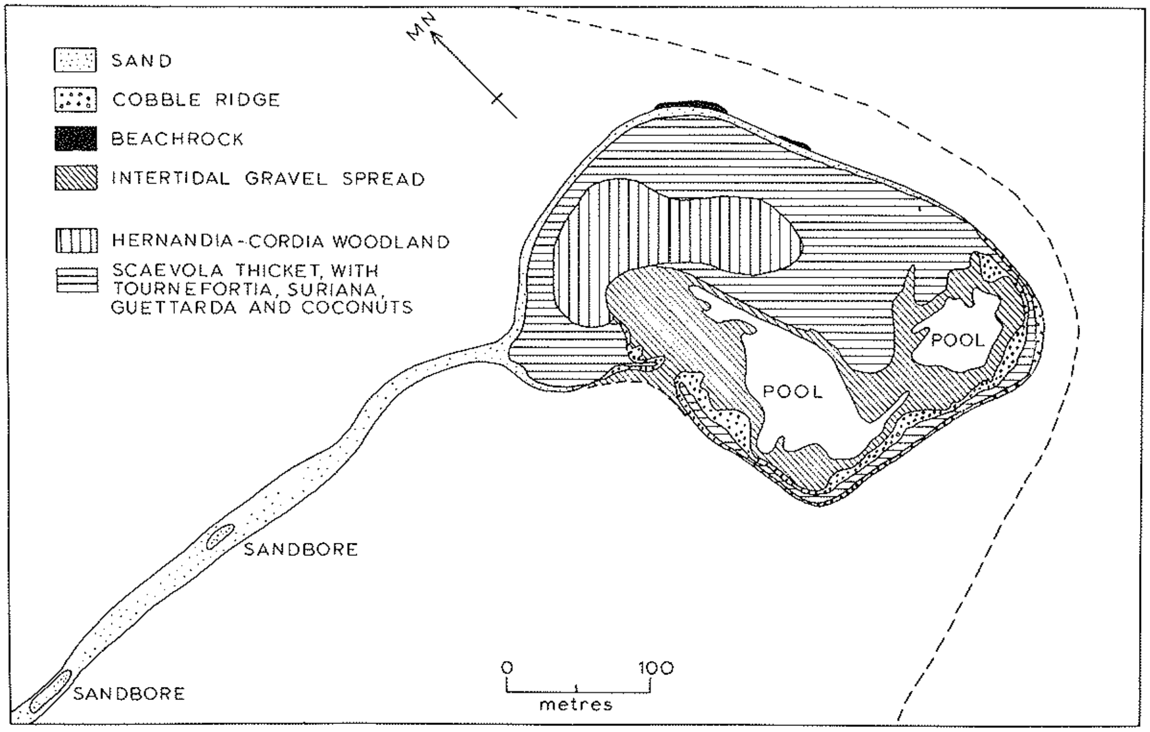


Fig. 10. Middle Island.

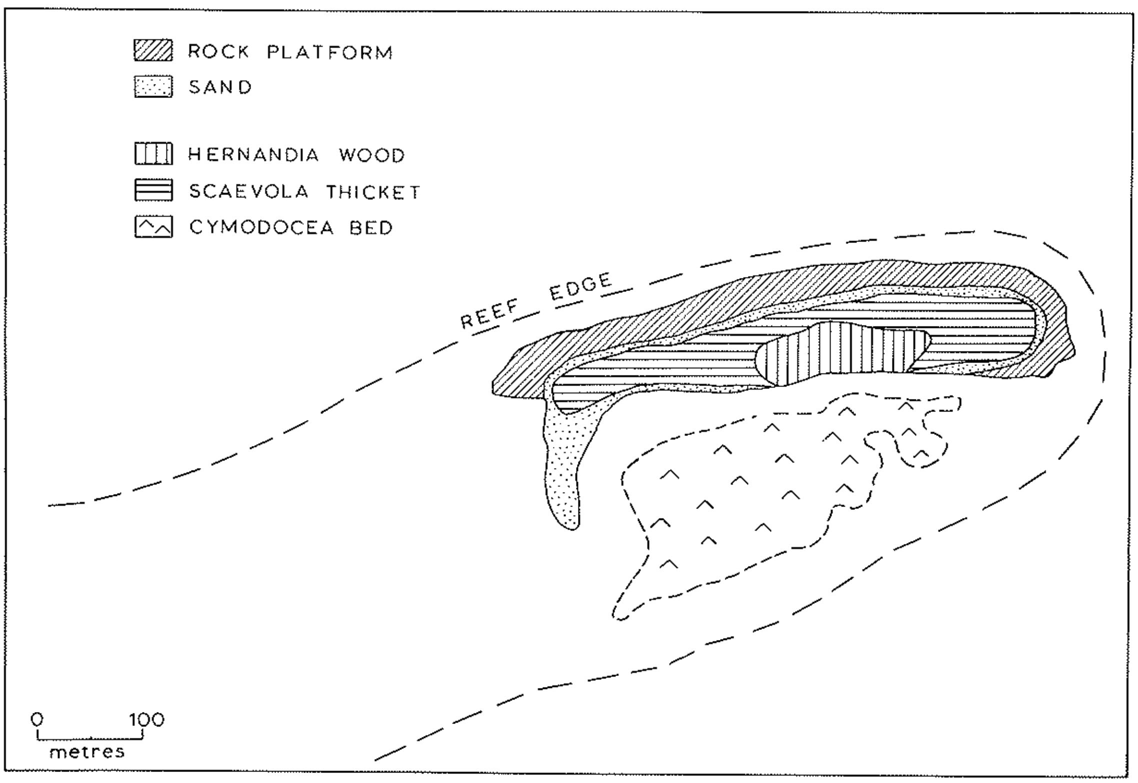


Fig. 11. East Island.

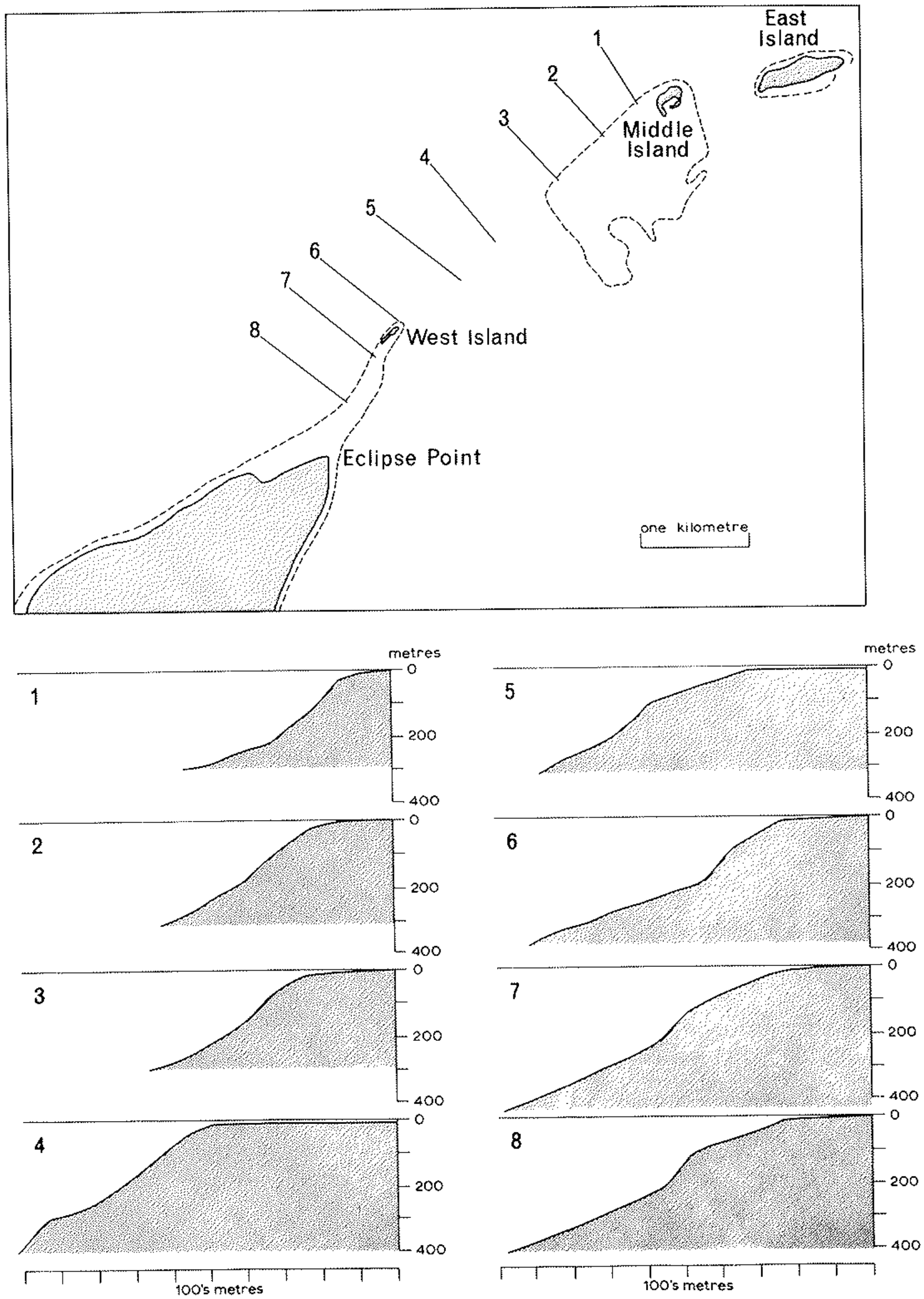


Fig. 12. Profiles of the seaward reef front, north side of the atoll. From a survey by HMS Vidal 1967 and reproduced with the sanction of the Controller, Her Majesty's Stationery Office and of the Hydrographer of the Navy.

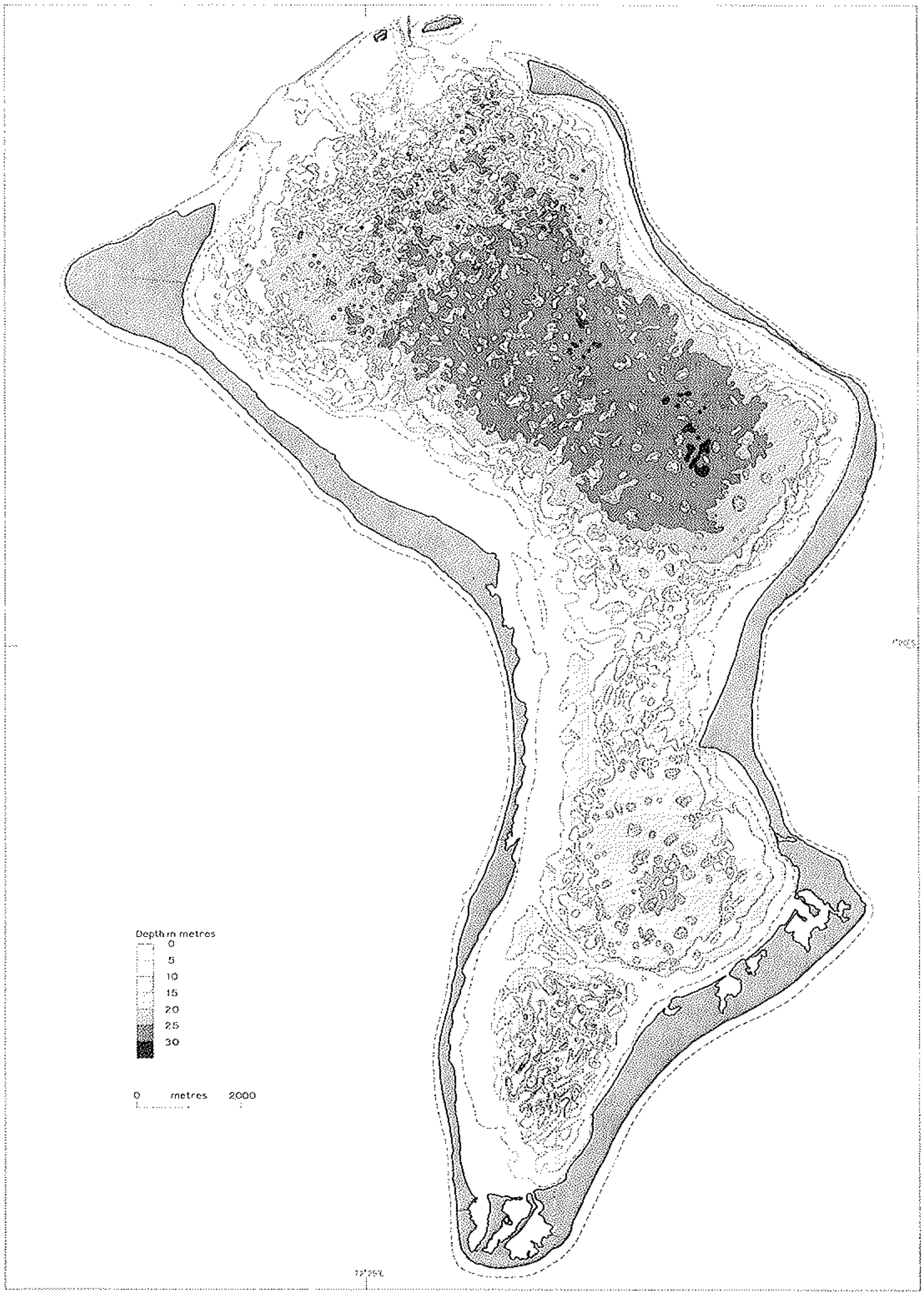


Fig. 13. Bathymetry of the lagoon floor. From a survey by Captain C.R.K. Roe, DSC, RN, HMS Vidal 1967 and reproduced with the sanction of the Controller, Her Majesty's Stationery Office and of the Hydrographer of the Navy.

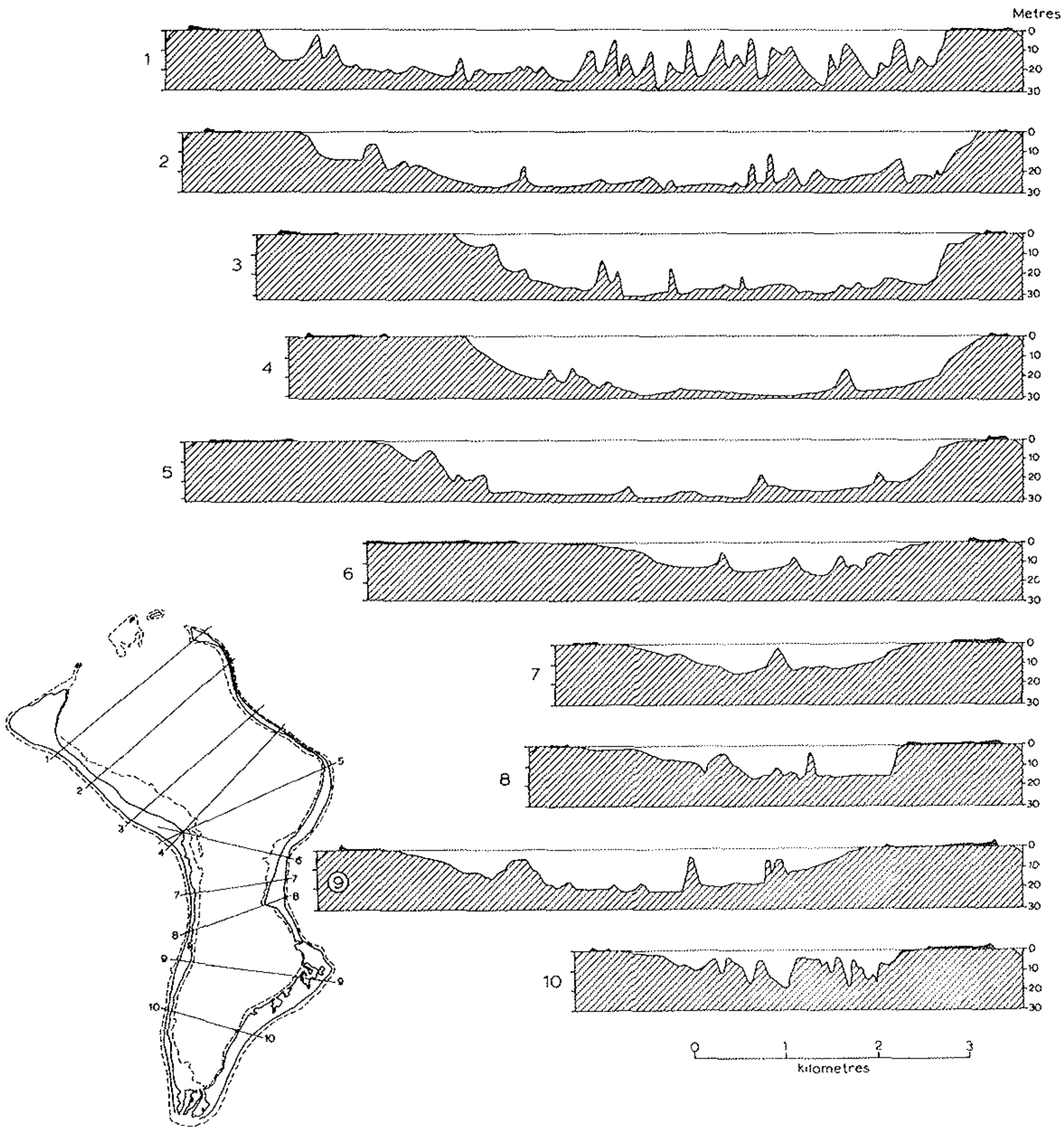


Fig. 14. Profiles of the lagoon floor. From a survey by HMS Vidal 1967 and reproduced with the sanction of the Controller, Her Majesty's Stationery Office and of the Hydrographer of the Navy.

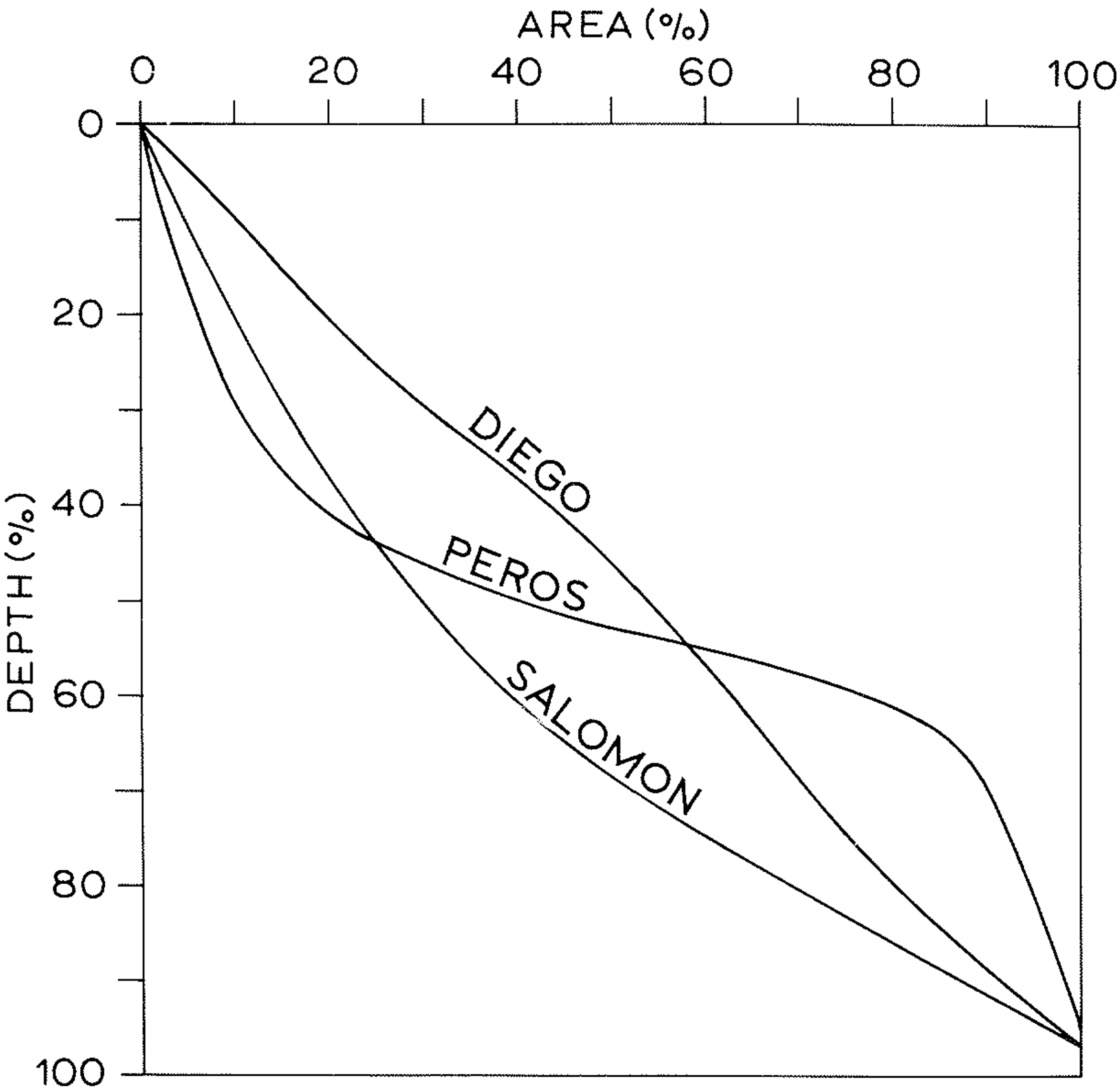


Fig. 15. Hypsometric curves for lagoons of atolls in the Chagos Archipelago.

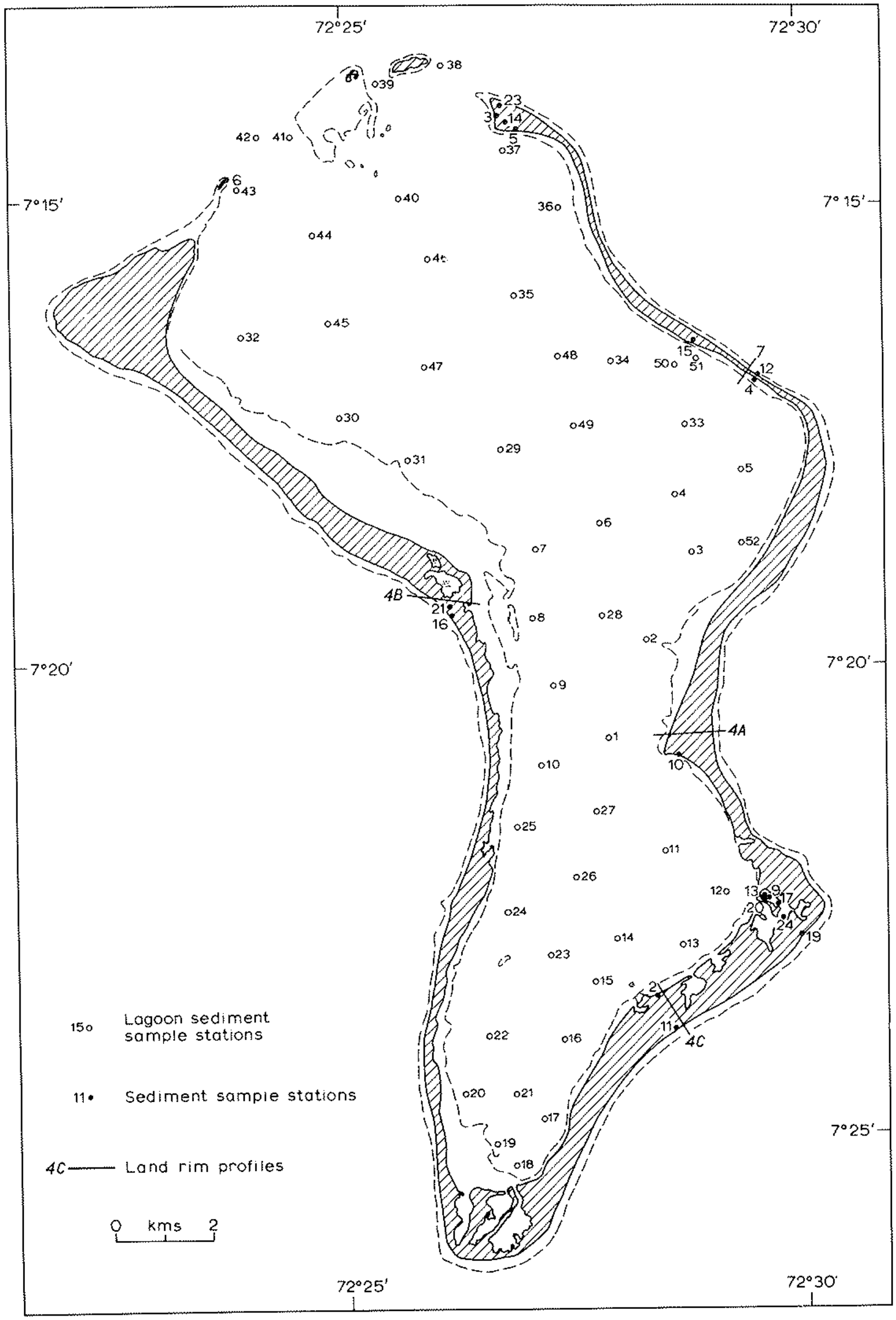


Fig. 16. Location of sediment samples. (a) Land rim and (b) Lagoon floor.

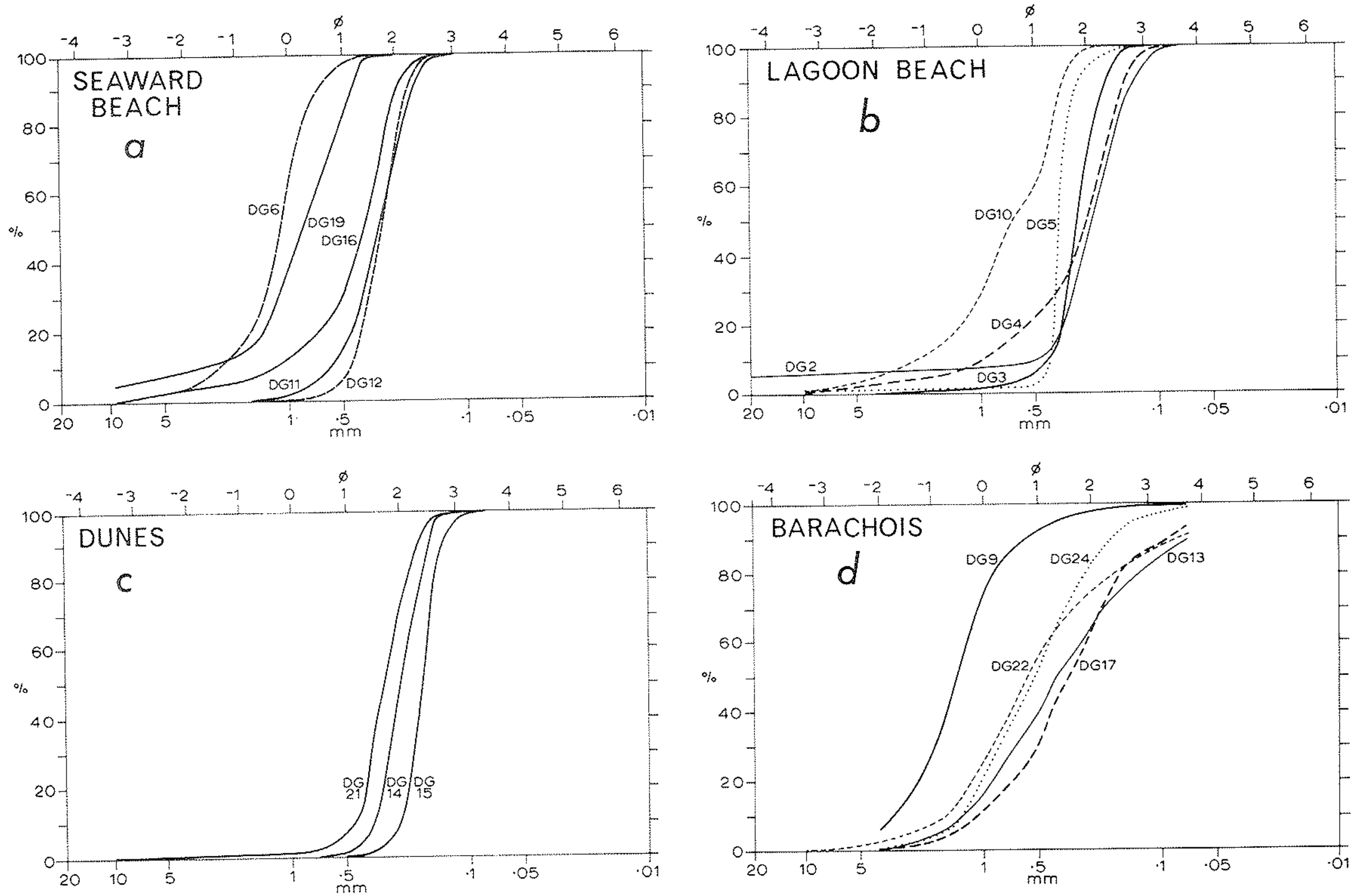


Fig. 17. Cumulative frequency curves for sediment samples from (a) seaward beach, (b) lagoon beach, (c) dunes, and (d) barachois environments.

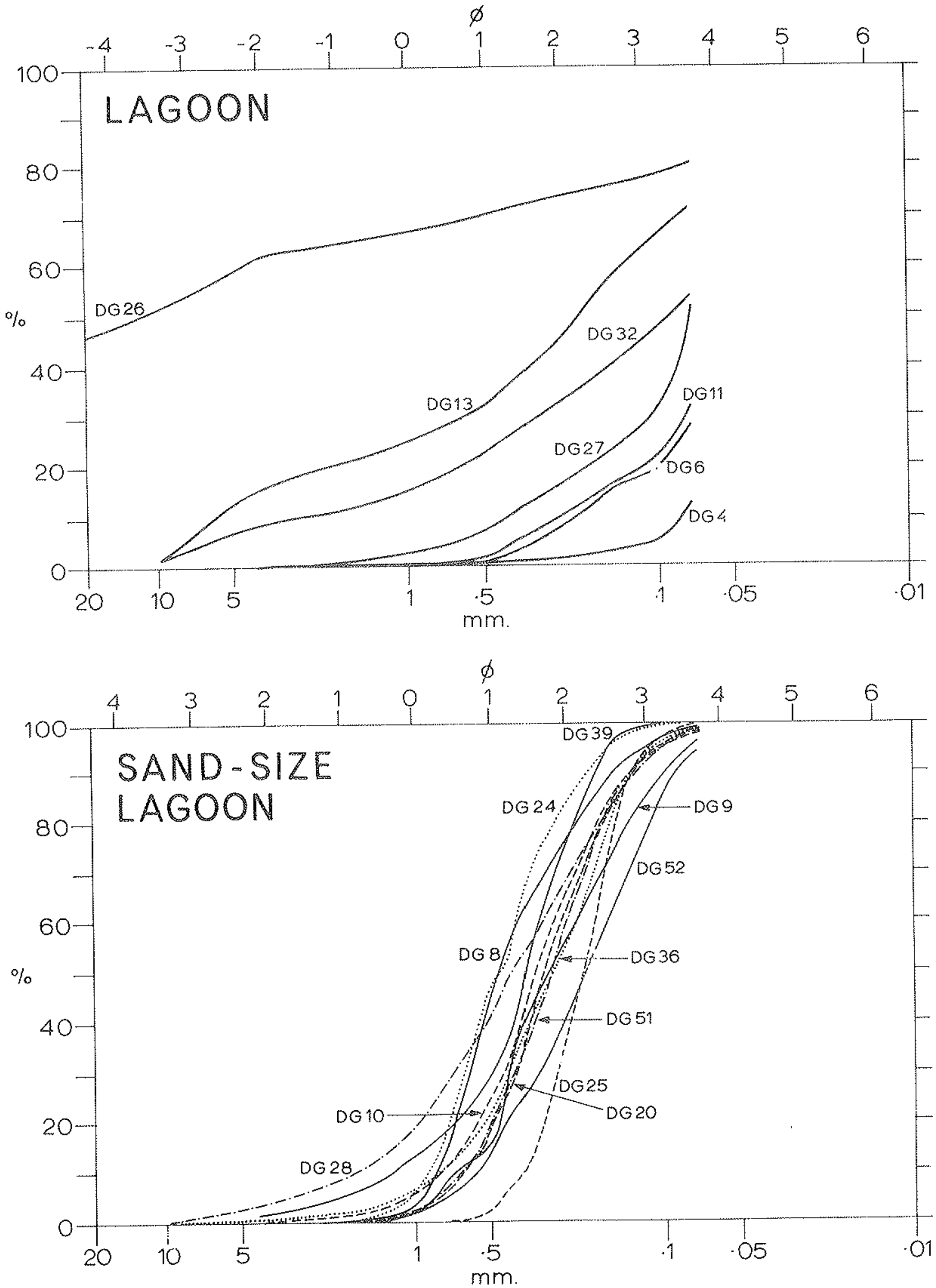
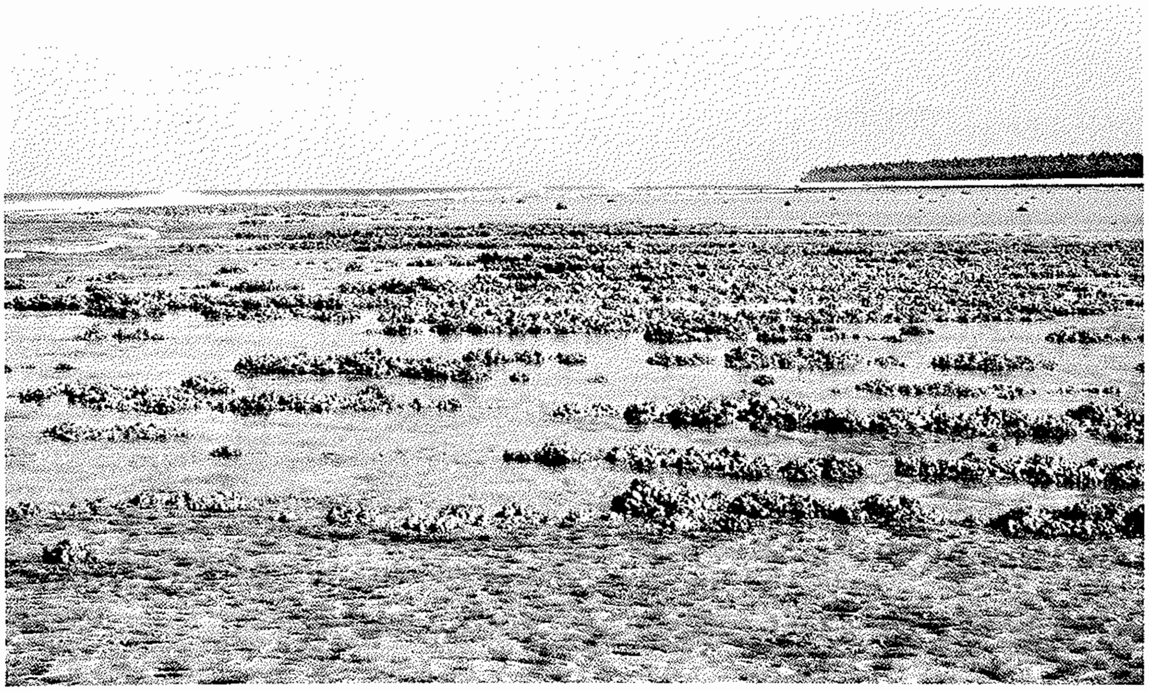
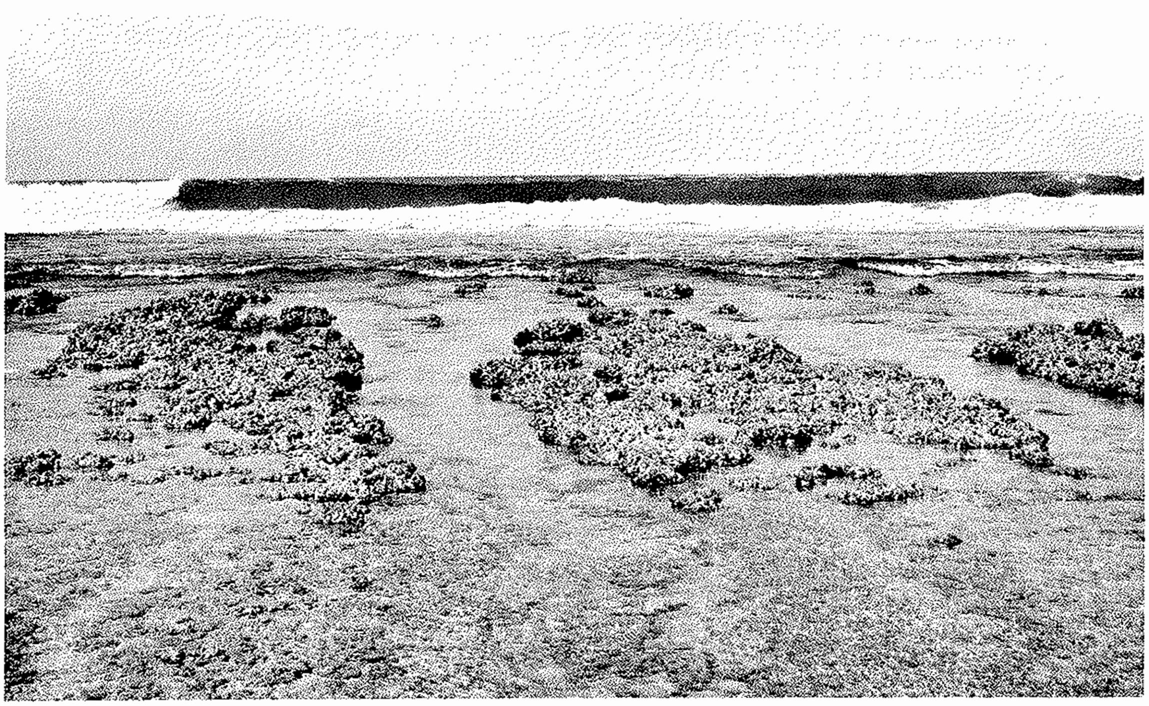


Fig. 18. Cumulative frequency curves for lagoon floor sediment samples.



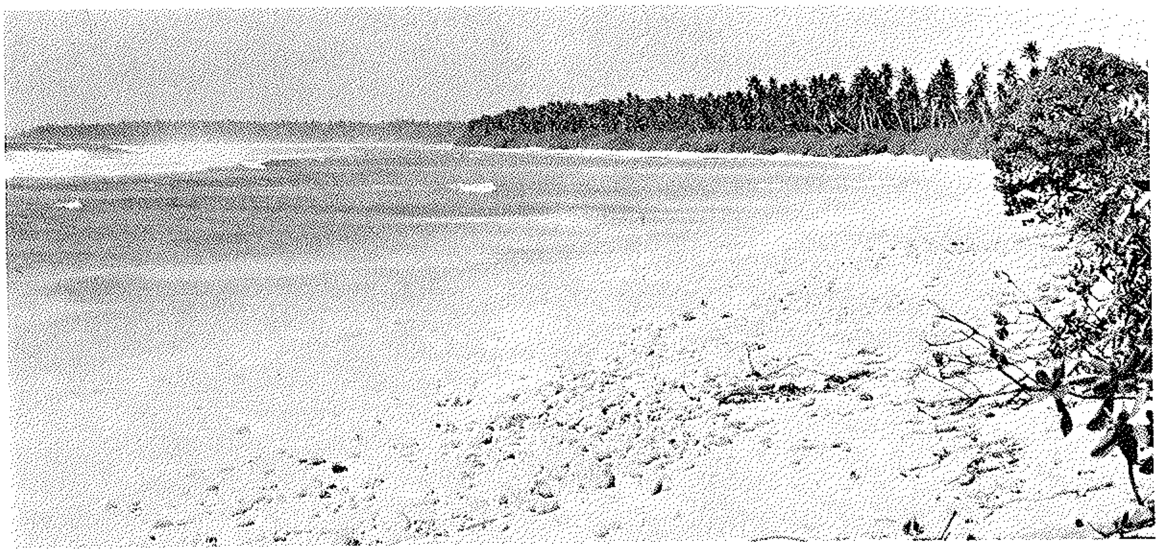
1. Algal rim of seaward reef flat, west coast reefs near Pointe Marianne

2. Surge channels in the algal rim; same locality as Plate 1



3. Boulder spread on the seaward reef flat at Barton Point

4. Low sand beach with boulders on the inner reef flat, seaward coast south of Barton Point



5. Wide sandy beach with *Scaevola* hedge and coconut woodland, seaward coast at East Point, looking south to Horsburgh Point

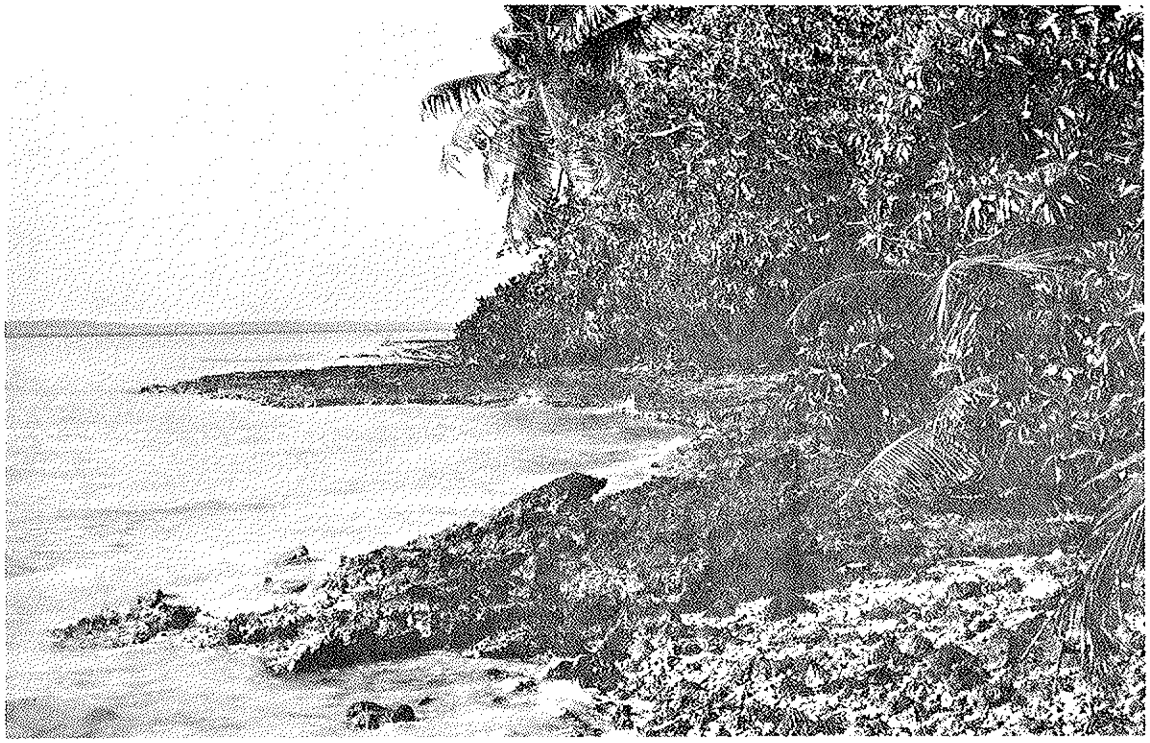
6. East coast sand and gravel beach at Horsburgh Point, looking north to Cust Point

7. Cobble beach on exposed and retreating seaward coast, south-east coast 4 km northeast of Barachois Sylvain

8. Wide low-angle sandy beach, west coast, looking north from Pointe Marianne to Simpson Point

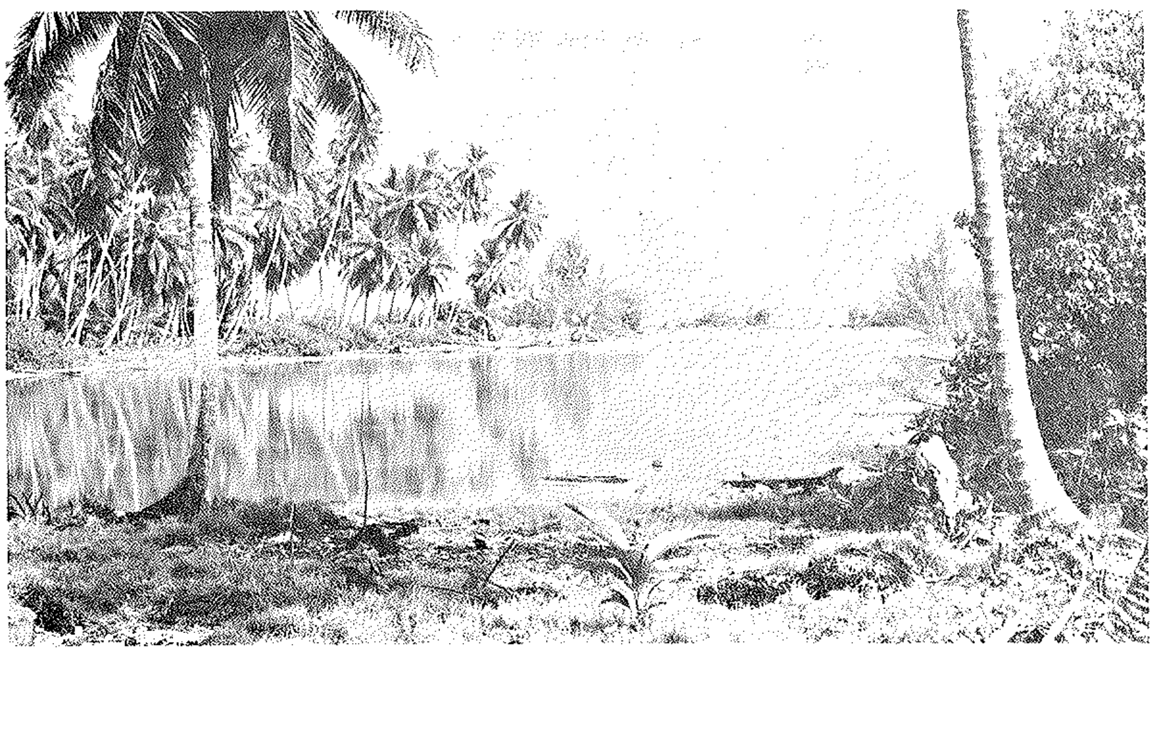
9. Retreating sandy beach with slightly cliffed dunes covered with *Scaevola*, seaward coast at Simpson Point

10. Lagoon coast, northeast rim between Cust Point and Observatory Point: most of this coast is lined with *Scaevola*, but at this point the vegetation has been cleared to reveal the lagoon dune ridge



11. Lagoon coast near Mamzelle Adélie, west rim: the coast is formed by a low eroding rock platform and there is no beach

12. Small barachois at Carcasse, looking from the seaward beach ridge towards the lagoon entrance



13. Barachois Maurice: blackened surface gravel with cones of white sand excavated by Cardisoma

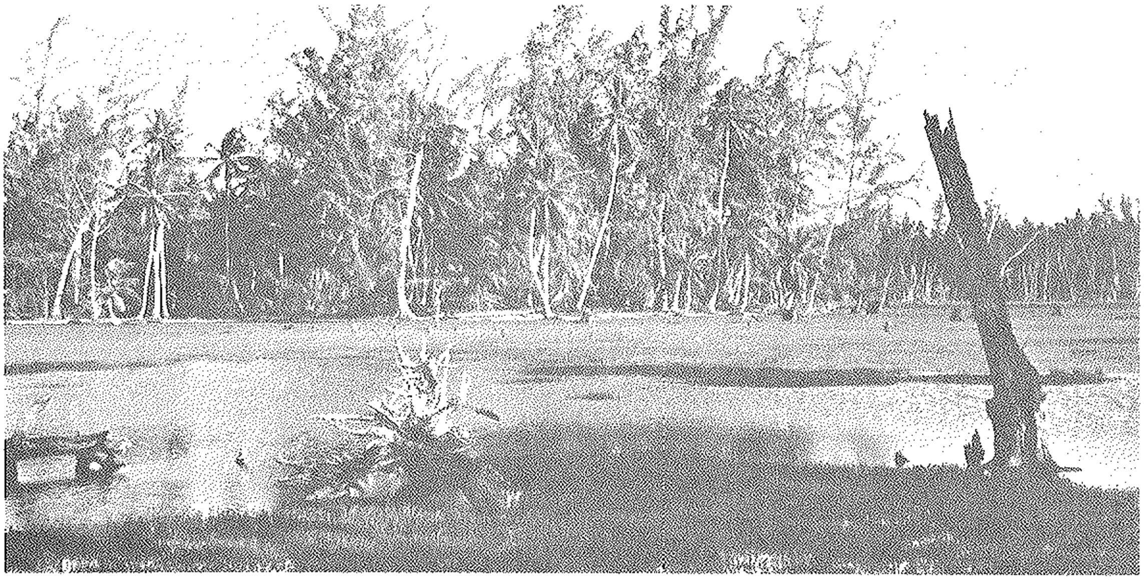
14. Paspalum turf in the higher parts of Barachois Maurice; immediately below the turf is the Uca zone, and many of these crabs can be seen

15. Meandering tidal channels, floored with calcilutite, and incised into the sandy Uca flats, Barachois Maurice

16. Large barachois at Pointe Marianne, surrounded by coconut woodland, and with Bacopa monnieri growing in the water

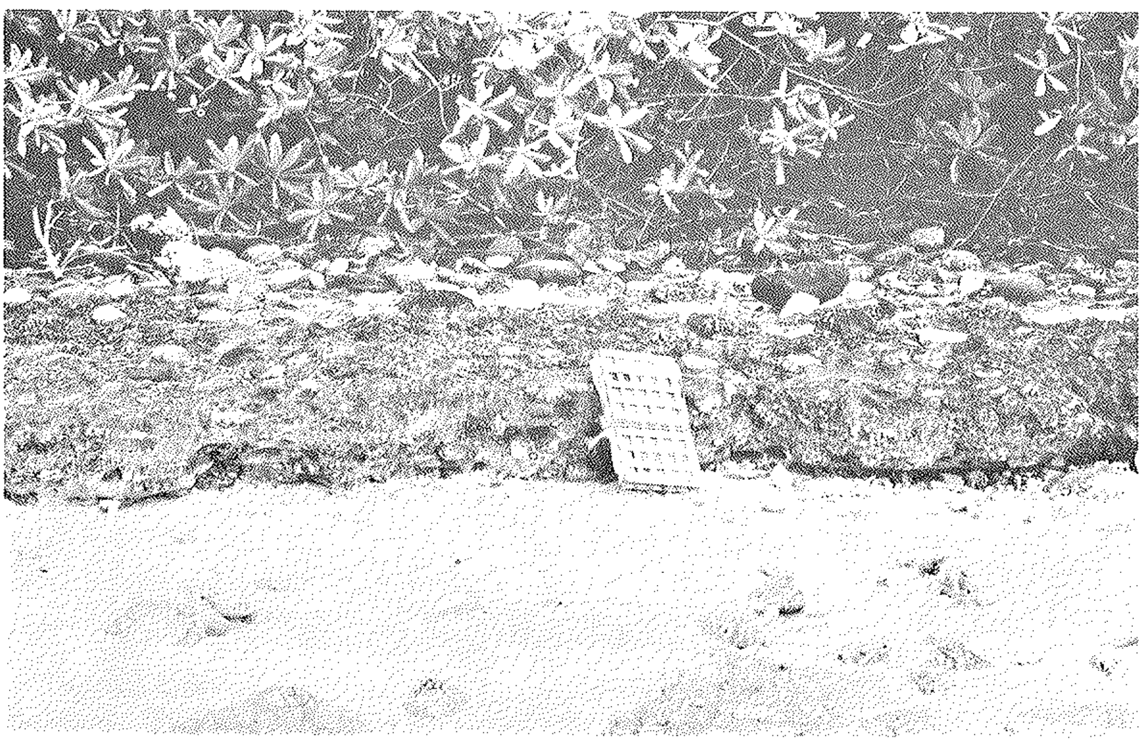
17. Large barachois at Pointe Marianne, surrounded by coconut woodland, and with Bacopa monnieri growing in the water

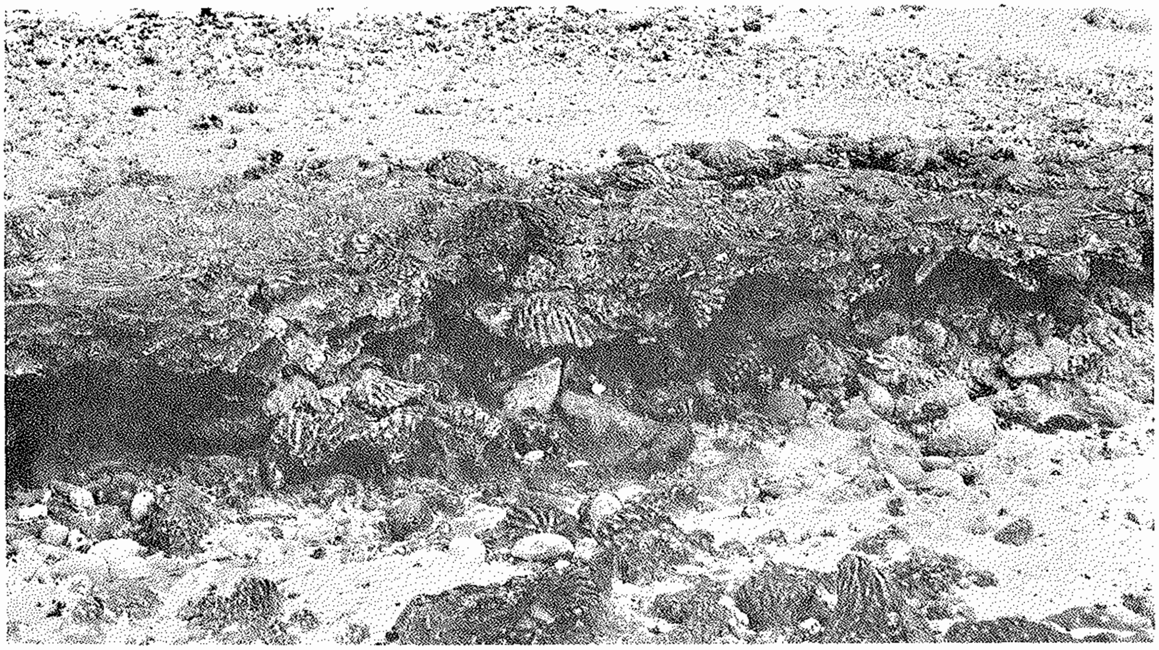
18. Dead coconut trees near the margins of the barachois at Pointe Marianne



19. Casuarina woodland on the margin of the Pointe Marianne barachois

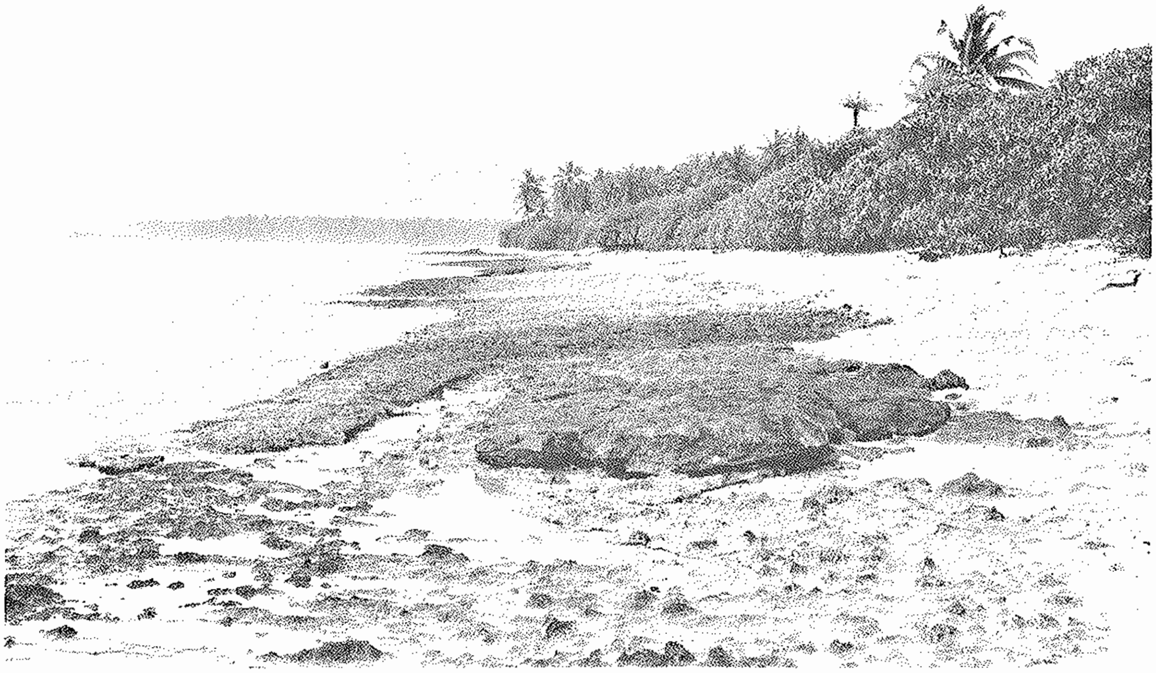
20. Ledge of conglomerate rock exposed in the mid and upper beach on the seaward coast at East Point: the rock contains many corals, mainly Acropora species, but not in the position of growth





21. Ledge of conglomerate rock exposed in the mid and upper beach on the seaward coast at East Point: the rock contains many corals, mainly Acropora species, but not in the position of growth

22. Eroded upper beach on the seaward coast at East Point, near to the rock exposure shown in Plates 20-21. The sediments are not cemented, but otherwise they closely resemble in calibre and composition the conglomerates exposed nearby

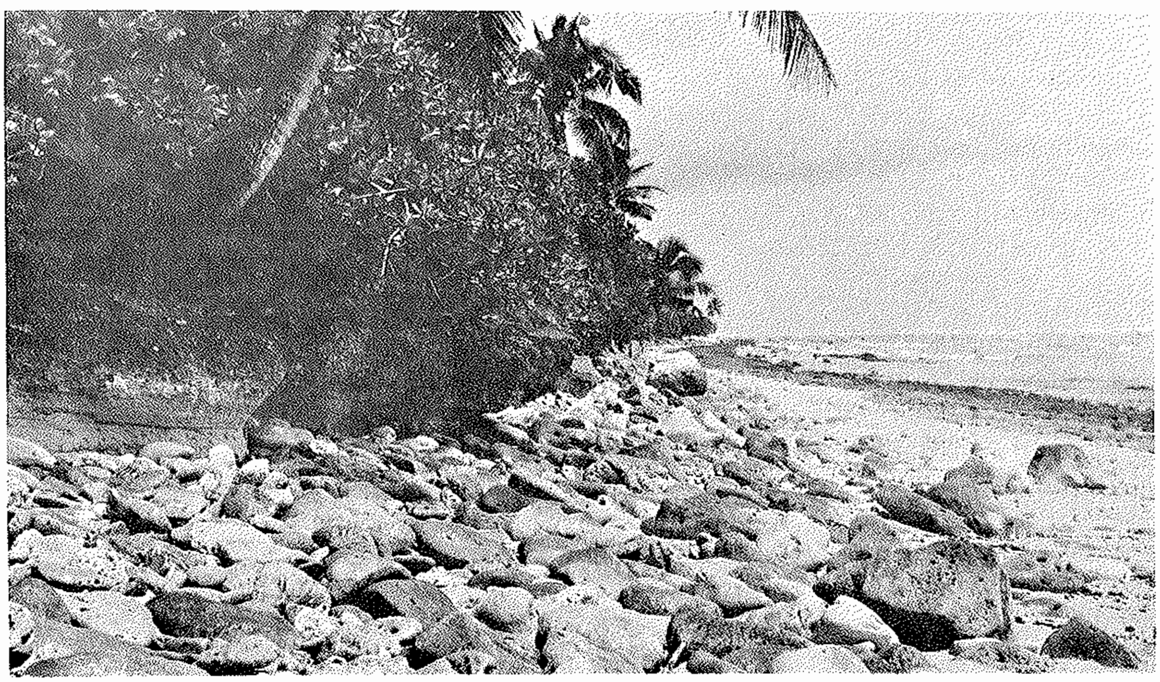


23. The conglomerate ledge of Plates 20-21, which shows no clear dip, passes laterally southwards into an eroded beach-foot platform which is in places surmounted by seaward-dipping calcarenites which resemble typical beach rock

24. Well-developed flaggy beach rock on the southeast seaward coast, 6 km northeast of Barachois Sylvain

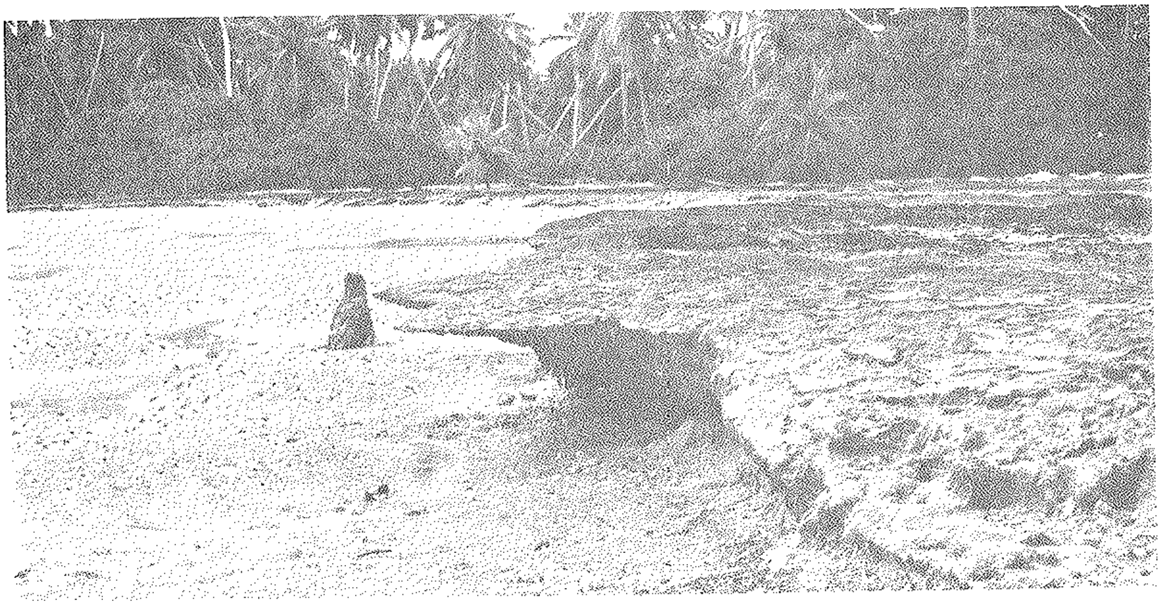
25. Massive fine-grained calcarenites forming an eroding ledge on the upper beach, western seaward coast north of the southern point

26. Massive calcarenites showing a slight seaward dip and also undercutting, near the exposure shown in Plate 25; a rock platform also outcrops on the lower beach



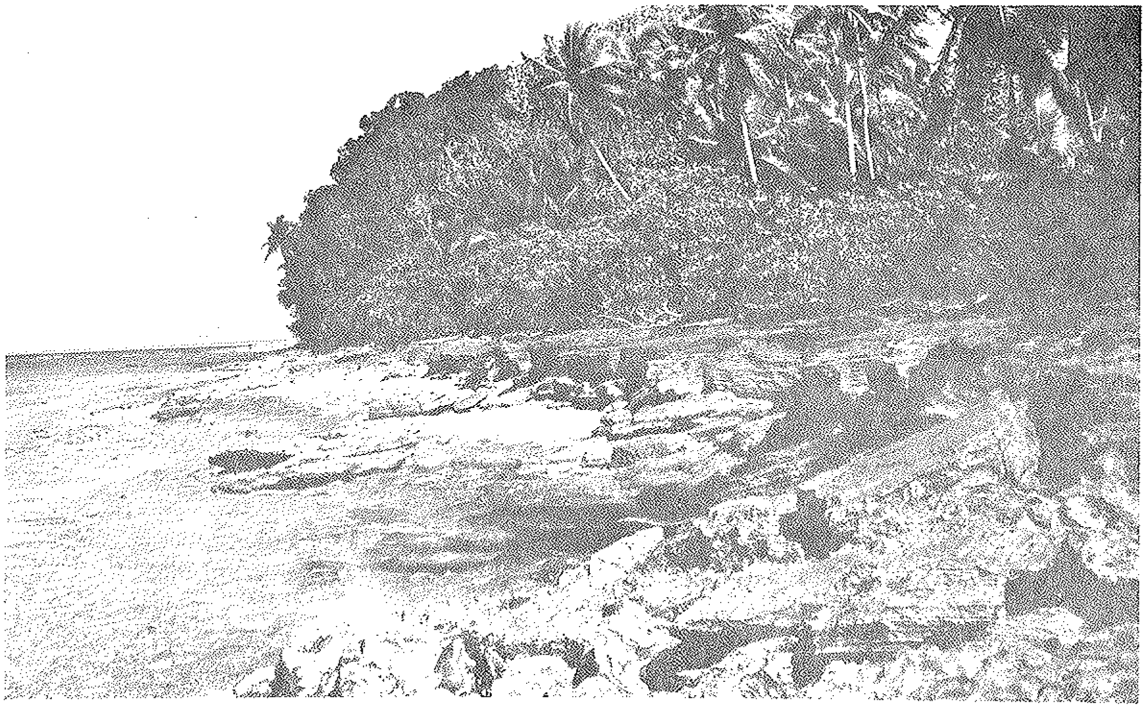
27. Smooth flaggy beach rock on a fine sand beach at Simpson Point

28. Grooved and fluted fine-sand beach rock at Simpson Point



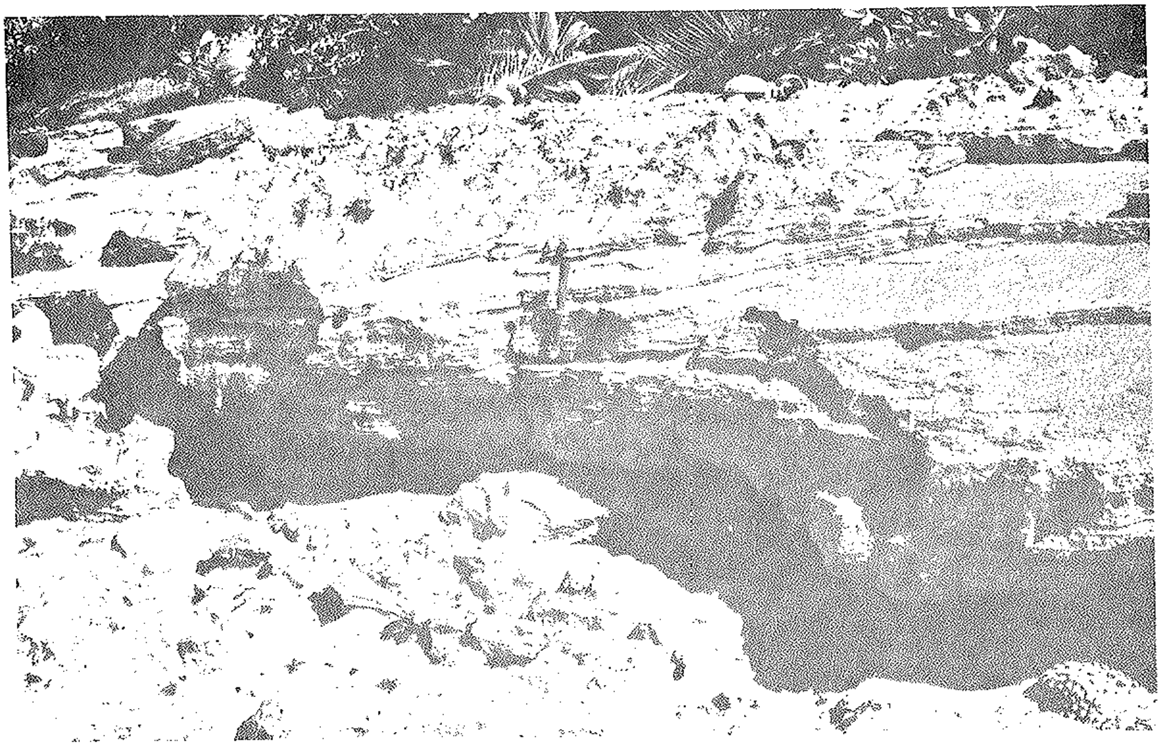
29. Undercut cliffs in cemented sands round the inner margins of Barachois Maurice: the Uca zone is immediately below the cliffs, and the surface above the cliffs is covered with an algal mat

30. Isolated remnants of a formerly more extensive cemented surface, similar to that of the marginal cemented sands, are found within Barachois Maurice itself, surrounded by the Uca zone



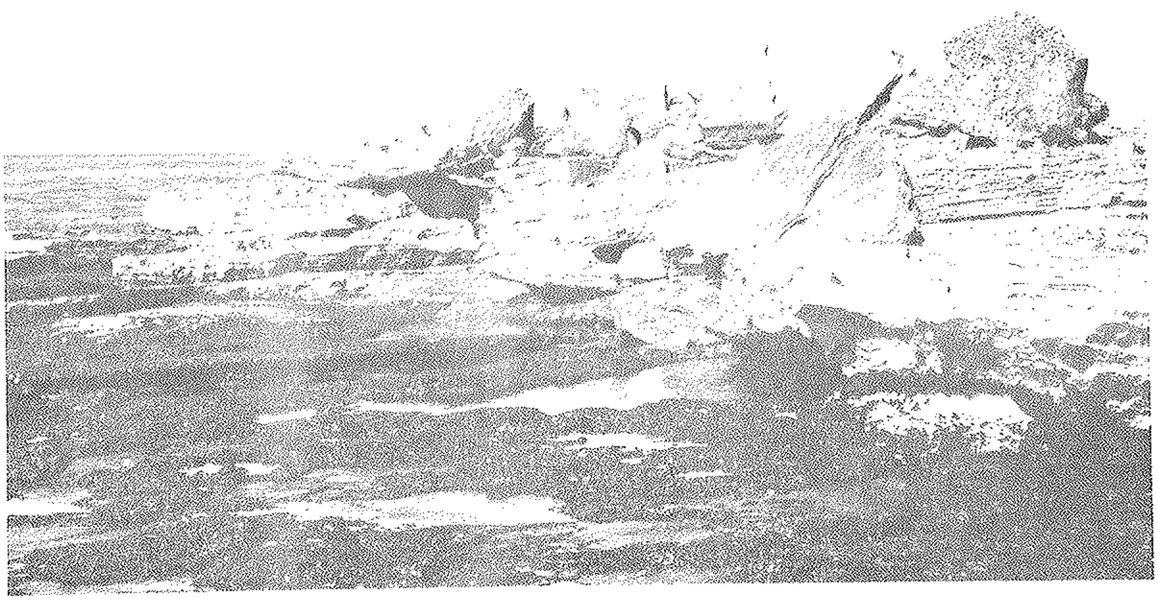
31. Massive bedded calcarenites, dipping to the south, exposed on the southeast coast of East Island

32. Same as 31



33. Details of the East Island bedded calcarenites

34. Details of the East Island bedded calcarenites. Towards the eastern end of the island the calcarenites are much broken by wave erosion, forming large blocks



3. DIEGO GARCIA CLIMATE AND MARINE ENVIRONMENT

D. R. Stoddart

A. Climate

The climate of the Chagos Archipelago is governed primarily by the seasonal migration north and south across the area of a zone of equatorial westerlies separating the Northeast Trades and the Southeast Trades. The zones of convergence between the Equatorial Westerlies and the trades form shear zones with unsettled and often squally weather. The same controls are also recognisable at Addu Atoll, 650 km to the north (Stoddart, ed., 1966, 7-9), but in the higher latitude of Diego Garcia the seasonal distinctions are more clearly defined.

Recording began at the atoll in January 1951, covering temperature, rainfall, and surface winds; some rainfall records are also available for earlier years. Upper wind data are also recorded using a Decca radar wind finder and in some cases theodolite, and upper air soundings are made with M-60 Graw radio-sondes. The service is maintained by the Meteorological Department, Mauritius, and records are published in the Department's monthly series Meteorological Observations and Climatological Summaries. I am indebted to Mr E. G. Davy, Director, Meteorological Services, Mauritius, for providing me with abstracts of the Diego Garcia records. Meteorological records are also kept at Peros Banhos and Salomon Atolls, further north in the Chagos, in both cases since 1951, and the rainfall data from these and other Indian Ocean coral island have been reported separately (Stoddart 1970c).

1. Wind

Figure 19 plots wind frequencies for each month at 0000, 0600 and 1200 GMT for 1956-60, and Figure 20 the same for 0000, 0600, 1200 and 1800 GMT for 1961-1965. Four wind seasons may be distinguished:

(1) During December-March winds are variable but mainly westerly. The westerlies are most pronounced in February, when easterlies are absent or nearly so.

(2) April and May represent transitional conditions, with the westerlies weakening and the south-easterlies becoming more important.

(3) June, July, August and September form the season of the Southeast Trades, with dominant direction 120-150°. Diurnal varia-

tions in constancy are apparent, with maxima at 1200 hrs. By September the Trades are beginning to weaken, and to spread from east round to south.

(4) October and November represent a second transition period. Winds are variable, though still concentrated at 90-120°. By December, season 1 is again established, with approximate co-dominance of easterlies and westerlies.

The occurrence of calms (Fig. 21) shows a similar seasonal distribution with some diurnal variability; during the Trades calms are infrequent at all times. Modal wind speeds during the period of the westerlies lie in the class 0-2 knots (0.5-1 m/sec) throughout the day; during the Trades the modal class is either 3-7 or 8-12 kts (1.5-3.6 or 4.1-6.2 m/sec). In the period 1961-65 more than 15 per cent of wind velocities recorded in both July and August were of 8-12 kts (4.1-6.2 m/sec). Winds in excess of 18 kts (9.3 m/sec) are not common, though they occasionally occur during the Trades. No wind speeds higher than 25 kts (12.9 m/sec) are recorded.

2. Temperature

The temperature regime follows the seasonal wind pattern. During the period of Equatorial Westerlies and calms, temperatures are higher than during the Trades (Fig. 22). Mean monthly temperature varies from a maximum of 30.75°C in March to a minimum of 28.03° in August, an annual range of 2.7°. Similar variations occur in monthly mean maximum and minimum temperatures:

	Highest	Lowest
Mean maximum	30.75 (March)	28.03 (August)
Mean minimum	25.39 (April)	23.89 (August)

The highest temperatures recorded in each month follow the same seasonal pattern, and are generally 3° higher than the monthly mean maximum, but the lowest temperatures are more erratic. These data are very similar to those for Addu Atoll in the southern Maldives, though the Diego Garcia figures are slightly higher. The highest temperature recorded so far is 33.4°C on 23 January 1958, and the lowest 19.4°C on 16 August 1965, an absolute range of 14°. The diurnal temperature range, as would be expected in such a maritime location, is less than 10°.

3. Rainfall

Rainfall is high and fairly evenly distributed (Fig. 23). The mean annual rainfall for the periods 1937-38 and 1951-66 is 2599 mm (102.32 inches). Actual annual totals, however, vary from 1465 mm to 3805 mm, and the coefficient of variation for the 20 years of record ($\sigma/X \times 100$) is 17.9. These figures may be compared with those for the other Chagos atolls and for Addu Atoll:

Location	Years of record	Mean annual total mm	Lowest recorded	Highest recorded	Coefficient of variation
Diego Garcia	20	2599	1465	3805	17.9
Peros Banhos	14	3999	1612	5410	29.6
Salomon	14	3751	2585	5679	22.9
Addu	9	2383	1881	2990	13.3

It is clear that a narrow ridge of very high rainfall lies across the northern part of the Chagos between Addu and Diego Garcia: from Diego Garcia to Salomon, a distance of 220 km, there is a rainfall gradient of approximately 6 mm per km. It is also apparent that in this area the higher rainfalls are also least reliable.

Monthly rainfall at Diego Garcia is highest in January, February and October, and lowest during the Trades, in April to August, when the monthly mean is less than 200 mm. Actual monthly rainfalls for each year of record tend to be normally distributed about the means, except for the occasional months (six in the 20 years of record) when exceptionally high rainfalls occurred. Monthly rainfalls of more than 500 mm (20 inches) have occurred six times in the period of record, with a maximum of 757 mm (almost 30 inches) in May 1963. Larger monthly totals are experienced much more frequently, however, at both Peros Banhos and Salomon, where monthly falls greater than 500 mm occurred 31 times in 14 years at the former and 33 times in 18 years at the latter; the maximum recorded in a single month is 1037 mm in June 1952 at Peros Banhos. Abnormally low monthly rainfalls are much less common. At Diego Garcia, monthly totals of less than 25 mm (1 inch) occurred five times during the period of record, once each in July, May, September, October and November. The minimum monthly rainfall recorded is 9 mm in June 1937. The mean rainfall per rain day (Fig. 24) also varies seasonally, with a distinct minimum (less than 10 mm) at the height of the Trades in June and July. The maximum daily fall in each month shows considerable scatter but little seasonal trend. Daily falls of more than 100 mm (4 inches) have occurred at least twice in each month over 1951-1967 in all months except November and December. The maximum recorded daily fall, 328.7 mm, occurred on 19 August 1955.

4. Tropical cyclones

Because of the low latitude of Diego Garcia, tropical cyclones are rare, though according to Mr E. G. Davy (personal communication) fresh westerly winds may be experienced when cyclones form or pass to the south of the Atoll. Mr Davy states that "nevertheless, on the 16-17th September 1944, cyclonic winds sufficient to be of importance in ecological studies almost certainly occurred. There are no records of wind speed but a cyclone of moderate strength passed just south of the island and destroyed two Catalina flying boats."

B. Tides

Tides at Diego Garcia are semi-diurnal, and rather greater in amplitude than those of the southern Maldives. Several periods of record are available, the most recent being those made by H.M.S. *Vidal* from 14 June to 27 July 1967 (Fig. 25). The most complete record is that for the East Point settlement. The maximum range at springs is 1.6 m and the minimum at neaps 0.7 m (compare 0.97 and 0.27 m respectively at Addu Atoll). Records are also available for Eclipse Point, just within the lagoon entrance. Comparison of the two curves shows no significant lag or change in amplitude between the lagoon entrance and a point 15 km within it. This is perhaps surprising in view of the shallowness of the entrances and the degree of enclosure of the lagoon.

No other data are available from Diego Garcia itself on water temperature and salinity, though the general characteristics of the area can be found in many oceanographic texts.

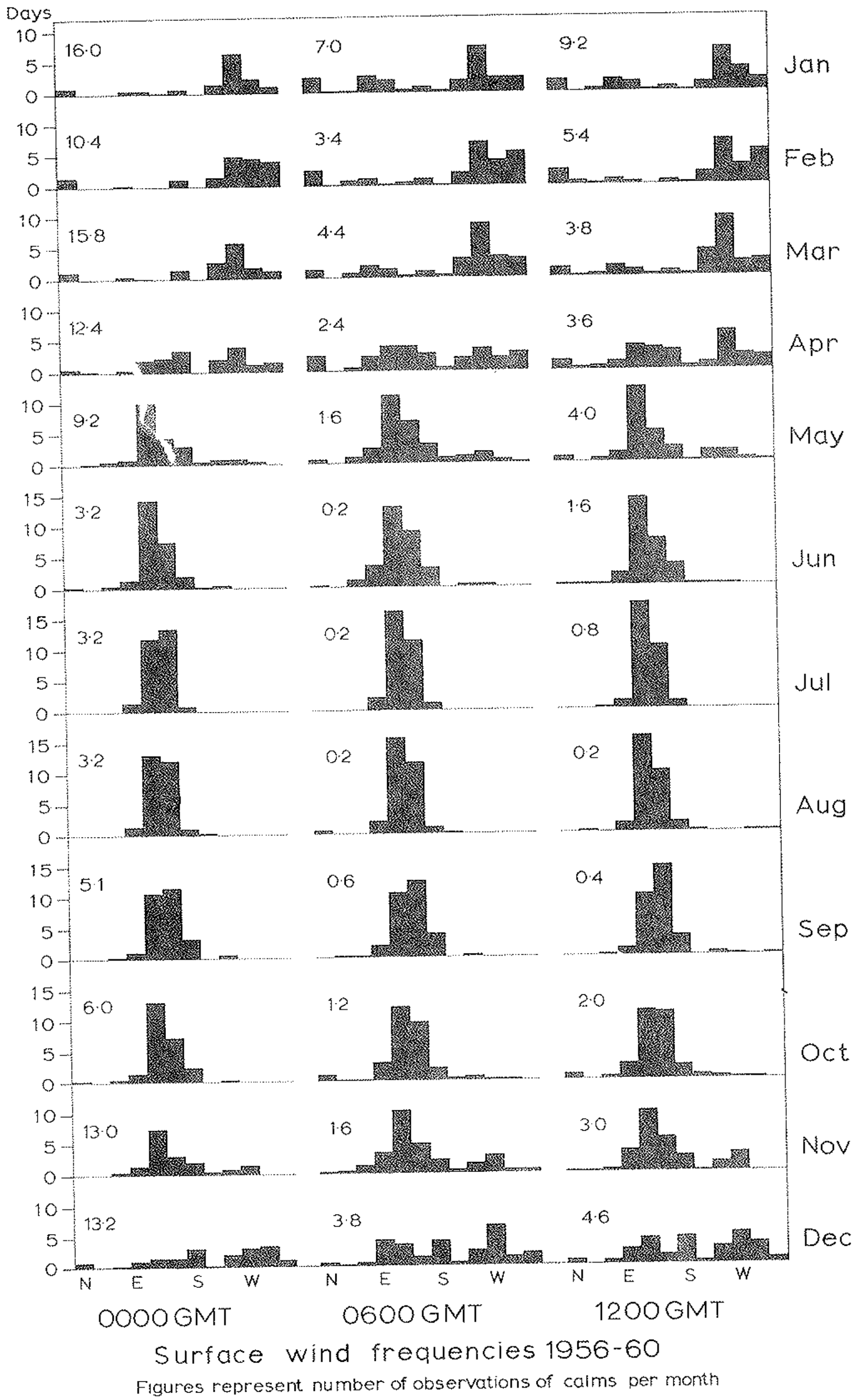


Fig. 19. Surface wind frequencies for each month at 0000, 0600 and 1200 GMT, 1956-1960.

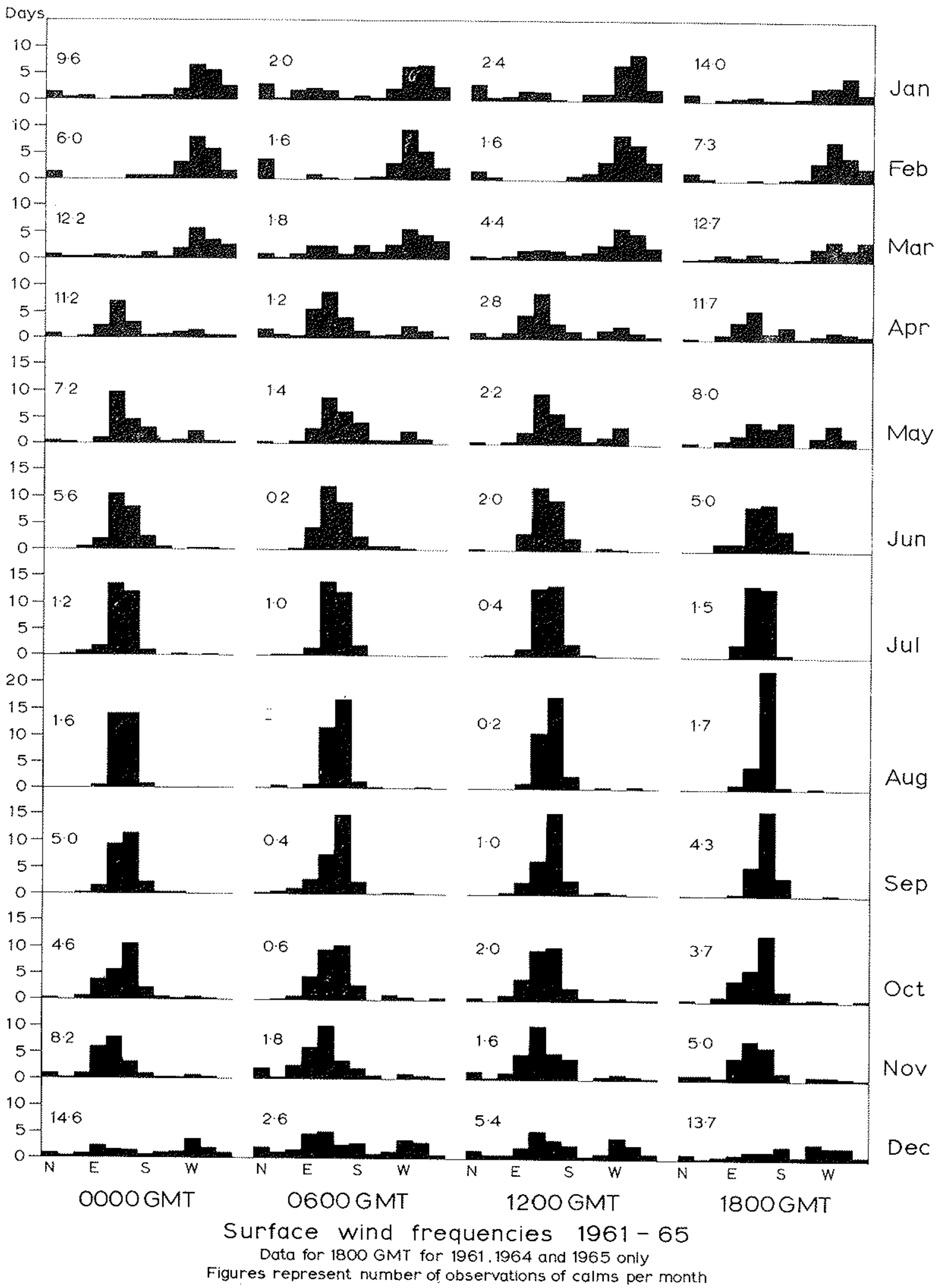


Fig. 20. Surface wind frequencies for each month at 0000, 0600, 1200 and 1800 GMT, 1961-1965.

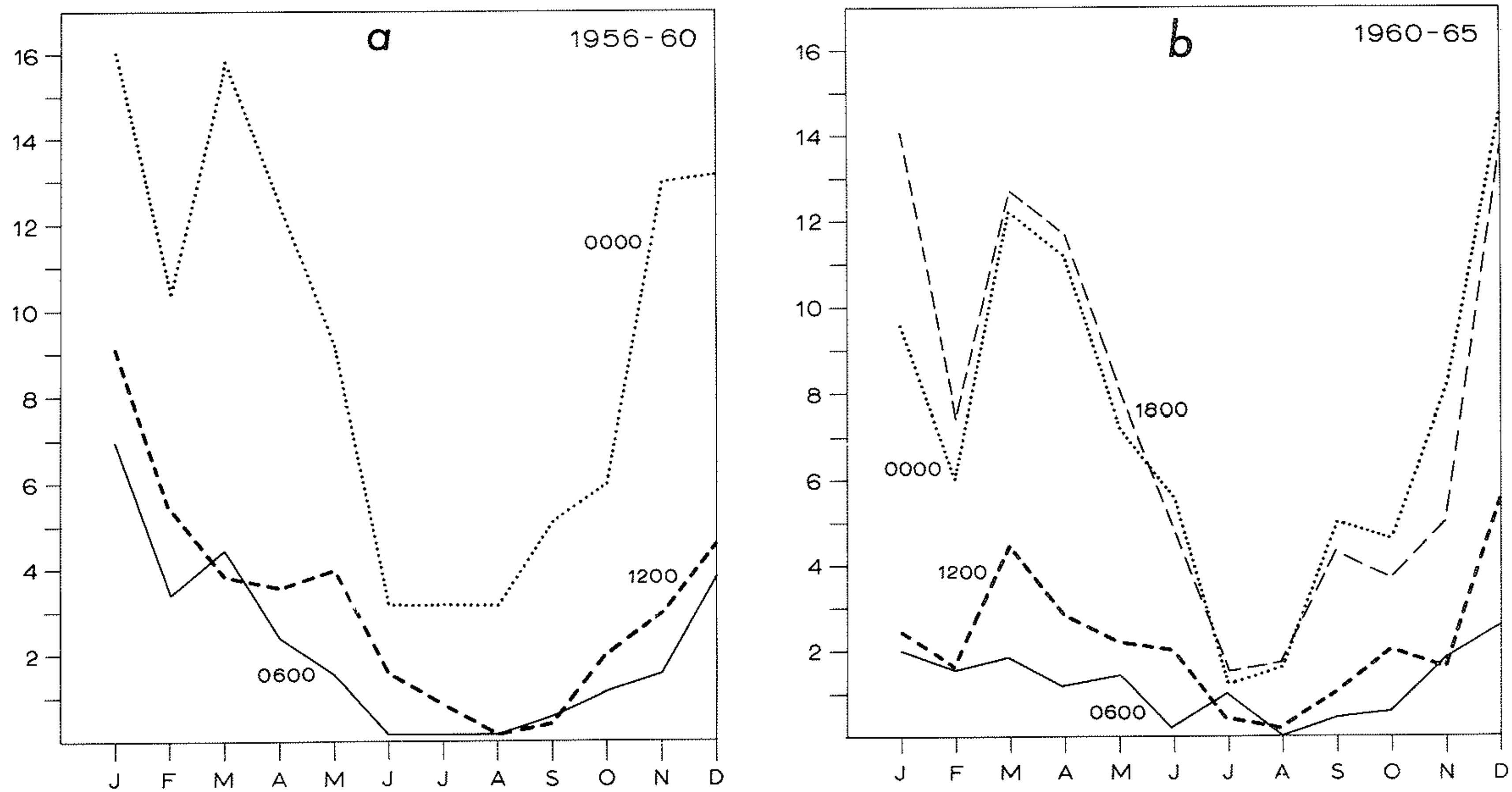


Fig. 21. Occurrence of calms, (a) 1956-1960, (b) 1961-1965.

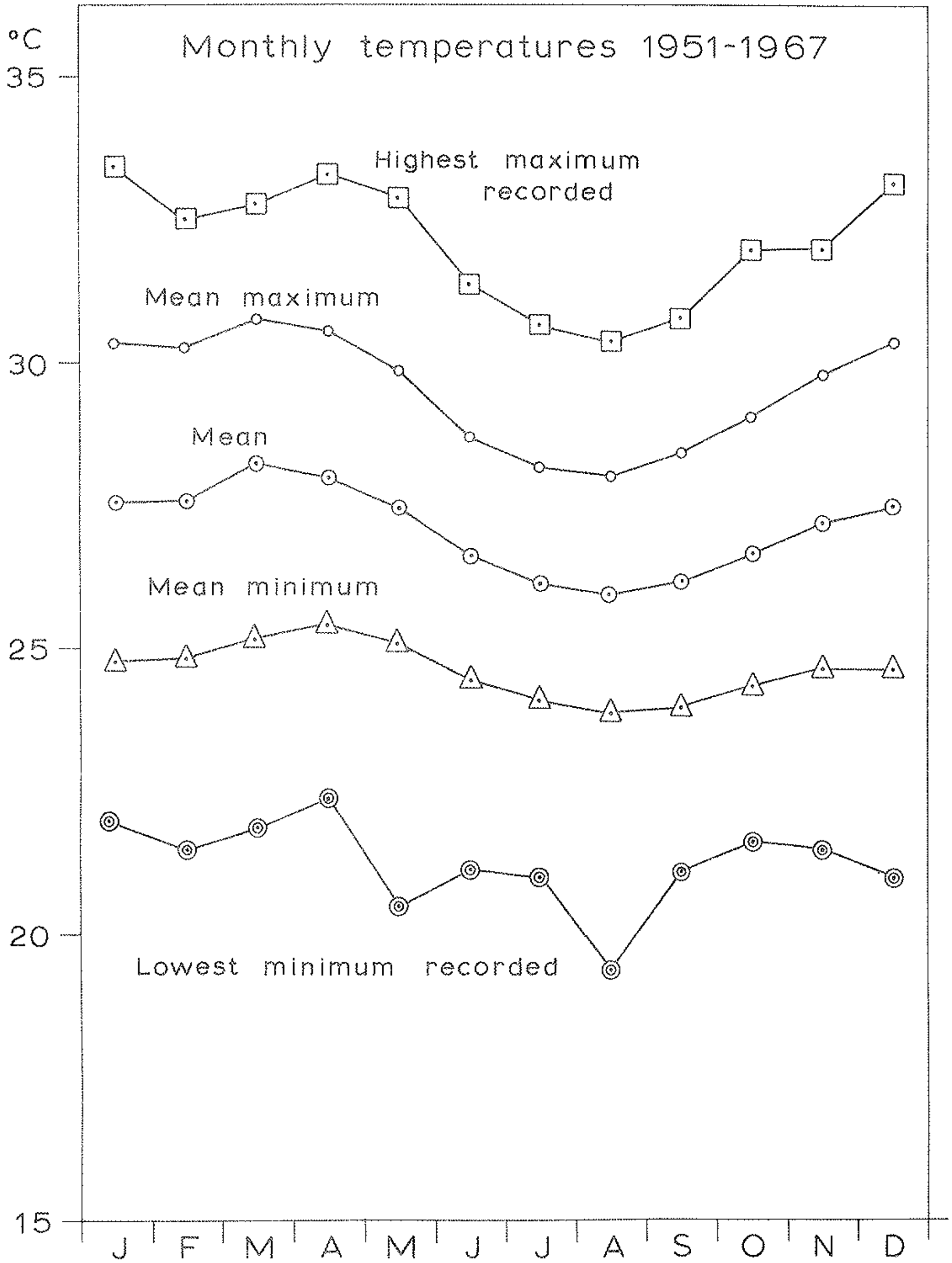


Fig. 22. Monthly temperatures 1951-1967.

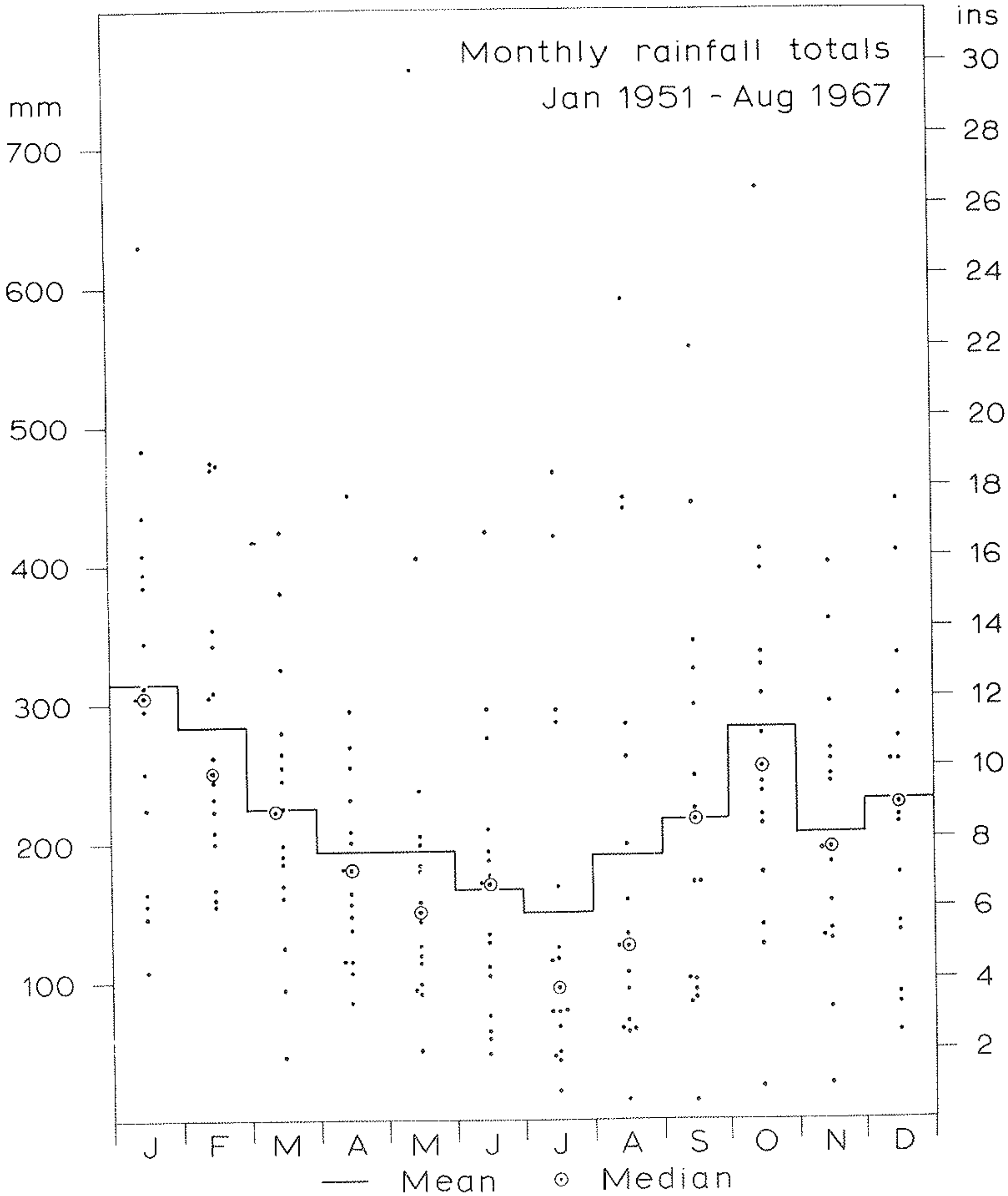


Fig. 23. Monthly rainfall 1937-1938, 1950-1966.

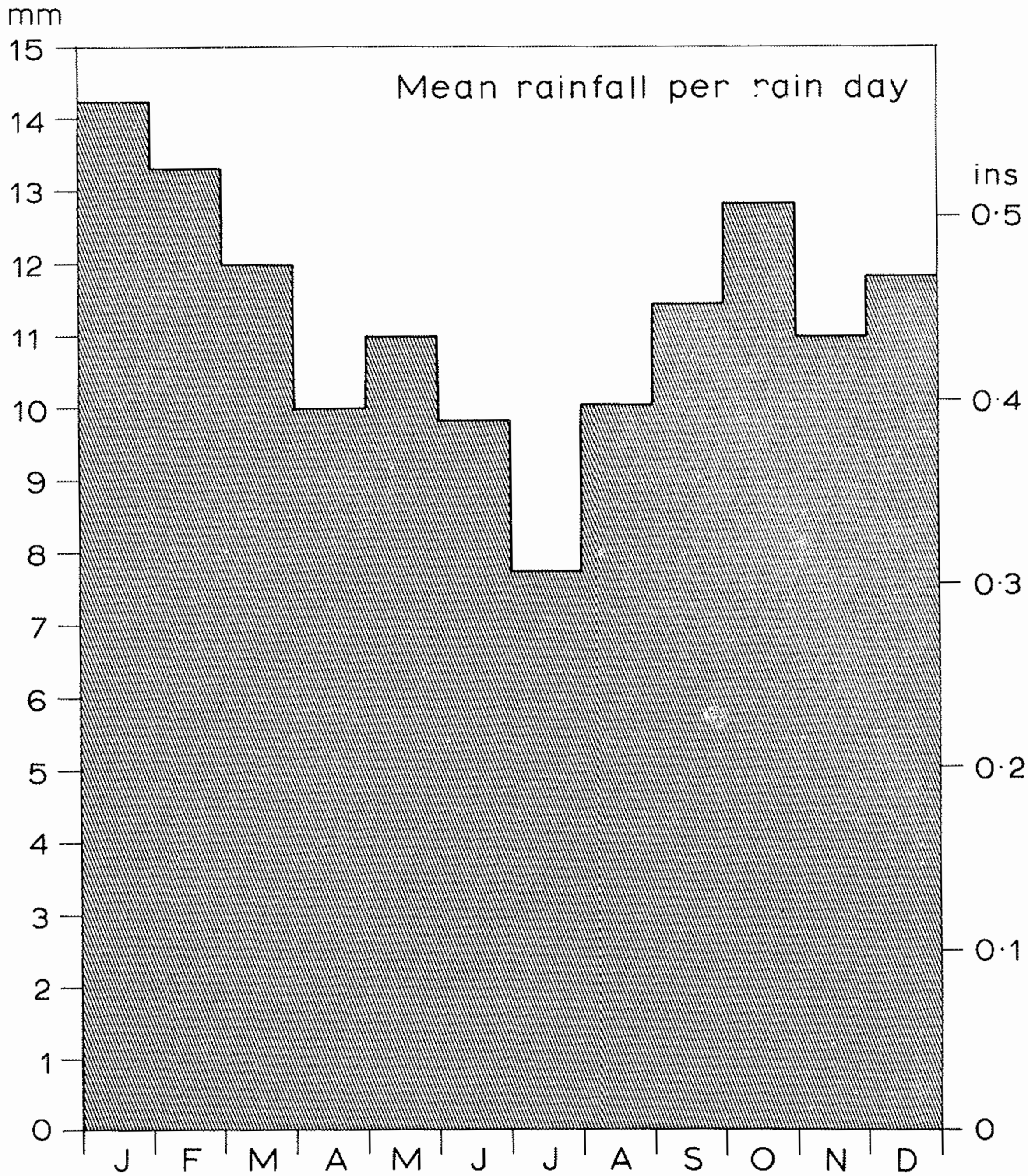


Fig. 24. Mean rainfall per rain day for each month.

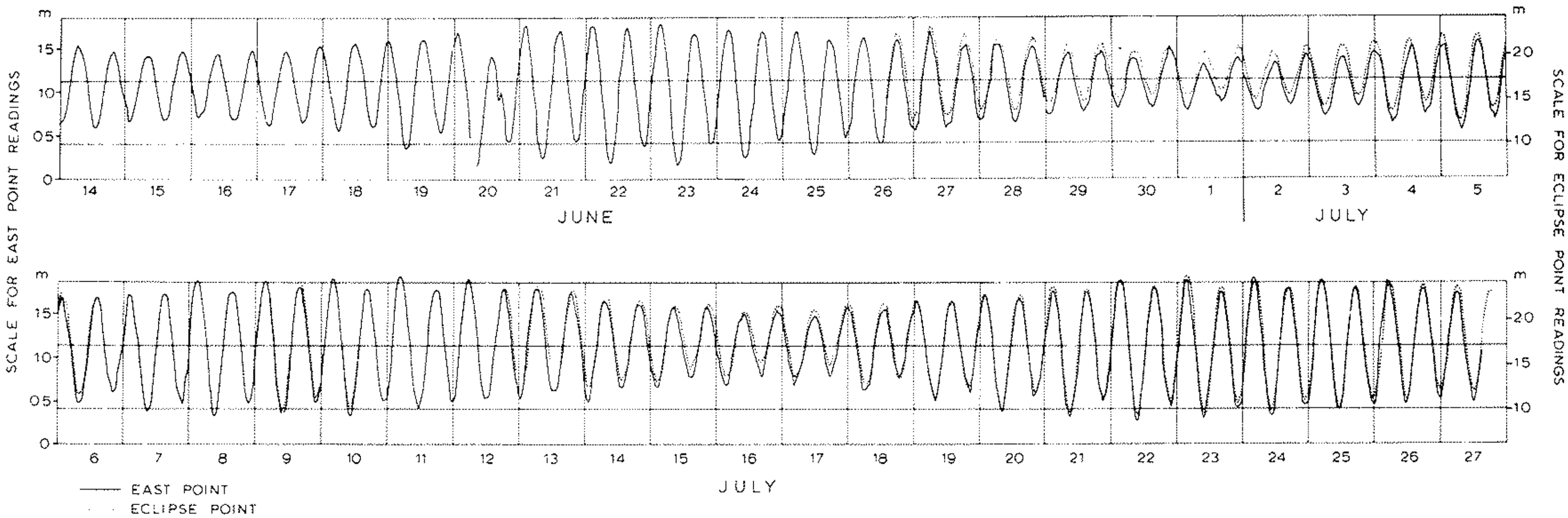


Fig. 25. Tidal records at East Point and Eclipse Point, June-July 1967. From observations by HMS Vidal and reproduced with the sanction of the Controller, Her Majesty's Stationery Office and of the Hydrographer of the Navy.

4. OBSERVATIONS ON THE SHALLOW-WATER MARINE FAUNA

John D. Taylor

The following observations on the zonation and distribution of marine invertebrates were made during the course of 18 days reconnaissance collecting in July 1967.

A. Intertidal zonation

Under this heading is discussed zonation on beachrock and on vegetation in the littoral fringe* and eulittoral zones.

On seaward shores beachrock exposures are common either as continuous units, broken blocks or both. On lagoon shores beachrock is not frequent but in the southern parts of the lagoon there are widespread exposures of horizontally bedded limestone associated with the barachois. Intertidal fauna may occur on tree trunks and vegetation overhanging the lagoon shores.

The most exposed seaward shore studied on Diego Garcia is at West Island. Here there is a raised limestone ramp with surge channels and potholes at the lower portions and loose boulders higher up the shore (Fig. 26).

The littoral fringe* is occupied by blue green algal encrustations on the limestone and a sparse colonisation by the gastropods *Littorina glabrata* and *Nerita plicata*. Below this there is a bare grey coloured zone about 5 m in width followed by a red algal turf, a green algal zone, and in the surf a crust of calcareous red algae. This lower eulittoral zone is characterised by many predatory gastropods such as *Drupa*, *Morula*, *Strigatella litterata*, *Engina bonasina* and *Conus sponsalis*. The only other common species is *Nerita albicilla*. Limpets and barnacles are conspicuously absent. *Grapsus tenuicrustatus* is common all over the shore and *Clibanarius* abundant in the lower parts of the eulittoral zone.

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* For an explanation of zonation and terminology, see Lewis, J. R., 1964, The ecology of rocky shores, and Taylor, J. D., Phil. Trans. R. Soc. London B, 254: 129-206, 1968.

Atoll Research Bulletin No. 149: 31-39, 1971.

At South Point on a beachrock exposure (Fig. 27) the zonation is essentially similar to that of West Island but with fewer molluscan species in the eulittoral zone. The higher parts of the beachrock are occupied by blue green algae and the lower by calcareous red algae. Limpets and barnacles are again absent. The crab Eriphia laevimana is common in the mid-eulittoral.

At other beachrock sites the fauna is similar but usually less abundant and frequently the beachrock is colonised solely by blue green algae, Littorina glabrata and Nerita plicata.

In the lagoon a rather different fauna is seen. Nerita plicata and the usual predatory gastropods are uncommon and most of the fauna consists of algal grazers. The zonation on a gently shelving cobbled shore at Carcasse is shown in Figure 28. The cobbles on the lower shore are colonised by the green algal Enteromorpha and the higher portions by blue-greens which produce a blackening effect. Cerithium morum and Cerithium pretosum are both exceedingly abundant, replaced a little higher on the shore by Nerita albicilla and Planaxis sulcata.

At Mamzelle Adélie (Fig. 29) the beachrock is horizontally bedded and stepped. The most conspicuous element of the higher levels is a blue green algal crust which supports a few Littorina scabra. Lower on the shore Cerithium morum and Cerithium pretosum are common with occasional Morula granulata which feeds upon polychaetes.

B. Beaches

Both seaward and lagoon beaches are colonised by the crabs Ocypode ceratopthalma and Coenobita rugosa. The burrowing bivalve Atactodea glabrata is only found on lagoon shores.

C. Seaward platforms

Shallow water marine invertebrate collections and observations were made at a number of sites around the Atoll. These included Eclipse Point, West Island, South Point, Point Thomas, East Point, Cust Point and Barton Point. Because of a lack of mobility the most comprehensive collections were made at East Point.

The seaward platform is remarkably uniform in character around the atoll and the descriptions given below for East Point and Eclipse Point cover most of the variations found.

1. East Point

The reef platform here is about 120 m in width. It lies at a shallow sublittoral level and is not fully emersed at low spring tides, many boulders however project up into the eulittoral zone.

At the base of the beach there is a zone about 10 m in width of coral boulders up to 0.5 m in diameter. Outwards there is then a narrow (5-10 m) belt of rippled sand which is followed abruptly seawards by a crust consisting predominantly of the byssate bivalve Modiolus auriculatus and the calcareous red alga Jania. The bivalves are attached in some places to an irregular reef platform or in others to masses of coralgal cobbles and debris. The surface of the crust is fairly uniform but interrupted by depressions which may be floored by sand or bare reef rock.

Interspersed with the Modiolus crust are sporadic patches of Cymodocea ciliata (=Thalassodendron ciliatum) with the rhizomes and roots deeply embedded between the cobbles.

Small coral growths of Pocillopora demicornis, Porites lutea and Platygyra lamellina are common.

Toward the seaward edge of the platform, calcareous algae become much more common and form a low cavernous "algal ridge." Corals occur on the outer edge of the ridge and these are small, stumpy or encrusting growths and include Acropora disticha, Pocillopora danae, Favites yamanarii and Leptoria phrygia. In the surf zone the cavernous "algal ridge" becomes smoother and more solid and small surge channels develop which are lined with small growths of Pocillopora danae and Acropora disticha but dominantly by sheets of calcareous algae. The surface of the algal ridge is covered by growths of the soft algae Turbinaria, Dictyosphaeria, Caulerpa and Dictyurus.

The upper surface of the boulders at the base of the beach are bare except for growths of Enteromorpha. Beneath the boulders the gastropods Strigatella litterata, Cypraea annulus and Cerithium nesioticum are particularly common. The small xanthid crab Leptodius sanguineus and the porcelain crab Petrolisthes lamarckii are extremely abundant.

In the Modiolus/Cymodocea area of the mid-platform the fauna is much more diverse. Large boulders up to 1 m in diameter are common all across the platform and these are colonised by the algae Turbinaria and Dictyosphaeria. Beneath the boulders and cobbles the large encrusting Foraminifera Carpentaria, Homotrema and Sporadotrema and many sponges occur.

Apart from Modiolus only a few invertebrates are present on open surfaces. About 30 m from the shore there is a belt about 15-20 m width in which the echinoid Tripneustes pileolus is exceedingly common; Holothurians are also abundant and in particular Holothuria atra, Actinopyga mauritiana and Microthele nobilis. Other holothurians are found beneath the boulders in crevices or in sand pockets; these are Holothuria cinerascens, H. albiventer, and Bohadschia argus. Ophiuroids particularly Ophiocoma erinaceus and O. scolopendrina and O. brevipes, live in the crevices of the platform and boulders. Echinoids are less common (excepting Tripneustes) and only Echinometra matthai and Echinosterphus molaris were found in crevices beneath the boulders and in the cavernous algal platform.

Gastropods are very common mostly occurring beneath the boulders or within crevices. Drupa morum occurs on the upper surfaces of boulders and Rissoina ambigua, R. plicata and Pyrene azora occur in the algal turf.

Predators such as Conus ebraeus, C. lividus, C. rattus, Vasum turbinellus, Cymatium pileare, C. nicobaricum and Bursa bufonia are found beneath the boulders.

On the leaves of Cymodocea, Cypraea annulus, C. moneta, Cerithium rostratum and Smaragdia rangiana are characteristic.

Crabs occurring in this belt are Percnon planissimum, Actaea rufopunctata, Xanthias lamarckii, Daira perlata, Dromiopsis dormia and Petrolisthes lamarckii.

2. Eclipse Point

At North West Point the seaward platform is about 250 meters in width. The platform is very shallow and almost dries at low spring tides. The major morphological zonation features are shown in Figure 30. At the base of the beach there is a narrow (5 m) belt of cobbles up to 10 cm in diameter resting on sand. These may be coated with green algae. Seawards there is then a belt of 130-150 m wide of Cymodocea ciliata beds resting upon a patchy cobble, sand and boulder substrate held together by thick rhizome growths. The seaward edge of the Cymodocea beds is irregular and passes into a belt about 30 m wide consisting of boulders up to 30 cm in diameter resting upon the hard substrate of the reef platform. The boulders are coated with encrusting growths of calcareous algae. Seaward from this boulder belt is an area of bare reef platform which, with the exception of isolated boulders and small pockets, is sediment-free and smooth in appearance. This also is coated with sheet-growths of calcareous red algae. This bare area passes transitionally into an area of much prolific calcareous algal growth accompanied by a rise in height of about a third of a meter. This area is a low "algal ridge" and consists of prolific growth of calcareous algae into branching heads and encrusting sheets. The resulting structure is cavernous and many boulders are cemented to the surface by the growth of the algae. Surf conditions did not permit observations further seawards but the heads of many small surge channels lined with calcareous algae were observed.

a) Cymodocea beds

The growth of the phanerogam Cymodocea at this site is more continuous and luxuriant than any other seaward site observed around the atoll. Algae such as Caulerpa, Laurencia and Halimeda grow amongst the phanerogam and Turbinaria and Dictyosphaeria occur attached to the boulders and cobbles. The leaves of the Cymodocea are encrusted by melobesioid red algae and many other small epiphytes. Only a few animals live on the open surface of the beds and these include Holothuria atra and the echinoid Tripneustes gratilla. Some species live upon the leaves of the Cymodocea, these include the crab Menaethius monoceros, the gastropods Cerithium rostratum and Smaragdia rangiana, and the foraminiferan Marginopora. Most of the fauna is found beneath the boulders and cobbles common throughout the beds. The molluscan fauna is prolific and gastropods particularly common. These include the herbivores Trochus flammulatus, Cerithium nesioticum and two species of Rissoina. Common predatory gastropods are Drupa ochrostoma, Morula margariticola, Vasum turbinellus, Strigatella litterata, Bursa granularis, Cantharus undosus and Conus lividus. General grazers are Cypraea annulus and five other species of Cypraea. Bivalves are uncommon and the only records are of the byssate Pinctada margaritifera, Barbatia helblingi and Lima fragilis, and a small Tridacna maxima.

Crabs, particularly Xanthias lamarckii and Acteus rufopunctata, are abundant beneath the boulders. The ophiuroid Ophiocoma brevipes is abundant in crevices within the blocks.

b) Boulder belt

The boulders rest upon a relatively smooth substrate coated with a crust of calcareous algae. Most of the fauna in this zone is found beneath the shelter of the boulders. Encrusting sponges, ascidians, bryozoa and hydroids are common. The boulders are extensively penetrated by boring polychaetes. The undersides support a very diverse molluscan fauna. Bivalves are limited to the cemented Chama aspersa, Ostrea numisma and the byssate Barbatia helblingi and small Pinctada margaritifera. Gastropods are much more common and include a large proportion of vermivorous predators such as six species of Conus (especially Conus ebraeus, C. lividus, C. rattus and C. sponsalis), Vasum turbinellus, Bursa granularis. Other predators include Thais armigera, Morula uva, Maculotriton digitalis, Cymatium poleare and Bursa bufonia. Grazers on the encrusting fauna and flora include four species of Cypraea, two species of Rissoina, Triphora monilifera, Modulus tectum, Cerithium nesioticum and Vanikoro.

The porcelain crab Petrolisthes lamarckii is exceedingly common upon and beneath the boulders. The rest of the crab species occurring here are very similar to those occurring on the algal ridge discussed below.

c) Algal ridge

Within the algal ridge are heads of branching Porolithon which become much more abundant seawards, as do the corals. The corals are all small with semi-encrusting or stubbily branching species and include Tubipora musica, Stylophora mordax, Pocillopora eydouxi and Acropora disticha. Species of Millepora were remarkable by their absence.

The species composition of the molluscan fauna is essentially similar to that found in the boulder zone but more abundant.

The ophiuroids Ophiocoma erinaceus and O. scolopendrina are abundant in crevices.

Crabs are common and include the Percnon planissimum, Zosimus aeneus, Daira perlata, Actaea rufopunctata, Liomera bellus, Liomera monticulosus, Pilumnus hirsutus and Eriphia scrabicula.

3. South Point

Here the seaward platform is about 200 m wide and has many of the features described for East Point. The reef here receives more wave action and the inshore area is covered by boulders. The platform has an algal ridge, a Modiolus crust and a turf of red algae. On the algal ridge corals are much more abundant than at East Point and include the additional species Millepora tenera and M. platyphylla. The invertebrate fauna is very similar to that described for the other sites. Some of the boulders are very large and project up into the eulittoral zone; they are penetrated by vast numbers of sipunculids and by the boring barnacle Lithotrya valentiae. Cypraea caputserpentis, a species tolerant of wave action, was found in small crevices in the boulders.

4. Barton Point

At Barton Point almost the entire width of the seaward platform is covered by boulders up to 0.5 m in diameter. Calcareous red algae are prolific cementing the boulders together. Other algae present are Dictyosphaeria, Caulerpa, Dictyurus, Halimeda and Turbinaria. The fauna on and beneath the boulders is very similar to that found on and beneath the boulders at the sites discussed previously.

D. Lagoon shores

On lagoon shores the beaches are shallowly dipping, consist of fine sand and are overhung by supralittoral vegetation.

At the base of the beach there is usually an accumulation of small cobbles. On the eastern lagoon shores the platform is variable in width from 75 to 300 m and on the western side the widest point is at Pointe Marianne which is 950-1150 m wide. The depth of the platform varies between intertidal and 2-3 meters but in many places the lagoonward edge of the platform is not sharp and slopes more or less gradually into the deeper central lagoon. The platform margins on the western side appear rather sharper than those to the east.

On the eastern side the platform is covered by a thick accumulation of fine sand upon which sporadic patches of algae, Cymodocea and corals occur. The zonation on the lagoon platform seen 0.5 km north of East Point is fairly typical for the eastern side of the lagoon. The platform shelves gently from the beach lagoonwards with an average depth of 1-2 m. Nearshore the fine sandy substrate is colonised by patches of the algae Padina and Laurencia between which there is open sand colonised by several species of sponge embedded into the sediment. Further lagoonwards patches of Cymodocea ciliata occur with the Padina and Laurencia. In these patches are small colonies of the corals Porites lutea and Pocillopora damicornis. The holothurian Holothuria atra and the asteroid Culcita schmideliana are abundant. The Cymodocea is heavily infested with epiphytic algae.

Further from the shore corals appear, becoming more abundant lagoonwards. They occur in patches separated by areas of open sand with abundant polychaetes. The coral patches are not more than 1.5 m high and largely dead on the upper surfaces and centres of the patches. These patches are made up of quite a diverse coral fauna. Most common is the branching Porites nigrescens with a massive Porites, spray growths of Acropora reticulata, Lobophyllia costata, massive Favia pallida and Porites (Synaraea) iwayamaensis. Other species occurring are Goniopora cf. savignyi, Porites solida, Favia pallida, several species of Montipora, Astreopora ocellata, large colonies of Stylophora pistillata and Pocillopora damicornis. The free living species Fungia repanda and Halomitra philippensis occur on the sand between the coral colonies.

The corals form a substrate for a large number of epifaunal and boring molluscs. In crevices and on dead branches the byssate species Barbatia helblingi and Isognomon legumen, I. perna and Septifer bilocularis are very common. Other species are Lima lima, Gloripallium pallium. Pedum spondyloideum occurs solely in narrow crevices in massive Porites colonies. The coral colonies themselves are bored by Lithophaga teres, Botula cinnamomea and Gastrochaena cuneiformis. Tridacna maxima occurs byssate on upper surface of coral colonies and in crevices. The holothurian Stichopus chloronotus is common amongst the corals and on the sand surrounding the patches. The sand patches themselves support a sparse fauna of polychaetes, Rhinoclavis asper and the bivalve Fragum fragum.

The sponge colonies which occur nearer the shore support an individual fauna including many ophiuroids of the species Ophiactis savignyi, O. exigua, crangonid shrimps, and an erycinid bivalve.

At Carcasse the lagoon platform is 70 m wide and the patches of algae, Cymodocea and coral much more sparse than at East Point. The coral colonies at this site are particularly heavily colonised by the boring and epifaunal molluscs. The upper surfaces of the coral colonies are covered by growths of the algae Turbinaria, Padina, and Dictyosphaeria.

At Cust Point the lagoon platform is wider but the inshore areas for about 200 m are covered by luxuriant Cymodocea beds. Together with Cymodocea ciliata, algae are common particularly Halimeda, Laurencia, Hydroclathrus, Caulerpa and Codium. On cobbles and dead coral colonies Turbinaria and Dictyosphaeria are epilithically attached. The Cymodocea and Turbinaria are infected by abundant epiphytic algae and are coated with abundant marginoporoid foraminifera. Brown sponges are common. Coral occurring in this bed are Porites lutea, Porites nigrescens and Pocillopora damicornis. The stems of the Cymodocea are frequently encrusted by bryozoan colonies.

The holothurians Holothuria atra and Stichopus chloronotus and the ophiuroids Ophiocoma scolopendrina and O. brevipes are abundant.

The molluscs occurring upon the Cymodocea leaves and stems include Cypraea moneta and C. annulus, Smaragdia rangiana, Cerithium rostratum, Strombus decorus decorus and Drupa margariticola. Burrowing into the sediment are Polynices mammilla, Pinna muricata, Anadara urypigymelana and Codakia tigerina.

On the western side of the lagoon at Pointe Marianne there is a wide intertidal sandy belt with isolated patches of Laurencia, Padina and some Cymodocea. Further from the shore the amount of Cymodocea progressively increases. In the open sandy areas there are large quantities of brown sponges buried in the sediment and small cobbles coated with Dictyosphaeria. Other sponges contain the commensal bivalve Vulsella spongiarum. The crab Calappa hepatica is very common in the sand and Thalamita amongst the algae. Holothuria atra is present in numbers up to 2-3 per square meter and Stichipus chloronotus rather less common. Further out in the Cymodocea the molluscs Strombus decorus decorus, S. labiatus, Cypraea moneta, Cerithium rostratum, Codakia tigerina, Ctena divergens and Pinna muricata are present.

The edge of the platform on this western side was not studied but observations from a boat indicate a platform front of massive coral colonies, probably Porites, 2-3 m in diameter.

Near the entrance to the lagoon, the lagoon shore supports a more prolific coral fauna. On the lagoon side of Eclipse Point there is a coral-dominated area with a large number of species. The dominant coral in terms of area occupied is Acropora reticulata which occurs in plate-like growths over a meter in diameter. Acropora palifera in club-shaped branches is also abundant. There is some growth of staghorn *Acropora*. *Lobophyllia costata* occurs in large mound-like growth. *Goniastrea pectinata*, *Favia halicora*, *Favia abdita* and *Porites australensis* occur as small rounded heads. Delicate foliose growths of *Echinopora lamellosa* are also abundant. Other corals include *Cyphastrea microphthalma*, *Platygyra lamellina*, *Porites (Synaraea) iwayamaensis*, *Herpolitha limax*, *Pavona varians* and *Stylophora pistillata*. The alcyonaceans *Sinularia* and *Lobophyton* are common in masses up to 50 m in diameter.

E. The barachois

The barachois situated at the southern end of the lagoon have narrow entrances and represent areas of extremely restricted circulation opening on to an area of lagoon which also has restricted circulation. It is not surprising, therefore, that the fauna is rather peculiar.

The higher fringes of the barachois are occupied by the crab *Cardisoma carnifex*, causing extensive disturbance of the sediment. Lower in the true intertidal areas where the sediment is a fine lime mud it is colonised by vast numbers of the fiddler crab *Uca tetragonon*. Other Crustacea include alpheid prawns and the crab *Thalamita crenata*. Deposit-feeding bivalves are more common in the barachois than at other sites: species include *Asaphis deflorata*, *Leptomya rostrata*, *Quidnipagus palatam* and *Scissulina dispar*. Suspension feeders *Gafrarium pectinatum* and *Atactodea glabrata* occur in coarser sediments. The gastropods *Cerithium morum* and *Rhinoclavis asper* are abundant.

The beachrock surrounding the barachois is colonised by the ellobiid gastropod *Melampus castareus* and *Littorina scabra* and sometimes under overhangs *Ostrea cucullata*.

Stromatolithic-like masses of algally fixed sediment are common around the edges of the barachois. Amongst these masses two holothurians are found together with burrowing crangonid shrimps, and *Thalamita*.

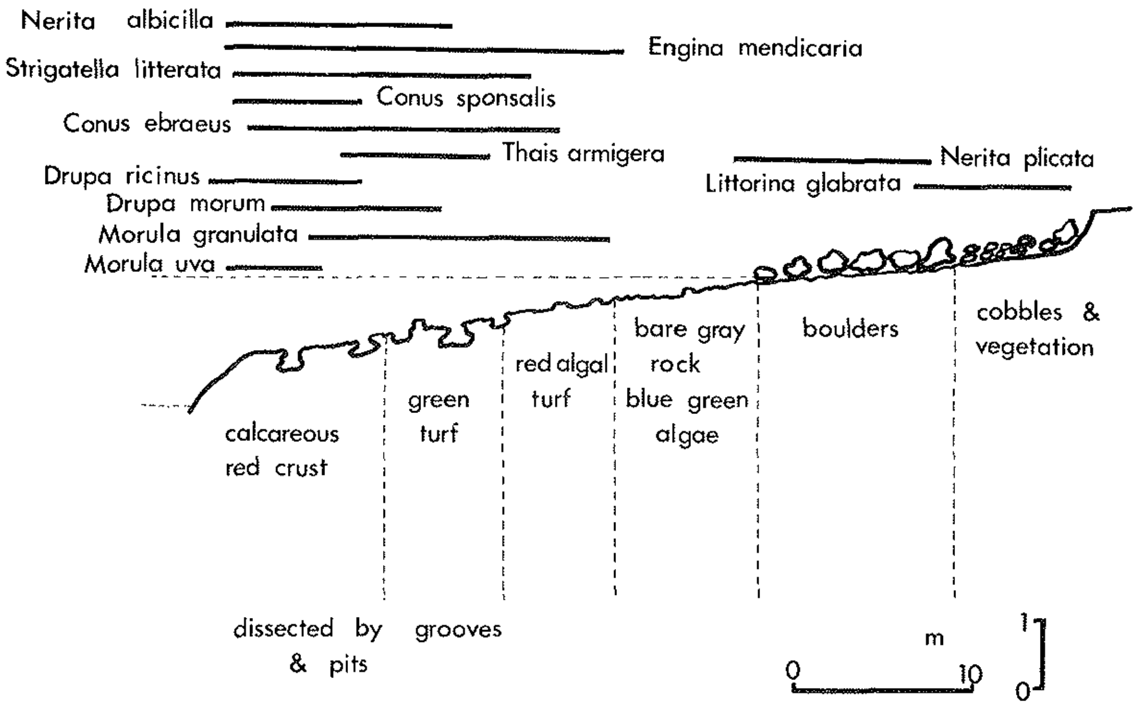

Fig. 26. Intertidal zonation on the seaward shore of West Island.

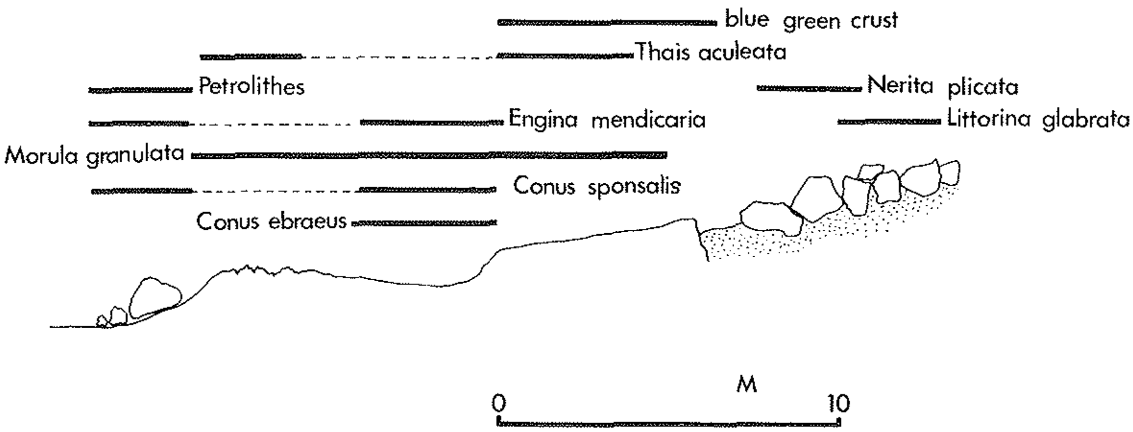

Fig. 27. Intertidal zonation on seaward beachrock at South Point.

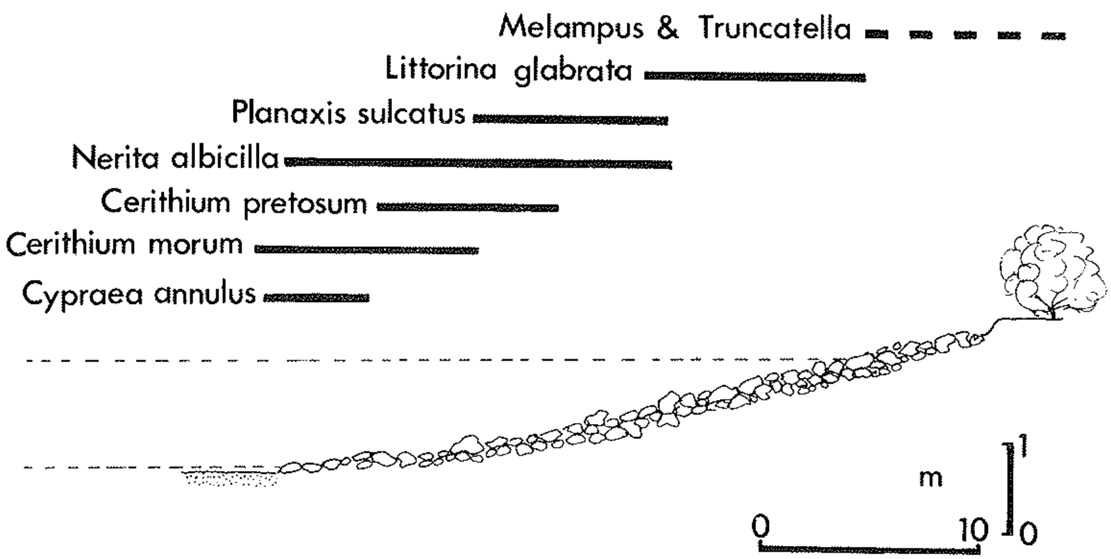

Fig. 28. Intertidal zonation on a cobbled lagoon shore, Carcasse.

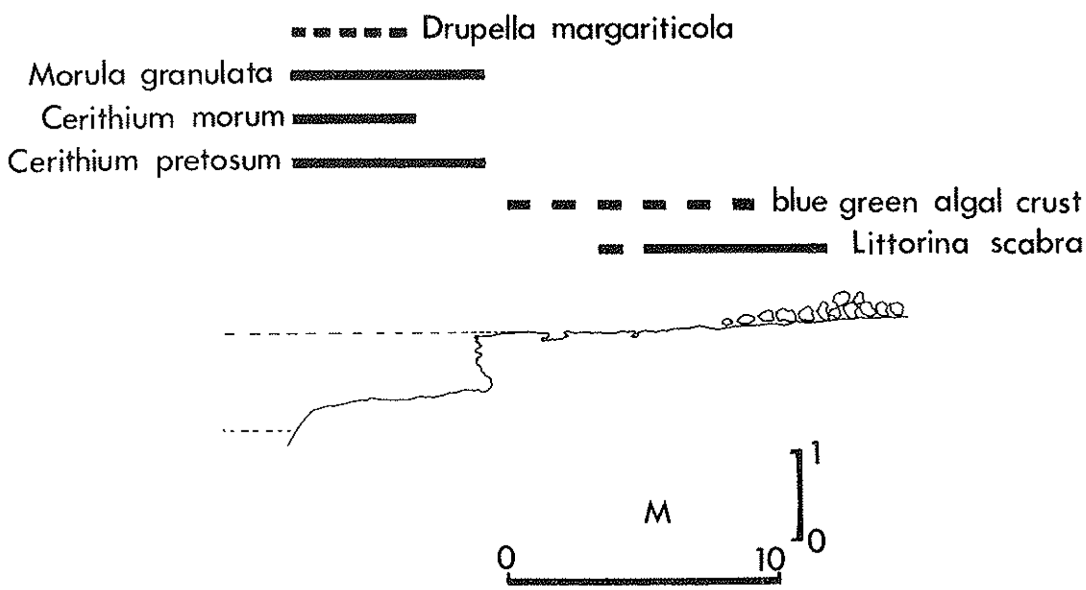

Fig. 29. Intertidal zonation on beach rock, entrance to Barachois Maurice.

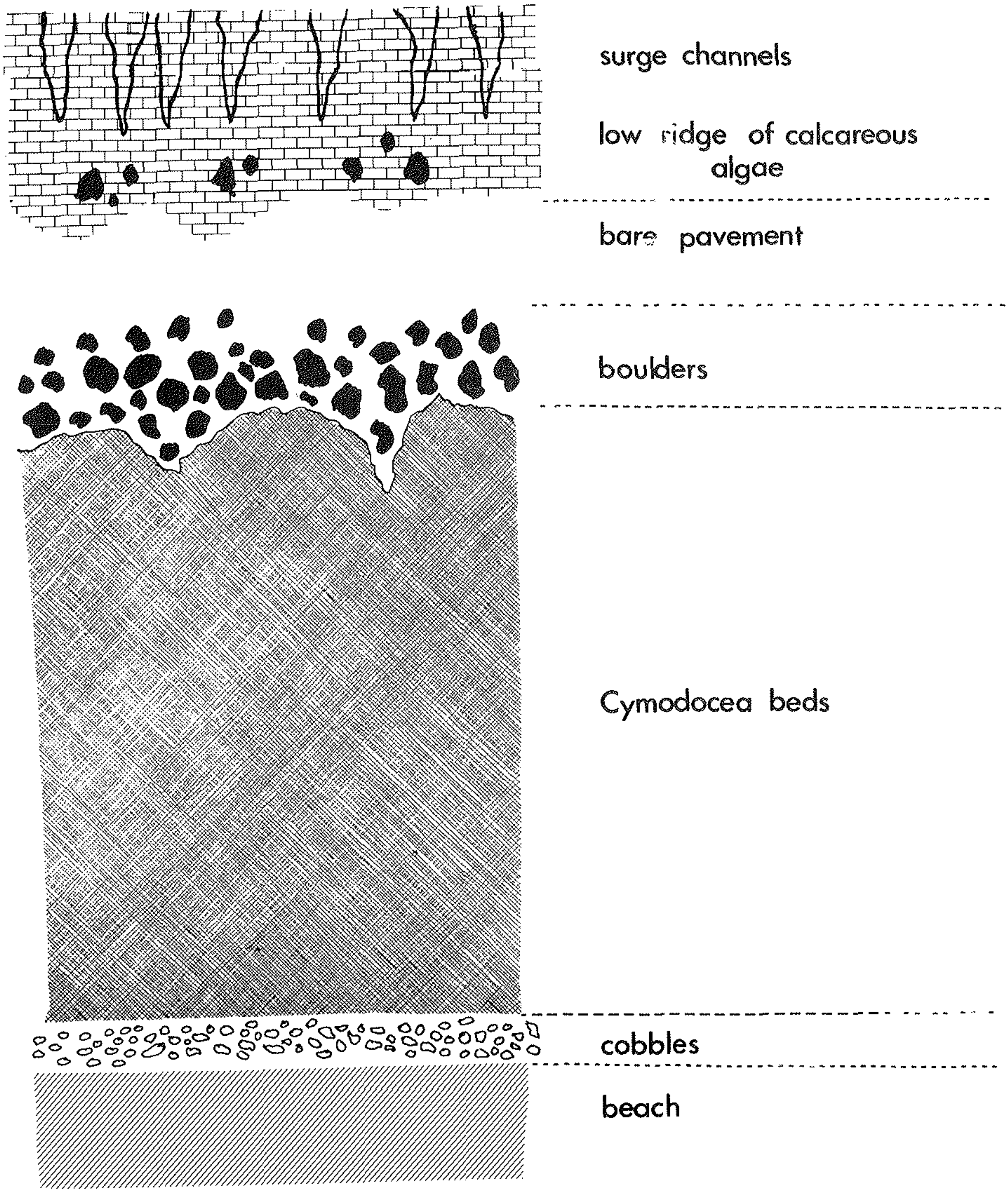

Fig. 30. Intertidal zonation on the reef platform at Northwest Point.

5. MARINE ALGAE OF DIEGO GARCIA

by Charles F. Rhyne

INTRODUCTION

The algal flora of Diego Garcia atoll seems after preliminary studies to compare closely with that found by earlier investigations (Hemsley, 1887; Gepp and Gepp, 1909; Weber-van Bosse, 1913; Reinbold, 1907) and with the floras of some adjacent islands and continental shores in the western Indian Ocean. Many new records of species on the atoll were established by the recent collection. Also, names of some entities in the 43 species collected around the turn of the century have been corrected when synonymy was noted by the author.

This list includes 115 known algal taxa from Diego Garcia. Seventy-one are new records for this central Indian Ocean atoll. These new records consist of 8 in the Myxophyceae, 30 in the Chlorophyceae, 9 in the Phaeophyceae and 25 in the Rhodophyceae. One new species of green alga is included, belonging to the new genus *Struveopsis* described elsewhere (Rhyne and Robinson, 1968). Earlier authors recorded 43 species, but only 14 of these were recollected by the writer. One terrestrial blue-green alga is included in this report.

Several entities have been purposely omitted for lack of sufficient data. Some groups, which ary melobesioid corallines, *Ceramium*, *Herposiphonia*, *Chondria*, *Sargassum*, *Turbinaria*, *Cladophora* and *Bryopsis*, posed such taxonomic difficulty they are presently listed only by genera. Identifications of *Halimeda* are to be made later by Dr. Llewellya H. Colinvaux.

I wish to thank Dr. Francis Drouet, Academy of Natural Sciences, Philadelphia, for identifying the Myxophyceae and Mr. Roy T. Tsuda, University of Guam, for the annotated determinations of the genus *Caulerpa*. I am grateful to Dr. Harold Robinson, Department of Botany, Smithsonian Institution, who critically read the manuscript.

The bibliography does not include citations of the original descriptions of the species unless pertinent data or figures are used in the discussion of the species. Original citations for many of the species can be found in Dawson (1954).

All numbered specimens are deposited in the herbarium of the Smithsonian Institution (US). CR collection numbers are those of the author.

Atoll Research Bulletin No. 149: 41-65, 1971.

HABITAT DESCRIPTIONS

Collections were almost wholly intertidal with occasional shallow sublittoral ones (to 3.3 m). There was a general lack of substantial growth in deeper waters of the lagoon and the extremely treacherous conditions along the "Porolithon" ridge area made collecting nearly impossible there. Despite the ubiquity of many species throughout the reef environment, a short summary of habitat descriptions will be given and a note of certain niches that contained distinctive species.

A. Lagoon shore, east and west sides

By far the most frequent ecological situation was a sloping sand beach consisting of occasional exposed rock reefs at low water spring (LWS) tide. Coral pebbles and cobbles, a few centimeters to 20 cm in diameter, were either embedded in intertidal sand or kept in continuous motion by the pounding surf driven by the SE winds. The surf was particularly evident along the western side of the lagoon.

The intertidal zone along the NW lagoon shore was largely devoid of attached algae except for *Enteromorpha* and *Giffordia duchassaigniana*. However, just below the turbulent intertidal area, a prevalent benthic flora appeared. As shallowly as 0.3-0.5 m, *Dictyota*, *Pocockiella papenfussii*, *Hypnea*, *Halimeda*, a melobesioid red and long skeins of *Schizothrix* were attached on dead and dying portions of erect corals. Here patches of *Cymodocea ciliata* in 0.3-1.0 m of water supported the barest epiphytic flora with occurrences of *Bryopsis*. *Cymodocea* and a melobesioid alga covered large areas of coral in 1.0-2.5 m of water. In deeper water, 2.4-4.0 m, *Microcoleus lyngbyaceus* appeared on loose coral cobbles while *Padina* produced thick scattered clumps over small isolated outcrops of coral. Otherwise the loose sandy bottom appeared as a rather desolate habitat for algal growth.

As one walked along the high intertidal zone at LWS tide a few species were found frequently in the drift. Among the drift *Cymodocea ciliata*, *Hypnea pannosa* and *Pocockiella papenfussii* were generally attached to small coral cobbles and *Jania decussata-dichotoma* was intimately associated with *Dictyota*. Sprigs of *Turbinaria* and *Sargassum* were occasional along the high intertidal zone. At Point Marianne occasional clumps of drift *Hypnea pannosa* were washed about in the shallow embayment.

Shallow water, limestone cliffs, high turbidity and high insolation characterized the seemingly desolate southern portion of the lagoon shore, but under the 0.8-1.7 m high cliffs, a distinct flora could be observed in the cavities. At LWS tide some of these depressions were completely shaded and although exposed for periods up to 6 hours the extreme dampness supported thick growth of *Cryptonemia*, *Cladophora socialis*, *Botryocladia skottsbergii*, *Valonia utricularis*, *Caulerpa peltata* and *Avrainvillea*. Long skeins of *Schizothrix mexicana*, *Halimeda*, Chaetomorpha, Bryopsis pennata, Codium geppii, Galaxaura filamentosa and Gelidiopsis intricata were observed hanging from the ceiling of these cavities. Also under the ledges Halimeda was extremely abundant with Cladophoropsis sundanensis growing profusely over exposed coral flats at LWS tide. Schizothrix arenaria formed a large moss-like felt covering expanses of slightly raised coral ledges that were exposed even at HWS tides.

In the lower intertidal to 0.5 of water Hypnea pannosa was extremely abundant as scattered ball-like formations 20-45 cm in diameter. The cavity of these algal spheres afforded protection and a complete microenvironment for small fish, crab and shrimp.

Slightly NE of this southern tip of the lagoon Rhipidiphyllon reticulatum was observed under ledges. In tide pools Schizothrix calcicola was locally common with the ever present Calothrix pilosa. In water to 1 m in depth Gelidiella acerosa, Boodlea composita, Galaxaura filamentosa and Herposiphonia were collected. Also Spyridia filamentosa was found extremely abundant as an epiphyte upon Cymodocea.

B. Islets

The Cymodocea beds surrounding three islets at the mouth of the lagoon yielded an abundant variety of algae. Dictyurus purpurescens, Valonia ventricosa, Dictyospheria cavernosa, Caulerpa peltata and Acetabularia moebii were found in a distinct environment beneath a thick canopy of the seagrass leaves. Epiphytes such as Sphacelaria furcigera, Amphiroa fragilissima, Fosliella farinosa, Enteromorpha flexuosa, Microdictyon pseudohapteron, Champia parvula, Hypnea, Jania tenella and Lophosiphonia were seemingly specific for certain portions of Cymodocea. Melobesioids appeared commonly scattered about the bottom near the extensive Cymodocea beds.

C. Lagoon floor

SCUBA and free diving allowed observation and collection of the flora on the lagoon floor. In the northern portion dives ranged from 3-10 m and to 2-3 m in the southern portion. The deeper dives revealed a paucity of fleshy forms with some Halimeda and melobesioid algae predominating. The bottom at 10 m was composed of 80 % soft coral sediments. Toward the southern end of the lagoon a survey of the bottom in 2-3 m of water revealed large areas of sand with sizable depressions filled with drift Padina to a depth of 0.5 m. Also, isolated coral heads rose within 1.0-1.5 m of the surface and supported luxuriant growths of Sargassum, Turbinaria, Padina, Jania, Galaxaura and Dictyota. These coral heads were the only observed sites for attached Sargassum.

D. Ocean shore, east and west sides

An intermediate area between the true lagoon environment and the ocean side was observed at Eclipse Point. The location of the area afforded protection from daily heavy wave action at high tide. At LWS tide the reef was almost totally exposed with occasional tidal pools with 1-15 cm of water and large coral-conglomerate rocks breaking the surface. Cymodocea patches were scattered about, but individual plants were only 7-20 cm tall in contrast to the deeper placed plants on the lagoon side which reached 18-28 cm in height. Very fine calcareous silt settled over the entire reef flat camouflaging much of Schizothrix mexicana, Dictospheria, Boodlea composita, Gelidiella acerosa, Turbinaria, Laurencia, Jania capillacea, Herposiphonia and Cladophoropsis sundanensis which were common as a felt over the coral rocks. Larger coral rocks supported a significant number of plants on the lower surfaces where they were protected from the extremely high insolation. Melobesioids were common members of this micro-environment. Schizothrix calcicola, Microcoleus lyngbyaceus and Rivularia polyotis formed extensive patches over sandy areas, while Halimeda was scattered commonly over the reef flat area and appeared to be the dominant large species.

A large cemented beach-rock formation south of the preceding location yielded a substantially different flora related to the change in habitat type. Rock shelving extended ca. 100 m outward from the high intertidal zone to the "Porolithon" ridge, ranging in depth from zero to 0.6 m of water at LWS tide. Rivularia polyotis was found as dark gelatinous clumps on tops of coral rubble. Jania decussata-dichotoma was frequent in crevices, while Dictyospheria intermedia covered the sandy bottom at times, and Halimeda, as stubby plants, commonly grew from larger crevices. Cladophora, attached to coral rocks was the main element in the algal felt.

Along the extremely turbulent ocean side near the southern end of the atoll melobesioids were common at the edge of the ridge and as cast-up material. Microdictyon pseudohapteron, Boodlea composita, Schizothrix calcicola and Microcoleus lyngbyaceus were common entities covering large areas over coral cobbles along with the ever present dwarfed Turbinaria.

At Horsburgh Point, Botryocladia skottsbergii, Ralfsia, Caulerpa peltata and C. urvilliana were under ledges and in deep crevices formed by small limestone cliffs. At extreme low tides this area was left dry for several hours at a time, with only the deepest portions of the crevices remaining damp enough to support their unique floras. In 0.5-1.0 m of water Pocockiella papenfussii and Laurencia nidifica were observed as common patches over a flat rock bottom swept essentially clean by an extremely fast current running parallel to the shore.

Approximately 1 mile north of this area a wide reef flat with ca. 100 m of exposed coral and reef rock formation was observed. The vegetation was predominantly *Jania* and *Laurencia* with abundant clumps of melobesioids up to 20 cm in diameter.

Adjacent to East Point village the reef floor consisted of pavement-like surface with scattered coral rocks and boulders. What could be seen of a well-formed "Porolithon" ridge enticed the author to sample it, but wave action forced him to "observe" only. *Jania*, a melobesioid, *Boodlea composita* and *Turbinaria* were all common in 0.7-1.3 m of water while *Gelidiella acerosa* was abundant in the intertidal zone.

At Minni-Minni ca. 2 miles north of East Point village a flat coral reef appeared quite representative for the ocean side environment. However, this particular area along the outer reef edge and "Porolithon" ridge supported a rich diversity of forms not seen earlier. Unfortunately collecting was nearly impossible because of the strong surge and dangerous waves. Well-formed surge channels extending almost from the ridge to the sloping sand shore allowed good water circulation even at LWS tide. The collected vegetation was of a matted habit with *Jania capillacea*, *Laurencia*, *Boodlea composita*, *Microdictyon pseudohapteron*, *Caulerpa urvilliana*, *Halimeda* and melobesioids predominating. An unidentified peltate red alga was also collected in the extremely turbulent area between the ridge and reef proper.

COLLECTING STATIONS

Station 1. Coral reef flat on oceanside at Eclipse Point. 11 June 1967.

Station 1a. Cemented beach rock ledge ca. 200 m S of Sta. 1. 14 June 1967.

Station 2. Drift material along coral cobble and sand lagoon shore in vicinity of Northwest Point. 12 June 1967.

Station 3. Coral reef in 0.6-1.3 m of water along lagoon shore in vicinity of Northwest Point. 12, 13, 15, 17 June 1967.

Station 3a. In 2.4-4.0 m of water on sand-coral bottom at Sta. 3. 15 June 1967.

Station 3b. Drift material from Sta. 3. 14 June 1967.

Station 4. Lagoon side of West Island in shallow but thick *Cymodocea* beds. 16, 22 June 1967.

Station 5. On spur reef at West Island in 0.3-1.0 m of water amid sand and coral pieces and in 1-2 m of water on coral reef. 21 June 1967.

Station 6. Lagoon shore ca. 2 miles S of East Point village in shallow reef area. 23 June 1967.

Station 6a. Beach rock and sand shoreline ca. 100 m S of Sta. 6. 18 July 1967.

Station 7. Epiphytic material on various substrates in 0.5-1.0 m depths along lagoon shore at East Point village. 26 June 1967; drift - 5 July 1967.

Station 8. Drift material along seaward sand and coral cobble beach at East Point village. 26 June; 1, 3 July 1967.

Station 9. Seaward side of the "Porolithon" ridge in 1.7-4.0 m of water at East Island. 27 June 1967.

Station 10. Drift along sandy shoreline at Point Marianne. 28 June 1967. Epiphytic material in shallow intertidal area. 25 July 1967.

Station 11. In 1.3-2.0 m of water on lagoon floor ca. 4 miles S of East Point village in *Cymodocea* beds and scattered coral heads. 29 June 1967.

Station 12. In shallow recessed tidal lagoon ca. 6 miles S of East Point village. 29 June 1967.

Station 13. Sand and coral cobble lagoon shore ca. 1.5 miles N of East Point village. 1, 4 July 1967.

Station 14. Shallow coral flat area along seaward side at East Point village. 1, 5, 10 July 1967.

Station 15. Sand and eroded coral ledge, lagoon shore ca. 1 mile S of East Point village. 4 July 1967.

Station 16. Oceanside of "Porolithon" ridge in 2.0-3.5 m of water at Observation Point. 6 July 1967.

Station 16a. Over disturbed sand and coral rock bottom in 0.3-1.0 m depths at Observation Point. 6 July 1967.

Station 17. Exposed oceanside coral reef flat at LWS tide ca. 1 mile N of Horsburgh Point. 7 July 1967.

Station 17a. Beach-rock and eroded coral cliff habitat at Horsburgh Point (CR-575 - CR-578). In 0.3-1.0 m of water (CR-579 - CR-582). 7 July 1967.

Station 18. Coral reef flat and sand area in vicinity of southern-most tip of lagoon. 8 July 1967.

Station 19. Lagoon side of East Island in 0.3-0.7 m depths at LWS tide. 9 July 1967.

Station 20. In temporarily dried fresh water pond ca. 0.75 miles S of East Point village. 12 July 1967.

Station 21. Southern-most tip of lagoon, physically similar to Sta. 18. 12 July 1967.

Station 22. Vicinity of southern-most tip of lagoon, physically similar to Sta. 18. 13 July 1967.

Station 23. Ca. 1 mile S of East Point village along lagoon shore in 0.3-0.7 m of water on sand and coral cobble bottom. 18 July 1967.

Station 24. In large shallow recessed tidal lagoon ca. 3 miles S of East Point village. 18 July 1967.

Station 25. Highly exposed oceanside reef flat ca. 3-4 miles N of southern tip of atoll on W side. 19 July 1967.

Station 26. Beach-rock and sand lagoon shore ca. 3 miles N of southern tip on W side. 19 July 1967.

Station 27. Seaward coral reef flat exposed at LWS tide ca. 1 mile N of Cust Point. 20, 21 July 1967.

Station 28. Thick *Cymodocea* beds and rich coral area in 0.7-2.7 m depths on lagoon side ca. 1 mile N of Cust Point. 20, 21, 22 July 1967.

Station 29. Seaward reef flat exposed at LWS tide at Minni-Minni. 24 July 1967.

Station 30. In 10 m of water on lagoon floor ca. 1 mile due S of East Island. 26 July 1967.

Station 31. In 8.3 m of water on lagoon floor ca. 1500 m SSW of Observation Point. 27 July 1967.

Station 32. In 5 m of water on lagoon floor ca. 1500 m SE of Eclipse Point. 27 July 1967.

SYSTEMATIC LIST

Myxophyceae

Calothrix crustacea Schousb. & Thur.
Stations: 12, locally common in tide pools, CR-515; 21, consolidated over sand, CR-624a; 23, abundant on beach-rock exposed at LWS tide, CR-697, CR-698.

Calothrix pilosa Harv.
Stations: 12, extensive growth over beach-rock, CR-516; 18, abundant on coral flat, CR-588; 23, over beach-rock, CR-697.

Microcoleus lyngbyaceus (Kütz.) Crouan
Earlier records: Reinbold 1907 (as Hydrocoleum lyngbyaceum Kütz.)
Stations: 1, CR-355; 3a, CR-410; 6, CR-468, CR-475; 13, CR-526; 14, CR-538, CR-558; 23, CR-698, CR-699; 6a, CR-701, CR-702; 25, CR-719; all common over sand or coral substrates.

Nostoc commune Vauch.
Stations: 3, terrestrial, abundant over sandy soil, CR-387.

Rivularia polyotis (J. Ag.) Born. & Flah.
Stations: 1, over sand, CR-356; 1a, common on coral rocks, CR-395; 14, common on coral rocks, CR-552.

Schizothrix arenaria (Berk.) Gom.
Stations: 18, abundant over coral flats exposed at LWS tide, CR-588; 20, on soil of temporary brackish pond, CR-623; 21, over sand, CR-624a; 25, common over coral rocks, CR-719.

Schizothrix calcicola (Ag.) Gom.
Stations: 1, CR-355; 1a, CR-395; 12, CR-515; 14, CR-552, CR-558; 20, CR-623; 21, CR-624a; 23, CR-697; CR-698; CR-699; 25, CR-719; all common over sand or coral substrates.

Schizothrix mexicana Gom.
Stations: 1, CR-339; 2, CR-361; 3, CR-377, CR-384; 17, CR-573; 21, CR-634; 22, CR-644; all common over coral rocks or under ledges.

Scytomena hofmannii Ag.
Stations: 20, locally abundant on soil of temporary brackish pond, CR-623.

Chlorophyceae

Acetabularia moebii Solms-Laubach
Stations: 4, rare, at base of Cymodocea bed mixed with larger algae, CR-431. Plants ca. 6-7 cm tall; disks ca. 2 mm in diameter with ca. 13 rays with rounded tips; rays calcified together.

Avrainvillea sp. cf. A. amadelpha Gepp & Gepp 1911: 42, pl. 14, figs. 112-115.
Stations: 12, CR-508; 21, CR-633; rare under ledges at both stations.

Seemingly dwarfed specimens of A. amadelpha but also rather close to A. lacerata (Harv.) J. Ag. Plants to 2.5 cm tall, of a spongy texture and somewhat zonate; frond filaments without tenaculae, ca. 15-25 μ in diameter.

Boodlea composita (Harvey) Brand; Dawson 1954: 390, fig. 9c, f.
Stations: 1, common over sandy area, CR-343; 12, common over coral and beach-rock, CR-510, CR-519; 14, common over coral reef, CR-564, CR-559; 25, common as tufts over coral rocks, CR-718; 29, common over reef flat exposed at LWS tide, CR-782.

Filaments ranging in size from 250-400μ in diameter as a short felt over the substrate. The dry material appears to differ somewhat from other herbarium specimens; however, dimensions and habit of the wet material indicate B. composita.

Boodlea vanbossei Reinbold; Dawson 1956: 29, fig. 6.
Earlier records: Reinbold 1907.

Bryopsis pennata Lamx. var. leprieurii (Kütz.) Collins & Hervey; Taylor 1960: 132. Stations: 21, infrequent from ceiling of ledge, CR-635.

Almost identical with CR-700 except that numerous vacant spaces exist along main axis.

Bryopsis pennata Lamx. var. secunda (Harv.) Collins & Hervey; Taylor 1960: 132, pl. 9, fig. 12.
Stations: 6a, mixed with various other matted algal forms, CR-700.

Main axis 200-275μ in diameter, pinnae ca. 60-80μ in diameter, plants ca. 3-5 cm tall with strong secund branching in many areas.

Bryopsis sp. #1
Stations: 14, over coral rocks, CR-554, CR-606.

Main axis to 1 mm in diameter; with pinnae 40-60μ in diameter and 2-3 mm long; plants 2-3 cm tall; material seems to indicate pinnae situated at random around branch. Possibly close to B. hypnoides.

Bryopsis sp. #2
Stations: 3, locally infrequent in sand in Cymodocea beds, CR-435.

Plumose habit with distichous branching; pinnae arranged as characteristic of B. indica, but generally only at lower portions of thallus, main axis ca. 300μ in diameter, pinnae 50-75μ in diameter.

Caulerpa antoensis Yamada 1944: 27, pl. 1, fig. 1; Dawson 1956: 36, fig. 20.
Stations: 4, rare over sand in Cymodocea beds, CR-430.

The cylindrical rhizome bears numerous short rhizoids which are firmly attached to fine sand particles. The simple or branched foliar branches, about 1 cm high, possess apiculate ramuli which are distinctly upcurved and arranged in a verticillate manner.

Caulerpa cupressoides (Vahl) Weber-van Bosse
Earlier records: Reinbold 1907.

Caulerpa cupressoides Weber-van Bosse var. mamillosa f. nuda Weber-van Bosse
Earlier records: Gepp and Gepp 1909, on reef exposed at dead low tide.

Caulerpa freycinetii Ag. var. typica f. spiralis Weber-van Bosse
Earlier records: Gepp and Gepp 1909, on reef exposed at dead low tide.

Caulerpa mamillosa Mont.
Earlier records: Hemsley 1887.

Caulerpa peltata Lamx. 1809: 145; Taylor 1950: 65.
Stations: 4, rare over sand in Cymodocea bed, CR-429; 14, infrequent under large coral rocks, CR-539; 17a, infrequent under ledges, CR-578; 21, frequent under ledges, CR-632.

The branched cylindrical rhizomes, about 0.5-1.0 mm in diameter, bear single entire peltate ramuli which are about 2-4 mm in height. Occasionally the ramuli may be branched.

Caulerpa racemosa var. peltata (Lamx.) Eubank 1946: 421, fig. 2r.
Stations: 14, infrequent, with other matted forms, CR-560.

The ramuli on this specimen consist of two morphological forms, the "turbinata" type and the "peltata" type. Past field observations in Hawaii and Guam have revealed that C. racemosa v. peltata and C. peltata are two different entities. The former can be differentiated from the latter by the presence of the peltate ramuli on an erect axis as opposed to the ramuli occurring directly on the rhizome in the latter species.

Caulerpa serrulata var. typica (Weber-van Bosse) Tseng 1936: 178, pl. 1; Eubank 1946: 418.
Stations: 1, CR-353; 3a, CR-412; 5, CR-438; 6, CR-469; 11, CR-504; 13, CR-532; 16a, CR-569; all over sand or coral rocks.

The twisted serrated flattened foliar branches, about 1.0-4.5 cm in height, may arise singly, dichotomously or irregularly.

Caulerpa urvilliana Montagne 1845: 21; Taylor 1950: 62, pl. 31, fig. 2.
Stations: 16a, locally frequent on coral rocks and on sand, CR-570; 17a, over coral rocks and abundant in drift, CR-579, 25, frequent in drift, CR-715; 29, frequent over reef flat, CR-786.

The specimens seem to be referrable to v. typica f. tristicha (J. Ag.) Weber-van Bosse. The foliar portion branches near the base and reaches a height of 6 cm.

Chaetomorpha aerea (Dillw.) Kütz.
Earlier records: Reinbold 1907.

Chaetomorpha gracilis Kütz.; Taylor 1960: 70.
Stations: 12, locally abundant under tree exposed at LWS tide, CR-513; 21, infrequent under ledge, CR-638.

Filaments ca. 55-80µ in diameter, cells 150-275µ long, walls 5-15µ thick.

Chaetomorpha sp. cf. C. brachygona Harvey; Taylor 1960: 70, pl. 2, fig. 9.
Stations: 6a, locally frequent over soft bottom in 0.3-0.7 m of water, CR-703.

Filaments ca. 110-135µ in diameter, cells 115-225µ long, cell walls 15-25µ thick, no basal cell observed.

Chaetomorpha sp.
Stations: 6, common over intertidal coral cobbles, CR-462; 7, abundant over small coral rocks, CR-547.

Filaments ca. 140-200µ in diameter, cells mostly shorter than broad or equal; basal cell in CR-462 ca. 350µ long and ca. 100µ in diameter.

Cladophora demissa J. Ag.
Earlier records: Hemsley 1887.

Cladophora socialis Kütz.; Børgesen 1946: 28; Dawson 1956: 24.
Stations: 12, common under ledges, CR-511; 21, abundant over various coral substrates, CR-624b; 21, abundant under ledges, CR-629.

Branches ca. 75-110µ in diameter, with cells ca. 0.8-3.0 mm long, some rhizoidal processes observed; Børgesen used the name C. patentiramea f. longiarticulata for this plant in earlier works.

Cladophora sp. #1
Stations: 3b, one piece, CR-390; 6a, locally common over bottom in 0.3-0.7 m of water, CR-704.

Branches ca. 100-150µ in diameter, cells 0.5-3.0 mm long. This may be a robust form of C. socialis.

Cladophora sp. #2
Stations: 24, very common in tufts over bottom, CR-708.

Cells ca. 75-125µ in diameter and seemingly larger at one end than at the other, 250-400µ long.

Cladophoropsis sundanensis Reinbold: Dawson 1956: 31.
Earlier records: Reinbold 1907.
Stations: 1, locally frequent over coral and sand substrates, CR-349; 6, common over sand and coral substrates, CR-470, CR-473, CR-476; 18, very common over reef flat exposed at LWS tide, CR-589; 21, frequent over reef flat exposed at LWS tide, CR-640.

All specimens but those of CR-349 seem to be rather robust forms of the species as branch size was 105-165 μ in diameter. At first C. limicola Setchell was thought to compare well by description. However, owing to previous collections on Diego Garcia and the fact that Dawson (1956) states that C. sundanensis can approach 175 μ in branch diameter, the specimens are placed here.

Codium geppii O. C. Schmidt; Børgesen 1946: 49, figs. 195-199.
Stations: 8, infrequent over coral cobbles, CR-489; 14 infrequent over large coral rocks, CR-534; 21, locally common under ledges, CR-637.

Utricles ca. 400-750 μ long, 150-325 μ in diameter; end wall ca. 1 μ thick; CR-489 and CR-534 branches to 2 mm in diameter; CR-637 with branches 2-4 mm in diameter, appearing as a much more robust and luxuriantly formed specimen, with gametangia ca. 250 μ long and 50-60 μ in diameter.

Dictyospheria cavernosa (Forsk.) Børg.; Taylor 1950: 43, pl. 27, fig. 2; Dawson 1954: 388, fig. 8i.
Earlier records: Reinbold 1907 [as Dictyospheria favulosa (Mert.?) Dcne.]
Stations: 1a, infrequent, CR-402; 4 infrequent in Cymodocea beds, CR-417; 6, locally infrequent, CR-465.

Dictyospheria intermedia Weber-van Bosse; Taylor 1950: 42.
Stations: 1, along sides and under surfaces of large coral rock, CR-342; 1a, frequent over sand bottom, CR-403; 6, locally infrequent, CR-464; 11, in Cymodocea bed, CR-499; 28, very common over coral rocks, CR-726; 31, on coral rock, CR-795.

It is difficult to be sure that internal spines were not present.

Enteromorpha flexuosa (Wulfen ex Roth) J. Ag. cf. subsp. flexuosa: Bliding 1963: 73, figs. 38-41.
Stations: 4, infrequent on Cymodocea stems, CR-422; 6, common over coral cobbles in intertidal zone, CR-461; 14, distinct band over coral rocks at low water mark, CR-553.

Short tufted tubular thalli to 3 cm tall with dense branching generally from lower portion of main axis only; branches to 1 mm in diameter; cells in longitudinal order, 15-30 μ long, 12-22 μ in diameter; 2-4 pyrenoids.

Enteromorpha flexuosa (Wulfen ex Roth) J. Ag. cf. subsp. paradoxa (Dillwyn) Bliding; Bliding 1963: 79, figs. 42-45.
Stations: 3b, one piece over coral rocks in intertidal zone, CR-388; 21, epiphytic upon Cocos pinnae, CR-624; 23, epiphytic upon Casuarina twigs in 0.3 m depths, CR-692.

Tufts to 3-4 cm tall; filaments thin, 125-300 μ in diameter; cells in longitudinal order, sometimes in transverse order; cells ca. 15 μ square to 12-20 μ in diameter, 18-30 μ long; 1-5 pyrenoids; a much more finely branched and elongate form than subsp. flexuosa.

Enteromorpha lingulata J. A.
Earlier records: Reinbold 1907.

In discussing the determination of E. lingulata, Reinbold relates these specimens closely to E. crinita.

Halimeda incrassata (Ell. & Sol.) Lamx.
Earlier records: Reinbold 1907.

Halimeda opuntia Lamx.
Earlier records: Hemsley, 1887; Gepp & Gepp 1909.

Halimeda opuntia f. typica E. S. Barton (verging towards f. cordata and triloba)
Earlier records: Gepp & Gepp 1909.

Halimeda tuna (Ell. & Sol.) Lamx.
Earlier records: Reinbold 1907.

Microdictyon pseudohapteron Gepp & Gepp 1909: 165, pl. 22, figs. 1-4; Dawson 1956: 36.
Stations: 4, locally common on Cymodocea stems, CR-423; 17a, drift, CR-582; 25, CR-716; 27, CR-724; 29, CR-783; all common on or under large coral rocks.

Segments to 260 μ in diameter, ca. to 400 μ long; ends of anastomosing membranes crenulate in appearance.

Microdictyon pseudohapteron Gepp & Gepp cf. f. luciparense Setchell 1929: 549, figs. 72-75.
Stations: 4, locally infrequent on Cymodocea stems, CR-447.

Segments to 200 μ in diameter, to 500 μ long, with seemingly a wider mesh than in the type.

Noemeris mucosa Howe 1909: 84, pl. 1, fig. 5 & pl. 5, figs. 1-14.
Stations: 1a, rare in sand, CR-396; 28, locally frequent over coral rocks, CR-729.

Length of primary branches ca. 300-500 µ long; 50-75 µ in diameter; plants 6-13 mm tall.

Rhipidiphyllon reticulatum (Askenasy) Heydrich; Taylor 1950: 45; Dawson 1956: 32, fig. 10.
Stations: 4, infrequent on Cymodocea stems, CR-424a; 12, infrequent under ledges, CR-509.

Lower cells to 175 µ in diameter with anastomosing branchlets.

Struvea anastomosans (Harv.) Piccone & Grunow; Egerod 1952: 359, pl. 31, fig. 4a-h.
Station: 22, on bivalve shell, CR-649.

With definite anastomosing habit and tenaculae; plants to 3 cm tall; stripe ca. 275-300 µ in diameter.

Struveopsis chagoensis Rhyne & H. Robinson 1968: 472, figs. 1-3.
Stations: 4, epiphytic upon Cymodocea, in 0.3-0.7 m of water, CR-421 (holotype-US); infrequent as epiphyte in Cymodocea bed, CR-450.

Valonia utricularis (Roth) C. Ag.
Earlier records: Reinbold 1907.
Stations: 12, associated with other larger algae, CR-505; 17a, infrequent on beach rock, CR-577; 21, very common under ledges, CR-631; 28, common as epiphyte on Cymodocea, CR-737.

The form of V. aegagropila was somewhat observed in CR-372, CR-505 and CR-577; however, these specimens are still probably dwarf forms of V. utricularis.

Valonia ventricosa J. Ag.
Stations: 4, infrequent in Cymodocea beds, CR-415, CR-445.

Spherical cells to 15 mm in diameter.

Valoniopsis pachynema (Martens) Børg.
Stations: 12, infrequent as epiphyte on larger algae, CR-520; 8, epiphytic on melobesioid alga, CR-545.

Highly contorted branching, branches up to 900 µ in diameter.

Phaeophyceae

Dictyota barteyresiana Lamx.
Earlier records: Reinbold 1907.

Dictyota sp. cf. D. divaricata Lamx.
Stations: 6, locally frequent under ledges, CR-456; 23, drift, CR-691.

Plants short to 5-6 cm tall; upper branches extremely narrow.

Dictyota sp. cf. D. friabilis Setchell 1926: 91, pl. 13, figs. 4-7, pl. 20, fig. 1; Dawson 1954: 401, 16a, b.
Stations: 2, common in drift, CR-370; 3, abundant on coral, CR-378; 11, frequent as epiphyte on Sargassum and Turbinaria, CR-503; 22, locally abundant patches, CR-642.

The low growing with concrescent thalli are as in D. friabilis Setch. Sporangia in our material measure ca. 80 μ in diameter, whereas in D. friabilis, Setchell indicates 160 μ.

Giffordia duchassaigniana (Grunow) Taylor; Dawson 1956: 43, fig. 32, (as Ectocarpus indicus Sonder in Zollinger).
Stations: 7, epiphytic upon Cymodocea, CR-494b; 23, over sand bottom in 0.3-0.7 m depths, CR-693; 10, locally frequent on various substrates in sand, CR-792.

Hydroclathrus clathratus (Bory) Howe
Earlier records: Reinbold 1907 (as Hydroclathrus cancellatus Bory)
Stations: 6, scattered in 0.3-0.7 m of water, CR-466; 13, locally abundant in drift, CR-528; 21, one clump in 0.3-0.7 m depths, CR-636.

Padina commersonii Bory
Earlier records: Reinbold 1907.
Stations: 2, drift, CR-368; 6, abundant over sand bottom, CR-457; 7, drift over sand bottom, CR-495; 11, abundant as drift over sand bottom, CR-498.

Padina sp. cf. P. tetrastomatica Hauck; Misra 1966: 158, fig. 84.
Stations: 13, very common in drift, CR-525.

Padina sp.
Stations: 3, scattered over small reef patches, CR-411.

Completely void of incrusting lime, but perhaps a form of P. commersonii.

Pocockiella papenfussii Taylor 1950: 98, pl. 54, fig. 2; Dawson 1956: 44.
Stations: 2, CR-359; 3, CR-375; 4, CR-416; 8, CR-546; 17a, CR-580; 19, CR-601; 28, CR-725. Most are common on coral or Cymodocea in 0.3-0.7 m depths.

Thalli to 325+ μ thick; ca. 8-9 cell tiers high.

Pocockiella variegata (Lamx.) Papenfuss
Earlier records: Gepp & Gepp 1909 (as Zonaria variegata Mart.) in lagoon.
Stations: 11, epiphytic upon Dictyospheria, CR-500.

Thallus, 140-160 μ thick.

Ralfsia sp.
Stations: 17a, infrequently matting floors under ledges, CR-576.

The habit and internal structure agree with the genus Ralfsia; however, without fertile material, a determination is not possible.

Rosenvingea intricata (J. Ag.) Børg.; Misra 1966: 125.
Stations: 6, infrequent under ledges, CR-467.

Hollow thallus with small superficial cells, 15-25 μ long; larger cells beneath, (100)-175-200-(300) μ long, 75-125 μ in diameter.

Sargassum subrepandum (Forsk.) Kütz.
Earlier records: Reinbold 1907.

Sargassum spp.
Stations: 2, CR-366; 13, CR-530; 7, CR-550; all as drift; 11, attached and locally abundant on scattered coral heads; seemingly sterile, CR-496.

Sphacelaria furcigera Kütz.
Stations: 4, common as epiphyte on Cymodocea stems, CR-418.

Sphacelaria novae-hollandiae G. Sonder; Dawson 1954: 399, fig. 14g.
Stations: 3, epiphytic growth on coconut husks, CR-379.

Propagulum 90-110 μ long; 65-80 μ wide at tip with corner cells divided as in Dawson's figure. Filaments however, are only 15-20 μ in diameter rather than 50-70 μ as described by Børgesen 1941: 45.

Turbinaria conoides (J. Ag.) var. conoides f. laticuspidata Taylor; Taylor 1966: 97.
Earlier records: Hemsley 1887 (as Turbinaria vulgaris var. decurrens J. Ag.)

Turbinaria ornata J. Ag.
Earlier records: Gepp & Gepp 1909, on reefs exposed at dead low tide.

Turbinaria trialata Kütz.
Earlier records: Reinbold 1907.

Turbinaria spp.
Stations: 1, CR-345; 2, CR-369; 6, CR-455; 11, CR-497; 14, CR-561; 6a, CR-705; 28, CR-734; most as stubby growth on various coral substrates.

All specimens are evesiculate and many seemingly dwarfed. Most are without dentate, lateral longitudinal ridges.

Rhodophyceae

Amphiroa fragilissima (L.) Lamx.; Dawson 1954: 430, fig. 40g, h.
Stations: 4, in Cymodocea beds, CR-419.
Segments ca. 300 μ in diameter with evident nodal swellings.

Amphiroa sp. cf. A. anastomosans Weber-van Bosse; Dawson 1956: 50, fig. 45.
Stations: 6, locally abundant over beach rock, CR-459.
Segments ca. 250 μ in diameter, perhaps a little larger for this species, fertile.

Amphisbetema indica (J. Ag.) Weber-van Bosse 1913a: 133, pl. 13, fig. 24, pl. 14, fig. 34, and text fig.
Earlier records: Hemsley 1887 (as Dasya indica J. Ag.); Weber-van Bosse 1913a.
Stations: 14, drift, CR-541; 19, locally abundant on coral reef in 0.3-0.7 m depths, CR-600.

Botryocladia skottsbergii (Børg.) Levring
Stations: 12, CR-506; 17a, CR-575; 21, CR-630; all as infrequent tufts under limestone ledges.

Centroceras clavulatum (Ag.) Mont.
Stations: 13, CR-531, CR-548; common over coral rocks in 0.3-0.7 m of water.

Ceramium repens Harvey
Earlier records: Reinbold 1907.

Ceramium spp.
The collections have not yet been determined to species.

Champia compressa Harvey
Earlier records: Reinbold 1907.

Champia parvula (Ag.) Harvey
Stations: 4, locally frequent on Cymodocea stems, CR-424, rather dwarfed.

Champia sp.
Stations: 14, one piece, CR-563.

Cystocarps 475-525 µ in diameter, somewhat urceolate; wall with one layer of cells, these being 20-30 µ in diameter with smaller ones interspersed, 7-10 µ in diameter; branches concrescent here and there, to 1+ mm in diameter. This specimen has some characters of C salicornioides and compressa, but may be a rather robust form of C. parvula.

Chondria pumila Vickers; Weber-van Bosse 1913a: 125, pl. 12, fig. 8.
Earlier records: Weber-van Bosse 1913a.

Chondria spp.
Stations: 2, drift, CR-363; 18, frequent over coral cobbles, CR-587.

Cryptonemia sp. cf. C. crenulata J. Ag.
Stations: 21, locally frequent under limestone ledges, CR-628, CR-628a.

Thallus ca. 200 µ thick, filamentous medulla and inner cortex.

Dictyurus purpurascens Bory
Earlier records: Weber-van Bosse 1913a.
Stations: 4, locally abundant in Cymodocea beds, CR-414; 5, infrequent under ledges, CR-442; 4, locally frequent in Cymodocea bed, CR-448.

Fosliella sp. cf. F. farinosa (Lamx.) Howe; Dawson 1954: 425, fig. 37c.
Stations: 2, CR-358; 4, CR-420; 19, CR-601a; all as epiphytes on Cymodocea blades and Pocockiella thalli.

Galaxaura filamentosa Chou; Chou 1945: 39, pl. 1, figs. 1-6, pl. 6, fig. 1; Dawson 1954: 419, fig. 30a.
Stations: 1, CR-360; 11, CR-502; 12, CR-512; 12, CR-521; 14, CR-535; 22, CR-643; epiphytes on other algae, Cymodocea or various coral substrates.

Gelidiella acerosa (Forsk.) Feldm. & Hamel
Earlier records: Weber-van Bosse 1928 (as Gelidiopsis rigida (Vahl) Weber-van Bosse) on reefs.
Stations: 1, CR-344; 6, CR-458; 8, CR-488; 12, CR-518; 10, CR-605; 21, CR-625; 28, CR-739; generally frequent to common over various coral and beach-rock substrates.

Gelidiella sp. cf. G. myrioclada (Børg.) Feldm. & Hamel; Dawson 1954: 473.
Stations: 21, abundant over coral cobbles, CR-625a; 21, abundant over sand flats, CR-627.

Branches ca. 150-200 µ in diameter; wiry texture; with apical cell; no rhizoids observed.

Gelidiopsis intricata (Ag.) Vickers; Dawson 1954: 423, fig. 34a-d.
Stations: 6, locally common over coral rocks, CR-471; 18, very common on beach-rock, exposed at LWS tide, CR-585; 28, frequent as wiry tufts under ledges, CR-647, CR-648; 23, frequent in 0.3-0.7 m of water, CR-694.

Branches 150-250 μ in diameter; with no apparent apical cell; tough wiry texture; tetrahedral tetraspores, ca. 30-40 μ in diameter; sporangia terminally placed, ca 430 μ wide, 700 μ long.

Gelidiopsis variabilis (Grev.) Schm.
Earlier records: Reinbold 1907.

Gelidium crinale (Turn.) Lamx.
Earlier records: Reinbold 1907; Weber-van Bosse 1913a.

Gelidium crinale var. perpusillum Picc. & Grun. in Piccone;
Earlier records: Reinbold 1907.
Stations: 26, locally common on beach-rock, exposed at LWS tide, CR-722.

Small tufts to 5 mm tall; branches 75-125 μ in diameter; with bilocular cystocarps.

Gelidium sp. cf. G. pusillum (Stackh.) Le Jolis; Dawson 1954: 420, fig. 31a-c.
Stations: 3b, one piece over coral rock, CR-389; 3, locally frequent on various coral substrates, CR-408; 6 locally common on coral rocks, CR-472.

Stubby growth to 1 cm tall; rhizoids seemingly concentrated in medulla; branches compressed to 1+ mm; with bilocular cystocarps in CR-408.

Herposiphonia tenella (Ag.) Ambronn; Børg. 1918; 286, figs. 287-289; Dawson 1954: 452, fig. 59a.
Stations: 3, epiphytic on Halimeda, CR-381.

Main axis ca. 100-125 μ in diameter, with ca. 8-10 pericentral cells that are 125-135 μ long; branching regular with a branch per cell over most of the plant; branches 50-75 μ in diameter.

Herposiphonia sp. #1
Stations: 13, on tree trunk in water, CR-527; 15, abundant over beach rock cobble, CR-549.

Herposiphonia sp. #2
Stations: 1, CR-348; 8, CR-491; 12, CR-522; frequent to common over various coral substrates.

Hypnea hamulosa (Turn.) Mont.
Earlier records: Reinbold 1907 (this may possibly be Hypnea valentiae (Turn.) Mont. as discussed in Dawson 1961: 239).

Hypnea pannosa J. Ag.; Tanaka 1941: 247, fig. 20; Dawson 1956: 51, fig. 46.
Earlier records: Reinbold 1907.
Stations: 2, drift, CR-365; 3, frequent in crevices of corals, CR-376; 10 infrequent in drift, CR-482; 7, on steel pilings, CR-492.

The following specimens seem referrable to H. pannosa but with reservations. 4, locally frequent on Cymodocea stems, CR-425; 26, drift, CR-721: both as dwarfed material; 2, drift, CR-364; 6, entangled with other matted forms, CR-474; 12, infrequent over coral cobbles, CR-514; 18, abundant over coral cobbles, CR-583. The last four specimens were sterile.

Tetrasporic areas when found were only near lower portions of thallus near holdfast; sporangial areas were variable, being observed in some cases to encircle the branchlet, in other to form saddle-shaped sori as described for H. nidulans, or to be concentrated on one side as described for H. pannosa. Dawson 1961: 237, concludes that H. pannosa J. Ag. and H. nidulans Setchell are conspecific and should be known under the name H. pannosa.

Jania capillacea Harvey; Dawson 1954: 432, fig. 41a, b.
Stations: 1, frequent as epiphyte on Cymodocea and on various coral substrates, CR-347; 1, locally common on Halimeda, CR-350; 28, common Cymodocea, CR-736; 29 common over reef flat exposed at LWS tide, CR-780.

Segments ca. 100 μ in diameter, widely spreading branches at dichotomies.

Jania decussata-dichotoma (Yendo) Yendo; Dawson 1956: 49, fig. 44.
Stations: 2, drift, CR-367; 1a, frequent in crevices of coral rock, CR-398; 6, locally abundant as matted growth on beach-rock, CR-460; 8, abundant in drift, CR-490; 11, abundant on Cymodocea stems CR-501.

Fertile branches ca. 100-175 μ in diameter; segments generally 4-7 diameters long; with characteristic branching habit; conceptacles ca. 300 μ long, 400 μ in diameter.

Jania tenella Kütz.; Dawson 1956: 49, fig. 43.
Earlier records: Reinbold 1907 [as Corallina tenella (Kütz.) Heydr.]
Stations: 4, abundant on Cymodocea stems, CR-426.

Fertile segments terminal, ca. 100 μ in diameter.

Laurencia perforata Mont.
Earlier records: Reinbold 1907.

Laurencia pygmaea Weber-van Bosse 1913a: 122, pl. 12, fig. 6; Dawson 1954: 458, fig. 62k.
Earlier records: Weber-van Bosse 1913a.
Stations: 18, infrequent over coral cobbles, CR-592.

Repent, lax habit; branches 125-200 μ in diameter, somewhat constricted at their bases; surface cells ca. 20 μ in diameter, 30 μ long, other up to 80 μ long. Additional structures could not be seen clearly in cross sections.

Laurencia spinulifera Kütz.
Earlier records: Weber-van Bosse 1913a.

Laurencia sp. cf. L. nidifica J. Ag.; Yamada 1931: 202; Cribb 1958: 168, pl. 5, fig. 12; pl. 6, fig. 1-3.
Stations: 1, infrequent over various coral substrates, CR-346; 1a, drift, CR-397; 8, CR-487; 17, frequent over reef flat, CR-574; 17a, abundant over coral bottom in 0.3-0.7 m depths, CR-581; 29, on reef flat near "Porolithon" ridge, CR-784.

Branches ca. 450-750 μ in diameter; low matted entangled habit; with some lenticular thickening in a few specimens; tetraspores 60-100 μ in diameter.

Laurencia sp. cf. L. obtusa (Huds.) Lamx. var.?; Yamada 1931: 222, pl. 16, figs. a-c; pl. 17, figs. a-c; Cribb 1958: 173, pl. 9, fig. 3.
Stations: 29, matted growth on reef flat near "Porolithon" ridge, CR-781.

Seemingly a member of the Cartilagineae; short stubby habit with branches to 3 mm in diameter, somewhat compressed in places, with tuberculate-like branchlets. See also L. corymbosa, L. parvipapillata & L. paniculata.

Liagora sp.
Stations: 29, frequent at edge of coral reef in 0.1-0.3 m depths, CR-779.

Possibly dwarfed L. ceranoides or L. rugosa.

Lithophyllum kaiseri Heydrich; Foslie 1907: 104.
Earlier records: Reinbold 1907.

Lithophyllum simulans Foslie
Earlier records: Reinbold 1907

cf. Lophosiphonia villum (J. Ag.) Setch. & Gardn.
Stations: 4, on Cymodocea stems, CR-432.

Main axis 50-60 μ in diameter; four pericentral cells 100-125 μ long; branches mostly simple but with some secondary branching, ca. 60 μ in diameter; branch pericentral cells ca 75 μ long; nonseptate rhizoids arising in many cases in middle of axis cells, irregularly placed in other cases; rhizoids do not seem to have a cross wall between themselves and main axis cells.

Neogoniolithon myriocarpum (Fosl.) Setch. & Mason; Dawson 1954: 428, fig. 39b.
Earlier records: Reinbold 1907 (as Goniolithon myriocarpon Foslie).

Peyssonelia calcea Heydrich; Weber-van Bosse 1921: 277, fig. 94; Dawson 1954: 425, fig. 37a.
Stations: 28, infrequent on coral reef in 1.3-2.3 m depths, CR-733.

Yellow-brown in color with very thick calcification.

Peyssonelia sp.
Stations: 22, infrequent on coral rocks, CR-646.

Large incrusting thalli but loosely adhering with septated rhizoids; thallus ca. 100-125 μ thick, seemingly closest to P. squammaria (Gmel.) Dcne. Sterile fragments.

Polysiphonia sp. cf. P. ferulacea Suhringar
Stations: 7, on Cymodocea stem, CR-493a.

Main axis ca. 175-200 μ in diameter with 4 pericentral cells; cells 150-170 μ long; tetraspores 45-50 μ in diameter

Porolithon oncodes (Heydrich) Foslie; Taylor 1950: 125, pls. 9, 61, 62 & 63.
Earlier records: Reinbold 1907 (as Lithophyllum onkodes Heydr.)

Spyridia filamentosa (Wulf.) Harvey
Stations: 7, CR-493; 12, CR-517; 13, CR-529; 21, CR-626; 23, CR-690; 10, CR-793: most as epiphytes on Cymodocea.

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6. ANNOTATED CHECK LIST AND BIBLIOGRAPHY OF CORALS OF THE CHAGOS ARCHIPELAGO (INCLUDING THE RECENT COLLECTION FROM DIEGO GARCIA), WITH REMARKS ON THEIR DISTRIBUTION

Brian R. Rosen

INTRODUCTION

The coral faunae of the Red Sea, Maldives, Southern India, Ceylon, Bay of Bengal, Cocos Keeling, Singapore and the Indonesian region are relatively well known. To the south and east, however, the central western Indian Ocean (which includes the Seychelles, Comoros, Mascarenes, Chagos, Madagascar and the East African coast) perhaps deserve further attention. No synthesis of coral records from Chagos has been published before, as far as is known, and the coral list which follows therefore fills this gap, and also provides further information about the region as a whole. The coral list is based on three collections:

1. That of G. C. Bourne from Diego Garcia, in 1885,
2. that of J. Stanley Gardiner et al., during the Percy Sladen Expedition to the Indian Ocean in 1905,
3. that of J. D. Taylor made during his recent visit to Diego Garcia, July, 1967. This consists of about 100 specimens identified for the present paper.

Publication of the first two collections has never been completed, but a reasonably representative picture of the Chagos coral fauna could hitherto be obtained by combining the two sets of appropriate publications. Only Bourne's Astrocoeniina and Poritidae are well covered by the literature, whereas these are precisely the groups in the Sladen collection which are still undescribed. Additional coral names are also to be found in general accounts of the islands, but these usually consist of generic names only (Bourne, 1888; Gardiner, 1936; Gardiner & Cooper, 1907). Knowledge of the Chagos corals is however rather uneven, since Diego Garcia is not really represented by Sladen material, while Bourne and Taylor only visited (as intended) Diego Garcia. With the completion of the present list, Diego Garcia is now best known of the four principal atolls with regard to its corals (see table 6).

The corals from all three visits are part of the collection in the British Museum (Natural History), London. A considerable number of specimens from the previous two visits have been examined by the author in the course of this and other work, but although some changes are in fact necessary, no attempt has been made here to revise names or synonymies. Names have only been changed where current usage requires this. Such instances will be clear from the list, which must, however, be regarded as provisional.

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While other expeditions have visited the Chagos group, no coral collections appear to have been made by them.

REMARKS ON THE CORAL FAUNA

1. Genera

The total of 54 genera and subgenera, shown in Table 5, includes 42 hermatypic scleractinians. It is interesting to compare this figure with data given in Wells' map (1954, pl. 186). For the comparison to be valid however the subgenera of *Fungia* must be taken as a single genus (the map is earlier than Wells' 1966 subdivision of *Fungia*), and *Agariciella* disregarded. The adjusted figure then becomes 38, which is slightly lower than the figure interpolated from Wells' map (40-45). This anomaly is probably an indication of incomplete collecting, especially in deeper water. Relatively little dredging has been done in the course of the three principal visits to the archipelago. Hence deeper water sampling together with further surface reef collecting and examination of unpublished material in the British Museum (Natural History) may produce specimens of *Psammocora* (*Plesioseris*), *P.* (*Stephanaria*), *Pavona* (*Polyastra*), *Merulina*, and a number of widespread, though not abundant representatives of the Fungiidae and Pectiniidae. With regard to the first of these families, Wells' map (1966, Fig. 5) predicts a further three genera and one subgenus (see note in check list), whilst the second is noticeably not represented at all yet.

Of those genera recorded, *Siderastrea*, *Agariciella* and *Ctenella* are noteworthy. The first is unfortunately only a sight record and may possibly have referred to a *Pavona*, as explained in the check list. *Siderastrea* is one of the few genera known both from the West Indian and Indo-Pacific regions, though Indo-Pacific species are restricted to the western Indian Ocean. If Gardiner's record is confirmed, Chagos will be the easternmost limit of its known distribution in southern tropical waters. *Ctenella* is a very rare genus known only from Chagos and the Saya de Malha bank to the south of the Seychelles. *Agariciella* (usually as "*Agaricia*") is a third genus of rare occurrence. Its distribution may also be restricted, but confusion with *Pavona* (*Polyastra*) obscures any pattern that may exist. Other less common genera known from Chagos include *Plerogyra* and *Oulophyllia*.

Of the eight genera known only from sight records, four are hermatypic scleractinians: *Seriatopora*, *Alveopora*, *Euphyllia* and, as already mentioned, *Siderastrea*. Two are ahermatypic (*Fungiacyathus* and *Madrepora*) and the remaining two are non-scleractinians (*Stylaster* and *Heliopora*).

The scleractinian fauna is almost entirely hermatypic. This is in accord with the above conclusion that relatively little sampling has been done in deeper water. Of the four ahermatypic genera, two are only sight records (*Fungiacyathus* and *Madrepora*), and the other two are

Table 5. Genera and subgenera collected by expeditions to the Chagos Archipelago

Investigators	Genera for each visit		New records		Net total of different genera	
	Sight records	specimens and sight records	sight records	specimens and sight records	sight records	specimens and sight records
Bourne (in 1885)	5	11	5	11	5	11
Gardiner (in 1905)	15	48	10	38	12	49
Taylor (in 1967)	0	26	0	5	8	54

Table 6. Genera and species recorded from each atoll*

	Diego Garcia	Egmont	Peros Banhos	Salomon	Whole group
Total number of genera and sub-genera	28	19	21	40	54
Number of hermatypic Scleractinian genera and subgenera	25	16	16	29	42
ditto, adjusted for comparison with Wells (1954)	23	13	16	26	38
Total number of species (approx.)	64	23	24	56	107
Number of hermatypic Scleractinian species (approx.)	60	20	20	44	91

* 1 genus (1 species?) was also recorded from banks to the southeast of the group, but this does not alter final column.

probably from shallow water (Balanophyllia and Dendrophyllia). Horst's (1926) descriptions give no depths for the latter.

The depth range of dredging (Percy Sladen Expedition only) is 0.1098 m. Dredging in waters deeper than about 20 m was mainly done in the vicinity of Salomon. Five out of eight non-scleractinian genera were dredged, all of them from this area, as were Fungiacyathus and Madrepora.

Non-scleractinian genera are mostly from deep water, however (five out of eight).

2. Species

The value of conclusions made on the basis of species-level consideration is open to doubt because of the severity of the species-problem in corals. Following Bourne's visit to Diego Garcia, there were about 20 species known from Chagos. Gardiner's Sladen Expedition visit to the group raised this figure to about 75, and Taylor's to Diego Garcia to about 105. Of these 91 are hermatypic Scleractinia, a figure which may be compared with some of the surface reef species figures given by Wells (1954, 395): 150 in the Marshalls, Palau Islands, and Fiji, 155 in the Philippines and 200 in the Great Barrier Reef region. The Chagos fauna thus appears small, as is also indicated by the number of genera present there. The difference however is in approximate proportion to the number of genera present, though this has been shown above to be somewhat lower than expected, probably on account of incomplete collecting. The true number of species should probably be about 120-140, assuming no radical differences in species definitions. Further species may be provided by the predicted but unrecorded genera mentioned above, together with further species of Psammocora, Seriatopora, Acropora, Montipora, Goniopora, Synaraea and Goniastrea. Noticeably absent are staghorn species of Acropora, A. humilis and Goniastrea retiformis. On the other hand, comparison and examination of existing Chagos specimens of Acropora, Montipora and Porites may well show some of those listed to be the same.

Other points relevant here have already been made in the preceding section.

3. Individual atolls

Table 6 shows that the coral faunae of Diego Garcia and Salomon are better known than those of Egmont and Peros Banhos. This is a more probable explanation of the different numbers of genera and species than an ecological one. The table shows that more genera have been recorded from Salomon than Diego Garcia, but more species from Diego Garcia. The difference in genera is largely made up of ahermatypic and non-scleractinian corals, most of which are from depths greater than 60 fms (109m). There is no record of dredging round Diego Garcia. A second factor originates with the published collection lists. Previous to Taylor's visit, the Diego Garcia corals that had been described and published were mainly Astrocoeniina, i.e. few genera represented by a relatively high number of species. For Salomon, visited by Gardiner, the Faviina and Fungiina were the most important of the published groups, these consist of relatively few species within each genus. Gardiner apparently collected very few corals in Diego Garcia. Whilst Taylor's collection substantially balances the picture for Diego Garcia, Salomon (and the other two atolls) remain better known for their Faviina and Fungiina alone. Relevant material in fact awaits examination in the British Museum (Natural History).

Taylor's collection adds 19 genera and subgenera to the coral list from Diego Garcia, 17 of these being hermatypic Scleractinia. About 40 species have been added. Comparison of these figures with Table 6 shows that previous to his visit, this atoll was least well represented.

CORAL CHECK LIST

In the following list:
* indicates new records for the Chagos Archipelago,
(*) indicates species or genera whose only previous record from Chagos was a sight record, and
sr indicates sight records.

The three principal collections are indicated under each species by the initials of the three investigators concerned; thus, B (Bourne), G (Gardiner) and T (Taylor), and localities given for each, followed by references and comments where applicable. When a genus has been recorded without a species name in a general, non-systematic work, this has been quoted under the generic name concerned. It is assumed that more than one species may have been covered by such references. References in systematic papers (e.g. Allopora sp.) are listed as species.

Classification from Wells, 1956.

Class ANTHOZOA
Subclass ZOANTHARIA
Order Scleractinia
Suborder Astrocoeniina
Family ASTROCOENIIDAE
Subfamily Astrocoeniinae

* Stylocoeniella

* Stylocoeniella armata (Ehrenberg)
T: Diego Garcia - Lagoon, East Point.

Family THAMNASTERIIDAE

Psammocora
sr G: "submerged banks to the south-east" of the Chagos group (Gardiner & Cooper, 1907: 54)

<u>Psammocora planipora</u> Edwards & Haime
G: Salomon (Horst, 1922: 425)

Family POCILLOPORIDAE

(*) <u>Stylophora</u>
sr G: Diego Garcia (Gardiner, 1936: 420)
sr Egmont (Gardiner, 1936: 414, 415; Gardiner & Cooper, 1907: 53)
sr Peros Banhos - Coin 5-10fms (9-18m) (Gardiner & Cooper, 1907: 38)
sr Salomon (Gardiner & Cooper, 1907: 36) and down to 10fms (18m) (Gardiner, 1936: 406, 407, 409)

* <u>Stylophora pistillata</u> (Esper)
T: Diego Garcia - North Point Lagoon and Lagoon Reef East Point

* <u>Stylophora mordax</u> (Dana)
T: Diego Garcia - algal ridge North West Point.

<u>Seriatopora</u>
sr G: Salomon (Gardiner, 1936: 408)

<u>Seriatopora stricta</u> Brueggemann
sr B: Diego Garcia (Bourne, 1888: 450)

(*) <u>Pocillopora</u>
sr B: Diego Garcia (Bourne, 1888: 450)
sr G: Salomon (Gardiner, 1936: 404, 407)
sr Peros Banhos - Ile du Coin, 5-10fms (9-18m) (Gardiner & Cooper, 1907: 38)

* <u>Pocillopora eydouxi</u> Edwards & Haime
T: Diego Garcia - algal ridge North West Point

* <u>Pocillopora damicornis</u> (Linnaeus)
T: Diego Garcia - windward reef South Point, North Point lagoon, Cust Point.

* <u>Pocillopora danae</u> Verrill
T: Diego Garcia - windward reef South Point.

Family ACROPORIDAE

<u>Acropora</u>
sr B: Diego Garcia (Bourne, 1888: 450, as <u>Madrepora</u>)
sr G: Egmont (Gardiner, 1936: 414)
sr Peros Banhos - Ile du Coin, 5-10fms (9-18m) (Gardiner & Cooper, 1907: 38, as <u>Madrepora</u>)
sr Salomon, less than 10fms (18m) (Gardiner, 1936: 404-410; "<u>Madrepora</u>" dredged from less than 10fms, p. 409 is probably <u>Acropora</u>)

Acropora aspera (Dana)
sr B: Diego Garcia (Bourne, 1888: 454, as Madrepora aspera)

Acropora cytherea Dana ?
B: Diego Garcia (Brook, 1893: 99, as Madrepora ?cytherea)

* Acropora sp.cf. cymbicyathus (Brook)
T: Diego Garcia - windward reef South Point.

Acropora disticha Brook
B: Diego Garcia. TYPES (Brook, 1893: 84, pl. 33, fig. D, as M. disticha)
T: Diego Garcia - windward reef South Point, algal ridge East Point. These specimens are intergradational with A. murrayensis Vaughan

Acropora diversa (Brook)
B: Diego Garcia TYPE (Brook, 1891: 461, 1893: 141, pl. 16, fig. B, as M. diversa)

Acropora eurystoma (Klunzinger)
B: Diego Garcia (Brook, 1893: 137 as M. eurystoma and M. eurystoma var. parvula Brook)

* Acropora glochiclados (Brook)
T: Diego Garcia - North Point lagoon.

Acropora haimei (Edwards & Haime) ?
B: Diego Garcia (Brook, 1893: 77, as Madrepora ?haimei)

Acropora hyacinthus (Dana)
B: Diego Garcia (Brook, 1892: 452, 1893: 100, TYPES in part of Madrepora armata. See synonymy, Wells, 1954: 421)

* Acropora murrayensis Vaughan
T: Diego Garcia - windward reef South Point.

Acropora palifera (Lamarck)
B: Diego Garcia (Brook, 1893: 131)
T: Diego Garcia - North Point lagoon.

* Acropora reticulata (Brook)
T: Diego Garcia - North Point lagoon.

* Astreopora

* Astreopora ocellata Bernard
T: Diego Garcia - lagoon flats immediately North of East Point, lagoon North Point, lagoon reef East Point.

<u>Montipora</u>
sr G: Salomon, down to 5fms (9m). (Gardiner, 1936: 406-410)
sr Diego Garcia (Gardiner, 1936: 420)

* <u>Montipora</u> sp.cf. <u>brueggemanni</u> Bernard
T: Diego Garcia - lagoon reef East Point.

* <u>Montipora edwardsi</u> Bernard
T: Diego Garcia - lagoon East Point.

<u>Montipora effusa</u> (Dana)
B: Diego Garcia (Bernard, 1897: 144)

* <u>Montipora</u> sp.cf. <u>hispida</u> (Dana)
T: Diego Garcia - lagoon flats immediately north of East Point

<u>Montipora lobulata</u> Bernard
B: Diego Garcia. TYPE. (Bernard, 1897: 76, pl. 16)

* <u>Montipora</u> sp.cf. <u>tuberculosa</u> (Lamarck)
T: Diego Garcia - lagoon flats immediately north of East Point, lagoon North Point, lagoon reef East Point.

* <u>Montipora</u> sp.
T: Diego Garcia - lagoon reef East Point. Coral has grown round stems of <u>Cymodocea</u> (= <u>Thalassodendron</u>) weed.

Suborder <u>Fungiina</u>
Superfamily AGARICIICAE
Family AGARICIIDAE

<u>Pavona</u>
sr G: Salomon, down to 10fms (18m) (Gardiner, 1936: 408, 409) "<u>Siderastrea</u>" (Gardiner & Cooper, 1907: 38), from Ile du Coin, Peros Banhos, less than 4fms (7m), may have referred to <u>Pavona</u>

<u>Pavona explanulata</u> (Lamarck)
G: Salomon (Horst, 1922: 418); (sr - Gardiner, 1936: 405)

<u>Pavona varians</u> Verrill
G: Egmont (Horst, 1922: 419)
Peros Banhos (ibid.)
Salomon (ibid.)
T: Diego Garcia - lagoon North Point.

<u>Pavona clavus</u> Dana
G: Egmont (Horst, 1922: 420)
Salomon (ibid.)

Agariciella

Agariciella ponderosa (Gardiner)
G: Salomon (Horst, 1922: 418, as Agaricia ponderosa)

Leptoseris

Leptoseris incrustans (Quelch)
G: Peros Banhos, 15-16 fms (27-29m) (Horst, 1922: 422)

Pachyseris

Pachyseris levicollis (Dana)
G: Salomon (Horst, 1922: 427)

Family SIDERASTREIDAE

sr Siderastrea
(?) G: Peros Banhos - Ile du Coin, less than 4 fms (7m) (Gardiner & Cooper, 1907: 38. This may have been Pavona; see for instance Gardiner, 1906: 934-936, for then current concept of Siderastrea.)

Superfamily FUNGIICAE
Family FUNGIIDAE

In addition to those genera listed below, Wells' map (1966: fig. 5) indicates that the Chagos archipelago lies within the limits of the known geographical distribution of Cycloseris, Fungia (Ctenactis), Polyphyllia, and Podabacia.

Fungia
sr G: Salomon (Gardiner, 1936: 406)

Fungia sp. Authocaulus stage (ca. 5 mm diam.)
T: Diego Garcia

Fungia (Pleuractis) scutaria Lamarck
G: Egmont (Gardiner, 1909: 267, 272)
Peros Banhos (ibid.)
Salomon (ibid.)
T: Diego Garcia - windward reef South Point.

Fungia (Verrillofungia) concinna Verrill
G: Egmont (Gardiner, 1909: 267, 276)
Salomon (ibid.)

Fungia (Verrillofungia) fieldi Gardiner
G: Salomon, TYPE (Gardiner, 1909: 267, 277, pl. 33, figs. 3, 4, pl. 34, fig. 7)

* Fungia (Verrillofungia) repanda Dana
T: Diego Garcia - lagoon flats immediately north of East Point.

Fungia (Danafungia) corona Döderlein
G: Egmont (Gardiner, 1909: 267, 278)

Fungia (Fungia) fungites (Linnaeus)
sr B: Diego Garcia (Bourne, 1888: 450, as Fungia dentata Dana. See Döderlein, 1902: 136)
G: Egmont (Gardiner, 1909: 267, 279)
Salomon (ibid.)

* Herpolitha

* Herpolitha limax (Esper)
T: Diego Garcia - lagoon flats immediately north of East Point, lagoon North Point.

Halomitra Dana

Halomitra philippensis Studer
B: Diego Garcia (Gardiner, 1909: 281)
G: Salomon (ibid. "protected reefs of lagoon lying free in holes, between large fixed growths of massive corals.")
T: Diego Garcia - lagoon flats immediately north of East Point, lagoon East Point.

Fungiacyathus
sr G: off Salomon, 350-600fms. (640-1098m) (Gardiner & Cooper, 1907: 42), as Bathyactis.

Superfamily PORITICAE
Family PORITIDAE

(*) Goniopora
sr G: Salomon, less than 10fms (18m) (Gardiner 1936: 409)

* Goniopora sp.cf. savignyi Dana
T: Diego Garcia - lagoon flats immediately north of East Point, lagoon reef East Point. The specimens are identical to Goniopora "xd" Bernard, 1903: 158, pl. 8, fig. 5. This was previously identified as G. savignyi Dana by Brueggemann (MS) but Bernard states that this is "out of the question."

Porites
sr B: Diego Garcia (Bourne, 1888: 450, 454)
sr G: Diego Garcia (Gardiner, 1936: 420; Gardiner & Cooper, 1907: 46)
sr Egmont (Gardiner, 1936: 414)

sr Peros Banhos (Gardiner, 1936: 423) - Ile du Coin, less than 4fms (7m) (Gardiner & Cooper, 1907: 38)
sr Salomon down to 10fms (18m) (Gardiner, 1936: 400-410)

Porites (Porites) "Diego Garcia (3) 1 Bernard"
B: Diego Garcia (Bernard, 1905: 216, pl. 32, fig. 1)

Porites (Porites) "Diego Garcia (3) 2 Bernard"
B: Diego Garcia (Bernard, 1905: 216, pl. 32, fig. 2)

Porites (Porites) "Diego Garcia (3) 3 Bernard"
B: Diego Garcia (Bernard, 1905: 217, pl. 32, fig. 3, pl. 34, fig. 4)

* Porites (Porites) lutea Edwards & Haime
T: Diego Garcia - lagoon flats immediately north of East Point, lagoon reef East Point, Cust Point. Wells (1954: 453) states that this species "does not appear to occur in the Red Sea or Indian Ocean." Preliminary examination suggested that this was the closest species, but further study may lead to an alternative identification.

* Porites (Porites) solida (Forskål)
T: Diego Garcia - lagoon reef East Point.

* Porites (Porites) australensis Vaughan
T: Diego Garcia - lagoon North Point.

* Porites (Porites) lichen Dana
T: Diego Garcia - windward reef South Point.

* Porites (Porites) andrewsi Vaughan
T: Diego Garcia - lagoon reef East Point, Cust Point.

* Porites (Porites) nigrescens Dana
T: Diego Garcia - Cust Point.

* Porites (Synaraea) iwayamaensis Eguchi
T: Diego Garcia - lagoon North Point, lagoon reef East Point, lagoon East Point.

Alveopora
sr G: Peros Banhos - Ile Diamant, 15fms (27m) (Gardiner & Cooper, 1907: 28)
sr Salomon (Gardiner, 1936: 409)

Suborder	Faviina
Superfamily	FAVIICAE
Family	FAVIIDAE
Subfamily	Faviinae

Gardiner & Cooper (1909: 28, 38) give sight records of Orbicella from Peros Banhos, but Gardiner's use of this generic name (e.g. see Gardiner, 1906: 774-778) makes it difficult to interpret which form(s) he was referring to. Orbicella sensu Gardiner might correspond in current usage to Diploastrea, Leptastrea, Plesiastrea, or Favia. It would therefore appear to be safer to omit it from the list. Caution is also required in interpreting Prionastrea, Favia and Goniastrea as given by Gardiner (1936) and Gardiner & Cooper (1907) but in general these may be taken to correspond to more recent concepts of Favites, Favia and Goniastrea respectively (but note Matthai's 1914 usage of Favia, which Gardiner might conceivably have adopted). Confusion of nomenclature has also surrounded the brain corals. Maeandra, Maeandrina, Coeloria, Platygyra and Leptoria have all been used to refer to representatives of the last two named genera. Thus Bourne's (1888) sight record of "Maeandrina" might have meant Platygyra, Leptoria or even a number of other genera. Like Orbicella above it would therefore be safer to omit it.

Plesiastrea

Plesiastrea versipora (Lamarck)

G: Salomon (sr - Gardiner, 1936: 407; Matthai, 1914: 103, both as Favia versipora. See synonymies in Yabe, Sugiyama & Eguchi, 1936: 23, Orbicella versipora, and Wells, 1954: 460)

Favia

sr G: Egmont (Gardiner, 1936: 414)
sr Salomon (ibid, 405, 409)

Favia stelligera (Dana)

sr B: Diego Garcia (Bourne, 1888: 450 as F. lobata.) See synonymy Vaughan 1918: 101)
G: Egmont (Matthai, 1914: 102, as F. acropora. See synonymy Vaughan, 1918: 101)
Salomon (Matthai, 1914: 102, pl. 25, fig. 3, pl. 33, fig. 1, as F. acropora).
T: Diego Garcia - lagoon North Point.

Favia favus (Forskål)

G: Salomon (Matthai, 1914: 79)
T: Diego Garcia - lagoon flats immediately North of East Point, lagoon reef East Point. Specimen from latter locality is intergradational with F. pallida.

Favia pallida (Dana)

G: Peros Banhos - Ile du Coin (Matthai, 1914: 84 as F. doreyensis)
Salomon (sr - Gardiner, 1936: 407; Matthai, 1914: 84. Both as F. doreyensis. See synonymy Vaughan, 1918: 105).
T: Diego Garcia - lagoon reef East Point.

Favia speciosa (Dana) facies "clouei"
G: Egmont (Matthai, 1914: 89, as F. clouei. See synonymy Vaughan, 1918: 103)
Salomon (ibid. Also pl. 25, fig. 2. As F. clouei)

Favites
sr G: Peros Banhos - Ile Diamant, 15fms (27m) (Gardiner & Cooper, 1907: 28, as Prionastrea) and Ile du Coin, less than 4 fms (7m) (ibid. 38, as Prionastrea)

Favites abdita (Ellis & Solander)
G: Egmont (Matthai, 1914: 91, as Favia abdita. See synonymy Vaughan, 1918: 109)
Salomon (ibid. Also pl. 9, fig. 5, as F. abdita) Favia orbita (Gardiner, 1936: 405) from Salomon may be this species (sr)
T: Diego Garcia - lagoon North Point.

Favites halicora (Ehrenberg)
G: Egmont? (Matthai, 1914: 106, as Favia halicora. See synonymy Vaughan, 1918: 110)
Peros Banhos - Ile Diamant, 15fms (27m) (ibid., as F. halicora)
Salomon (ibid. Also pl. 26, figs. 5-7, as F. halicora)
T: Diego Garcia - lagoon North Point.

Favites virens (Dana)
G: Egmont (Matthai, 1914: 108, pl. 27, fig. 3, as Favia vasta. See synonymy Vaughan, 1918: 111)
Salomon (Matthai, 1914: 108, pl. 27, fig. 5, as F. vasta)

Favites melicerum (Ehrenberg)
G: Salomon (Matthai, 1914: 95, as Favia pentagona. See synonymy Vaughan, 1918: 112)

* Favites aspera (Verrill)
T: Diego Garcia - windward reef South Point.

* Favites yamanarii Yabe & Sugiyama
T: Diego Garcia - windward reef South Point, algal ridge East Point.

Oulophyllia

Oulophyllia crispa (Lamarck)
G: Salomon (Matthai, 1928: 257, pl. 19, fig. 2)

Goniastrea
sr G: Peros Banhos - Ile du Coin, less than 4fms (7m) (Gardiner & Cooper, 1907: 38)

sr Salomon (Gardiner, 1936: 405)

Goniastrea? hombroni (Rousseau)
G: Salomon (Matthai, 1914: 107, pl. 26, figs. 1, 2, pl. 33, fig. 2, as Favia hombroni. See Vaughan, 1918: 100) Professor John W. Wells kindly informs me that he has examined Rousseau's type and says that it is a specimen of Favia stelligera.

Goniastrea pectinata (Ehrenberg)
G: Egmont (Matthai, 1914: 121, pl. 31, fig. 8, as G. planulata. See synonymy Crossland, 1952: 135)
Salomon (sr - Gardiner, 1936: 407, as G. planulata; Matthai, 1914: 121, as G. planulata; Matthai, 1914: 120).
T: Diego Garcia - lagoon North Point.

Platygyra
sr G: Salomon (Gardiner, 1936: 404, 407, as Coeloria)

Platygyra lamellina (Ehrenberg)

* facies astreiformis (Edwards & Haime)
T: Diego Garcia - windward reef South Point, lagoon North Point.

facies sinensis (Edwards & Haime)
G: Salomon (Matthai, 1928: 24, pl. 5, fig. 1, as Coeloria daedalea. See Wells, 1954: 462 and Stephenson & Wells, 1955: 35-36)

* facies rustica (Dana)
G: Diego Garcia - lagoon flats immediately north of East Point, windward reef South Point, lagoon reef East Point.

facies lamellina Ehrenberg
G: Salomon (Matthai, 1928: 37, pl. 6, fig. 5, as Coeloria lamellina. See Stephenson & Wells, 1955: 35-36. Text gives locality as "Chagos"; plate caption gives "Salomon, Chagos".)

* Leptoria

* Leptoria phrygia (Ellis & Solander)
T: Diego Garcia - windward reef South Point.

Hydnophora

Hydnophora exesa (Pallas)
G: Egmont (Matthai, 1928: 140)
Salomon (ibid.)

Hydnophora microconos (Lamarck)
G: Peros Banhos - Ile du Coin (Matthai, 1928: 144, pl. 17, fig. 4, pl. 49, fig. 5)
Salomon (Matthai, 1928: 144)

Subfamily Montastreinae

Leptastrea
sr G: Salomon (Gardiner, 1936: 405, 409)

Leptastrea purpurea (Dana)
G: Egmont (Matthai, 1914: 68, as *L. ehrenbergana*. See synonymy Vaughan, 1918: 91)
Salomon (Matthai, 1914: 68, pl. 19, fig. 4, as *L. ehrenbergana*)
The next species may belong here also.

Leptastrea roissyana Edwards & Haime
G: Salomon (Matthai, 1914: 67. Matthai's concept of this species appears to overlap with that of other authors' *L. purpurea* and *L. transversa*, e.g. see Vaughan's discussion of the genus, 1918: 90-97. Crossland, 1952: 114 states that all these intergrade.)

Leptastrea bottae (Edwards & Haime)
G: Salomon (Matthai, 1914: 69, pl. 18, figs. 3 and 6, as *L. solida*. See synonymy Vaughan, 1918: 94)

Cyphastrea
sr G: Salomon (Gardiner 1936: 405)

Cyphastrea chalcidicum Klunzinger
G: Salomon (Matthai, 1914: 41)

Cyphastrea microphthalma (Lamarck)
G: Egmont (Matthai, 1914: 43, pl. 12, fig. 6)
Salomon (Matthai, 1914: 43)
T: Diego Garcia - lagoon North Point

Echinopora
sr G: Salomon, down to 10fms (18m) (Gardiner, 1936: 408-409)

Echinopora lamellosa (Esper)
G: Peros Banhos - Ile du Coin (Matthai, 1914: 50, pl. 14, fig. 4)
Salomon (Matthai, 1914: 50, pl. 14, fig. 6)
T: Diego Garcia - lagoon North Point

Echinopora hirsutissima Edwards & Haime
G: Peros Banhos - Ile du Coin (Matthai, 1914: 51, pl. 15, fig. 2)
Salomon (Matthai, 1914: 51, pl. 15, fig. 3)

Family OCULINIDAE
Subfamily Oculininae

Madrepora

sr G: off Salomon, 350-600fms (640-1098m) (Gardiner & Cooper, 1907: 42, as Amphihelia.)

Subfamily Galaxeinae

Galaxea

Galaxea clavus (Dana)
G: Peros Banhos - Ile du Coin (Matthai, 1914: 62, as G. musicalis. See synonymy Vaughan, 1918: 99)

Galaxea lamarcki Edwards & Haime
G: Peros Banhos - Ile du Coin, and Ile Diamant 16fms (29m) (Matthai, 1914: 64. This species is close to G. clavus and may only be a deeper water facies of it.)

Family MEANDRINIDAE
Subfamily Meandrininae

Ctenella

Ctenella chagius Matthai
G: Egmont (Matthai, 1928: 172, pl. 54, fig. 2. TYPE)

Family MUSSIDAE

Acanthastrea

Acanthastrea echinata (Dana)
G: Salomon (Matthai, 1914: 110, as Favia hemprichii. See Wells, 1954: 467)

Lobophyllia

sr G: Peros Banhos - Ile Diamant 15fms (27m), and Ile du Coin 5-10 fms (7-18m) (Gardiner & Cooper, 1907: 28 and 38 respectively, as Mussa)
sr Salomon, down to 10fms (18m) (Gardiner, 1936: 408-409)

Lobophyllia corymbosa (Forskål)
sr B: Diego Garcia (Bourne, 1888: 450, as Mussa corymbosa. See synonymy Matthai, 1928: 210)
G: Diego Garcia (Matthai, 1928: 210)
Peros Banhos - Ile du Coin (ibid. Also pl. 60, fig. 6)
Salomon (sr - Gardiner, 1936: 407; Matthai, 1928: 210)

Lobophyllia costata (Dana)
G: Peros Banhos - Ile du Coin (Matthai, 1928: 216, pl. 47, fig. 8). The caption to pl. 28, fig. 1 of this species gives "Chagos: Salomon" for the locality. This is not mentioned in text. The British Museum (Natural History)

register No. of the specimen indicates that it can be neither Bourne's nor Gardiner's material because it was registered before either expedition. It does however accord with Guppy's Salomon Is. material. Hence for "Salomon" read "Solomons".)

T: Diego Garcia - lagoon flats immediately north of East Point.

Symphyllia

Symphyllia nobilis

G: Egmont (Matthai, 1928: 227, pl. 31, fig. 1. For "Chagos: Salomon" in caption to pl. 30, fig. 4, read "Solomon Is." See note under Lobophyllia costata above.)

Suborder Caryophylliina
Family CARYOPHYLLIIDAE
Subfamily Eusmiliinae

Euphyllia

sr G: Salomon, down to 10fms (19m) (Gardiner, 1936: 409)

Plerogyra

Plerogyra sinuosa (Dana)

G: Peros Banhos - Ile du Coin (Matthai, 1928: 184)

Suborder Dendrophylliina
Family DENDROPHYLLIIDAE

Balanophyllia

Balanophyllia regularis (Gardiner)

G: Peros Banhos - Ile du Coin (Horst, 1926: 50)
Salomon (ibid.)

Dendrophyllia

Dendrophyllia aurea (Quoy & Gaimard)

G: Salomon (Horst, 1926: 46)

Turbinaria

* Turbinaria sp.cf. irregularis Bernard

T: Diego Garcia - lagoon reef East Point

Turbinaria globularis Bernard

B: Diego Garcia (Bernard, 1896: 68, pl. 20, pl. 32, fig. 20. TYPE)

Subclass OCTOCORALLIA
Order Stolonifera
Family TUBIPORIDAE

(*) Tubipora
sr G: Egmont (Gardiner, 1936: 414)
sr Peros Banhos - Ile du Coin, less than 4fms (7m) (Gardiner & Cooper, 1907: 38)
sr Salomon (Gardiner, 1936: 406, 408)

(*) Tubipora musica (Linnaeus)
T: Diego Garcia - algal ridge North West Point. There being only one known species of Tubipora, the references without species names above, may be taken to indicate T. musica, and the recording of the actual species from Chagos is not completely new.

Order Coenothecalia
Family HELIOPORIDAE

Heliopora
sr G: Peros Banhos (Gardiner, 1936: 423) - Ile du Coin, less than 4fms (7m) (Gardiner & Cooper, 1907: 38)
sr Salomon (Gardiner, 1936: 406-409)

Heliopora coerulea (Pallas)
sr G: Peros Banhos, Salomon (as above). There is only one known species of Heliopora, and the above references may be taken to be this species.

Class HYDROZOA
Order Milleporina
Family MILLEPORIDAE

Millepora
sr B: Diego Garcia (Bourne, 1888: 454)
sr G: Egmont (Gardiner, 1936: 414)
Peros Banhos - Ile du Coin, less than 4 fms (7m) (Gardiner and Cooper, 1907: 38)
sr Salomon (Gardiner, 1936: 400-409)

Millepora platyphylla Hemprich & Ehrenberg
B: Diego Garcia (Boschma, 1949: 665)
T: Diego Garcia - windward reef South Point

Millepora tenera Boschma
B: Diego Garcia (Boschma, 1949: 669)
T: Diego Garcia - windward reef South Point

Order Stylasterina
Family STYLASTERIDAE
Subfamily Stylasterinae

Stylaster

?sr G: Salomon, 60-337fms (109-612m) (Gardiner, 1936: 412. Boschma, 1957 quotes Gardiner on p. 18 and comments, "Hickson & England, 1909, do not record a species of Stylaster from this locality; they list a coral from Salomon Atoll as Allopora sp.?" Gardiner's record thus appears doubtful.)

Allopora

Allopora sp.?
G: off Salomon, 60-120fms (109-219m) (Hickson & England, 1909: 346; Boschma, 1957: 30)

Crypthelia

Crypthelia ramosa Hickson & England
G: off Salomon, 120-150fms (219-274m) (Hickson & England, 1909: 351; Boschma, 1957: 38)

Conopora

Conopora tenuis Moseley
G: off Salomon, 120-150fms (219-274m) (Hickson & England, 1909: 351; Boschma, 1957: 39)

Subfamily Distichoporinae

Distichopora

sr G: off Salomon, 60-337fms (109-612m) (Gardiner, 1936: 412. Boschma, 1957: 47 implies in his comment on Gardiner's record that this was D. violacea because Hickson & England 1909 record this species from shallow water, Egmont. However, these authors record D. profunda, from deep water off Salomon, and this appears to be a more likely interpretation.)

Distichopora violacea (Pallas)
G: Egmont - shallow water (Hickson & England, 1909: 346; Boschma, 1957: 49; Boschma, 1959: 134. Also see note above)

Distichopora profunda Hickson & England
G: off Salomon, 120-150fms (219-274m) (Hickson & England, 1909: 348, pl. 44, text-figs. 4-7, TYPE; Boschma, 1957: 46; Boschma, 1959: 162. Also see note above.)

Distichopora sp.
T: Diego Garcia - windward reef South Point.

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B, G: indicates expedition, as in coral list (Bourne, Gardiner)

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---------- 1897. Catalogue of the madreporarian corals in the British Museum (Natural History). Volume III. The genus *Montipora*, the genus *Anacropora*. Trustees of the British Museum (Natural History). vii + 192 pp., 34 pls. (B, 2 species of *Montipora*, Diego Garcia).

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Boschma, H., 1949. Notes on specimens of the genus *Millepora* in the collection of the British Museum. Proc. Zool. Soc. Lond. 119: 661-672, pl. 1-2. (B, 2 species, Diego Garcia).

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Gardiner, J.S. & Cooper, C.F., 1907. Description of the Expedition. [Percy Sladen Expedition to the Indian Ocean in 1905]. Trans. Linn. Soc. Lond., Zool. (2)12: 1-56, 111-175, pls. 1-10, 14-18, text-figs. 1-23, 35-46, 2 tables. (G, sight records of genera: 1 from Diego Garcia (p. 46), 1 from Egmont (53), 14 from Peros Banhos (28 and 38), 2 from deeper water off Salomon (42), 1 from banks to the southeast of archipelago (54)).

Hickson, S.J. & England, H.E., 1909. The Stylasterina of the Indian Ocean. Trans. Linn. Soc. Lond., Zool. (2)12: 345-354, pl. 44. (G, 4 genera, 5 species, Egmont but mostly Salomon).

Horst, C. J. van der 1922. Madreporaria: Agariciidae. Trans. Linn. Soc. Lond., Zool. (2)18: 417-429, pls. 31-32, text-figs. 1-2. (G, 5 genera, 7 species, Egmont, Peros Banhos and Salomon).

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---------- 1928. Catalogue of the madreporarian corals in the British Museum (Natural History). Volume VII. A monograph of the Recent meandroid Astreidae. Trustees of the British Museum (Natural History). v + 288 pp., 72 pls., 35 text-figs. (G, Faviidae, Mussidae, Meandrinidae, Eusmiliinae, 7 genera, 10 species, Egmont, Peros Banhos and Salomon).

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7. ECHINODERMS FROM DIEGO GARCIA

A. M. Clark and J. D. Taylor

This annotated list comprises specimens collected in 1967 by J. D. Taylor and identified by Miss A. M. Clark, British Museum (Natural History). The collection has B.M. reg. nos. 1969.5.27.1 to 1969.5.27.81.

Previous records of echinoderms from Diego Garcia are from the Deutsche Tiefsee-Expedition (Döderlein 1906, Hertz 1927, Heding 1940), and from the Percy Sladen Trust Expedition (Bell 1909). Records by these previous workers are also included in this list.

ECHINODERMATA

ECHINOIDEA

Eucidaris metularia (Lamarck)
Recorded by Döderlein (1906).

Tripneustes gratilla (Linnaeus)
East Point, seaward, sublittoral fringe* 20 m from shore.

Echinothrix diadema (Linnaeus)
Recorded by Döderlein (1906).

Echinothrix calamaris (Pallas)
Recorded by Döderlein (1906).

Echinostrephus molaris (de Blainville)
East Point, seaward, mid-reef flat, crevices, sublittoral fringe, 8 July, 1967.

Echinometra mathaei (de Blainville)
East Point, seaward, mid-reef flat beneath boulders, sublittoral fringe, 8 July, 1967. Carcasse, lagoon, coral colonies, in crevices, sublittoral 1 m, 9 July, 1967. Recorded by Döderlein (1906) as *Mortensenia oblonga* and by Bell (1909) as *Echinometra lucunter*.

Gymnechinus sp.
N. W. Point, seaward, *Thalassia* beds, beneath loose block, sublittoral fringe, 21 July, 1967.

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* For an explanation of zonation and terminology, see Lewis, J. R., 1964, The ecology of rocky shores, and Taylor, J. D., Phil. Trans. R. Soc. London B, 254: 129-206, 1968.

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Parasalenia gratiosa Agassiz
Recorded by Bell (1909).

Brissus latecarinatus (Leske)
Recorded by Döderlein (1906).

OPHIUROIDEA

Ophiactis savignyi Müller and Troschel
East Point, lagoon, sublittoral 1 m, on sponge, 7 July, 1967.
East Point, lagoon, sublittoral 1 m, on sponge, 12 July, 1967.

Ophiothrix savignyi Müller and Troschel
East Point, lagoon, sublittoral 2 m on coral patch, 12 July, 1967.

Ophiothrix exigua Lyman
East Point, lagoon, sublittoral 1 m on sponge, 7 July, 1967.

Macrophiothrix hirsuta (Müller and Troschel)
East Point, seaward, mid-reef flat, sublittoral fringe, cryptofauna, 6 July, 1967.

Ophiocoma erinaceus Müller and Troschel
East Point, seaward, mid-reef flat, sublittoral fringe, cryptofauna, 6 July, 1967. East Point, seaward, mid-reef flat, sublittoral fringe, cryptofauna, 8 July, 1967.

Ophiocoma scolopendrina (Lamarck)
North of Point Thomas, seaward, boulder zone, sublittoral fringe, cryptofauna, 13 July, 1967. North West Point, seaward, boulder zone, cryptofauna, 21 July, 1967. Also recorded by Hertz (1927) from the lagoon.

Ophiocoma brevipes Peters
North of Point Thomas, seaward, boulder zone, sublittoral fringe, cryptofauna, 13 July, 1967.

Ophiocoma brevipes Peters
South Point, seaward, beneath boulders, sublittoral fringe, 11 July 1967. East Point, seaward, beneath boulders, sublittoral fringe, 6 July, 1967. Also recorded by Hertz (1927) from the littoral.

Ophiocoma pica Müller and Troschel
South Point, seaward, mid-reef, beneath boulders, 11 July, 1967.

Ophiocomella sexradia (Duncan)
East Point, seaward, mid-reef flat, cryptofauna, 6 July, 1967.

Ophiolepis superba H. L. Clark
East Point, seaward, mid-reef flat, sublittoral fringe, cryptofauna, 6 July, 1967.

ASTEROIDEA

Culcita schmideliana Retzivs
East Point, lagoon, sand, sublittoral 1 m, 5 July, 1967.

HOLOTHUROIDEA

Holothuria (*Semperathuria*) *cinerascens* (Brandt)
South Point, seaward, beneath beach rock, sublittoral fringe, 11 July, 1967. East Point, seaward, mid-reef flat, beneath boulders, 6 July, 1967. East Point, seaward, beneath boulders at base of beach, 8 July, 1967. Also recorded by Heding (1940).

Holothuria (*Thymiosycia*) *hilla* (Lesson)
Barton Point, seaward, beneath boulders, sublittoral fringe, 7 July, 1967.

Holothuria (*Thymioscyia*) *impatiens* (Forskål)
Carcasse, lagoon, in crevices in coral colony, 9 July, 1967. Also recorded by Heding (1940).

Holothuria (*Lessonothuria*) *pardalis* Selenka
Barachois Maurice, burrowing in fine sediment, near beach rock, 16 July 1967.

Holothuria (*Mertensiothuria*) *leucospilota* (Brandt)
Barachois Maurice, burrowing in fine sediment, 15 July, 1967.

Holothuria (*Halodeima*) *atra* Jager
Pointe Marianne, lagoon, *Thalassia* beds, epifaunal, 22 July, 1967. East Point, lagoon, sublittoral 1 m, sand and algae, 7 July, 1967. Also recorded by Heding (1940) from the lagoon.

Holothuria (*Metriatyla*) *albiventer* Selenka
East Point, seaward, mid-reef flat, beneath boulders, sublittoral fringe, 6 July 1967.

Holothuria vagabunda Selenka
Recorded by Heding (1940).

Actinopyga mauritiana (Quoy and Gaimard)
Carcasse, lagoon, sand, sublittoral 1 m, 9 July 1967. East Point, seaward, mid-reef flat, epifaunal, 6 July 1967. Also recorded by Heding (1940).

Actinopyga echinites Jager
East Point, seaward, mid-reef flat, epifaunal, sublittoral fringe, 6 July 1967.

Bohadschia argus Jager
East Point, seaward, mid-reef flat, in crevices of boulders, sublittoral fringe, 6 July 1967.

Labidoemas rugosa (Ludwig)
East Point, seaward, mid-reef flat, in crevices of boulders, sublittoral fringe, 6 July 1970. Barton Point, seaward, beneath boulders, sublittoral fringe, 7 July 1967. East Point, lagoon, coral patch, in crevices, sublittoral 1 m, 19 July 1967.

Ohshimella ehrenbergi (Selenka)
East Point, lagoon, coral patch, sublittoral 1 m, in crevices, 9 July 1967.

Microthele nobilis (Selenka)
East Point, seaward, mid-reef flat, shallow sublittoral, 8 July 1967. Recorded by Heding (1940).

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8. CRUSTACEA: BRACHYURA AND ANOMURA FROM DIEGO GARCIA

J. D. Taylor

This list consists mainly of species collected in July 1967 by J. D. Taylor, who also made the identifications. The specimens are deposited in the British Museum (Natural History). Previous records are also included in the list; these are mainly small collections made by expeditions during short stops at the Atoll. The most notable of these are those of the Deutsche Tiefsee-Expedition (Doflein 1904, Doflein and Balss 1913, Balss 1912) and of the Percy Sladen Trust Expedition (Rathbun 1911, Laurie 1926, Borradaile 1907). The crabs in the Desjardins Museum of the Mauritius Institute were listed by Ward (1942), and amongst them were many species from Diego Garcia collected by J. Morin in 1936.

Brachyura

DIVISION OXYRHYNCA

Menaethius monoceros (Latreille)
North West Point seaward reef, *Cymodocea* beds, cryptofauna, sublittoral fringe*, 21 July 1967. East Point, seaward, cryptofauna reef flat, sublittoral fringe, 6 July 1967. East Point lagoon reef, *Cymodocea* beds, on leaves, sublittoral 1 m, 1 male, 1 female, 7 July 1967. Rathbun (1911) lagoon 14 fathoms.

Xenocarcinus tuberculatus White
Rathbun (1911) lagoon 14 fathoms.

Parthenopoides erosus Miers
Ward (1942).

Kraussia sp.
South Point, seaward, coral colonies, sublittoral fringe, 11 July 1967.

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* For an explanation of zonation and terminology, see Lewis, J. R., 1964, The ecology of rocky shores, and Taylor, J. D., Phil. Trans. R. Soc. London B, 254: 129-206, 1968.

Atoll Research Bulletin No. 149: 93-101, 1971.

DIVISION BRACHYRHYNCHA

Cardisoma carnifex (Herbst)
Barachois Maurice, burrows around edge of barachois. Littoral fringe and supralittoral. Common around lagoon shores, and barachois.

Ocypode ceratophthalma (Pallas)
Barton Point, lagoon beach, supralittoral, 7 July 1967. Ward (1942). Doflein (1904).

Ocypode cordimana Desmarest
East Point seaward shore, sandy beach, supralittoral, 5 July 1967. North East Point, seaward beach. South Point, windward beach, 18 July 1967. Ward (1942).

Uca tetragonon (Herbst)
Barachois Maurice, white mud, intertidal, 15 July 1967. Barachois Maurice, base of barachois rock, 1 male, 16 July 1967. Carcasse, intertidal mud, 4 male, 3 female, 9 July 1967. Borradaile (1907) Barachois.

Grapsus tenuicrustatus (Herbst)
South Point, beachrock, intertidal, 11 July 1967. Cust Point, lagoon shore, beachrock, intertidal, 14 July 1967. Barton Point, on boulders, intertidal, 7 July 1967. East Point, seaward reef, beachrock, intertidal, 1 female, 8 July 1967.

Geograpsus grayi (Milne Edwards)
East Point, mid island, beneath vegetation, terrestrial, 7 July 1967. Doflein (1904).

Metopograpsus messor (Forskål)
Barachois Maurice, beneath rocks around margin, intertidal, 9 July 1967. Lagoon shore S. of Mamzelle Adélie, beachrock, intertidal, 17 July 1967.

Metopograpsus thukuhar (Owen)
Carcasse, tidal inlet, 9 July 1967.

Pachygrapsus minutus Milne Edwards
East Point, lagoon shore, coral cobbles, base of beach, intertidal, 5 July 1967.

Metasesarma rousseauxi Milne Edwards
Barton Point, terrestrial, beneath old coconut husks, 7 July 1967. Ward (1942).

Percnon abbreviatum (Dana)
East Point, seaward reef, algal ridge, cryptofauna, sublittoral fringe, 8 July 1967.

Percnon planissimum (Herbst)
Barton Point, beneath rocks at base of beach, eulittoral, 7 July 1967. East Point, seaward reef, mid-reef flat, cryptofauna, beneath block, sublittoral fringe, 8 July 1967. West Island, seaward platform, eulittoral, 23 July 1967. Doflein (1904).

Carupa laeviscula Heller
Ward (1942).

Portunus orbitosinus Rathbun
East Point, seaward reef, base of beach beneath boulders, eulittoral, 8 July 1967.

Thalamita admete (Herbst)
East Point, lagoon on coral colony, sublittoral, 1 m, 19 July 1967. Ward (1942).

Thalamita gloriensis Crosnier
South Point, seaward reef, in weed, sublittoral fringe, 11 July 1967.

Thalamita integra Dana
Pointe Marianne, lagoon shore, Cymodocea beds, 22 July 1967. Rathbun (1911) lagoon.

Thalamita picta Stimpson
East Point, seaward reef, reef flat, cryptofauna, sublittoral fringe, 6 July 1967. Ward (1942).

Thalamita poissoni (Audouin and Savigny) ?
Barachois Maurice, beneath rock at base of barachois rock, intertidal, 16 July 1967.

Thalamita prymna (Herbst)
Ward (1942).

Carpilius maculatus (Linnaeus)
Ward (1942) 1 female.

Zosimus aeneus (Linnaeus)
East Point, seaward shore, beneath boulders on reef flat, close inshore, sublittoral fringe, 8 July 1967. North West Point, seaward reef, algal ridge beneath boulders, sublittoral fringe, 21 July 1967.

Chlorodiella nigra (Forskål)
Carcasse, lagoon reef, from coral colony, 1 metre depth, 8 July 1967; East Point seaward reef, algal ridge cryptofauna, sublittoral fringe. Rathbun (1911) lagoon.

Xantho cf. *voeltzkowii* (Lenz)
East Point seaward reef, cryptofauna, 6 July 1967.

Xantho sp.
South Point, beach rock, cryptofauna, eulittoral, 11 July 1967.

Leptodius cavipes (Dana)
Ward (1942).

Leptodius quinquedentatus Krauss
East Point, lagoon shore, cobbles at base of beach. Intertidal, 5 July 1967. East Point, seaward shore, boulders at base of beach, 8 July 1967.

Leptodius sanguineus (Milne Edwards)
South Point, in beach rock crevices, cryptofauna, eulittoral, 11 July 1967; South Point seaward reef flat, base of beach rock, eulittoral, 11 July 1967; East Point, seaward reef, base of beach, boulders, eulittoral, 8 July 1967; East Point, seaward reef, cryptofauna, sublittoral fringe, 6 July 1967; West Island seaward platform, eulittoral, 23 July 1967. Doflein (1904).

Actaea (*Glyptoxanthus*) *cavipes* (Dana)
East Point, seaward flats, midreef flat, cryptofauna. 3 specimens; Headland N. of Point Thomas, beneath boulders, sublittoral fringe, 13 July 1967. Ward (1942) under *A. fossulata* Girard.

Actaea banareias (Rathbun)
Ward (1942).

Actaea rufopunctata (Milne Edwards)
East Point, seaward reef, mid reef flat, cryptofauna, sublittoral fringe, 8 July 1967; 6 July 1967; North West Point, seaward reef *Cymodocea* beds, cryptofauna, sublittoral fringe, 21 July 1967. North West Point seaward reef algal ridge beneath boulders, sublittoral fringe. South Point; seaward reef, sublittoral fringe, 1 female, 11 July 1967; West Island, lagoon reef, *Cymodocea* beds, cryptofauna, sublittoral fringe, 23 July 1967.

Actaea speciosa Dana
South Point, seaward in coral, sublittoral fringe, 11 July 1967.

Actaea parvula (de Haan)
Doflein (1904).

Lachnopodus subacutus (Stimpson)
South Point, seaward reefs, under cobbles, 1 male, 11 July 1967.

Platypodia cristata Milne Edwards
Rathbun (1911) lagoon.

Chlorodopsis spinipes Heller
Rathbun (1911) lagoon, 10 fathoms.

Pseudoliomera natalensis Ward
Ward (1942).

Liomera bellus (Dana)
North West Point, seaward reef, algal ridge, boulders, sublittoral fringe, 21 July 1967.

Liomera monticulosus (Milne Edwards)
North West Point, seaward reef, algal ridge, boulders, sublittoral fringe, 21 July 1967; Barton Point, seaward shore, boulder zone, cryptofauna, intertidal, 7 July 1967; Headland immediately North of Point Thomas, beneath boulders, cryptofauna, sublittoral fringe, 13 July 1967; South Point, seaward reef, sublittoral fringe, 11 July 1967; East Point, seaward flats, cryptofauna, mid reef, sublittoral fringe, 6 July 1967.

Liomera tristis (Dana)
East Point, seaward reef, cryptofauna, mid reef flat, sublittoral fringe, 8 July 1967; West Island, lagoon reef, Cymodocea beds, sublittoral fringe, 23 July 1967.

Liomera sp.
North West Point, seaward reef, algal ridge, beneath boulders, sublittoral fringe, 21 July 1967.

Xanthias lamarckii (Milne Edwards)
East Point, seaward reef, cryptofauna, reef flat, sublittoral fringe, 6 July 1967, several collections. East Point, seaward reef, cryptofauna, mid reef flat, sublittoral fringe, 8 July 1967. East Point, seaward reef, algal ridge, cryptofauna, sublittoral fringe, 8 July 1967. South Point, seaward reef, coral colony, sublittoral fringe, 11 July 1967. North West Bay, seaward Cymodocea beds, cryptofauna, sublittoral fringe, 21 July 1967. Doflein (1904).

Xanthias latifrons (de Man)
Ward (1942).

Phymodius ungulatus Milne Edwards
Doflein (1904); Rathbun (1911) lagoon, 10 fathoms.

Etisodes armatus Ward
Ward (1942).

Etisus dentatus (Herbst)
Doflein (1904).

Etisus laevimanus Randall
Rathbun (1911) Barachois; Ward (1942).

Etisus electra (Herbst)
North West Point, seaward Cymodocea beds, cryptofauna, sublittoral fringe, 21 July 1967; East Point, lagoon shore, cobbles at base of beach, intertidal, 5 July 1967.

Etisus demani Odhner
East Point, seaward, 8 July 1967.

Menippe sp.
Barton Point, beneath rocks at base of beach, intertidal, 7 July 1967.

Juxtaxanthias livida (Lamarck)
Ward (1942).

Lioxantho subacutus (Stimpson)
Ward (1942).

Macromedaeus punctatus Ward
Ward (1942).

Medaeus simplex Milne Edwards
Ward (1942).

Platyozius laevis (Borradaile)
Ward (1942).

Ozius guttatus garciaensis Ward
Ward (1942).

Pseudozius caystrus (Adams and White)
Barton Point, seaward reef, beneath rocks at base of beach, intertidal, 7 July 1967. Rathbun (1911) Lagoon 10 fathoms. Ward (1942) (tentative identification).

Epixanthus frontalis (Milne Edwards)
Lagoon shore South of Mamzelle Adélie, beach rock, intertidal, 17 July 1967; South of Mamzelle Adélie lagoon, beach rock, cryptofauna, intertidal, 17 July 1967; Carcasse, lagoon shore, cobbles and sand, intertidal. Carcasse, tidal inlet, 9 July 1967.

Pilumnus longicornis Hilgendorf
Rathbun (1911) lagoon 14 fathoms.

Pilumnus cf. hirsutus Stimpson
North West Point, seaward reef algal ridge, boulders, sublittoral fringe, 21 July 1967.

Daira perlata (Herbst)
East Point, seaward reef, cryptofauna, algal ridge, sublittoral fringe, 8 July 1967; East Point, seaward reef, cryptofauna, mid reef flat, sublittoral fringe, 8 July 1967; North West Point, seaward, algal ridge, boulders, sublittoral fringe, 21 July 1967. South Point, seaward reef off coral colony, sublittoral fringe, 11 July 1967. Doflein (1904).

Eriphia laevimana Guérin
South Point, seaward shore, beach rock, intertidal, 11 July 1967; East Island, beach rock, intertidal, 26 July 1967.

Eriphia scabricula Dana
North West Point, seaward algal ridge, sublittoral fringe, 21 July 1967; East Point, seaward, cryptofauna, mid reef, sublittoral fringe, 6 July 1967, 8 July 1967.

Eriphia scabricula garciaensis Ward
Ward (1942), (not separable from above).

Trapezia cymodoce Herbst
East Point, seaward flats, mid reef, cryptofauna, sublittoral fringe, 6 July 1967. Rathbun (1911), lagoon 12 fathoms.

Trapezia digitalis Latreille
Eclipse Point, seaward flats, algal ridge, in coral sublittoral fringe, 21 July 1967.

Trapezia ferruginea Latreille
East Point, seaward reef, cryptofauna, reef flat, sublittoral fringe, 6 July 1967.

Trapezia speciosa Dana
South Point, seaward, coral colony, sublittoral fringe, 11 July 1967.

Tetralia glaberrima (Herbst)
South Point, seaward reef, coral colony, sublittoral fringe, 11 July 1967.

Euruppellia annulipes (Milne Edwards)
East Point, seaward reef, beach rock crevices, intertidal, 8 July 1967.

Dromidiopsis dormia (Linnaeus)
North West Point, seaward flats, Cymodocea beds, cryptofauna, sublittoral fringe, 21 July 1967; East Point, seaward reef, cryptofauna, reef flat, sublittoral fringe, 6 July 1967; East Point, Cymodocea beds, cryptofauna.

Calappa hepatica (Linnaeus)
Pointe Marianne, lagoon shore, Cymodocea beds, sublittoral fringe, 22 July 1967.

Cryptochirus marsupialis (Stimpson)
East Point, lagoon, in Stylophora colony, 1 m depth, 10 July 1967.

Anomura

PAGURIDEA

Calcinus elegans Milne Edwards
Balss (1912).

Calcinus laevimanus (Randall)
Headland immediately N. of Point Thomas, reef flat, beneath boulders, sublittoral fringe, 13 July 1967.

Calcinus terraereginae Haswell
Balss (1912).

Calcinus sp.
Barton Point, windward shore, beneath boulders, cryptofauna, intertidal, 7 July 1967.

Dardanus guttatus Olivier
Balss (1912).

Dardanus megistos (Herbst)
Pointe Marianne, lagoon flats, Cymodocea beds, intertidal, 22 July 1967; Cust Point, lagoon, Cymodocea beds, epifaunal, 1 m depth, 14 July 1967.

Coenobita clypeatus (Latreille)
North East Point, beach, July 1967; East Point, terrestrial, 26 July 1967; Minni Minni, in vegetation, terrestrial.

Coenobita perlatus (Milne Edwards)
South Point, beach, 11 July 1967.

Coenobita rugosus Milne Edwards
East Point, lagoon side, sandy beach, supralittoral, 26 July 1967; East Point, seaward beach, supralittoral, 5 July 1967. Balss (1912); Ward (1942).

Birgus latro (Linnaeus)
Common over much of atoll land rim.

GALATHEIDEA

Petrolisthes barbatus (Heller)
Ward (1942).

Petrolisthes lamarckii Leach
East Point, seaward flats, cryptofauna, mid reef, sublittoral fringe, 6 July 1967. Barton Point, beneath rocks at base of beach, intertidal, 7 July 1967; seaward reef, beneath boulders, intertidal, eulittoral, 7 July 1967. North West Point, seaward reef, algal ridge, boulders, sublittoral fringe, 21 July 1967. Doflein & Balss (1913).

Pachycheles cf. natalensis (Krauss)
South Point, seaward reef, coral colony, sublittoral fringe, 11 July 1967.

Polyonyx biunguiculatus Dana
Laurie (1926), lagoon 14 fathoms.

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9. CRUSTACEA: CIRRIPEDES FROM DIEGO GARCIA

W. A. Smith

Only two species were collected in July 1967. These were identified by W. A. Smith, British Museum (Natural History). A single species was recorded by Gruvel (Trans. Linn. Soc. London II, Zool., 13: 23-27, 1909), presumably from drift material.

Tetraclita wireni africana Nilsson-Cantell
West Island, on beach rock, eulittoral, 23 July 1967.

Lithotrya nicobarica Reinhardt
South Point, seaward reef, boring into boulders, 11 July 1967.

Lepas australis Darwin
Recorded by Gruvel (1909).

10. MARINE MOLLUSCA FROM DIEGO GARCIA

John D. Taylor

The marine mollusca of the atoll have been very incompletely collected and with the present collection number only 179 species compared with 504 species recorded from Cocos-Keeling (Maes 1967). Some of the paucity is due to dispersal phenomena associated with the isolation of the Chagos.

The first account of molluscs from the atoll is by Liénard (1877) who lists 39 species. Kohn & Robertson (1968) point out that for the genus *Conus* a good proportion of Liénard's records for the Chagos have not been confirmed by subsequent work. In addition it is difficult in many cases to decide to what species some of his names refer: all of Liénard's records have therefore been omitted from the present list.

Fischer (1891) lists in distribution records of species from Indo-China a number of species from the Chagos Archipelago including seven from Diego Garcia. The Deutsche Tiefsee Expedition of 1898-1899 called briefly at Diego Garcia and subsequent reports by von Martens (1903) and Thiele and Jaekel (1931) record six gastropods and one bivalve respectively. The Percy Sladen Expedition collected 32 species from the atoll which are described and listed in Melvill (1909).

Schilder and Schilder (1937) record 44 species of *Cypraea* from the Chagos Archipelago, but do not list species from individual atolls.

Since then the only molluscan record known to the author is a new genus and species of gastropod (*Tomlinella miranda*) from Diego Garcia by Viader (1938). Poisson (1954) listed a few molluscs from the Chagos Archipelago but none specifically from Diego Garcia. The species of *Conus* from the Maldive and Chagos groups are listed by Kohn and Robertson (1968) but they do not separate records from individual atolls although all Kohn's collections were made on Peros Banhos.

A list of molluscs collected in July 1967 is given below together with short habitat notes. Records by other workers are also included. The species are grouped by superfamilies.

Atoll Research Bulletin No. 149: 105-125, 1971.

GASTROPODA

FISSURELLACEA

Emarginula peasei Thiele
East Point, seaward, beneath loose block, sublittoral fringe*, 1 specimen, 6 July 1967.

Diodora singaporensis (Reeve)
East Point, lagoon, on coral colony, 1 m, 1 specimen, 10 July 1967. North West Point, seaward, algal ridge, cryptofauna, sublittoral fringe, 1 specimen, 21 July 1967.

PATELLACEA

Cellana sp.
East Point, lagoon, coral. 1 m, 1 specimen, 12 July 1967.

TROCHACEA

Trochus flammulatus Lamarck
East Point, lagoon, on coral, sublittoral, 1 m, 1 specimen, 12 July 1967. Barton Point, seaward shore, on boulders at base of beach, low eulittoral, 1 specimen, 7 July 1967. North West Point, Cymodocea beds, cryptofauna, sublittoral fringe, 1 specimen, 21 July 1967.

Tectus mauritianus (Gould)
East Point, lagoon, epifaunal on coral, 1 m, 1 specimen, 12 July 1967.

Gena strigosa A. Adams
Melvill (1909), from Barachois.

Clanculus margaritarius Philippi
Melvill (1909), from Barachois.

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* For an explanation of zonation and terminology, see Lewis, J. R., 1964, The ecology of rocky shores, and Taylor, J. D., Phil. Trans. R. Soc. London B, 254: 129-206, 1968.

Stomatella varia A. Adams
Cust Point, seaward, off bryozoan colony, _Cymodocea_ beds, 14 July 1967.

Turbo argyrostomus Linnaeus
West Island, lagoon, _Cymodocea_ beds, beneath dead blocks, 1 specimen, 23 July 1967.

Turbo intercostalis Menke
Pointe Marianne, lagoon, _Cymodocea_ beds, beneath loose block, 1 specimen, 22 July 1967.

NERITACEA

Nerita albicilla Linnaeus
East Point, seaward, eulittoral, beneath boulders at base of beach, 1 specimen, 8 July 1967. East Point, lagoon, eulittoral, beneath cobbles at base of beach, 1 specimen, 5 July 1967. Barton Point, seaward, eulittoral, beneath boulders, 8 specimens, 7 July 1967. West Island, seaward, eulittoral, epifaunal open surface, 1 specimen, 23 July 1967. Headland N. of Point Thomas, seaward, eulittoral, beneath boulders, 27 specimens, 13 July 1967.

Nerita plicata Linnaeus
Barton Point, seaward, eulittoral, on open surfaces of boulders, 2 specimens, 13 July 1967.

Nerita polita Linnaeus
Headland N. of Point Thomas, seaward, eulittoral, beneath boulders at base of beach, 10 specimens, 13 July 1967. Carcasse, lagoon, eulittoral beneath cobbles at base of beach, 5 specimens, 9 July 1967. Barton Point, seaward, eulittoral, beneath boulders at base of beach, 1 specimen, 7 July 1967.

Nerita undata Linnaeus
Barton Point, seaward, eulittoral, on open surfaces of boulders, 20 specimens, 7 July 1967.

Smaragdia rangiana (Recluz)
North West Point, seaward, sublittoral fringe, in algae on reef flat, 1 specimen, 21 July 1967.

LITTORINACEA

Littorina scabra (Linnaeus)
South Point, lagoon, littoral fringe on beach rock, 1 specimen, 12 July 1967. Barachois Maurice, lagoon, littoral fringe, on beach rock, 20+ specimens, 16 July 1967, 15 July 1967. East Point, lagoon, littoral fringe, on tree trunks, 20+ specimens, 5 July 1967.

Littorina glabrata (Philippi)
East Point, lagoon, littoral fringe, on tree trunks, 8 specimens, 5 July 1967. Cust Point, lagoon, littoral fringe, on tree trunks, 4 specimens, 14 July 1967.

RISSOACEA

Rissoina ambigua Gould
East Point, seaward, beneath loose blocks, 4 specimens, 6 July 1967; algal ridge, beneath block, sublittoral fringe, 1 specimen, 8 July 1967. North West Point, seaward, in algae, sublittoral fringe, 1 specimen, 21 July 1967. Headland N. of Point Thomas, seaward, 1 specimen, 13 July 1967.

Rissoina plicata A. Adams
East Point, seaward, beneath dead coral blocks, sublittoral fringe, 2 specimens, 6 July 1967. North West Point, seaward, in algae, 1 specimen, 21 July 1967. Headland N. of Point Thomas, seaward, beneath loose blocks, 1 specimen, 13 July 1967.

CERITHIACEA

Planasix lineatus (Da Costa)
Barton Point, seaward, on sand and beneath boulders, base of beach, eulittoral, very common, 7 July 1967. Headland N. of Point Thomas, seaward, beneath boulders at base of beach, eulittoral, 100+ specimens, 13 July 1967.

Planaxis sulcatus Born
Mamzelle Adelie, lagoon, on beach rock, epifaunal, eulittoral, 20 specimens, 17 July 1967. Carcasse, lagoon, eulittoral, beneath cobble of beach, 20+ specimens, 9 July 1967. Melvill (1909) records it from Barachois.

Modulus tectum (Gmelin)
Barton Point, seaward, beneath boulders at base of beach, 1 specimen, 7 July 1967. North West Point, seaward, sublittoral fringe, algal ridge, 1 specimen, 21 July 1967.

Rhinoclavis asper (Linnaeus)
East Point, lagoon, sublittoral (1 m) sand burrowing, 1 specimen, 9 July 1967. Barachois Maurice, eulittoral, burrowing in fine sand with Uca. 20 specimens, 16 July 1967. Melvill (1909), in barachois; von Martens (1903).

Cerithium obeliscus Bruguière
East Point, seaward, reef flat, dead, 1 specimen, 6 July 1967.

Cerithium pretosum Wood
East Point, lagoon, eulittoral, beneath cobbles at base of beach, 50+ specimens, 5 July 1967. Carcasse, lagoon, beneath beach

cobbles, 20+ specimens, 9 July 1967. Mamzelle Adélie, lagoon, eulittoral, amongst green algae, 20+ specimens, 17 July 1967. Melvill (1909) in barachois.

Cerithium rostratum Sowerby
North West Point, seaward, Cymodocea beds, on leaves, 2 specimens, 21 July 1967. Pointe Marianne, lagoon, Cymodocea beds, on leaves, 2 specimens, 22 July 1967.

Cerithium (Conocerithium) atromarginatum Dautzenberg & Bouge
North West Point, seaward, algal ridge, beneath loose blocks, 3 specimens, 21 July 1967.

Cerithium cf. (Conocerithium) egenum Gould
East Point, seaward, algal ridge beneath blocks, 2 specimens, 8 July 1967.

Cerithium (Semivertagus) ianthinum Gould
North West Point, seaward, algal ridge, beneath loose blocks, 1 specimen, 21 July 1967; Cymodocea beds, 1 specimen, 21 July 1967. East Point, seaward reef, algal ridge, 1 specimen, 8 July 1967.

Cerithium (Semivertagus) nesioticum Pilsbry and Vanatta
East Point, seaward, inner reef flat, beneath boulders, 1 specimen, 8 July 1967. North West Point, seaward, Cymodocea beds, 1 specimen, 21 July 1967.

Cerithium sp.
Carcasse, lagoon, beneath cobbles, eulittoral, 20+ specimens, 9 July 1967. Barton Point, seaward, beneath boulders, eulittoral, 6 specimens, 7 July 1967.

Triphora aurea (Hervier)
East Point, lagoon, off coral, sublittoral, 1 specimen, 19 July 1967.

Triphora coetivensis Melvill
Barton Point, seaward beneath boulders at base of beach, 1 specimen, 7 July 1967.

Triphora monilifera (Hinds)
North West Point, seaward, in algae, 1 specimen, 21 July 1967.

Triphora sp.
East Point, lagoon, off coral, sublittoral, 1 specimen, 19 July 1967.

Tomlinella miranda Viader
Viader (1938).

HIPPONICACEA

Vanikoro cancellata Lamarck

North West Point, seaward, in algae, sublittoral fringe, 1 specimen, 8 July 1967. East Point, seaward, beneath loose blocks, 2 specimens, 6 July 1967; algal ridge beneath boulders, 4 specimens, 8 July 1967.

Hipponyx conica Schumacher

East Point, seaward, mid-reef flat on Conus, heavy infestation, July 1967. South Point, seaward, beach rock crevices, epifaunal mostly on species of Conus, 11 July 1967. North West Point, seaward, algal ridge, commensal on Conus, 21 July 1967. Von Martens (1903) as Hipponyx acutus Quoy and Gaimard, on Conus distans.

CALYPTRAEACEA

Cheilea equestris (Linnaeus)

East Point, seaward, cemented beneath loose blocks on algal ridge, 2 specimens, 8 July 1967. Headland N. of Point Thomas, seaward, cemented beneath blocks, 2 specimens, 13 July 1967.

STROMBACEA

Strombus decorus decorus Röding

Cust Point, lagoon flats, Cymodocea beds, epifaunal, 1 m, 2 specimens, 14 July 1967. Pointe Marianne, lagoon, Cymodocea beds, epifaunal, 3 specimens, 22 July 1967. East Point, lagoon, amongst algae, 1 m, 3 specimens, 14 July 1967.

Strombus labiatus (Röding)

Pointe Marianne, lagoon, Cymodocea beds, epifaunal, 1 specimen, 22 July 1967. East Point, lagoon, amongst algae, epifaunal, 1 m, 4 specimens, 14 July 1967.

Strombus mauritianus Lamarck

Melvill (1909), Diego Lagoon.

Strombus mutabilis Swainson

East Point, lagoon, amongst weed, epifaunal, 1 m, 4 specimens, 14 July 1967.

Lambis crocata (Link)

Beach washed. 2 specimens.

NATICACEA

Polynices melanostoma(Gmelin)

Barachois Maurice, lagoon, burrowing in mud with Uca, 2 specimens, 16 July 1967. Cust Point, lagoon, Cymodocea beds.

TONNACEA

Bursa bufonia (Gmelin)
North West Point, seaward, algal ridge, beneath loose boulders, 1 specimen, 21 July 1967. East Point, seaward, beneath dead coral blocks, sublittoral fringe, 5 specimens, 6 July 1967. South Point, seaward, epifaunal mid-reef flat, 1 specimen, 11 July 1967. Headland N. of Point Thomas, seaward, epifaunal, reef flat, 1 specimen, 13 July 1967.

Bursa granularis Röding
East Point, seaward, epifaunal, sublittoral fringe, 10 specimens, 8 July 1967; 6 July 1967. North West Point, seaward, Cymodocea beds, epifaunal, 2 specimens, 21 July 1967; algal ridge, beneath loose blocks, 2 specimens, 21 July 1967.

Bursa rhodostoma (Sowerby)
North West Point, seaward, algal ridge, beneath boulders, 1 specimen, 21 July 1967.

Apollon bituberculare (Lamarck)
North West Point, seaward, Cymodocea beds, beneath cobble, 1 specimen, 21 July 1967.

Cymatium pileare (Linnaeus)
North West Point, seaward, algal ridge, 1 specimen, 21 July 1967. Pointe Marianne, lagoon, Cymodocea beds beneath dead coral blocks, 2 specimens, 22 July 1967. South Point, seaward, beach rock crevices, eulittoral, 1 specimen, 11 July 1967.

CYPRAEACEA

Cypraea annulus Linnaeus
East Point, seaward reef flat, cryptofauna, sublittoral fringe, 3 specimens, 6 July 1967; inner reef flat, seaward reef, beneath cobbles, sublittoral fringe, 2 specimens, 8 July 1967. North of Point Thomas, seaward, headland, cryptofauna, 2 specimens, 13 July 1967. North West Point, Cymodocea beds, cryptofauna, seaward, 2 specimens, 21 July 1967.

Cypraea carneola Linnaeus
West Island, lagoon shore, sublittoral fringe, Cymodocea beds, 1 specimen, 23 July 1967.

Cypraea childreni Gray
Fischer (1891).

Cypraea chinensis Gmelin
North West Bay, seaward flats, algal ridge, sublittoral fringe, 1 specimen, 21 July 1967.

Cypraea helvola Linnaeus
North West Point, Cymodocea beds, cryptofauna beneath cobbles, 4 specimens, 21 July 1967.

Cypraea histrio Gmelin
West Island, lagoon shore, Cymodocea beds, sublittoral fringe, 1 specimen, 23 July 1967. North East Point, seaward reef, Cymodocea beds beneath boulder, sublittoral fringe, 1 specimen, 21 July 1967. North West Point, seaward reef, algal ridge, cryptofauna, 3 specimens, 21 July 1967.

Cypraea isabella Linnaeus
Fischer (1891), beach washed.

Cypraea lynx Linnaeus
East Point, lagoon flats, beneath cobbles, 1 m. 2 specimens, 14 July 1967. North West Point, seaward reef, Cymodocea beds, cryptofauna, 1 specimen, 21 July 1967.

Cypraea depressa (Gray)
North West Point, seaward, algal ridge, cryptofauna sublittoral fringe, 2 specimens, 21 July 1967. East Point, seaward, mid-reef flat, 1 specimen, 7 July 1967.

Cypraea moneta Linnaeus
East Point, seaward reef, cryptofauna beneath dead coral blocks, sublittoral fringe, 1 specimen, 6 July 1967. Cust Point, lagoon shore, Cymodocea beds, on leaves, 1 m, 3 specimens, 14 July 1967; East Point, lagoon shore amongst algae, 1 m, 2 specimens, 14 July 1967. Pointe Marianne, lagoon flats, Cymodocea beds, 1 specimen, 22 July 1967. Carcasse, lagoon shore beneath cobbles, eulittoral, 2 specimens, 9 July 1967. Headland north of Point Thomas, seaward flats, sublittoral fringe, 2 specimens, 13 July 1967. North West Point, Cymodocea beds, cryptofauna, sublittoral fringe, 5 specimens, 21 July 1967. Melvill (1909) from barachois.

Cypraea kieneri Hidalgo
East Point, seaward, cryptofauna, 1 specimen, 7 July 1967. North West Point, seaward reef algal ridge, cryptofauna, 3 specimens, 21 July 1967.

Cypraea staphylaea Linnaeus
Melvill (1909).

Cypraea talpa Linnaeus
Beach washed.

Cypraea caputserpentis Linnaeus
South Point, seaward, mid-reef, crevice, 1 specimen, 11 July 1967.

Trivia insecta (Mighels)
South Point, seaward, in branching coral colony crevices, sublittoral fringe, 3 specimens, 11 July 1967.

MURICACEA

Murex adustus Lamarck
Melvill (1909), Barachois Maurice.

Drupa morum Röding
South Point, seaward, reef flat, eulittoral, 3 specimens, 11 July 1967, base of beach rock, 3 specimens, 11 July 1967. East Point, seaward, epifaunal on loose blocks, 3 specimens, 6 July 1967. West Island, seaward platform, epifaunal, 2 specimens, 23 July 1967. Barton Point, seaward, boulders at base of beach, eulittoral, 6 specimens, 7 July 1967.

Drupa ricinus (Linnaeus)
South Point, seaward, eulittoral, base of beach rock, 4 specimens, 11 July 1967. West Island, seaward, eulittoral, epifaunal, 1 specimen, 23 July 1967. North West Point, seaward, sublittoral fringe, algal ridge, 1 specimen, 21 July 1967; *Cymodocea* beds, 21 July 1967. Barton Point, seaward, eulittoral, boulders at base of beach, 6 specimens, 7 July 1967. East Point, seaward, eulittoral, on loose blocks, 8 July 1967. Headland North of Point Thomas, seaward, sublittoral fringe, beneath boulders, 2 specimens, 13 July 1967.

Drupa cornus Röding
East Point, lagoon, off *Favia* colony, sublittoral, 1 m, 2 specimens, 9 July 1967.

Drupella margariticola (Broderip)
East Point, lagoon, beneath cobbles at base of beach, eulittoral, 13 specimens, 5 July 1967. Cust Point, lagoon, *Cymodocea* beds on loose blocks, 3 specimens, 14 July 1967. Mamzelle Adélie, lagoon, on beach rock, eulittoral, 8 specimens, 17 July 1967. Carcasse, lagoon, beneath cobbles, eulittoral, 7 specimens, 9 July 1967. North West Point, seaward, *Cymodocea* beds, beneath cobbles, 1 specimen, 21 July 1967. Headland North of Point Thomas, seaward, beneath boulders at base of beach, eulittoral, 4 specimens, 13 July 1967. Melvill (1909) as *Sistrum fiscellum* Chemnitz.

Drupella ochrostoma (Blainville)
North West Point, seaward, *Cymodocea* beds, beneath loose blocks, 4 specimens, 21 July 1967.

Morula anaxeres (Kiener)
Mamzelle Adelie, lagoon, beach rock, eulittoral, 4 specimens, 17 July 1967.

Morula granulata (Duclos)
Barton Point, seaward, eulittoral, boulders at base of beach, 10 specimens, 7 July 1967. West Island, seaward platform, eulittoral, 3 specimens, 23 July 1967. South Point, seaward, eulittoral, base of beach rock, 12 specimens, 11 July 1967. East Point, seaward, reef flat, 1 July 1967. Mamzelle Adelie, lagoon, eulittoral, beach rock, 5 specimens, 17 July 1967.

Morula spinosa (H. & A. Adams)
Listed by Melvill as Sistrum iostoma (Reeve).

Morula uva (Röding)
South Point, seaward, reef flat, 3 specimens, 11 July 1967. Barton Point, seaward, eulittoral, boulders at base of beach, 10 specimens, 7 July 1967. North West Point, seaward, sublittoral fringe, algal ridge, 1 specimen, 21 July 1967. West Island, seaward platform, eulittoral, 1 specimen, 23 July 1967.

Nassa francolina (Bruguière)
Headland North of Point Thomas, seaward, cryptofauna, 1 specimen, 13 July 1967.

Thais aculeata Deshayes
Mamzelle Adelie, lagoon, base of beach rock, eulittoral, 3 specimens, 17 July 1967. West Island, seaward, epifaunal, eulittoral, 1 specimen, 23 July 1967. South Point, seaward, base of beach rock, eulittoral, 3 specimens, 11 July 1967. Headland North of Point Thomas, seaward, beneath loose blocks, 1 specimen, 13 July 1967. Barton Point, seaward, beneath boulders at base of beach, 4 specimens, 7 July 1967.

Thais armigera (Link)
North West Point, seaward, algal ridge, beneath blocks, 1 specimen, 21 July 1967. South Point, seaward flat, epifaunal, 5 specimens, 11 July 1967. West Island, seaward, eulittoral, on platform, 2 specimens, 23 July 1967. East Point, seaward, mid-reef flat, epifaunal, sublittoral fringe, 2 specimens, July 1967.

Thais tuberosa (Röding)
Headland North of Point Thomas, seaward, epifaunal, reef flat, 1 specimen, 13 July 1967. East Point, seaward, inner reef flat, epifaunal on dead coral blocks, eulittoral, 1 specimen, 8 July 1967; 3 specimens, 6 July 1967. South Point, seaward reef, epifaunal, sublittoral fringe, 1 specimen, 11 July 1967.

Maculotriton digitalis (Reeve)
Barton Point, seaward, beneath boulders at base of beach, eulittoral, 4 specimens, 7 July 1967. East Point, seaward, algal ridge, beneath loose blocks, sublittoral fringe, 1 specimen, 8 July 1967. Headland North of Point Thomas, seaward, beneath boulders, 1 specimen, 13 July 1967. East Point, seaward, inner reef flat beneath boulders, 1 specimen, 8 July 1967. South

Point, seaward, in beach rock crevices, eulittoral, 1 specimen, 11 July 1967. Cust Point, lagoon, Cymodocea beds, beneath blocks, 1 specimen, 14 July 1967. North West Point, seaward, algal ridge, beneath blocks, 4 specimens, 21 July 1967.

Maculotriton serriale (Laborde and Deshayes)
Barton Point, seaward, beneath boulders at base of beach, 2 specimens, 7 July 1967. East Point, seaward, boulders at base of beach, 2 specimens, 8 July 1967.

Quoyala madreporarum (Sowerby)
East Point, lagoon, on Pocillopora, July 1967.

Coralliophila monodonta (Quoy and Gaimard)
Melvill (1909).

BUCCINACEA

Columbella turturina Lamarck
North West Point, seaward, Cymodocea beds, beneath loose blocks, 5 specimens, 21 July 1967. Fischer (1891).

Columbella varians Sowerby
East Point, seaward, algal ridge, beneath loose blocks, 2 specimens, 8 July 1967. Barton Point, seaward, beneath boulders at base of beach, 6 specimens, 7 July 1967.

Pyrene azora (Duclos)
Carcasse, lagoon, beneath cobbles on beach, eulittoral, 20+ specimens, 9 July 1967. North West Point, seaward, algal ridge, in crevices, 1 specimen, 21 July 1967.

Pyrene sp.
East Point, lagoon, on algae on Tridacna maxima, 9 July 1967. Cust Point, lagoon, Cymodocea beds, beneath loose blocks, 10 specimens, 14 July 1967.

Cantharus undosus Linnaeus
East Point, lagoon, sublittoral (1 m) on Favia colony, 4 specimens, 9 July 1967; 10 July 1967. Headland North of Point Thomas, seaward, reef flat, beneath blocks, 2 specimens, 13 July 1967. North West Point, seaward, Cymodocea beds, beneath blocks, 2 specimens, 21 July 1967; algal ridge beneath boulders, 1 specimen, 21 July 1967. Melvill (1909), from Barachois Maurice.

Engina bonasina (von Martens)
North West Point, seaward, algal ridge, beneath block, 1 specimen, 21 July 1967.

Engina lineata (Reeve)
North West Point, seaward, algal ridge, beneath blocks, 7 specimens, 21 July 1967; Cymodocea beds, beneath loose blocks, 7 specimens, 21 July 1967.

Engina mendicaria (Linnaeus)
East Point, seaward, eulittoral, beneath boulders at base of beach, 5 specimens, 8 July 1967; beneath coral blocks, mid-reef flat, 2 specimens, 6 July 1967. Headland North of Point Thomas, beneath loose blocks, 2 specimens, 18 July 1967; boulders at base of beach, 10 specimens, 13 July 1967. Barton Point, seaward, eulittoral, beneath boulders at base of beach, 20+ specimens, 7 July 1967. West Island, seaward, eulittoral, on platform, 5 specimens, 23 July 1967. North West Point, seaward, Cymodocea beds, sublittoral fringe, 1 specimen, 21 July 1967. South Point, seaward, eulittoral, in beach rock crevices, 20 specimens, 21 July 1967.

Nassarius arcularis (Linnaeus)
Fischer (1891).

Nassarius gaudiosus (Hinds)
North West Point, seaward, algal ridge, beneath loose block, 1 specimen, 21 July 1967.

Nassarius maldivensis (Smith)
Melvill (1909), lagoon.

Nassarius paupera (Gould)
Cust Point, lagoon, Cymodocea beds, epifaunal, sublittoral, 1 m, 1 specimen, 14 July 1967. East Point, lagoon, sand burrowing, sublittoral, 1 m, 1 specimen, 9 July 1967.

Latirus craticulatus (Linnaeus)
North West Point, seaward, algal ridge, beneath boulders, 1 specimen, 21 July 1967. West Island, lagoon, Cymodocea beds, cryptofauna, 1 specimen, 23 July 1967.

Latirus polygonus (Linnaeus)
Melvill (1909), Barachois Maurice.

Peristernia sp.
Barton Point, seaward, beneath boulders, 1 specimen, 7 July 1967.

Latirolagena smaragdula (Linnaeus)
Barton Point, seaward, beneath boulders at base of beach, eulittoral, 1 specimen, 7 July 1967. North West Point, seaward, algal ridge, beneath blocks, 3 specimens, 21 July 1967.

Fusinus tuberculatus Lamarck
Melvill (1909), Barachois Maurice.

VOLUTACEA

Mitra cucumerina Lamarck
North West Point, seaward, algal ridge, 1 specimen, 21 July 1967.

Mitra stictica (Link)
East Point, seaward, in sand pockets, 1 specimen 6 July 1967. South Point, seaward reef flat in sand pockets, 1 specimen, 11 July 1967.

Strigatella litterata (Lamarck)
Barton Point, seaward, eulittoral, beneath boulders at base of beach, 10 specimens, 7 July 1967. East Point, seaward, eulittoral, beneath boulders at base of beach, 2 specimens, 8 July 1967. South Point, seaward, eulittoral, in crevices in beach rock, 1 specimen, 11 July 1967. Headland North of Point Thomas, seaward, beneath boulders, 3 specimens, 13 July 1967. North West Point, Cymodocea beds, beneath loose block, 1 specimen, 21 July 1967.

Strigatella paupercula (Linnaeus)
South Point, seaward, cryptofauna, 1 specimen, 11 July 1967.

Vasum turbinellus (Linnaeus)
Headland north of Point Thomas, seaward, mid-reef flat, epifaunal, 1 specimen, 13 July 1967. North West Point, seaward, algal ridge, beneath blocks, 1 specimen, 21 July 1967.

Harpa amouretta Röding
North West Point, seaward, Cymodocea beds, beneath loose block, 1 specimen, 21 July 1967.

CONACEA

Conus catus Hwass
Barton Point, seaward reef, beneath boulders, 1 specimen, 7 July 1967. South Point, seaward reef, epifaunal, intertidal (lower eulittoral) on beachrock, 5 specimens, 11 July 1967.

Conus chaldeus (Röding)
South Point, seaward reef, epifaunal, mid-reef flat, sublittoral fringe, 6 specimens, 11 July 1967. North West Point, seaward reef, algal ridge, beneath boulders, sublittoral fringe, 1 specimen, 11 July 1967. East Point, seaward, mid-reef flat, 1 specimen, 7 July 1967.

Conus distans Hwass
Von Martens (1903).

Conus ebraeus Linnaeus
West Island, seaward platform, eulittoral, epifaunal, 1 specimen, 23 July 1967. South Point, on beachrock, intertidal (eulittoral),

11 July 1967. East Point, seaward reef, sublittoral fringe, 1 specimen, 6 July 1967. Headland North of Point Thomas, seaward reef, sublittoral fringe, 3 specimens, 13 July 1967. North West Point, _Cymodocea_ beds, cryptofauna, sublittoral fringe, 2 specimens, 21 July 1967. Von Martens (1903).

Conus flavidus Lamarck
South Point, base of beach rock, intertidal, epifaunal, 1 specimen, 11 July 1967.

Conus fulgetrum Sowerby
Barton Point, seaward, eulittoral, beneath boulders at base of beach, 1 specimen, 7 July 1967.

Conus lividus Hwass
North West Point seaward reef, algal ridge, epifaunal, sublittoral fringe, 6 specimens, 21 July 1967. North West Point, seaward, _Cymodocea_ beds, epifaunal, sublittoral fringe, 3 specimens, 21 July 1967. Headland North of Point Thomas, seaward reef, epifaunal, 5 specimens, 13 July 1967. South Point, seaward reef, epifaunal, sublittoral fringe, 3 specimens, 11 July 1967. East Point, seaward reef, epifaunal, open surfaces, sublittoral fringe, 1 specimen, 6 July 1967. East Point, seaward reef inner flat, intertidal (low eulittoral), 1 specimen, 8 July 1967.

Conus miles Linnaeus
North West Point, seaward reef, algal ridge, cryptofauna, sublittoral fringe, 5 specimens, 21 July 1967. North West Point, seaward reef _Cymodocea_ beds, 1 specimen, 21 July 1967. Headland North of Point Thomas, seaward reef, cryptofauna, 3 specimens, 13 July 1967. East Point, seaward, mid-reef flat, 1 specimen, July 1967.

Conus musicus Hwass
South Point, seaward reef, epifaunal, sublittoral fringe, 1 specimen, 11 July 1967.

Conus nussatella Linnaeus
Headland North of Point Thomas, seaward reef, 1 dead specimen, 13 July 1967.

Conus rattus Hwass
South Point, seaward reef, epifaunal, outer reef flat, sublittoral fringe, 10 specimens, 11 July 1967. East Point, seaward, mid-reef flat, 1 specimen, July 1967.

Conus sponsalis Hwass
North West Point, seaward reef, algal ridge, epifaunal, 1 specimen, 21 July 1967; seaward reef, _Cymodocea_ beds, cryptofauna, 1 specimen, 21 July 1967. Headland North of Point Thomas, seaward reef, epifaunal, 7 specimens, 13 July 1967. South Point,

seaward flats, cryptofauna, 4 specimens, 11 July 1967; seaward reef, intertidal (eulittoral), on beach rock, 30 specimens, 11 July 1967. West Island, seaward platform intertidal (eulittoral), 2 specimens, 23 July 1967. East Point, seaward, mid-reef flat, 1 specimen, July 1967. Barton Point, seaward, eulittoral, beneath boulders, 1 specimen, 7 July 1967.

Conus virgo Linnaeus
Headland North of Point Thomas, seaward reef, 1 specimen, 13 July 1967.

PYRAMIDELLACEA

Eulima sp.
South Point, seaward reef, off holothurians, in beach rock crevices, 1 specimen, 11 July 1967.

Balcis sp.
East Point, seaward, algal ridge, 1 specimen, 8 July 1967.

PERACLEACEA

Volvatella cincta (G. & H. Nevill)
North West Point, seaward, amongst algae, 1 specimen, 21 July 1967.

SCAPHOPODA

Dentalium gemmiparum Melvill
Melvill (1909), dredged from lagoon.

BIVALVIA

ARCACEA

Arca (Arca) avellana Lamarck
East Point, lagoon, sublittoral, 1 m, coral colony crevices, 2 specimens, 10 July 1967; 19 July 1967; seaward, mid-reef flat, crevice, 1 specimen, July 1967.

Arca plicata (Dillwyn)
East Point, lagoon, sublittoral, byssate on *Tridacna maxima*, 1 specimen, 9 July 1967.

Anadara urypigymelana (Bory)
Cust Point, lagoon, burrowing in *Cymodocea* beds, 1 m, 14 July 1967. Recorded by Melvill (1909) as *A. holoserica* Reeve, from lagoon (10 fathoms) and Barachois Maurice.

Striarca tenebrica (Reeve)
East Point, lagoon, sublittoral 1 m, byssate, in coral crevice, 3 specimens, 12 July 1967; 10 July 1967.

Barbatia decussata (Sowerby)
East Point, lagoon, sublittoral, 1 m, byssate in coral crevices, 10 specimens, 19 July 1967; 10 July 1967; 12 July 1967.

Barbatia helblingi Bruguière
East Point, lagoon, byssate beneath coral colonies, sublittoral 1 m, 30 specimens, 19 July 1967; 10 July 1967.

Barbatia tenella (Reeve)
North West Point, seaward, algal ridge, boulder zone, byssate, 1 specimen, 21 July 1967. Headland North of Point Thomas, seaward, byssate, beneath coral blocks, 2 specimens, 13 July 1967.

Barbatia fusca Bruguière
East Point, lagoon shore, byssate, on coral colony, 1 m, 19 July 1967.

MYTILACEA

Modiolus auriculatus Krauss
East Point, seaward, byssate groups, sublittoral fringe, 30 specimens, 6 July 1967. South Point, seaward, byssate, mid-reef flat, 1 specimen, 11 July 1967. North West Point, seaward, Cymodocea beds, byssate, around stems, 2 specimens, 21 July 1967.

Brachiodontes variabilis Krauss
Barachois Maurice, eulittoral, byssate, beneath cay rock, 1 specimen, 16 July 1967.

Septifer bilocularis (Linnaeus)
Carcasse, lagoon, sublittoral, byssate, beneath coral colony (Favia), 6 specimens, 9 July 1967. East Point, lagoon, byssate, beneath coral colony, 1 m, 2 specimens, 10 July 1967. Barachois Maurice, lagoon entrance, byssate, on beach rock, eulittoral, 6 specimens, 15 July 1967. Recorded by Melvill (1909) from 10-14 fathoms in lagoon. Also recorded by Thiele and Jaekel (1931), Station 224.

Leiosolenus nasuta (Philippi)
Carcasse, lagoon, sublittoral 1m, boring into Favia colony, 10 specimens, 9 July 1967.

Lithophaga teres (Philippi)
Carcasse, lagoon, sublittoral, 1 m, boring into Favia colony, 3 specimens, 12 July 1967. East Point, lagoon, sublittoral, 1 m, boring into massive coral, 3 specimens, 12 July 1967; 19 July 1967. Melvill (1909) records it from the lagoon.

Botula cinnamomea (Lamarck)
Carcasse, lagoon, sublittoral, 1 m, boring into Favia colony, 10 specimens, 9 July 1967.

PINNACEA

Pinna muricata Linnaeus
Cust Point, lagoon, Cymodocea beds, burrowing, 1 m, 1 specimen, 14 July 1967.

PTERIACEA

Electroma alacorvi (Dillwyn)
North West Point, seaward, Cymodocea beds, dead, 21 July 1967. East Point, lagoon, byssate beneath coral colony, in crevices, 1 m, 3 specimens, 10 July 1967.

Pinctada margaritifera (Linnaeus)
Headland North of Point Thomas, seaward, byssate, beneath loose blocks, 1 specimen, 13 July 1967. North West Point, seaward, Cymodocea beds, byssate, beneath block, 1 juvenile, 21 July 1967.

Pinctada sp.
Headland North of Point Thomas, seaward, byssate, beneath dead coral lumps, 2 specimens, 13 July 1967.

Isognomon legumen (Gmelin)
Carcasse, lagoon, sublittoral, byssate, beneath Favia colony, 10 specimens, 9 July 1967. East Point, lagoon, byssate, in crevices beneath coral colony, 10 specimens, 10 July 1967; 19 July 1967.

Isognomon perna (Linnaeus)
East Point, seaward, byssate beneath dead coral blocks, 1 specimen, 6 July 1967; 8 July 1967.

Vulsella spongiarum (Lamarck)
Pointe Marianne, lagoon, in sponges in Cymodocea beds, 10 specimens, 22 July 1967.

PECTINACEA

Gloripallium pallium (Linnaeus)
East Point, lagoon, sublittoral 1 m, in branches of coral colony, 2 specimens, 19 July 1967; 10 July 1967.

Chlamys reticulatus (Reeve)
Recorded by Melvill (1909) from lagoon at 28 m.

Chlamys lemniscatus (Reeve)
West Island, lagoon; Cymodocea beds, byssate, on stems, 1 specimen, 23 July 1967.

Pedum spondyloideum (Gmelin)
East Point, lagoon, byssate, in crevices of massive Porites colonies, 4 specimens, 10 July 1967.

Plicatula chinensis Morch
North West Point, seaward, algal ridge, cemented beneath blocks, sublittoral fringe, 1 specimen, 21 July 1967.

Spondylus aurantius Lamarck
Carcasse, lagoon, sublittoral fringe, 1 m, cemented, 1 specimen, 9 July 1967.

LIMACEA

Lima fragilis (Gmelin)
North West Point, seaward, sublittoral fringe, *Cymodocea* beds, beneath loose block, 1 specimen, 21 July 1967.

Lima lima (Linnaeus)
East Point, lagoon, sublittoral, 1 m, byssate, in coral colony, 6 specimens, 10 July 1967; 19 July 1967. Carcasse, lagoon, sublittoral, 1 m, byssate, in crevices of *Favia* colony, 2 specimens, 9 July 1967.

OSTREACEA

Ostrea numisma Lamarck
North West Point, seaward, algal ridge, cemented beneath boulders, 2 specimens, 21 July 1967; *Cymodocea* beds beneath loose block, 1 specimen, 21 July 1967. Headland north of Point Thomas, seaward, mid-reef flat, cemented beneath block, 1 specimen, 13 July 1967.

CHAMACEA

Chama aspersa Reeve
East Point, seaward reef flat, cemented beneath dead coral blocks, 1 specimen, 8 July 1967; lagoon, cemented dead coral surface, 1 m, 1 specimen, 19 July 1967. West Island, lagoon, *Cymodocea* beds beneath loose blocks, 2 specimens, 23 July 1967. Headland, North of Point Thomas, seaward reef flat, cemented beneath loose blocks, 2 specimens, 13 July 1967. South Point, seaward, beneath blocks, 1 specimen, 11 July 1967. Barton Point, seaward reef flat. North West Point, seaward flats, algal ridge, cemented beneath blocks, 4 specimens, 21 July 1967; *Cymodocea* beds, 2 specimens, 21 July 1967.

Chama cf. *imbricata* Broderip
Carcasse, lagoon flats, cemented beneath coral colony, 1 m, 2 specimens, 9 July 1967.

LUCINACEA

Ctena divergens (Philippi)
Pointe Marianne, lagoon, *Cymodocea* beds, burrowing, 1 specimen, 22 July 1967.

Codakia tigerina (Linnaeus)
Pointe Marianne, lagoon, Cymodocea beds, burrowing, 1 specimen, 22 July 1967. Recorded by Melvill (1909) as Codakia exasperata Linnaeus from Barachois Maurice.

"Wallucina" sp.
Headland north of Point Thomas, seaward, beneath boulders, 1 specimen, 13 July 1967.

LEPTONACEA

"Erycina" sp.
North West Point, seaward, byssate, beneath loose blocks on algal ridge, 1 specimen, 21 July 1967. West Island, lagoon, Cymodocea beds, byssate, beneath loose blocks, 1 specimen, 23 July 1967. East Point, seaward, byssate, beneath loose blocks, 2 specimens, 6 July 1967.

CARDIACEA

Fragum fragum (Linnaeus)
East Point, lagoon, seaward, beach washed, in sand, juvenile, 6 July 1967.

Parvicardium sueziense (Issel)
East Point, lagoon, dead, 1 specimen.

TRIDACNACEA

Tridacna maxima (Röding)
Cust Point, lagoon, Cymodocea beds, byssate, sublittoral 1 m, 1 1/2 specimens, 14 July 1967. East Point, lagoon, on coral, byssate, sublittoral, 1 m, 2 specimens, 9 July 1967; 10 July 1967.

MACTRACEA

Atactodea glabrata (Gmelin)
Carcasse, lagoon, eulittoral, burrowing in sand amongst cobbles, 20+ specimens, 9 July 1967. Barachois Maurice, lagoon, in mud beneath cay rock, eulittoral, in beach, 1 specimen, 16 July 1967. East Point, lagoon, eulittoral, in beach, 2 specimens, 5 July 1967.

Ervilia bisculpta (Gould)
Carcasse, lagoon, in sand, 1 m, 2 specimens, 9 July 1967.

TELLINACEA

Asaphis violascens (Forskål)
Mamzelle Adélie, lagoon, eulittoral, beneath loose block of beach rock, 1 specimen, 17 July 1967. Recorded from Barachois

Maurice as *A. dellorata* (Linnaeus) by Melvill (1909).

Quidnipagus palatam Iredale
Barachois Maurice, lagoon, intertidal, base of beach at barachois entrance, 1 specimen, 15 July 1967; burrowing in mud with *Uca*, 6 specimens, 16 July 1967; burrowing in mud beneath cay rock overhang, 6 specimens, 16 July 1967. Recorded from Barachois by Melvill (1909) as *Tellina rugosa* Born.

Scutarcopagia scobinata (Linnaeus)
Headland north of Point Thomas, seaward, sublittoral fringe, burrowing in shallow sand pocket, 1 specimen, 13 July 1967.

Scissulina dispar (Conrad)
Barachois Maurice, burrowing in *Uca* mud, 6 specimens, 16 July 1967.

Leptomya rostrata Hanley
Barachois Maurice, burrowing in *Uca* flats, 5 specimens, 16 July 1967.

VENERACEA

Gafrarium pectinatum (Linnaeus)
Cust Point, lagoon, *Cymodocea* beds, 1 dead specimen, 14 July 1967. Barachois Maurice, lagoon, intertidal, in fine sand beneath cay rock, 6 specimens, 16 July 1967; base of beach at entrance, 20 specimens, 15 July 1967; in mud with crab *Uca*, 3 specimens, 16 July 1967. Recorded as *Crista pectinata* by Melvill (1909) from Barachois Maurice.

Gafrarium tumidum (Röding)
Recorded by Melvill (1909) as *Crista gibba* from Barachois Maurice.

GASTROCHAENACEA

Gastrochaena cuneiformis (Spengler)
East Point, lagoon, boring into *Favia* colony, 1 m, 1 specimen, 10 July 1967.

Gastrochaena mytiloides (Lamarck)
Carcasse, lagoon, boring into *Favia* colony, 1 m, 3 specimens, 9 July 1967.

MYACEA

Corbula sp. (cf. Plate 26, fig. E, Orr Maes 1967)
East Point, seaward, byssate beneath loose blocks.

Corbula modesta Hinds
Headland north of Point Thomas, seaward, byssate, beneath loose blocks, 1 specimen, 13 July 1967.

PHOLADACEA

Teredo sp.
Barton Point, dead valves from drift wood.

AMPHINEURA

Schizochiton incisus (Sowerby)
East Point, lagoon, off coral, sublittoral, 19 July 1967.

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11. LAND VEGETATION OF DIEGO GARCIA

D. R. Stoddart

The land vegetation of Diego Garcia consists almost entirely of coconut-dominated woodland, with some small areas of shrubs and occasional relict broadleaf trees. All parts of the atoll have been subject to continuous human interference for almost two hundred years, and man now actively controls vegetation growth in coconut plantations in many areas. Only the beach-crest vegetation, particularly on seaward beaches, is relatively unaltered in form and composition. In spite of this high degree of interference, however, many of the introduced species in the Diego Garcia flora are found at or close to present or former settlement sites, and large parts of the atoll have a much more restricted flora including many species which are presumably indigenous.

Description of the vegetation is made more difficult by the great length, variable width, and physiographic diversity of the land rim. The existence of environmental gradients, especially from seaward to lagoonward shores, and the scale of human interference have combined to form patterns in the vegetation, including zonations and mosaics. We first consider the distribution of vegetation in each of six main sectors of the atoll rim, plus the three lagoon-mouth islands, and then summarise the main types of vegetation present. A final section deals with the vegetation of the human settlements at East Point, Minni Minni, Pointe Marianne and elsewhere. This account is based on field notes made while collecting plants which were subsequently named by the Royal Botanic Gardens, Kew, and by Dr F. R. Fosberg; these determinations, which are used in this paper, are listed in the following chapter. Additional information on vegetation distribution has been obtained from the air photograph cover flown in 1967.

A. Regional description

1. Northeast Point

Physiographically the Northeast Point area consists of a seaward beach, channel beach, and lagoon beach, with a low dune field on the lagoonward half of the land rim and a low-lying flat area between the dune field and the seaward beach ridge. The beach crest vegetation round the entire point is dominated by a zone of *Scaevola taccada*, in

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in places replaced by Tournefortia argentea. On the seaward beach there are occasional specimens of Suriana maritima, and, on the landward side of the beach hedge, Guettarda speciosa. The dune area has been recently cleared and planted with coconut seedlings in circular depressions 2-3 m in diameter and up to 1 m deep. The dominant shrub is low and spindly Scaevola taccada, with, on the largely bare and scoured sand surface, Fimbristylis cymosa and Eragrostis tenella.

The low-lying seaward half of the land rim has a rather uneven surface covered with coconut woodland. The higher better-drained areas have a ground cover of Kalanchoe pinnata, Boerhavia repens, Cyperus dubius, Digitaria horizontalis and Eleusine indica. At slightly lower levels the Kalanchoe is replaced by the sedge Fimbristylis cymosa, and shallow pools in depressions are surrounded with the fern Thelypteris interrupta. The sedge Eleocharis geniculata grows in these pools in water a few inches deep. The common ferns Asplenium nidus and A. longissimum are found at higher levels in the Kalanchoe community, generally growing on the boles or fallen trunks of coconuts.

Further south, especially on the lagoon side, the coconut cover becomes less dense, and there are clumps of tall trees (Tournefortia argentea, Hernandia sonora) with Asplenium and Psilotum beneath.

2. Cust Point isthmus

At its narrowest the Cust Point isthmus is less than 45 m wide, and the seaward and lagoonward beach-crest communities are continuous across the land rim. Both are formed almost exclusively of Scaevola taccada, with occasional Tournefortia argentea and Suriana maritima on the seaward side. There are a few adventitious coconuts and Guettarda speciosa in the middle of the rim at its narrowest. Northward the land rim widens, the two beach-crest communities diverge, and the middle of the rim is covered with coconut woodland with many Hernandia trees and a ground cover of sedges, Kalanchoe and Passiflora. The ground is very damp, and fallen trees are thickly covered with ferns and creepers; one fallen tree was coated with the drab olive alga Lyngbya ceylanica (Myxophyceae). The lagoon beach crest, with its Scaevola hedge, is here topped by narrow dunes, with a pioneer vegetation of young Scaevola, Tournefortia and Calophyllum, and with mature Scaevola and Hernandia farther inland.

3. Minni Minni to East Point

The land rim in this sector consists of a zone of seaward dunes, a zone of dry sand, a zone of low-lying ground with standing water after rains, and a lagoon beach ridge. The seaward dunes are covered with a hedge of Scaevola taccada, with infrequent Suriana on its seaward, and Tournefortia and Guettarda on its landward, sides. The Scaevola belt is 30-50 m wide, with trees up to 6 m tall, and is much overgrown with Cassytha filiformis. The main part of the land rim is planted with coconuts with very variable undergrowth. On the higher dry areas on the seaward side this generally consists of low trees (Morinda citrifolia, Scaevola taccada, Pipturus argenteus) less than 6 m tall; where this tree layer has been cleared Kalanchoe is dominant. The lower wetter areas in the middle of the land rim are covered with sedges, the fern Asplenium longissimum, and tall Alocasia, mainly A. macrorrhiza but also A. plumbea. The dry sand area on the lagoon side is planted with coconuts in regular rows, with Morinda, Kalanchoe, and many introduced weeds. The lagoon shore has a fringe of Scaevola only 10 m wide (Suriana is absent and Tournefortia almost so), with, in places, very tall Calophyllum and more frequent Hernandia sonora. Near East Point settlement there are many juvenile Casuarina in the open coconut woodland.

4. East Point to Barachois Maurice

South of East Point the land rim vegetation is similar to that to the north, except (a) the seaward Scaevola hedge is lower and narrower, and (b) the lagoonward clumps of Calophyllum and Hernandia in the Scaevola hedge are replaced by Cordia subcordata, Hibiscus tiliaceus and Scaevola. The coconut woodland is lower, with less Morinda, and has an undergrowth of Kalanchoe and Rivina humilis. The small Barachois Carcasse has many young Casuarina round its edges, together with Cordia, and its margins and the surrounding marshy areas are covered with the sedge Cyperus ligularis.

5. Southeast rim

The Southeast rim is topographically more complex than other sectors of the Diego Garcia land rim, with the major lagoon indentations of Barachois Maurice and Barachois Sylvain and a more exposed seaward beach. The seaward beach-crest vegetation is again dominated by Scaevola taccada, but this is much lower than elsewhere (often less than 2 m) and it is often markedly wind-sheared. There are considerable stretches where Scaevola is replaced by Tournefortia argentea (e.g. immediately south of Horsburgh Point), which is unusual elsewhere round the atoll rim; and also patches of Suriana maritima, which is considerably affected by salt-spray and wind and in places is dead. The width of the Scaevola belt is very variable, and may reach 80 m. Inland from the seaward Scaevola hedge the vegetation consists of a mosaic of coconut woodland (mainly towards the lagoon) and pure stands of Scaevola and Suriana. The coconut woodland, except where actively cleared, has an intermediate tree storey with Guettarda and Morinda, and a ground cover of Kalanchoe, Ipomoea, sedges and grasses. The Scaevola and Suriana stands have a fairly uniform height of 3-4 m, and are patchily overgrown with Cassytha; the sand surface under these stands is largely bare, with trailing Cassytha, scattered clumps of Fimbristylis, and patches of a moss (Bryum sp.). The lagoon shore has a discontinuous fringe of Scaevola and some Suriana and Tournefortia, with a ground cover of Ipomoea and Paspalum distichum. The barachois themselves are unvegetated, except for patches of a sterile grass, probably Paspalum distichum, which are almost submerged at high water. Portulaca colonises the higher gravelly margins of the barachois on the landward side. Landward of the narrow Scaevola zone is coconut woodland with Guettarda: the littoral trees common elsewhere (Calophyllum, Cordia, Hibiscus) are not found along this shore.

6. West rim: southern sector

The southernmost sector of the west rim is flat-lying, with a narrow and low seaward beach ridge. The seaward hedge of Scaevola taccada is here invaded by "inland" species, with frequent Guettarda speciosa close to the shore, and even coconuts in places seaward of Scaevola where the beach is retreating. Tournefortia is found at the southernmost point, and northwards, in places replacing Scaevola.

The land area is dominated by coconuts, in places planted and with ground vegetation cleared, elsewhere forming dense thickets ("Cocos Bon-Dieu"). There is usually a shrub or small tree understorey up to 8 m tall, with Guettarda speciosa, Pipturus argenteus and Morinda citrifolia, and a ground layer of Rivina humilis, Kalanchoe pinnata, Achyranthes canescens, grasses, sedges, and Passiflora suberosa. One or two thickets of Scaevola taccada and Suriana maritima toward the lagoon shore are in the process of being cleared. The denser coconut thicket is quite difficult to penetrate: the fern Asplenium longissimum (Plate 41) is common in the damp undergrowth, together with fungi, particularly the large brown bracket fungus Trametes cingulata on tree trunks. The large and less common fern Asplenium macrophyllum is also found in deep shade in Tournefortia thickets. There are some tall broadleaf trees in addition to the coconuts, generally as scattered individuals and only rarely grouped together. They include large Ficus benghalensis near the occasional settlements, Hernandia sonora, and Ochrosia oppositifolia. Hernandia becomes more common further north, with trees reaching 30 m in height. Cordia subcordata and Calophyllum inophyllum are also seen inland, but are absent from the lagoon shore in this southern sector. The lagoon beach crest has an open hedge of Scaevola, Suriana and Tournefortia, generally only a single plant in width and very different to the tall, dense exclusive Scaevola hedge of the eastern lagoon shore. Small dry barachois have scattered low trees of Casuarina, Cordia and Hernandia.

7. West rim: central sector

Between Mamzelle Adélie and Pointe Marianne the land rim varies in width and topography. Immediately south of Pointe Marianne it consists of a seaward dune ridge, a flat zone of sand and cobbles, a low zone with standing water, and a narrow lagoon beach ridge. The dunes are covered with a community of pure Scaevola taccada, 150-200 m wide. The zone of high sand and cobbles supports coconut woodland with the undergrowth partially cleared. The low-tree storey in this woodland consists of Guettarda speciosa, Morinda citrifolia and Pipturus argenteus, and the ground cover of Achyranthes canescens, Rivina humilis, some Kalanchoe pinnata, and species of Asplenium. The lagoon beach has a thin growth of Suriana maritima and Scaevola.

As the land rim narrows southwards, Scaevola still tops the seaward ridge, but the coconuts are less numerous and the coconut woodland is in places replaced by an open woodland of Guettarda speciosa, with some tall trees (not shrubs) of Tournefortia argentea and a ground cover of Ipomoea macrantha, Passiflora suberosa and grasses. The lagoon shore along this sector is irregular in plan and lacks a well-developed beach ridge. Most of the headlands are marked by groves of tall Ficus, with a littoral vegetation of Cordia subcordata, Hernandia sonora and straggling Scaevola in the intervening bays.

8. West rim: northern sector

North of Pointe Marianne the land rim is fairly uniform in both topography and vegetation for about 8 km. The high seaward beach ridge is covered with a tall hedge of Scaevola taccada for this whole distance, with very occasional coconuts at the beach crest where retreat is taking place, and some Guettarda close to the shore. The lagoon beach has only a narrow zone of Scaevola, a single shrub wide, except close to Pointe Marianne, where the beach is higher, forms a bar enclosing standing water, and is covered with Scaevola, Tournefortia and Hernandia. The land vegetation in this sector consists of coconut plantation interspersed with medium-sized trees of Hernandia sonora and unusually abundant immature Casuarina. The low tree storey is largely absent, though there is some Morinda citrifolia; the ground cover consists of Kalanchoe pinnata, Achyranthes canescens, and grasses.

At the northwest point itself the land rim broadens to form a wide triangle of land which was only briefly investigated. A traverse was made due east from Simpson Point. The seaward beach-crest Scaevola zone is here succeeded inland by a zone of high coconut-dominated forest with a dense undergrowth of the ferns Asplenium nidus and A. longissimum. A large section of the centre of the rim is formed of low dunes, with an open vegetation of Scaevola, Casuarina, and some coconuts and Hernandia. Wedelia biflora is locally dominant, with a ground cover of Stachytarpheta jamaicensis and Euphorbia cyathophora. Traverses further south also showed a woodland of tall Hernandia and coconuts, with an undergrowth of Scaevola and Wedelia. Other ground plants in this area include Kalanchoe pinnata, Lippia nodiflora, Triumfetta procumbens, Aerva lanata and Psilotum nudum. Many of the trees, particularly tall Hernandia, are densely blanketed at heights up to 25 m by exceptionally luxuriant growths of Cassytha filiformis, and epiphytic vines of introduced Vanilla planifolia were seen on several coconut and Hernandia trees. The lagoon shore is dominated by a woodland of tall Casuarina, with many juveniles, and an undergrowth of Scaevola.

9. West, Middle and East Islands

All three islands at the mouth of the lagoon are covered with a dense woodland in which coconuts are present but not dominant. West Island, the smallest, has a beach crest hedge of Tournefortia and Scaevola, and a poorly developed woodland with some coconuts, Hernandia, immature Cordia, and a single Guettarda. The ground cover in the woodland consists of patches of the grass Stenotaphrum micranthum, forming a carpet 15-20 cm thick, together with Cyperus ligularis, Achyranthes canescens, Passiflora suberosa, Boerhavia repens and Sida parvifolia. There is one species of fern, Asplenium nidus, on coconut boles.

Middle Island is larger, with a shingle rampart enclosing a small lagoon on the south side. The shingle rampart is colonised mainly by Scaevola, together with Tournefortia, Guettarda and Suriana. On the seaward side of the island the beach-crest hedge is dominated by Tournefortia argentea, with subsidiary Scaevola. Tall broadleaf trees in the central woodland include Hernandia sonora, Cordia subcordata and Guettarda speciosa; wild Carica papaya is also present.

East Island is considerably larger than the other two. Its eastern half is covered with a belt of Scaevola taccada up to 5 m tall, with occasional Tournefortia, Guettarda and coconuts, and with small patches of sedges and grasses forming an outpost vegetation on the higher portions of the rock promenade. The western half of the island is covered either with coconut thicket, with an understory of Pipturus argenteus and Carica papaya 6-8 m tall, or with a tall dense woodland of massive Hernandia sonora. This Hernandia woodland has an understorey of Guettarda, and a ground cover of Rivina humilis, Asplenium nidus, Achyranthes canescens, Boerhavia repens, Passiflora suberosa, Stachytarpheta jamaicensis, Cyperus ligularis and Stenotaphrum micranthum.

Bourne (in Hemsley 1887, 334) noted the absence of coconut palms on all these islands.

10. Present and former settlements

(a) Minni Minni

The vegetation on the site of the former settlement at Minni Minni is dominated by tall broadleaf trees, notably a line of Calophyllum inophyllum along the shore; a double line of massive Ficus religiosa extending from the lagoon shore to what was presumably the old manager's office, with other Ficus scattered amongst the remains of buildings; and, most massive of all, Barringtonia asiatica, the mature trees being surrounded by saplings 3-4 m tall. Hernandia sonora is common, and coconuts are largely absent from the settlement area proper. Terminalia catappa is represented by several large trees. The dense canopy and dark foliage of these trees form a dark, damp environment for ground cover. Alocasia macrorhiza grows luxuriantly to heights of 3-4 m in and around the old building sites, with abundant ferns (Asplenium spp., Thelypteris opulenta) and a moss (Syrrhopodon revolutus) on tree boles, logs and masonry. The ground vegetation includes weeds (Euphorbia cyathophora, Stachytarpheta jamaicensis) and relics of cultivation (decoratives such as Haemanthus multiflorus, a conspicuous red-flowering lily, Asclepias curassavica, Hemigraphis alternata).

A number of common cultivated trees are absent at Minni Minni, particularly Artocarpus and Mangifera, the decorative shrub Hibiscus, and also Casuarina. The first three may have been introduced to the atoll after the Minni Minni settlement had been abandoned.

The clump of trees south of Minni Minni, marked on charts as Minni Minni Knob, near the lagoon shore, consists of tall Calophyllum and Hernandia trees, and may be a former settlement site.

(b) East Point

The vegetation at the present main settlement at East Point is floristically the most diverse on the atoll. Many of the species are clearly deliberate introductions, and are found only in gardens under cultivation. Thus the manager's garden includes such trees as Albizia lebbeck, the Norfolk Island pine Araucaria columnaris (one tree only), Averrhoa bilimbi, Eugenia javanica, the kapok Ceiba pentandra, and the exotic palms Phoenix sp. and Hyphaene sp. There is an introduced bamboo Bambusa vulgaris. Introduced decoratives found planted round houses and along roadsides in the village include Asclepias curassavica, Catharanthus roseus, Crinum latifolium, Haemanthus multiflorus, Hibiscus rosa-sinensis, Hymenocallis littoralis, Pentas lanceolata, Pithecellobium dulce, and Zephyranthes rosea; Bidens sulphurea is also growing in the small cemetery. Species introduced for economic reasons (including food plants) include cotton Gossypium hirsutum, banana Musa sp., a mint Mentha sp., the taros Alocasia macrorrhiza and A. plumbea, and limes and oranges, Citrus spp. A number of vegetables, including eggplant and lettuce, are under cultivation. Massive trees of Ficus benghalensis are found to the north of the settlement, and tall Casuarina in the quadrangle between the manager's house and the jetty.

Many weedy species are found at and near East Point, some of which (such as Ipomoea pes-caprae and I. macrantha) may be indigenous, though rare elsewhere on Diego Garcia, whereas others are certainly introduced (Mimosa pudica, for example, is found only at the head of the East Point jetty). Common weeds include Achyranthes canescens, Boerhavia repens, Cassia occidentalis, Spermacoce suffrutescens, Euphorbia cyathophora, Hippobroma longiflora, Mikania micrantha, Passiflora suberosa, Sida parvifolia, Stachytarpheta jamaicensis, Striga asiatica, Tridax procumbens, Triumfetta procumbens and Vernonia cinerea. Pathways are lined with sedges and grasses, some of which have not been recorded elsewhere on the atoll (Cyperus compressus, Cyperus dubius, Cyperus ligularis, Cyperus sphacelatus, Eleusine indica, Fimbristylis cymosa, Paspalum distichum, Stenotaphrum dimidiatum).

In 1885 Bourne (in Hemsley 1887, 334) found "bananas, sweet potatoes, bitter oranges, citrons and a few other tropical fruits. ... Maize is cultivated at Minny Minny." Bourne also collected Capsicum frutescens (Hemsley 1887, 339).

(c) Pointe Marianne

The settlement at Pointe Marianne is located on a lagoon beach ridge which encloses a wide area of standing fresh water, with dead and decapitated coconuts and Casuarina. The water contains a pondweed Bacopa monnieri, and the drying margins are being colonised by Paspalum disticum (?). The landward margins of the pool are covered with tall Casuarina and coconuts.

The lagoon beach at the settlement is fringed with massive trees of Calophyllum inophyllum, Hibiscus tiliaceus and Cordia subcordata, with Scaevola shrubs appearing only to the north and south. Between the houses of the settlement there are massive buttressed trees of Hernandia and Calophyllum, three tall trees of Artocarpus altilis, numerous Carica papaya, and some Musa sp., Terminalia catappa, and Mangifera indica. The ground cover consists of Wedelia biflora, Stachytarpheta jamaicensis, Euphorbia cyathophora, Hippobroma longiflora and Ageratum conyzoides. Near the manager's house there is a clump of sterile Pandanus, two trees of Leucaena leucocephala, and such flowering plants as Sida acuta, Pentas lanceolata and Ocimum gratissimum. Catharanthus roseus and Zephyranthes rosa are planted as decoratives round the houses. There is a long-disused cemetery south of Pointe Marianne, with tall Ficus and a number of relict cultivated plants, including Codiaeum variegatum.

B. Vegetation types

Wiehe (1939), in his general account of the Chagos atolls, discusses the vegetation in terms of (a) beach vegetation, (b) coconut groves, and (c) marshes. The following classification of the vegetation of Diego Garcia into eight categories is proposed largely as a means of organising the available information. The atoll land rim is so long and narrow, and the mosaic of vegetation types so intricate, that it must be regarded as highly approximate. The distribution of the main vegetation types has been mapped from air photographs in Figure 31, but though the photographs are of exceptional quality the small scale of the map means that it too is very generalised. Some comparisons are drawn in the following account with the vegetation of the other Chagos atolls, particularly Salomon and Peros Banhos, and of the southern Maldives.

1. Shoreline vegetation

(a) Scrub community of seaward beach

The scrub community of the seaward beach forms the most continuous and widespread vegetation unit on the atoll. Scaevola taccada forms a beach-crest hedge along almost the entire seaward coast (about 64 km) (Plate 5). Along the east coast, overlooking a wide beach, the Scaevola is tall (up to 6 m high) and bushy, forming a zone up to 50 m wide. Along the southeast, windward coast the Scaevola is much lower, wind-trimmed, and in places replaced by Tournefortia argentea. Along the west coast the Scaevola is again bushy, but in places the inland vegetation extends almost to the beach, especially in the south. Tournefortia argentea and Suriana maritima (Plate 35) occasionally replace Scaevola as the dominant species, and scattered bushes of Suriana are in places found to seaward of a continuous Scaevola hedge. On the inland side trees of Guettarda speciosa and Cocos nucifera are frequently found along the margin of or within the Scaevola belt.

Pemphis acidula has not been collected at Diego Garcia, though Wiehe (1939, 11) states that it is of more frequent occurrence than Suriana; Sophora tomentosa is likewise apparently absent, though both species are recorded from Addu Atoll, southern Maldives. No native Pandanus is found on Diego Garcia beaches, nor is the genus recorded from the Chagos Archipelago though present in the Maldives. A pioneer strand vegetation of vines, herbs and grasses is notably absent from seaward beaches of Diego Garcia: shrubs of Scaevola and associated species invariably form the outermost vegetation on Diego Garcia seaward shores.

(b) Lagoon-shore Scaevola community

Scaevola taccada is also the most widespread species on lagoon shores. It is dominant on the lagoon beach between Eclipse Point and Pointe Marianne, though forming only a narrow zone; from Pointe Marianne to Barachois Maurice, though limited over much of this tract by barachois development inland from the coast and the presence of a rock platform beneath a thin superficial cover of sand; and from Cust Point to Observatory Point, where the growth is more luxuriant on dune sands. Generally the plants are less bushy and more open in growth-form than on the seaward shore, and the zone may be only a few meters (a single plant) in width. Tournefortia occasionally replaces Scaevola, but Suriana is only found in place of Scaevola at the mouths of barachois, where it takes the place that Pemphis might be expected to occupy were it present. Coconuts crowd close to the lagoon beach. Where the Scaevola is more open there is a ground vegetation of grasses and sedges, but such vegetation is sparse and Ipomoea is almost completely absent.

(c) Lagoon-shore Calophyllum-Barringtonia community

Large shoreline trees of Calophyllum inophyllum and Barringtonia asiatica, with massive branches extending horizontally over the water and lower trunks and roots washed by waves, are common only on the lagoon shore between Cust Point and East Point, especially around Minni Minni. A few are found at Pointe Marianne and near Eclipse Point, but otherwise they are confined to a lee shore. The beach here is narrow, steep and cliffed, held up by tree roots. Consequently there is no pioneer strand vegetation. Of the two common species, Calophyllum is more numerous though less massive than Barringtonia.

(d) Lagoon-shore mixed woodland

A lagoon shore woodland of Cordia subcordata, Guettarda speciosa and Hibiscus tiliaceus is uncommon on Diego Garcia, being restricted to the shore between East Point and Barachois Maurice and again south of Pointe Marianne, where it is interspersed with Scaevola. H. tiliaceus is quite common though Hemsley (1887, 336) stated that this species was absent from Diego Garcia.

(e) Dune scrub communities

Where the shoreline is backed by low dunes, either on the seaward or lagoon coasts, shrubby species are dominant. These old dune tracts may be extensive on the inland parts of the land rim, as between Northwest Point and Barton Point, and along most of the southeast coast of the atoll. Scaevola taccada is the most common shrub species, reaching a maximum height on the southeast rim of 5-8 m, and with a much more open growth-form on the coast. Other species locally dominant are Suriana maritima and Wedelia biflora. The sand surface under the shrubs is generally bare, with clumps of Fimbristylis cymosa, round which sand may be eroding, some Portulaca, and grasses. On the southeast rim this zone may reach a width of almost 1 km. Parts of the dune scrub here and near Barton Point and Eclipse Point have been cleared for coconuts.

2. Broadleaf woodland

Before the spread of planted coconuts, broadleaf woodland must have been much more extensive at Diego Garcia than now, but few remnants of this woodland now remain. La Fontaine in 1770 is said to have found a vegetation of "fatamaka [sic, Calophyllum inophyllum], bois blanc bon pour pirogues [Hernandia sonora?], bois à brûler [Pemphis acidula?]" (Unienville 1838, 182). Hemsley (1887, 333) quotes Findlay's (1870, 459) general statement concerning the Chagos: "On nearly every part of these islands there grow at intervals great clumps of gigantic trees, the Bois Mapou or Rose Tree, which attains an enormous size and height, even to 200 feet [60 m]. Their fallen and decayed trunks form a large portion of the vegetable world of the Archipelago". Bourne (1886, 387) suggests that the large tree is Pisonia inermis, and Hemsley (1887, 335-336) either Pisonia or Afzelia (=Intsia) bijuga.

Apart from exceptionally large nearshore Calophyllum inophyllum and Barringtonia asiatica, and occasional Ficus benghalensis at settlements, the only common large tree now present on Diego Garcia is Hernandia sonora. In places, for example on the southern part of the west rim, this forms an open Hernandia woodland, elsewhere a mixed Hernandia-coconut woodland (Plate 36). Bourne (1886, 386) noted that Hernandia was "common, and may attain a considerable size; the natives use an infusion of the flowers as a medicine in gonorrheal complaints". Wiehe (1939) found Hernandia to be common and sometimes dominant.

Other species which may in the past have composed a native broadleaf woodland are now rare or apparently absent. These include Intsia bijuga, Ochrosia oppositifolia, Pisonia grandis, and Cerbera odollam. Wiehe (1939, 13) described a forest of Intsia bijuga on Salomon Atoll, which was cut down in 1825; the largest tree had a trunk diameter of 2.8 m. Bourne (1886, 387) found "a single group of larger trees confined to a single spot on the northeast of the main island" on Diego Garcia, and Hemsley (1887, 336) states that there were then only four or five trees left. Because of depredation by rats, Bourne doubted that the species was replacing itself. Rhyne collected Intsia at East Point in 1967, but otherwise it was not seen. Ochrosia oppositifolia was recorded without comment (as O. borbonica) by Hemsley (1887, 1919) and Willis and Gardiner (1930) at Diego Garcia. A single tree was seen at the southern end of the west rim in 1967, height 12 m. Pisonia inermis (P. grandis) was recorded at Diego Garcia by Bourne (Hemsley 1887, 1919) and Willis and Gardiner (1930); and was noted in the Chagos generally by Wiehe (1939) as "a common tree, sometimes reaching heights of over 125 feet [38 m]". A single tree was seen on the atoll in 1967, on the seaward shore on the west rim, opposite Mamzelle Adélie. Wiehe (1939, 14) also noted Cerbera odollam as "a common tree in all the islands", but it has apparently not been specifically recorded from Diego Garcia and was not seen there in 1967.

Wiehe also mentions Guettarda speciosa and Thespesia populnea as common smaller trees, particularly near the shore, with the latter forming a dense thicket at the northwest point. This may be an error (? for Hibiscus tiliaceus) for the species has not otherwise been recorded from Diego Garcia, and was not found in 1967.

3. Coconut woodland

Cocos nucifera is clearly the dominant tree species in the land vegetation of Diego Garcia, and has been so since at least the middle of the seventeenth century (Horsburgh 1809, 131; Unieville 1838). Though at present coconut plantations are actively maintained near East Point and Pointe Marianne, coconut thicket with greater or lesser amounts of low trees and ground vegetation covers most of the atoll. Sauer (1967, 42-49) has argued from historical evidence and from propensity of Indian Ocean coconut palms to volunteer from drift nuts that the species is indigenous in the western Indian Ocean islands, and may have spread from there eastwards into the Pacific. At Diego Garcia, germinating drift seeds are particularly common on the lagoon shores of the northern islets, especially Middle Island, but are rare elsewhere; however, it is these islands which alone on the atoll had no coconuts at the time of Bourne's visit in 1885. Without further historical evidence we can say little on the antiquity of coconuts on Diego Garcia, though it is probable that if they were introduced they were brought by pre-European sailors, a conclusion which applies to Cocos-Keeling, the rest of the Chagos, and other Indian Ocean reef islands.

Three types of coconut woodland can be distinguished on Diego Garcia:

(a) Coconut plantation

Intensively managed coconut plantations are found between East Point and Minni Minni, at Pointe Marianne, and southwest of Barachois Maurice (Plate 37). In these plantations the coconuts are planted in regular rows and the ground vegetation is usually not more than 0.5 m tall, though taller shrubs may grow between periods of clearing. Kalanchoe pinnata is one of the taller plants beneath the coconuts, replacing on Diego Garcia the Polynesian arrowroot Tacca leontopetaloides which is found in the Maldives and on many Pacific atolls. Kalanchoe is also recorded from Addu Atoll, southern Maldives, where, however, it is not common. Other widespread species in the ground layer include Achyranthes canescens, Rivina humilis, Passiflora suberosa, and the ferns Asplenium nidus and A. longissimum. On more open ground two small inconspicuous herbs are extremely common but may be overlooked: Pilea microphylla and Phyllanthus amarus. Striga asiatica is also common, especially on the east rim, where it grows to a height of 15 cm, compared with less than 5 cm on the drier atolls of the southwest Indian Ocean. The composition of the ground layer is rather restricted by comparison with similar habitats on other atolls: notably absent are certain members of the Euphorbiaceae such as Euphorbia chamissonis and E. atoto, common in other parts of the world. Epiphytes including ferns, Psilotum nudum and certain mosses are common, though less so in the more actively managed plantations, and the numerous piles of coconut husks, as well as tree trunks, are colonised by the moss Calymperes garciae.

(b) "Cocos Bon-Dieu"

More widespread than the managed plantations is a coconut woodland in which the coconuts themselves are irregularly distributed and largely self-sown, with intermediate storeys of small trees and tall shrubs 6-8 m tall and a luxuriant ground layer (Plate 38). In order of abundance the small tree layer consists of Morinda citrifolia, Pipturus argenteus, Guettarda speciosa and Scaevola taccada. Wiehe (1939) mentions Pipturus species as being common at Diego Garcia, and Premna obtusifolia as being present, though the latter was not collected in 1967. Examples of this woodland are found north of East Point, southwest of Barachois Maurice, and between Barachois Maurice and Carcasse. It is well developed between Barachois Sylvain and Mamzelle Adelie. The ground cover under Cocos Bon-Dieu consists of the species mentioned in the previous paragraph, except that Kalanchoe pinnata is absent.

(c) Mixed Coconut Woodland

Open coconut woodland is found in a few places mixed with Hernandia sonora and with a ground vegetation similar to that in actively managed coconut plantations. In places, as between Pointe Marianne and Mamzelle Adelie, a mixed woodland of coconuts with Guettarda speciosa and even trees of Tournefortia argentea is found. Tree density in such mixed woodland is generally low: there is no closed canopy and the vegetation is more open and park-like.

4. Casuarina Woodland

The status of Casuarina in the western Indian Ocean is uncertain. Often introduced in recent times, there is uncertain historical evidence for its pre-European occurrence on the Seychelles and Mascarene Islands, and Sauer (1967) considers it aboriginal in the former. It was first recorded from Diego Garcia by Bourne (1886, 386), who found "several clumps ... on the east side of the island ... [which] form conspicuous landmarks". Except at East Point, mature Casuarina is uncommon on the eastern rim today, though juveniles are common on Carcasse. The species is concentrated on the lagoon shore of the west rim, particularly from Pointe Marianne northwards (Plate 40), with juveniles invading coconut woodland. An extensive grove of pure Casuarina is found 1 km south of Eclipse Point on the lagoon shore, and the largest areas are near the seaward shore southwest of Eclipse Point.

5. Inland Marsh

At certain points on the land rim there is a depression between the lagoon and seaward ridges low enough to contain standing water or at least waterlogged soil. Near East Point, such depressions have a vegetation dominated by tall Alocasia macrorrhiza (Plate 42), the fern Asplenium longissimum, and sedges, but Alocasia is absent elsewhere on the land rim. Asplenium longissimum is common throughout the atoll in such situations. At the northeast point Thelypteris interrupta is found at the edge of standing water, and the sedge Eleocharis geniculata grows in the shallow water.

6. Barachois vegetation

The most striking feature of the barachois vegetation is its absence: no mangroves or associated species such as Acrostichum aureum are found on Diego Garcia, and in this respect the Chagos as a whole may be compared with the mangrove-free Tuamotus in the eastern Pacific. Mangroves are also absent from Cocos-Keeling Atoll in the eastern Indian Ocean, which in other respects also resembles Diego Garcia.

Six species of mangroves have been recorded from the Maldive Islands, of which only three are known from the southernmost atoll, Addu. These are (Fosberg 1957, Fosberg, Groves and Sigee 1966):

Sonneratia acida	L.	Malé, Miladumadulu, Addu
Bruguiera cylindrica	(L.) Bl.	Malé, Goifurfehendu, Kolumadulu, Miladumadulu
Bruguiera gymnorhiza	Lam.	Addu
Rhizophora mucronata	Lam.	Suvadiva, Addu
Lumnitzera littorea	(Jack.)Voight	Malé
Lumnitzera racemosa	Willd.	Suvadiva

The mangrove-associated leather fern Acrostichum aureum has not been recorded from the Maldives. At Addu Atoll, none of the three recorded mangrove species form a woodland or "swamp," at least in the areas visited in 1964, and all are inconspicuous or rare.

Three mangrove species are recorded from the Chagos Archipelago, of which one is introduced. The two native species are Sonneratia acida L. (Ile Moresby, Peros Banhos) and Xylocarpus moluccensis (Lam.) Roemer, the latter an exclusive dominant in the marsh at Ile Boddam, Salomon Atoll (Wiehe 1939). Wiehe also noted the introduction of Rhizophora mucronata from Mauritius to Ile Boddam, Salomon, in 1935, but there is no information on the present status of this species.

This paucity in mangroves on atolls of the eastern and central Indian Ocean contrasts with their considerable development on atolls of the western Indian Ocean, for example in the high mangrove woodland at Aldabra Atoll, where eight species of mangroves are recorded. While the regional problem of absence of mangroves must result from ocean-wide dispersal patterns, it is likely that, at Diego Garcia itself, mangrove colonisation on lagoon shores and especially in barachois would have been limited by the elevation of the barachois floor, considerable tidal range, and distance from open water: even in mangrove areas such tracts are often either bare or sparsely colonised by Lumnitzera.

In the absence of mangroves, the barachois are relatively unvegetated. The sandy and muddy areas are devoid of vegetation except in patches which reach the approximate level of high spring tides. These are colonised by a wiry sterile grass (probably Paspalum distichum) and no other plants (Plates 12-15). In some of the barachois, especially at Mamzelle Adélie, these vegetated patches are more extensive and have the appearance, intersected by a branching creek system, of a salt marsh. Salt-marsh species, including primary colonisers, such as Arthrocnemum, are, however, absent. Most of the barachois are surrounded by rock ledges, again almost unvegetated except for patches of Portulaca. The transition to terrestrial vegetation, by a hedge of Scaevola, Suriana or Tournefortia, is usually sharp. Macroscopic algae are rare in the barachois, though a Schizothrix-like alga forms pink crusts on the higher areas, and another forms stromatolithic mounds at intermediate levels.

7. Settlement vegetation

Apart from the larger settlements at Pointe Marianne, Minni Minni, and particularly at East Point, there are numerous isolated houses round the atoll rim, which probably mark the centres of former land holdings. These are characteristically marked by one or two tall trees of Ficus benghalensis, often Terminalia catappa, and frequently a number of Carica papaya and Musa sp. Weeds such as Stachytarpheta, decorative plants, and food plants are also found near the houses.

Massive trees of Ficus benghalensis are found at all three main settlements, but particularly at Minni Minni (Plate 46). East Point and Pointe Marianne also have a number of introduced decorative and food species, some of great size, including Artocarpus altilis, Mangifera indica, Terminalia catappa, Albizia lebbeck, Averrhoa bilimbi, Ceiba pentandra, Eugenia javanica and Araucaria columnaris. Cultivated decoratives include Catharanthus roseus, Hibiscus rosa-sinensis, and several lilies (Crinum sp., Haemanthus multiflorus, Hymenocallis littoralis, Zephyranthes rosea). Gossypium hirsutum is common at East Point but has not spread elsewhere, and the taros, Alocasia species, are also so restricted.

Many weedy species are restricted to East Point, clearly their point of introduction, or, if found elsewhere on the atoll, are especially abundant at settlements. Several have been noted in Section A.10 and will not be repeated here. It is of interest that most of these species were apparently absent in the collections made by Hume (Hemsley 1884) and Bourne (Hemsley 1887), and though these were admittedly incomplete it is probable that many introduced species were not present eighty years ago. Wiehe (1939), however, records many exotics, and the 1967 collections added about thirty new records. These are documented in the list by Fosberg and Bullock in Chapter 12. In spite of the continual human interference with the vegetation of the atoll, it is remarkable that many of the introduced species are still so localised.

C. Summary

In summary, the most striking features of the vegetation of Diego Garcia are as follows:

1. The dominance of Scaevola taccada on both seaward and lagoon coasts, especially on the former. Tournefortia and Suriana are also present, but not Pemphis.

2. The dominance of coconut woodland inland, either in the form of actively managed and cleared plantations with a ground cover of Kalanchoe pinnata (but no Tacca), herbs and grasses, or a more irregular, denser woodland ("Cocos Bon-Dieu") of coconuts with a small layer of Guettarda, Morinda, Pipturus and Scaevola.

3. The widespread distribution of *Hernandia sonora* among the indigenous broadleaf trees, and the rarity of other species.

4. The limited distribution of very large littoral trees such as *Calophyllum* and *Barringtonia*.

5. The presence of massive trees of *Ficus benghalensis* and other cultivated trees at settlements.

6. The absence of *Pandanus*, except for two cultivated individuals.

7. The luxuriance of the fern flora (six species, dominated by *Asplenium longissimum* and *A. nidus*), of the bryophytes (especially *Calymperes garciae* on tree trunks and coconut husks), and to a lesser extent of the fungi, both on the ground and on rotting logs.

8. The absence of mangroves and associated vegetation.

9. The large number of recently introduced species, mainly at East Point, contrasting with the simplicity of the vegetation and restricted flora over most of the atoll.

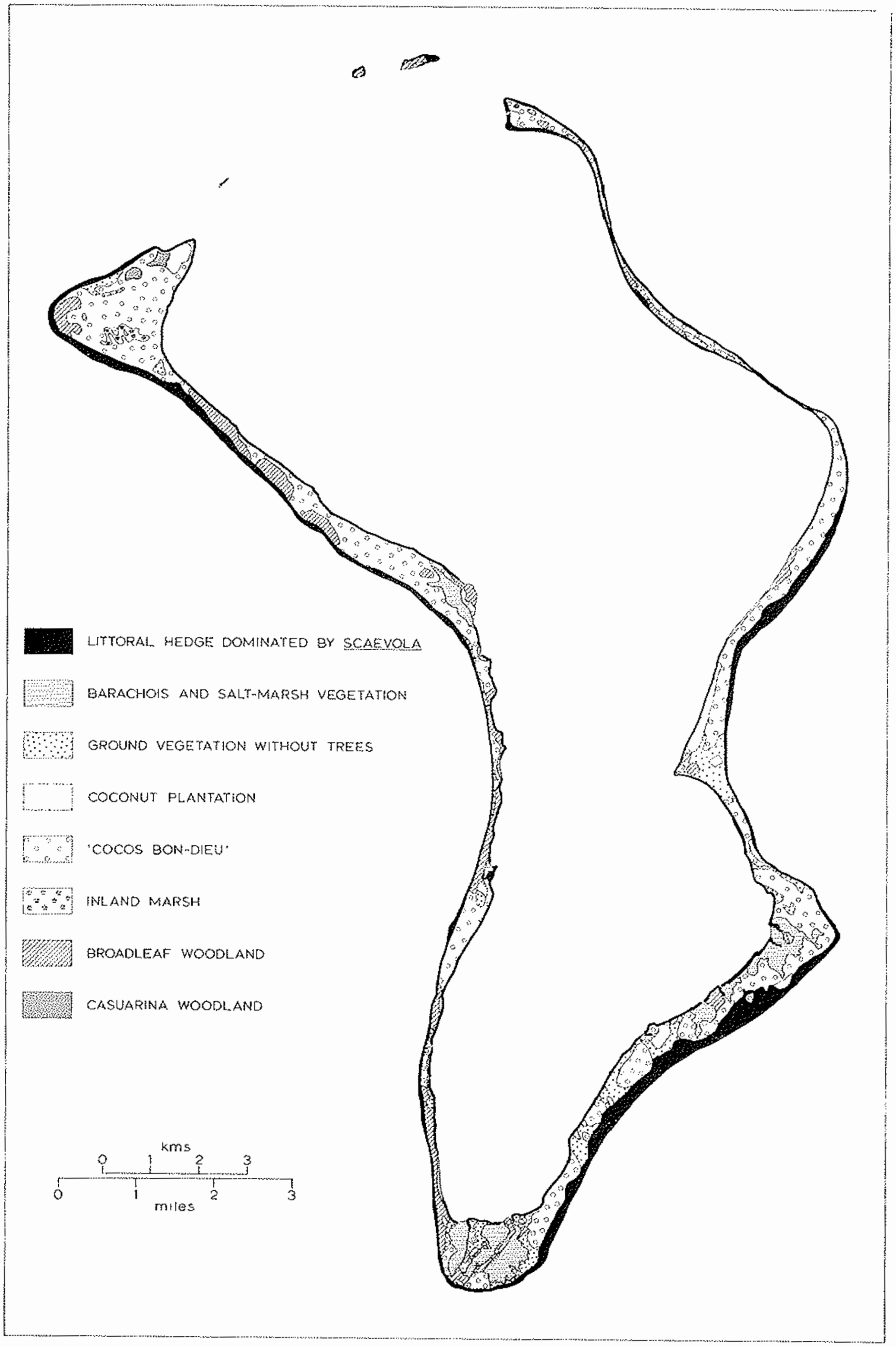
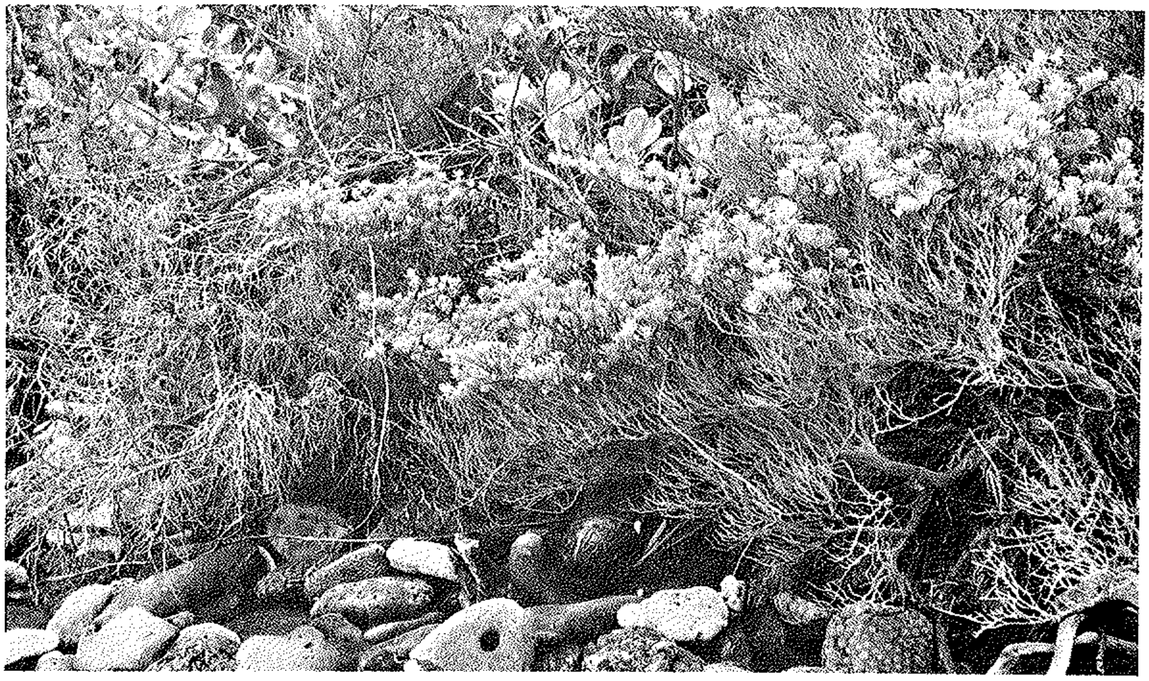
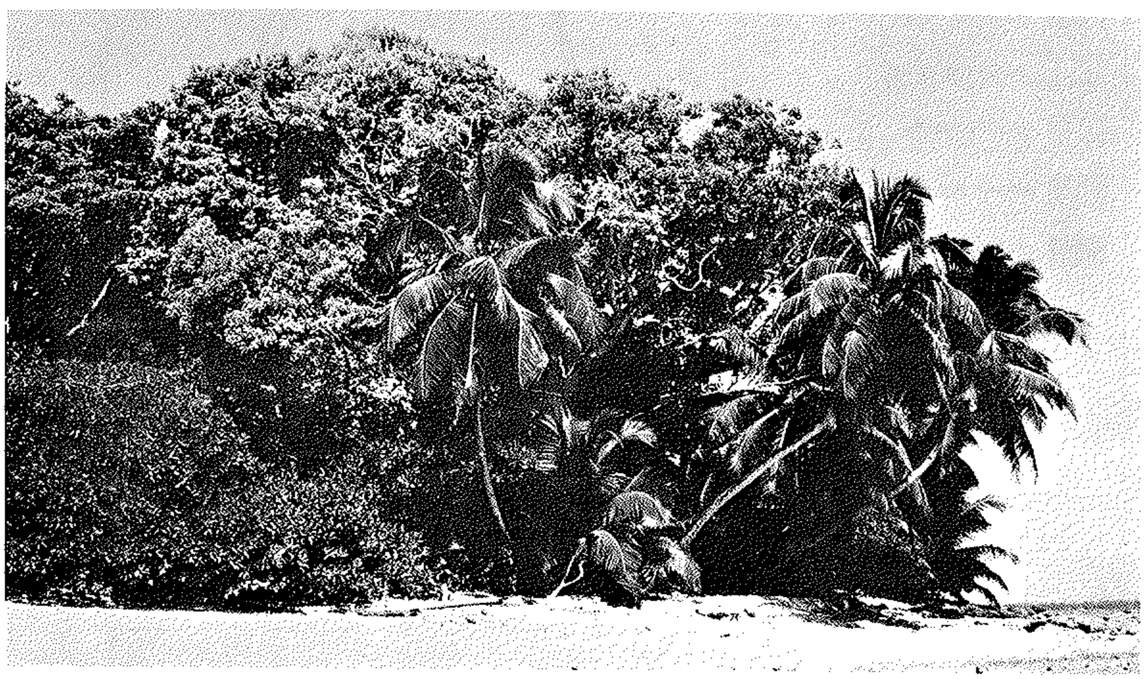


Fig. 31. Distribution of vegetation. Based largely on air photographs made available by the Ministry of Defence.



35. Suriana maritima largely killed by wave-spray in coastal scrub on the beach crest, southeast coast northeast of Barachois Sylvain

36. Broadleaf woodland of Hernandia, with coconuts and Scaevola scrub, northwest coast of East Island



37. Well-managed coconut plantations, southeast rim, southwest of Barachois Maurice

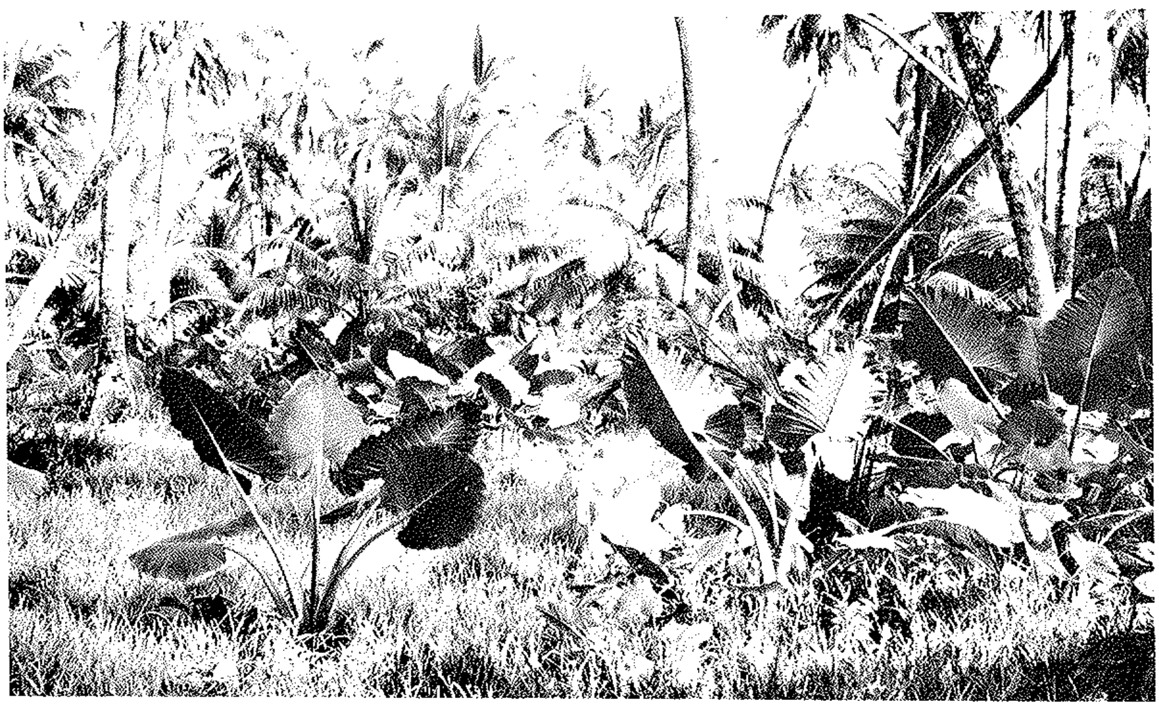
38. "Cocos Bon-Dieu" with Pipturus and other undergrowth species between Carcasse and Horsburgh Point

39. Germinating beach-drift coconuts on the southern beach ridge of Middle Island

40. <u>Casuarina</u> woodland on the lagoon coast south of Eclipse Point

41. Asplenium longissimum in dense woodland, western rim between Barachois Sylvain and Mamzelle Adélie

42. Alocasia species growing on low-lying ground in coconut woodland, centre of the east rim, north of East Point



12. LIST OF DIEGO GARCIA VASCULAR PLANTS

F.R. Fosberg and A.A. Bullock

This list does not pretend to be more than an account of the specimens from Diego Garcia Atoll examined by the authors, plus records from the Willis and Gardiner (1931) list, for those species of which they have seen no Diego Garcia specimens. Those from other Chagos atolls, or indicated by Willis and Gardiner as from all islands, or the whole group, without specific Diego Garcia records, have not been included. Except in one or two cases where very recent changes have been made, synonymy has not been included, though frequently earlier published records have been under names not accepted here.

It is planned that such taxonomic and nomenclatural details will be elaborated in a flora of the western Indian Ocean atolls that is being prepared.

A small collection of plant specimens made by Mr. Jack Frazier in 1970 has not been included, as the material is not yet available for determination. These specimens will also be cited in the flora mentioned above.

Fosberg accepts responsibility for the plant names used, as Bullock has not had an opportunity to see the list in its final form.

The symbols US, K and MAU in the specimen citations indicate the herbaria where the specimens are deposited, the U.S. National Herbarium, that of Kew Gardens, and that of the Sugar Research Institute, Mauritius, respectively.

PSILOTACEAE

Psilotum Sw.

Psilotum nudum (L.) Beauv.
East Point, Stoddart 791 (K); near ocean side at North-West Point, Rhyne 432 (US); East Point village near ocean, Rhyne 679 (US); s.l. Morin in 1939 (MAU); Wiehe in 1939 (MAU).

Atoll Research Bulletin No. 149: 143-160, 1971.

POLYPODIACEAE

Asplenium L.

Asplenium longissimum Bl.
East Point Settlement, Stoddart 767 (K); between Observation Point and Barton Point, Stoddart 799 (K); West Rim, Southern Point, Stoddart 851 (K); near ocean side at North-West Point, Rhyne 429 (US); East Point village, ocean side, Rhyne 671 (US). Chemin Long, Wiehe in 1939 (MAU); Carcasse, Wiehe 1617 (MAU).

Asplenium macrophyllum Sw.
s. l. Bourne 7 (K); West rim, south end, Stoddart 850 (K); ocean side North-West Point, Rhyne 436 (US); Chemin Long, Wiehe in 1939 (MAU); Carcasse, Wiehe in 1939 (MAU); Pointe Noroit, Wiehe 1621 (MAU).

Asplenium nidus L.
Between Observatory Point and Barton Point, Stoddart 796 (K); East Island, Stoddart 882 (K); West Island, Stoddart 867 (K); near ocean side at North-West Point, Rhyne 430 (US); Carcasse, Wiehe 1618 (MAU).

Asplenium tenerum Forst. (A. aequabile Baker)
S. l. Lady Barkly 6 (K, type of A. aequabile).

Pteris L.

Pteris tripartita Sw.
Carcasse, Wiehe in 1939 (MAU), Wiehe 1619 (MAU).

Pteris biaurita L. (sens. lat.)
Carcasse, Wiehe 1620 (MAU) (a large very open frond, broadly ovate, lobes well-separated, stipes with linear scales below).

Thelypteris Schmid.

Thelypteris opulenta (Kaulf.) Fosb.
Minni Minni, Stoddart 832 (K); ocean side at North-West Point, Rhyne 434 (US); East Point village vicinity ocean side, Rhyne 670 (US) (possibly this, but immature).

Thelypteris interrupta (Willd.) Iwatsuki (Dryopteris goggilodus (Schkuhr) O. Ktze.).
Between Observatory Point and Barton Point, Stoddart 801 (K); Pointe Noroit, Wiehe in 1939 (MAU).

ARAUCARIACEAE

Araucaria Juss.

Araucaria columnaris (Forst. f.) Hook.?
East Point Settlement, one tree in garden, Stoddart 837 (K, US); East Point village, Rhyne 689 (US).

PANDANACEAE

Pandanus L.

Pandanus sp.
Point Marianne, Rhyne 778 (US) (sterile).

POTAMOGETONACEAE

Thalassodendron den Hart.

Thalassodendron ciliatum (Forsk.) den Hart. (*Cymodocea ciliata* Ehrenb. ex Aschers.)
1-1/4 mi. south of Leconte Point, on lagoon side, Rhyne 735 (US); lagoon side near North-West Point, Rhyne 385 (US); ocean side near North-West Point, Rhyne 354 (US); southernmost end of lagoon, Rhyne 590 (US).

GRAMINEAE

Bambusa Schreb.

Bambusa vulgaris Wendl.
East Point, cult., Stoddart 888 (K).

Digitaria Fabr.

Digitaria horizontalis Willd.
Between Observatory Point and Barton Point, Stoddart 797 (K); West rim of atoll, South end, Stoddart 846 (K, US).

Digitaria timorensis (Kunth) Bal.?
Minni Minni, Wiehe in 1939 (MAU).

Eleusine Gaertn.

Eleusine indica (L.) Gaertn.
Between Observatory Point and Barton Point, Stoddart 806 (K, US); East Point village, cemetery, Rhyne 678 (US).

Eragrostis Host.

Eragrostis tenella var. *insularis* Hubb.
Between Observatory Point and Barton Point, Stoddart 798 (K, US); Stoddart 803 (K).

Lepturus R. Br.

Lepturus repens R. Br.
S. l., Wiehe in 1939 (MAU).

Paspalum L.

Paspalum distichum L.
East Point village vicinity, Rhyne 608 (US) (sterile); near

Dumoulon and Barachois Sylvain, Wiehe in 1939 (MAU). (With very short thick spikes).

Pennisetum Rich.

Pennisetum polystachion (L.) Schult.
North-West Point, Stoddart 856 (K, US); Pointe Marianne, Wiehe 1623 (MAU).

Stenotaphrum Trin.

Stenotaphrum dimidiatum (L.) Brongn.
East Point Settlement, Stoddart 818 (K, US); East Point village vicinity, Rhyne 609 (US) ? (sterile).

Stenotaphrum micranthum (Desv.) C. E. Hubb.
East Island, Stoddart 876 (K, US); West Island, Stoddart 869 (K, US). S. l., Wiehe in 1939 (MAU).

Zea L.

Zea mays L.
Minni Minni, cultivated, recorded by Bourne (Hemsley 1884, p. 334).

CYPERACEAE

Cyperus L.

Cyperus compressus L.
East Point Settlement, Stoddart 820b (K).

Cyperus dubius Rottb.
East Point Settlement, Stoddart 776 (K, US); between Observatory Point and Barton Point, Stoddart 805 (K, US).

Cyperus kyllingia Endl.
S. l., Willis & Gardiner 35 (K).

Cyperus ligularis L.
S. l., Bourne 19 (K); East Point Settlement, Stoddart 785 (K, US); East Island, Stoddart 878 (K, US); East Point village vicinity, Rhyne 661 (US).

Cyperus rotundus L.
East Point Settlement, Stoddart 819 (K, US).

Cyperus sphacelatus Rottb.
East Point Settlement, Stoddart 820a (K, US). (Young, atypical, scarcely showing brown on scales, inflorescence compact).

Eleocharis R. Br.

Eleocharis geniculata (L.) R. & S.
Between Observatory Point and Barton Point, Stoddart 800 (K, US).

Fimbristylis Vahl

Fimbristylis cymosa R. Br.
East Point village, Rhyne 658 (US, K); East Point Settlement, seaward coast, Stoddart 781 (K, US) (style branches 3); between Observatory Point and Barton Point, Stoddart 802 (K, US) (nut examined trigonous, smooth).

PALMAE

Cocos L.

Cocos nucifera L.
General on atoll, comprising plantations.

Hyphaene Gaertn.

Hyphaene sp. ?
East Point, Stoddart 897 (K). (This is a juvenile fan palm leaf from beneath a 60 ft. tree, summit of petiole with no spines, leaf must have been about 70 cm diameter.) (This determination made at Kew, not signed.).

Phoenix L.

Phoenix sp. (*P. dactylifera* ?)
East Point, Stoddart 895 (K, US). (Leaves rather delicate, greyish-green).

ARACEAE

Alocasia G. Don

Alocasia macrorrhiza (L.) Schott
East Point, Stoddart 827 (K, US); vicinity of Minni Minni, Rhyne 745 (US).

Alocasia plumbea van Houtte
East Point village near cemetery, Rhyne 620 (US); East Point, Stoddart 828 (K, US) (young leaves, only, base contracted, sinus narrow, basal lobes wide subtruncate leaves purplish beneath, dark green above, 3-4 ft. tall.).

COMMELINACEAE

Commelina L.

Commelina benghalensis L.
S. I., Wiehe in 1939.

AMARYLLIDACEAE

Crinum L.

Crinum latifolium var. *zeylanicum* (L.) Hook. f. ex Trim.
East Point Settlement, *Stoddart 821* (K).

Haemanthus L.

Haemanthus multiflorus Martyn
East Point Settlement, *Stoddart 771* (K, US); East Point village near cemetery, *Rhyne 619* (US).

Hymenocallis Salisb.

Hymenocallis littoralis (Jacq.) Salisb.
East Point, in garden, *Stoddart 855* (K).

Zephyranthes Herb.

Zephyranthes rosea (Spr.) Lindl.
East Point village near hospital, *Rhyne 613* (US); *Stoddart 772* (K, US).

MUSACEAE

Musa L.

Musa sapientum L
Bananas recorded by Bourne (Hemsley 1884, p. 334).

CASUARINACEAE

Casuarina Adans.

Casuarina equisetifolia L.
Lagoon shore south of East Point, *Stoddart 814* (K); North West Point, *Rhyne 440* (US).

URTICACEAE

Pilea Lindl.

Pilea microphylla (L.) Liebm.
Pointe Marianne, *Stoddart 893* (K, US).

Pipturus Wedd.

Pipturus argenteus (Forst.) Wedd.
East Island, *Stoddart 874* (K, US); East Point Settlement, *Stoddart 789* (K, US). S. l., *Wiehe* in 1939 (MAU); Pointe Noroit, *Wiehe 1622* (MAU).

MORACEAE

Artocarpus Forst.

Artocarpus altilis (Park.) Fosb.
Pointe Marianne, Rhyne 770 (US).

Ficus L.

Ficus benghalensis L.
S. l., Willis & Gardiner s.n. (K); East Point village, Rhyne 654 (US); Stoddart 807 (K, US).

Ficus religiosa L.
Vicinity of Minni Minni, Rhyne 744 (US).

Ficus sp.
S. l., Morin in 1937 (MAU). (Leaves only, large, like F. nautarum Bak.).

NYCTAGINACEAE

Boerhavia L.

Boerhavia repens L.
S. l., Bourne in 1885 (K); Morin in 1937 (MAU); Wiehe in 1939 (MAU).

Boerhavia repens L. (white flowered form)
West Island, Stoddart 870 (K); East Island, Stoddart 879 (K, US); East Point Settlement, seaward coast, Stoddart 782 (K, US), 777 (K, US); between Observatory Point and Barton Point, Stoddart 804 (K, US).

Pisonia L.

Pisonia grandis R. Br.
S. l., Morin in 1937 (MAU); Wiehe in 1939 (MAU).

AMARANTHACEAE

Achyranthes L.

Achyranthes canescens R. Br.
S. l., Hume in 1883 (K); s.l., Bourne (?) in 1885; East Island, Stoddart 875 (K, US); East Point Settlement, Stoddart 764 (K, US); West Island, Stoddart 871 (K, US); East Point village near ocean, Rhyne 683 (US).

Aerva Forsk.

Aerva lanata Juss.
North-West Point, Stoddart 859 (K, US).

Amaranthus L.

Amaranthus viridis L.
Seen by Wiehe in 1939.

PHYTOLACCACEAE

Rivina L.

Rivina humilis L.
East Point Settlement, Stoddart 769 (K, US), 766 (K); East Island, Stoddart 877 (K, US); west rim of atoll, south end, Stoddart 848 (K, US); Pointe Marianne, Rhyne 775 (US).

PORTULACACEAE

Portulaca L.

Portulaca sp. (aff. P. australis Endl.)
Pointe Marianne, Stoddart 891 (K, US); East Point Settlement, seaward coast to north of Settlement, Stoddart 787 (K, US); South Point, Stoddart 825 (K, US); East Point village, ocean side, Rhyne 675 (US).

Portulaca oleracea L.
Pointe Marianne, Stoddart 890 (K, US).

LAURACEAE

Cassytha L.

Cassytha filiformis L.
East Point Settlement, Stoddart 823 (K).

HERNANDIACEAE

Gyrocarpus Jacq.

Gyrocarpus americanus Jacq.
Seen by Wiehe in 1939.

Hernandia L.

Hernandia sonora L.
East Point, lagoon shore, Stoddart 792 (K, US); Minni Minni, lagoon shore, Stoddart 809 (K, US); East Point village near cemetery, Rhyne 618 (US); East Point village near ocean, Rhyne 688 (US); northwest, Wiehe in 1939 (MAU).

CRASSULACEAE

Kalanchoe Adans

Kalanchoe pinnata (Lam.) Pers.
East Point Settlement, seaward coast, Stoddart 763 (K, US); ocean side North-West Point, Rhyne 439 (US); East Point village vicinity, Rhyne 660 (US).

ROSACEAE

Photinia Lindl.

Photinia japonica Lindl.
Recorded by Willis and Gardiner (1931) but seems rather unlikely.

LEGUMINOSAE

Albizia Durazz.

Albizia lebbeck (L.) Benth.
East Point Settlement, Stoddart 831 (K, US) "seed pods also seen at Minni Minni".

Canavalia Adans.

Canavalia cathartica Thou.
East Point, lagoon shore, Stoddart 842 (K, US).

Cassia L.

Cassia occidentalis L.
East Point, Stoddart 844 (K, US); East Point Settlement, Stoddart 824 (K); East Point village, Rhyne 749 (US).

Intsia Thou.

Intsia bijuga (Colebr.) O. Ktze.
S. 1., Bourne 45 (K); East Point village vicinity, Rhyne 655 (US).

Leucaena Benth.

Leucaena leucocephala (Lam.) de Wit
Pointe Marianne, lagoon beach ridge, Stoddart 861 (K, US).

Mimosa L.

Mimosa pudica L.
East Point, Stoddart 884 (K, US), 841 (K, US).

Pithecellobium Mart.

Pithecellobium dulce (Roxb.) Benth.
East Point Settlement, cultivated, Stoddart 817 (K, US).

OXALIDACEAE

Averrhoa L.

Averrhoa bilimbi L.
East Point, Stoddart 887 (K, US); East Point village, ocean side, Rhyne 672 (US); Pointe Marianne, Rhyne 771 (US).

RUTACEAE

Citrus L.

Citrus aurantium L.
Bitter oranges recorded by Bourne (Hemsley 1884, p. 334).

Citrus medica L. ?
Pointe Marianne, *Rhyne 774* (US) (sterile).

SURIANACEAE

Suriana L.

Suriana maritima L.
East Point Settlement, seaward coast, *Stoddart 788* (K, US).

ANACARDIACEAE

Mangifera L.

Mangifera indica L.
Pointe Marianne, *Rhyne 772* (US).

EUPHORBIACEAE

Acalypha L.

Acalypha indica L.
S. l., *Bourne 34* (K).

Acalypha sp. ?
North-West Point, *Rhyne 437* (US) (seedlings).

Breynia Forst.

Breynia nivosa (Bull) Small
East Point village near cemetery, *Rhyne 617* (US).

Codiaeum A. Juss.

Codiaeum variegatum (L.) Bl.
Pointe Marianne, old cemetery, *Stoddart 892* (K, US).

Euphorbia L.

Euphorbia cyathophora Murr.
North of East Point village, lagoon side, *Stoddart 808* (K, US).

Euphorbia hirta L.
S. l., *Bourne 12* (K); s.l., *Rhyne 663* (US).

Euphorbia prostrata Ait.
Seen by Wiehe in 1939.

Phyllanthus L.

Phyllanthus amarus Sch. & Th.
S. l., Bourne 42 (K); Pointe Marianne, Stoddart 894 (K); East Point village, ocean side, Rhyne 674 (US).

Phyllanthus maderaspatensis L.
S. l., Herb. Justice Blackburn (K); East Point Settlement, seaward coast, Stoddart 779 (K, US).

Phyllanthus tenellus Roxb.?
S. l., Wiehe s.n. (MAU)(possibly from Diego Garcia, very lax, with large oblong leaves, a pistillate and a smaller staminate flower in an axil).

BALSAMINACEAE

Impatiens L.

Impatiens balsamina L.
"Near the old coal dump," recorded by Willis and Gardiner (1931).

TILIACEAE

Triumfetta L.

Triumfetta procumbens Forst.
East Point Settlement, seaward coast, Stoddart 780 (K, US); ocean side North-West Point, Rhyne 438 (US); East Point village near hospital, Rhyne 614 (US); s.l., Morin in 1937 (MAU).

MALVACEAE

Abutilon Mill.

Abutilon indicum (L.) Sweet
East Point, Wiehe in 1939 (MAU).

Gossypium L.

Gossypium hirsutum L. (glabrate form)
East Point Settlement, seaward coast, Stoddart 773 (K).

Hibiscus L.

Hibiscus manihot L.
S. l., Justice Blackburn (K) (leaf large, cordate, unlobed, crenate-serrate).

Hibiscus rosa-sinensis L.
East Point village, cultivated, Stoddart 816 (K, US); East Point village vicinity, Rhyne 662 (US)?

Hibiscus tiliaceus L.
East Point Settlement, Stoddart 794 (K, US); East Point village vicinity, Rhyne 664 (US), 665 (US); Pointe Marianne, Rhyne 773 (US).

Malvastrum A. Gray

Malvastrum coromandelianum (L.) Garcke
East Point, Wiehe in 1939 (MAU).

Sida L.

Sida acuta Burm. f.
Pointe Marianne, village, Stoddart 863 (K, US); Pointe Marianne, Rhyne 776 (US). (Showing some introgression from S. rhombifolia, indicated by rather long, articulate fruiting pedicels. Leaves are typical S. acuta).

Sida parvifolia DC.
West Island, Stoddart 872 (K, US); East Point Settlement, seaward coast, Stoddart 778 (K, US); s.l., Morin in 1937 (MAU).

BOMBACACEAE

Ceiba Mill.

Ceiba pentandra (L.) Gaertn.
East Point, cultivated, Stoddart 896 (K).

STERCULIACEAE

Melochia Rottb.

Melochia pyramidata L.
East Point Settlement, Stoddart 795 (K, US).

GUTTIFERAE

Calophyllum L.

Calophyllum inophyllum L.
East Point, shore line, Stoddart 790 (K, US); East Point village, Rhyne 607 (US); s.l., Morin in 1937 (MAU).

TURNERACEAE

Turnera L.

Turnera ulmifolia var. elegans Urb.
Recorded by Willis and Gardiner (1931).

CARICACEAE

Carica L.

Carica papaya L.
East Island, Stoddart 873 (K).

PASSIFLORACEAE

Passiflora L.

Passiflora suberosa L.
East Point Settlement, seaward coast, Stoddart 768 (K), Stoddart 765 (K); West Island, Stoddart 868 (K, US); East Island, Stoddart 881 (K); ocean side North-West Point, Rhyne 439a (US)? (sterile); west rim of atoll, southern end, Stoddart 847 (K, US).

CUCURBITACEAE

Cucumis L.

Cucumis melo L.
West rim of atoll, Stoddart 849 (K, US). (Fruits about 6-7 cm diameter globose).

Cucurbita L.

Cucurbita maxima Duch.
Recorded, as cultivated, by Willis and Gardiner (1931).

LYTHRACEAE

Pemphis Forst.

Pemphis acidula Forst.
Seen by Wiehe in 1939.

COMBRETACEAE

Terminalia L.

Terminalia catappa L.
S. l., Bourne 32 (K); East Point Settlement, Stoddart 830 (K).

LECYTHIDACEAE

Barringtonia J.R. & G. Forst.

Barringtonia asiatica (L.) Kurz
S. l., Hume in 1883 (K); Minni Minni, Stoddart 812 (K, US); East Point village vicinity, Rhyne 656 (US); s.l., Morin in 1937 (MAU).

MYRTACEAE

Eugenia L.

Eugenia javanica Lam.
East Point, Stoddart 886 (K, US).

SAPOTACEAE

Mimusops L.

Mimusops bojeri A. DC.
Reported by Lambrecht, m.s. WHO Rept., 1969.

APOCYNACEAE

Catharanthus G. Don

Catharanthus roseus (L.) G. Don
East Point Settlement, Stoddart 835 (K, US) (pink flowers); East Point, Stoddart 834 (K) (white flowers); East Point village vicinity, Rhyne 659 (US).

Cerbera L.

Cerbera odollam Gaertn.
Reported by Lambrecht, m.s. WHO Rept., 1969.

Ochrosia Juss.

Ochrosia oppositifolia (Lam.) K. Schum.
S. l., G. C. Bourne 39 (K); Wiehe in 1939 (MAU); West rim, South end, Stoddart 845 (K, US).

ASCLEPIADACEAE

Asclepias L.

Asclepias curassavica L.
Minni Minni, Stoddart 810 (K, US); East Point Settlement, Stoddart 762 (K); East Point village near hospital, Rhyne 612 (US); s.l., Wiehe in 1939 (MAU).

CONVOLVULACEAE

Ipomoea L.

Ipomoea batatas (L.) Lam.
Sweet potatoes recorded by Bourne (Hemsley 1884, p. 334).

Ipomoea pes-capreae L. ssp. pes-caprae
East Point Settlement, uncommon elsewhere, Stoddart 829 (K, US); Main island, Bourne 28 (K) (leaf shape better for ssp. brasiliensis); East Point village near hospital, Rhyne 611 (US).

Ipomoea macrantha R. & S (I. tuba (Schlecht.) G. Don)
S. l., Bourne 27 (K); Pointe Marianne and southwards, Stoddart 889 (K, US); East Point Settlement, seaward coast North of Settlement, Stoddart 786 (K, US).

BORAGINACEAE

Cordia L.

Cordia subcordata Lam.
S. l., Bourne 23 (K); lagoon shore south of East Point, Stoddart 815 (K, US); East Point village vicinity, Rhyne 666 (US); Pointe Noroit, Wiehe in 1939 (MAU).

Tournefortia L.

Tournefortia argentea L. f.
S. l., Bourne 6 (K); beach zone, Rhyne 393 (US); East Point Settlement, seaward side, Stoddart 822 (K); East Point village near ocean, Rhyne 687 (US).

VERBENACEAE

Lippia L.

Lippia nodiflora L.
North-West Point, Stoddart 858 (K, US).

Premna L.

Premna obtusifolia R. Br.
S. l., Bourne 4 (K) (a form with large oblong leaves with long petioles and unusually broad, complex panicle, flowers with some pubescence in throat, calyx only slightly dentate); Wiehe in 1939 (MAU).

Stachytarpheta Vahl

Stachytarpheta jamaicensis (L.) Vahl
S. l., Bourne 18 (K); s.l., Hume in 1883 (K); East Point Settlement, seaward coast, Stoddart 775 (K, US); East Island, Stoddart 880 (K, US); vicinity of Minni Minni, Rhyne 748 (US).

LABIATAE

Mentha L.

Mentha sp.
East Point, garden, Stoddart 843 (K, US) (almost glabrous, leaves abruptly contracted at base, petioles short; sterile).

Ocimum L.

Ocimum americanum L.
Pointe "Mardannes", Wiehe in 1939 (MAU).

Ocimum gratissimum L.
Pointe Marianne, in village, Stoddart 964 (K, US).

SOLANACEAE

Capsicum L.

Capsicum frutescens L.
S. l., Bourne 13 (K).

Solanum L.

Solanum nigrum L.
Seen by Wiehe in 1939.

SCROPHULARIACEAE

Bacopa Aubl.

Bacopa monnieri (L.) Wettst.
Pointe Marianne, in water to 2 ft deep, freshwater barachois, Stoddart 860 (K, US) (fruit 4-4.5 mm long, plant elongate); Pointe Marianne, Rhyne 777 (US); Pointe "Ramanne", Wiehe in 1939 (MAU).

Striga Lour.

Striga asiatica (L.) Kuntze
East Point, Settlement, seaward coast, Stoddart 784 (K, US).

ACANTHACEAE

Hemigraphis Nees

Hemigraphis alternata (Burm. f.) T. Anders.
Minni Minni, Stoddart 811 (K, US); Wiehe 1615 (MAU); vicinity Minni Minni, Rhyne 746 (US).

RUBIACEAE

Guettarda L.

Guettarda speciosa L.
S. l., Hume in 1883 (K); Morin in 1937 (MAU); East Point, Stoddart 770 (K, US); North-West Point, Rhyne 443 (US); East Point village near ocean, Rhyne 685 (US).

Morinda L.

Morinda citrifolia L.
South of East Point, lagoon side, Stoddart 813 (K, US); East Point village near ocean, Rhyne 686 (US).

Pentas Benth.

Pentas lanceolata ssp. cymosa (Klotzsch) Verdc.
Pointe Marianne, Stoddart 865 (K, US); East Point village near cemetery, Rhyne 622 (US).

Spermacoce L.

Spermacoce suffrutescens Jacq.
East Point Settlement, Stoddart 836 (K, US); East Point village near hospital, Rhyne 615 (US).

CAMPANULACEAE

Hippobroma G. Don

Hippobroma longiflora (L.) G. Don
Pointe Marianne, Stoddart 866 (K, US); East Point village, cemetery, Rhyne 677 (US).

GOODENIACEAE

Scaevola L.

Scaevola taccada (Gaertn.) Roxb.
East Point, Stoddart 887 (K), 883 (US) (glabrous form, sterile shoot with very large leaves and very little axillary hair); beach zone, Rhyne 392 (US).

COMPOSITAE

Ageratum L.

Ageratum conyzoides L.
Pointe Marianne, Stoddart 862 (K, US); vicinity of Minni Minni, Rhyne 747 (US).

Bidens L.

Bidens sulphurea (Cav.) Sch. Bip.
East Point Settlement, Stoddart 833 (K, US).

Cosmos Cav. (see Bidens L.)

Eupatorium L.

Eupatorium triplinerve Vahl
Recorded, as cultivated, by Willis and Gardiner (1931).

Mikania Willd.

Mikania scandens (L.) Willd.
East Point village near hospital, Rhyne 616 (US); East Point Stoddart 885 (K), 793 (K, US).

Synedrella Gaertn.

Synedrella nodiflora (L.) Gaertn.
East Point village, ocean side, Rhyne 676 (US).

Tridax L.

Tridax procumbens L.
East Point, Stoddart 783 (K, US).

Vernonia Schreb.

Vernonia cinerea (L.) Less.
S. 1., Bourne 2 & 3 (K); East Point village, ocean side, Rhyne 673 (US); East Point, Stoddart 774 (K, US); "Pte. N.E.", Wiehe 1616 (MAU).

Without capsules, but female flowers present. The excurrent nerve, apparently dioicous inflorescence and long perichaetium, as well as the areolation, all seem to indicate this pantropical moss. Brachymenium indicum is excluded by its synoicous inflorescence.

REFERENCE

Hemsley, W. B. 1887. Report on the vegetation of Diego Garcia. J. Linn. Soc. Bot. 22: 332-340.

14. TERRESTRIAL FAUNA OF DIEGO GARCIA AND OTHER CHAGOS ATOLLS

D. R. Stoddart

The terrestrial fauna of Diego Garcia, and indeed of all the Chagos atolls, is less well known than either the land flora or the marine fauna and flora. Apart from the collections made by G. C. Bourne and Bourne's brief discussions of the fauna of Diego Garcia itself (Bourne 1886a, 1886b), knowledge of the terrestrial fauna of the group derives almost entirely from the collections made by J. S. Gardiner and his colleagues, notably T. B. Fletcher, during five weeks in the Chagos Archipelago in 1905. Some further collections have been made since, for example of land mollusca and crustacea, and these are noted below. The collections of terrestrial fauna made in 1967 were very partial, and in some groups, especially the insects, were very small indeed.

In any discussion of the terrestrial fauna of the Chagos islands, therefore, two points must be stressed. First, the collections, which are few in number, have all been made rapidly, and can hardly be considered representative of the complete fauna. This is, however, also true of collections from most of the other western Indian Ocean islands, and comparisons are thus not entirely meaningless. It is probable that the collections adequately reflect the general character of the land faunas of such small and isolated islands. Second, because of the smallness of the collections from individual islands in the Chagos group, it would be unwise to place too great an emphasis on records for particular islands: a better impression of the land fauna is certainly obtained in the case of the Chagos by grouping the records from all the constituent islands.

Gardiner (1936b) has compared the fauna and flora of the Chagos atolls as a group with those of the Maldives and other western Indian Ocean coral islands, and Scott (1933) has made similar comparisons in greater detail for the Insects. Peake (1971) has recently discussed faunal sizes of many western Indian Ocean islands, including the Chagos, for a variety of taxa. In this chapter, attention is drawn particularly to those groups not treated elsewhere in this volume and for which data are available, mainly in the reports of the Percy Sladen Expedition. Special comparisons are made between the faunas of the Chagos atolls and those of the southern Maldives, though too little is known of individual Maldivian atolls, other than Male and Addu, to discuss faunal gradients with any confidence. The main introduced birds and mammals are also noted.

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A. Annelida

Four species of megascolecid earthworms are described in this volume by R. Sims, from Diego Garcia; no earthworms are known from the other Chagos atolls. Of these species, *Lampito mauritii* has also been recorded from the Maldives (as *Megascolex mauritii*), where Gardiner collected a total of three species (Beddard 1903).

B. Mollusca

Gardiner (1936b) noted only three species of land mollusca from the Chagos, compared with 40 species from the Seychelles. Madge (1946) listed many additional species from Diego Garcia, and Peake in this volume increases the recorded number of Diego Garcia species to 24, all of them small and inconspicuous. Madge's list also includes species from Salomon. It is of interest that the Giant African land snail *Achatina fulica* is not present on Diego Garcia or the other Chagos atolls, though it was numerous on Addu Atoll by 1964.

C. Arthropoda

1. Crustacea

Borradaile (1907) has listed the Percy Sladen Expedition land Brachyura, and Table 7 shows the distribution of these and other Crustacea, mainly marine, on the various Chagos atolls visited by this expedition. J. Morin collected at Diego Garcia in 1936, and his specimens are listed by Ward (1942). In this volume, Taylor includes these and also the *Valdivia* collections with those made in 1967. Budde-Lund (1912) lists six species of terrestrial isopods from the Chagos, two of which are recorded from Diego Garcia.

Among the land Crustacea, particular mention may be made of the coconut crab *Birgus latro*, which extends across the Indian Ocean to the Aldabra group and Zanzibar but is absent from the Maldive Islands. Other conspicuous "crabs" include *Cardisoma carnifex* and hermit crabs.

2. Arachnida

Hirst (1911) lists nine species of spiders from the Chagos (two from Egmont, three from Diego Garcia, five from Peros Banhos and six from Salomon). This compares with 23 species from the Maldive Islands (Pocock 1906). There is a widespread species of scorpion, *Isometrus maculatus*, on Diego Garcia and also in the Maldives.

Table 7. Crustacea recorded by the Percy Sladen Expedition in the Chagos Archipelago

Order	Reference	Peros Banhos	Salomon	Egmont	Diego Garcia	Total for Chagos Archipelago
ISOPODA	Budde-Lund 1912	5*	3	5	2	6
DECAPODA						
Anomura	Laurie 1926	6	12	4	1	15
	Borradaile 1910	-	2	-	-	2
Reptantia	Borradaile 1910	-	-	-	-	1
Natantia	Borradaile 1910	-	1	-	-	1
Brachyura	Rathbun 1911	27	58	34	13	85
STOMATOPODA	Borradaile 1907	2	3	-	1	5

* Figures indicate number of species.

3. Insecta

89 species of insects in eight orders were recorded by the Percy Sladen Expedition in the Chagos Archipelago as a whole; of these, 28 species were in Lepidoptera, 14 each in Orthoptera and Diptera, and 13 each in Coleoptera and Hymenoptera. The systematic papers on the Chagos insects collected on each atoll are keyed in Table 8. Scott (1933) has made general comments on the fauna, which is mainly of Oriental character and thus similar to the insect faunas of the Maldives and the Seychelles. Bourne (1886b, 391) considered the insect fauna to be poor in species but rich in individuals: flies, cockroaches (the common cockroach *Pycnoscelus surinamensis* (L.)), mosquitoes and ants were then, and now, conspicuous to the visitor. Of the orders present, the Coleoptera are poorly represented, though this may possibly be the result of inadequate collecting. The rhinoceros beetle *Oryctes rhinoceros* has been present on Diego Garcia for some decades and is a major pest in the coconut plantations. Mamet (1941) has also listed coccids of economic importance from Diego Garcia and other Chagos islands. A small collection of insects was made in 1967 by H. A. Fehlmann, and this is being worked up by Dr R. E. Crabill of the U. S. National Museum.

Gardiner (1936b, 453) gives the following comparison of the insect faunas of the Chagos and Maldive archipelagoes in terms of number of genera in each order:

	Chagos	Maldives
Orthoptera	12	24
Odonata	3	6
Hemiptera	3	20
Lepidoptera	26	67
Coleoptera	15	61
Hymenoptera	12	25

Table 8. Insects recorded by the Percy Sladen Expedition in the Chagos Archipelago.

Order	Reference	Peros Banhos	Salomon	Egmont	Diego Garcia	"Chagos"	Total for group	Total species per order
HEMIPTERA	Distant 1913	-	-	-	-	1*	1	2
	Green 1907	-	-	-	1	1	1	
ORTHOPTERA	Bolivar 1912	4	5	2	3	-	7	14
	Bolivar 1924	2	3	-	2	-	5	
	Burr 1910	-	-	1	-	1	2	
COLEOPTERA	Arrow 1922	-	-	1	-	-	1	13
	Aurivillius 1922	-	1	-	1	-	1	
	Bernhauer 1922	-	-	-	1	-	1	
	Champion 1914	1	1	1	-	1	2	
	Fleutiaux 1922	1	-	1	-	-	2	
	Grouvelle 1913	-	-	-	1	-	1	
	Scott 1912	1	-	2	1	-	4	
	Sicard 1912	1	1	-	1	-	1	
NEUROPTERA	Esben-Petersen 1927	1	1	-	-	-	1	1
LEPIDOPTERA	Fletcher 1910a	12	17	5	8	-	26	28
	Fletcher 1910b	-	-	-	-	1	1	
	Meyrick 1911	-	-	-	-	1	1	
ODONATA	Campion 1913 and Laidlaw 1907	2	1	-	3	-	4	4
DIPTERA	Bezzi 1923	2	2	-	-	1	5	14
	Lamb 1912	-	1	-	-	-	1	
	Lamb 1914	-	2	-	1	-	2	
	Lamb 1922	3	2	-	2	-	4	
	Stein 1910	-	-	-	-	1	1	
	Theobald 1912	1	-	-	-	-	1	

HYMENOPTERA	Cameron 1907, Meade Waldo 1912, Marley 1912	5	4	3	3	-	8	13
	Forel 1907	-	-	-	-	3	3	
	Turner 1911	-	-	-	-	2	2	
TOTALS		36	41	16	28	13	89	

* Figures indicate number of species

(In the original Gardiner quotes 22 genera for Chagos Hymenoptera, but this must be in error). This comparison clearly indicates the smaller size of the Chagos fauna, with particularly low relative representation in the Hemiptera and the Coleoptera. The insect faunas of both archipelagoes are, however, very inadequately known.

1. Pisces

One semi-freshwater fish was collected on Peros Banhos by Gardiner and was listed by Boulanger (1909) as Chanos salmoneus. This species, together with one species of true freshwater fish and four other species of semi-freshwater fish, is also recorded from the Maldive Islands (Regan 1903).

2. Amphibia

No amphibians are known on Diego Garcia or on other Chagos islands. The toad Bufo melanostictus is, however, common on Addu Atoll in the Maldives and was collected by Gardiner on this atoll and on Malé (Laidlaw 1903, Phillips, 1958b).

3. Reptilia

Two chelonians have been previously recorded from Diego Garcia. The side-necked turtle Pelusios subniger was collected by Gardiner in 1905 "in one swamp near East Point" (Gardiner and Cooper 1907, 48). Two specimens are in the British Museum (Natural History), and the species was listed by Boulenger (1909) as Sternothaerus nigricans (= Pelusios subniger). This is a widespread species of Africa and Madagascar and is also present in the Seychelles; it was probably introduced to Diego Garcia. G. C. Bourne in 1886 collected a terrapin Geoemyda trijuga thermalis (Lesson). Bourne (1886a, 333) referred to it only as "a mud-tortoise ... abundant in some of the marshy pools" though the specimen in the British Museum was identified by Boulenger. This species is native to Ceylon, India and Burma; it is also present in the Maldives, at many localities (Laidlaw 1903, Phillips 1958b). Both Pelusios subniger and Geoemyda trijuga were presumably introduced, though there is no direct evidence for this, and neither were found on Diego Garcia in 1967. According to local inhabitants, neither has been seen since at least 1945, and it is likely that the Geoemyda had become extinct by the time of Gardiner's visit in 1905.* Rothschild (1915) refers to the pre-

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* According to J. Frazier, who visited Diego Garcia in 1970, and Jean-Michel Vinson, the Meteorological Station staff on the atoll report that one or both of these reptiles are still extant though difficult to find during the dry season.

sence in the past of the Giant Land Tortoise Geochelone gigantea in the Chagos Archipelago, but there is apparently no evidence for this: if this tortoise did occur in the Chagos, it was presumably as an introduction which became extinct.

House geckoes are common in the settlements on Diego Garcia. Boulenger (1909) records the widespread species Hemidactylus frenatus Dum. and Beb. and the Malesian species Lepidodactylus lugubris Dum. and Beb. Fehlmann collected 91 specimens of the Hemidactylus in 1967, and these were identified by G. R. Zum of the Smithsonian Institution. The common gecko noted by Bourne (1886b, 391) was presumably these species. Gardiner also collected the same two species on Salomon, and the Lepidodactylus on Peros Banhos. Three lizards (including H. frenatus) and one skink are recorded from the Maldives (Laidlaw 1903).

There are no snakes recorded from the Chagos Archipelago. By comparison, two snakes (other than sea-snakes), a Typhlops and a colubrid, are recorded from the Maldive Islands (Phillips 1958b).

Marine turtles are no longer very common at Diego Garcia, though there is no evidence of their past status. According to Bourne (1886b, 392), Green Turtles Chelonia mydas are most numerous during the Southeast Trades and Hawksbill Eretmochelys imbricata during the northwesterlies, when three or four of the latter were taken each week. Hawksbill were seen in the lagoon in July 1967.

4. Aves

Loustau-Lalanne (1962) has given a general survey of the Chagos birds, and Bourne in this volume thoroughly reviews existing information on the birds of the whole archipelago. Whereas when the islands were first described colonies of breeding seabirds, particularly terns, noddies and shearwaters, were important, these have now virtually disappeared on Diego Garcia and possibly on the other larger atolls also. The most conspicuous birds on Diego Garcia are now all introduced land birds: Foudia madagascariensis, introduced before 1844; Streptopelia picturata, described as a subspecies chuni and introduced either from the Seychelles or Mauritius at an early date (Benson 1970); Francolinus pondicerianus; Geopelia striata, introduced from the Seychelles in 1960; and the now very common Mynah Acridotheres tristis, probably introduced between 1960 and 1964. Passer domesticus was also recorded by Gardiner from Salomon and Peros Banhos. There are thus no native land birds. Of the wading birds the Green Heron Butorides striatus is most distinctive (Ripley 1969); the Cattle Egret Ardeola ibis was introduced from the Seychelles in 1955. Bourne lists all the seabird records from the archipelago, but at least at Diego Garcia the seabirds are now inconspicuous, and are practically confined to the lagoon-mouth islets, where noddies, fairy terns and occasional frigatebirds were seen in 1967. Bourne stresses the total lack of ornithological information from the smaller Chagos islands, where there is greater likelihood of survival of seabird colonies and least of the introduction of land birds.

5. Mammalia

There are no native mammals in the Chagos Archipelago, and no records of either insectivorous or frugivorous bats. Pteropus in particular is absent, though the Indian P. giganteus is present in the Maldives (P. g. ariel Allen at Malé and North Malé atolls) and P. hypomelanus maris Allen is numerous at Addu Atoll. Species of Pteropus are also found in the Seychelles and at Aldabra (P. seychellensis), in the Andamans and Nicobars (P. melanotus) and in the Mascarenes (P. niger). Insectivorous bats are also found in the Maldives, at Aldabra, and on the high islands, but not in the Chagos.

Introduced mammals and other domestic animals are now numerous. Bourne (1886a, 332) found the following present in 1885: donkeys, hogs, fowls, rats. Cattle and sheep had also been introduced to Diego Garcia by that time, and Bourne noted that "cattle do not thrive, but sheep have been imported and appear to do well on the herbage which covers the more open spaces; the first consignment was unfortunately destroyed by the donkeys, to whom sheep were utter strangers" (1886a, 332). Bourne also refers (1886b, 387) to goats being destroyed by donkeys. Donkeys, chickens, cats and dogs are now present, and noted in Chapter 18. The common rat on Diego Garcia is Rattus rattus L. All of these introduced mammals are common on other Indian Ocean coral islands (Stoddart, in preparation). The shrew Suncus murinus, common in the Maldives at Malé and Addu, does not appear to have reached the Chagos.

15. EARTHWORMS OF DIEGO GARCIA

R. Sims

Four species of earthworm were collected on Diego Garcia by J. D. Taylor in July 1967. These were identified by R. Sims of the British Museum (Natural History) and are incorporated in the collections.

MEGASCOLECIDAE

Lampito mauritii Kinberg 1867
Litter sand and stones beneath *Scaevola*, East Point, 2 specimens, 18 July 1967.

Pheretima morrisi (Beddard 1892)
Litter beneath *Cocos*, East Point, 1 specimen, 13 July 1967.

Pheretima rodericensis (Grube 1879)
Litter beneath *Cocos*, Minni Minni, 1 specimen, 5 July 1967.

OCTOCHAETIDAE

Dichogaster sp.
Litter beneath *Cocos*, Minni Minni, 4 immature specimens, 5 July 1967.

16. NON-MARINE MOLLUSCA OF DIEGO GARCIA

J. F. Peake

This list includes all previous records for the atoll; those species collected in 1967 by J. D. Taylor are marked with an asterisk. A further account of the non-marine Mollusca of the Islands of the western Indian Ocean is in preparation.

*<u>Assiminea parvula</u> Morelet
Beneath cobbles, supra-littoral zone, lagoon shore, Carcasse; beneath stones, supra-littoral zone, Barachois Sylvain.

*<u>Blauneria exsilium</u> Preston
Beneath rotten wood, Carcasse barachois.

<u>Ellobium henleyanum</u> (Gassies)
Recorded by Madge (1946).

<u>Enterodonta conica</u> (Pease)
Recorded by Madge (1946).

*<u>Gastrocopta microscopica</u> Nevill
In litter beneath coconuts, East Point.

<u>Gulella bicolor</u> (Hutton)
Madge (1946).

*<u>Lamellaxis gracilis</u> (Hutton)
In litter beneath coconuts, East Point.

*<u>Louisia bardayi</u> (Benson)
Litter beneath trees, Minni Minni; litter, Eclipse Point.

<u>Melampus caffer</u> (Küster)
Madge (1946).

<u>Melampus kusteri</u> (Krauss)
Madge (1946).

<u>Melampus lividus</u> (Deshayes)
Madge (1946).

<u>Melampus luteus</u> (Quoy and Gaimard)
Nevill (1878), Lienard (1887) and Madge (1946).

Atoll Research Bulletin No. 149: 173-174, 1971.

Melampus parvulus Pfeiffer
Madge (1946).

*Melampus semiplicatus Pease
Rotten wood, supra-littoral, Carcasse; beneath stones, Barachois Sylvain.

Nesopupa peilei Madge
Madge (1946).

*Opeas goodalli Miller
Litter beneath trees, Minni Minni.

Opeas javanicum (Reeve)
Madge (1946).

Opeas clavulinum (Poties and Michaud)
Madge (1946).

Pedipes affinis Fenussac
Madge (1946).

Plecotrema bellum H. and A. Adams
Madge (1946).

Plecotrema clausa H. and A. Adams
Madge (1946).

*Subulina octona (Bruguière)
Litter beneath trees, Minni Minni; litter, Eclipse Point.

*Succinea concisa Morelet
Litter beneath trees, Minni Minni; beneath coconuts, East Point; freshwater pool, Barton Point; leaves on shore, Carcasse.

*Truncatella guerinii A. and J. B. Villa
On rotten wood at the edge of tidal pool, Carcasse; litter beneath coconuts, East Point; beneath stones, Barachois Sylvain; beneath beach cobbles, supra-littoral, Carcasse.

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17. THE BIRDS OF THE CHAGOS GROUP, INDIAN OCEAN

W. R. P. Bourne

Introduction

The Chagos Archipelago (Fig. 3) consists of five island groups and one small outlier scattered over an area 240 km from north to south and 130 km from east to west, around the largely submerged Chagos Bank between 5°20' to 7°35' S and 71°20' to 72°40' E in the centre of the Indian Ocean. They lie 390 km south of Addu Atoll at the southern end of the physically rather similar Laccadive-Maldive atoll chain, 1580 km east of the Seychelles, 1400 km SSW of Ceylon, 1930 km WSW of the East Indies, and 1610 km NNE of Mauritius, nearly as far from land as it is possible to be in this area. This is the region where the presence of inter-tropical fronts leads to an increased productivity in the sea and precipitation on land associated with the development in other oceans of particularly interesting natural communities. These are of even greater interest in this one, because of the occurrence of the monsoons associated with a seasonal reversal of the winds and ocean currents immediately to the north. Unfortunately there is little information on the birds, and that mostly for the largest island, Diego Garcia, which is now largely devasted from an ornithological point of view by nearly two centuries of the activities of man and other introduced animals. Because it seems possible that some of the comparatively unspoilt outlying islands and surrounding seas may still be of exceptional interest, and moreover in urgent need of conservation in view of current proposals for further development of the area, it may be useful to review what is known of the birds of the group as a whole and the waters close to it. The area is taken to include for convenience the seas lying between the equator and 15° S, and between 65° and 80° E.

A. Description and history of the group

The central Chagos Bank, 120 km across from east to west and approximately 80 km from north to south, is now entirely submerged except for half a dozen uninhabited islets along its western rim and one in the north. The main land area is now found in four outlying atolls, Diego Garcia and Egmont in the south, and Salomon and Peros Banhos in the north. According to Wiehe (1939) the soil of at least Iles du Coin, Peros Banhos, and Boddam Island, Salomon group, consists of layers of sand, organic matter, and old guano. Gardiner (1907) also reports that it is phosphatised on Egmont, so this is doubtless general. Guano has been exported

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from Diego Garcia in recent years, indicating the presence of important seabird colonies in the past, though they are now much reduced on the inhabited islands. It appears from early reports (summarized by Scott, 1961, and in accompanying papers in this volume) that all the islands were originally heavily forested, apparently mainly with huge specimens of Intsia bijuga, the natural vegetation being of cosmopolitan or Asiatic origin.

The islands were apparently discovered by the Portuguese during their first exploration of the Indian Ocean at the end of the fifteenth century, and were subsequently visited deliberately or accidentally by a variety of people. But they were not settled for nearly three centuries, when they were very rapidly and successfully colonized in the 1780's by the French, who with the assistance of slave labour probably derived directly from West Africa (where they were major participants in the slave trade in this time: Ingham, 1962) soon felled the majority of the native woodland and replaced it with exceptionally productive coconut plantations wherever there was room for them. Timber continued to be exported to Mauritius from the last and most luxuriant forest on Boddam Island in the Salomon group, well into the nineteenth century, and tree stumps could still be seen there very recently.

The British retained Mauritius and its dependencies after the peace treaty of 1810. By the time they had reallocated the French leases and taken the first steps to control the slave trade in the islands to the north in 1813, there existed well-organised plantations with a large population and a wide variety of imported domestic animals and plants and doubtless also pests (notably rats) and weeds. There is little precise information on the state of affairs over the next few decades i.e. the period leading up to the final termination of slavery in British possessions in 1839, although it seems likely that a good deal of surreptitious communication with the slave-markets in East Africa took place for some years, bypassing the seat of government in Mauritius via such staging-posts as the Seychelles, Aldabra, Madagascar and Comoros. However, by the time a commission was sent to investigate the situation in 1859 the numerous human population was found to have been largely freed from restraint, although not encouraged to leave, and thereafter the main traffic was with Mauritius.

There was a considerable amount of whaling based on Diego Garcia in the middle of the nineteenth century. The main species sought was the sperm whale caught in January, February and April with a few in May and September (Townsend 1931, 1935). The island also served briefly as a coaling station during the early phase of the development of the steamship route between Aden and Australia in 1882-1888, with a consequent increase in the human population and amount of disturbance to the environment. The main seabird colonies appear to have been wiped out there about that time, despite attempts at conservation by the manager, James Spurs (not a totally enlightened individual, however, since he later introduced cats to Aldabra in the face of some opposition). Otherwise conditions appear to have remained fairly stable throughout the group for over a century after the plantations were fully developed, until the smaller eastern islands which had always undergone vicissitudes finally had to be evacuated after their supply-ship the "Diego" was wrecked in 1935. Diego Garcia itself was further developed as a military base in the 1940s, and this is now under consideration again.

The description of the climate and local conditions on Diego Garcia in the accompanying chapters can probably be considered as typical for the group as a whole, and they will not be repeated here except in so far as they bear on the discussion of the ornithological findings.

B. The individual islands

1. Diego Garcia

This is the most southerly and largest of the islands. It consists of a bowed V convex to the east 19 km long, 10 km wide, and 50 km in circumference, with three small islets (West, Middle, and East Islands) spread across the mouth of the V. The birds have been investigated by a number of visitors, as follows:

Finsch (1887) made a brief excursion ashore while his ship was coaling on 8 July 1884. He remarks that this is the best atoll in the Indian Ocean, with more luxuriant vegetation but less wildlife and people than comparable sites in the Pacific, where he had vast comparative experience. He was most impressed by the number of terns, of which he took some eggs (Finsch and Blasius, 1887). They included possibly 100,000 Sooty Terns (scientific names are given in the systematic list in Section D), a tenth as many Common Noddies nesting on the ground inland, and a few White Terns nesting in the trees. He had seen boobies at sea offshore, but did not see them nesting (but he did not have time to visit the south end of the island). He only saw one frigate and no tropic-birds although he was told they occurred in small numbers. He remarks on the scarcity of heron and waders, though he saw a species of curlew. He only noticed one landbird, the fody, with a few males coming into breeding plumage, though the captain of the ship later reported that he saw doves at Pointe Marianne.

Bourne (1886) arrived for four months on 15 September the following year, 1885, and largely confirms this account. He reports that the inhabitants were taking many of the terns' eggs and he found boobies hatching chicks at the south end of the island, while he was told that frigates bred there at another season and shearwaters on the Ile des Oiseaux, though he did not see them himself. He made a useful collection, described at the time by Saunders (1886), and now mainly in the British Museum (Natural History), and including specimens of the Little Green Heron and Red-footed Booby, but apparently also failed to find the dove. Vanhoffen (1901) also made a small collection, now mainly in the Berlin Museum, during a brief stay by the research vessel Valdivia on 23 February 1899.

It includes specimens of the Madagascar Turtle Dove and Little Green Heron which were subsequently described by Reichenow (1900) as endemic forms, and also of the Lesser Noddy. The early phase of exploration of the group was brought to an end with the visit of the Percy Sladen Trust Expedition during an extensive tour of the whole archipelago on 7-13 July 1905. Unfortunately their notes on birds were always casual and particularly so here (Gardiner, 1907; Gadow and Gardiner, 1907), while none of the specimens that they took can be traced. They reported that terns, waders and herons were abundant, and that they saw a pair of White-tailed Tropicbirds nesting in a Pisonia tree said to have been in use for some years.

Thereafter there appears to have been a gap of half a century during which no important bird observations were made until Messrs. D. M. Neale and J. Branegan noticed ten species of seabird offshore during a brief visit by H.M.S. Gambia in July 1958 (Bourne, 1959). Two years later (December 1960) Loustau-Lalanne (1962) toured the inhabited islands of the archipelago briefly and made the most detailed survey yet reported. He recorded several new introductions to Diego Garcia, including the Grey Francolin at an unknown date, Cattle Egrets from the Seychelles in 1955, and the Barred Ground-dove in 1960. He also noted the occurrence of an unidentified moorhen and the reduction of the seabirds to a few hundred noddies on the outlying islands and a handful of White Terns in the trees. Lt. P. G. Odling-Smee added the Mynah to the list of recent introductions during a ten-day visit in July-August 1964 (Bourne, 1966), and Pocklington and Stoddart (Pocklington 1967a) found the introduced species still flourishing in May 1965 and July-August 1966 (when H. A. Fehlmann made a small collection for the Smithsonian Institution), so that it appears that if the seabirds are now largely lost a growing landbird fauna is becoming established.

2. The western islands: Egmont Atoll, Danger and Eagle Islands, and the Brothers

These are a series of small islands or groups scattered at intervals of 15 to 30 km along the western margin of the Chagos Bank. In recent times they were served from a plantation on Eagle Island, and were deserted with it when the barque "Diego" which provided communication with the larger atolls was wrecked in 1935.

Egmont is a small atoll with its main axis inclined WNW-ESE 120 km north-west of Diego Garcia and 30 km SSE of Danger Island on the Southwest aspect of the Chagos Bank. It was described by Bergne (undated) as a string of islands forming an oval 9 km long by 3 km wide around a shallow central lagoon with a good anchorage. It was formerly entirely planted with coconuts, and had a population of about fifty people at the beginning of the century. Scott (1961) reports that a concession for development was first given to Victor Duparrel in 1808, and that conditions were very poor in the 1840s, when it was overrun by 600 pigs as well as dogs, cats, and rats; contemporary sailing directions (Horsburgh, 1852; Findlay, 1882) also mention poultry and pigeons among the supplies available. The only ornithological observations were made by the Percy Sladen Trust Expedition during 14-23 July 1905 (Gardiner, 1907), who reported that Mynahs had also been introduced and that the "larger grey-headed tern" (presumably the Common Noddy?) had there taken to nesting in the trees, where Curlew and Whimbrel also took refuge when disturbed, and that there was a reed-marsh in the centre of Lubine Island.

Danger Island is about 2.4 km long by 1.2 km wide, and is described by Scott (1961) as inaccessible with palms and forest on the crown. Eagle Island itself, some 24 km to the north, is about 4 km long by 1.2 km across and was colonised by 1813. It held about sixty people and numerous donkeys by the beginning of this century, and is covered with palms. There is also a low outlier, the Ile aux Vaches Marines, two miles to the south. The Trois Frères lie along a NW-SE axis 8 km long 16 km farther to the ENE; the largest is 1.2 km long and also covered in palms; it was also inhabited for a time in the nineteenth century, but was apparently the first inhabited island to be abandoned. None of these islands ever appears to have been visited by an ornithologist, but Pocklington (1967a) reports that many birds can be seen at sea in the area, including numbers of Wedge-tailed and Audubon's Shearwaters, adult and immature Red-footed Boobies, and Sooty and Noddy Terns west of Eagle Island at 6°15'S, 71° 10.5' E on 22 October 1963, and a male Lesser Frigate-bird and more boobies between Danger Island and Egmont Atoll in May 1965. Thus it seems likely that since they were deserted they have become important seabird colonies.

3. Nelson or Legonne

This is a small island 2.4 km long by a 0.5 km wide on the north side of the Chagos Bank nearly 80 km ENE of the Brothers and 32 km south of Peros Banhos and Salomon atolls. It appears never to have been inhabited, cultivated, or even visited at all frequently. Gardiner (1907) reports that boats used to visit it from Salomon and Peros Banhos to take the eggs and young of the frigate-birds, which breed there in December and January, and Loustau-Lalanne (1962) was informed that Brown Boobies and both shearwaters also breed there at much the same season. Otherwise nothing was known about the birds until J. Frazier (pers. comm.) visited it for an hour in July 1970 and found a clump of palms, a hut, and colonies of Red-footed and Brown Boobies, the two noddies, White Terns, and Great Frigate-birds displaying, although he did not notice any Lesser Frigates. Its status is therefore probably much the same as that of the western islands, which are of course now even less accessible.

4. Peros Banhos

This is a large atoll including some thirty islands and islets distributed in a rectangle around a lagoon about 24 km across from east to west and 21 km north to south, with a total land area just over 11.5 square km. It lies some 160 km north-west of Diego Garcia and 32 beyond Nelson Island at the northern extremity of the Chagos bank. The western islands are larger, and have long been cleared and planted with coconuts;

they include from south to north the headquarters on the Ile du Coin, Poule, which has feral chickens, Petite and Grande Soeur, Pierre and Diamante. Considerable seabird colonies survive on the many smaller eastern islands. Bourne (in Saunders, 1886) was informed that shearwaters bred on the Ile aux Vaches Marines in the south, while in June 1905 the Percy Sladen Trust Expedition (Gardiner 1907; Gadow and Gardiner, 1907) found Black-naped Terns nesting in trees on Yéyé and White Terns nesting on the shores on Petite Ile Coquillage, where noddies also had eggs and some chicks, preyed upon by Little Green Herons. At various places around the atoll they also recorded a party of House Sparrows and a variety of Palaearctic waders, and they were informed that Crab Plovers bred locally in holes in December and that a variety of landbird migrants including raptors, crows and hirundines also occurred with north winds at that season.

More recently Hartman collected four Fodies on the Ile du Coin on 23 October 1967 and two Little Green Herons, two Black-naped and a Sooty Tern and a Lesser Noddy there two days later, now all in the Peabody Museum, Yale University (N.P. Ashmole, in litt.). Loustau-Lalanne (1962) confirmed the presence of the Fody and Sparrow and saw or heard of a number of breeding seabirds among the eastern islands in December 1960, including from south to north Wedge-tailed and Audubon's Shearwaters and Brown Boobies on the Coin du Mire; both shearwaters, Sooty and White Terns on Grande Ile Coquillage; Sooty, Black-naped and White Terns and both noddies on Petite Ile Coquillage; both shearwaters and all five terns on Yéyé; and all the terns on Longue. Scott (1961) also reports that myriads of seabirds breed on Moresby Island in the north. Nobody has confirmed that Crab Plovers breed on the central Indian Ocean atolls and it seems possible that the report really referred to the shearwaters and that the Crab Plovers are really migrants from the north.

5. Salomon

This is a small atoll lying 32 km north of the Chagos Bank and 20 km east of Peros Banhos. According to Bergne (undated) it was once called the Twelve Islands, though there are now only eleven, distributed around an irregular oval 18 km long in a NE-SW axis by 8 km across, with a total land area of 5 square km, now all planted with coconuts except the Ile Diable. The main island, Boddam, is apparently the most fertile in the Archipelago, and originally supported a dense forest of huge trees up to 40 m high, probably mainly *Intsia bijuga*. According to Scott (1961) five islands were forested at least until 1838, supplying timber for Mauritius, and Takamaka still is. The Percy Sladen Trust Expedition noted the presence of House Sparrows imported from Mauritius, Little Green Herons, Guinea Fowl on Takamaka, Fouquet, and Anglaise Islands, and various seabirds and waders. Loustau-Lalanne (1962) reports the presence of Fodies and moorhens as well. However, the coconut plantations on this atoll always appear to have been particularly prosperous and the numerous human population in association with its small size does not appear to have been compatible with a rich avifauna.

C. Birds at sea

Finsch (1887) saw boobies shortly before arriving at Diego Garcia from the NW on 9 July 1884 and Vanhoffen (1901) also records that large flocks of Common Noddies were seen fishing low over the water in an area which produced a large catch of the blue copepod Poulellida one day before the Valdivia reached the same atoll from the north on 22 February 1899. Otherwise few notes appear to have been made on the occurrence of birds at sea in the area until very recently. However, following the development of the Royal Naval Bird-watching Society's sea report programme since the last war, a growing number of notes have become available from naval personnel visiting the area or sailors crossing it along the trade-routes between Aden and Western Australia or between South Africa and Singapore. It was also traversed by several of the lines of stations along meridians of longitude investigated systematically by ornithologists participating in the International Indian Ocean Expedition of 1962-1965. Taken together these observations now cover with varying accuracy and completeness some 30 voyages across the area in all months of the year except February, as seen in table 9. This is sufficient to provide at least an indication of the general character of the seabird population if not its detailed distribution, especially when compared with other surveys of the areas to the west by Bailey (1966) and Gill (1967) and the east by Japanese and Russian observers (Ozawa and Seno 1966; Shuntov 1968). The implications of these findings will be discussed later in Section E.

D. Notes on species

The order and nomenclature of the following systematic list of bird species are modified from those of the Smithsonian Institution Preliminary Field Guide to the Birds of the Indian Ocean (Watson et al. 1963), which also contains maps and a description of the archipelago and descriptions and figures of most birds species normally occurring in the area except for some of the dark petrels, discussed by Bourne (1960) and Bailey et al. (1968). In order to avoid continual repetition of a limited number of key references the origin of routine observations for each island is indicated by the date when this can be done without ambiguity, and the appropriate reference can be located in section B. In some groups identifications are uncertain, in which case species are dealt with collectively under generic or family headings.

Macronectes sp. Giant Petrel

J. Frazier (in litt.) bought a Giant Petrel in Diego Garcia in July 1970, currently deposited at the Ministry of Agriculture in the Seychelles. If as seems probable it is immature it may be difficult to determine which it is of two sibling species Macronectes giganteus and M. halli breeding in the subantarctic islands to the south (Bourne and Warham, 1966).

Table 9: Observations of birds at sea between 0-15°S, 65-80°E

(Observations taken from records of the Royal Naval Bird-watching Society deposited in the British Museum (Natural History) and published sources).

January: C. B. Thomson passed NE of the Chagos group in 1954, P. P. O. Harrison to the SE in 1960, and J. B. Mitchell to the north in 1961.

March: G. S. Willis passed to the NE in 1956, and F. E. Greaves in 1957.

April: Elkington (1929) passed to the SW in 1929, F. W. Greaves in 1957, and R. S. Bailey (1968 and in litt.) and F. B. Gill (1967) investigated stations along the 67 1/2°E and 75°E meridians in 1964.

May: R. Pocklington (1967a) sailed between Danger Island and Egmont Atoll in 1965.

June: P. P. O. Harrison passed to the NE in 1955, and R. S. Bailey (1968 and in litt.) repeated investigations along the 67 1/2°E meridian in 1964.

July: J. Branegan and D. M. Neale crossed the area from north to south calling at Diego Garcia in 1958, P. P. O. Harrison passed to the SW in 1958 and T. B. Scott in 1959, P. G. Odling-Smee spent ten days on Diego Garcia during the course of the cruise through the area in 1964 (Bourne, 1966), and A. J. Palmer passed to the SE in 1968.

August: P. G. Odling-Smee completed his 1964 cruise.

September: P. P. O. Harrison passed to the SE in 1957, and A. J. Palmer in 1968.

October: Elkington (1930) passed to the NE in 1929 and P. P. O. Harrison in 1954 and to the SW in 1955, R. Pocklington and R. Risebrough (1964) passed west of Eagle Island in 1963, and K. Salwegter to the SE in 1963.

November: C. B. Thomson passed to the NE in 1952, J. B. Mitchell to the SE in 1960, and K. Salwegter returned in 1969.

December: Ozawa and Seno (1966) completed the majority of repeated surveys along the 78°E meridian in 1962 and 1963.

Fulmarus glacialoides Southern Fulmar

D. M. Neale provisionally identified as this species a large grey shearwater with a pale head, white underparts, a dark wing-tip and pale bill seen at 10°S 69°E on 11 July 1958.

Pachyptila sp. Prions

R. S. Bailey saw one at 12°42'S 67°18'E on 28 June 1964, and other possible examples at 13°40'S 67°24'E and 15°10'S 67°12'E over the next two days with water temperatures between 23-26°C; P. P. O. Harrison reported one and then two at 12°32'S 74°41'E with a water temperature of 27°C on 17 July 1958. They have been recorded even further north off East Africa (Bailey, 1968); it is debatable which of six similar species they may be.

Puffinus carneipes Flesh-footed Shearwater

Gill (1967) saw a possible bird at 4°11'S 75°00'E on 22 April 1964, and two at 2°14'S 75°14'E next day, Pocklington four at 8°30'S 66°50'E on 17 May 1965, P. G. Odling-Smee several between Diego Garcia and Gan in late July 1964, P. P. O. Harrison some ten large shearwaters, in three parties, at 2°13'S 71°30'E on 9 September 1957, and K. Salwegter one at 11°23'S 70°30'E on 10 Oct. 1969 and fifteen at 8°45'S 74°02'E next day. It appears that this species, which breeds in south-west Australia, must regularly pass the Chagos group on migration to its winter quarters around the northern periphery of the Indian Ocean, and some birds may winter in the area.

Puffinus pacificus Wedge-tailed Shearwater

Fouquets (the Creole name for shearwaters) were reported to breed on the Ile des Oiseaux, Diego Garcia, and the Ile des Vaches Marines at Peros Banhos, and it seems possible that the "Crab Plovers" reported in 1905 to breed in burrows in December on the latter atoll were really also shearwaters. Wedge-tailed Shearwaters were reported to breed on Coin de Mire, Grand Coquillage, and Yéyé islands, Peros Banhos, and Nelson Island in the period Nov.-Feb. (normal in the southern hemisphere) in 1960, and Bailey encountered them at sea along the 67 1/2°E meridian four times between 15°00'S and 0°50'S in April, and twice at 1°28'S in June; Neale saw them off Diego Garcia, Odling-Smee one at 3°04'S 73°11'E and Palmer one at 12°28'S 70°11'E in July; Odling-Smee saw several at 4°28'S 66°10'E in August, Harrison saw four at 6°04'S 76°18'S in September, and Salwegter saw two at 8°45'S 74°02'E and Pocklington (1967a) a number with other seabirds west of Eagle Island in October, so that they appear to occur both in the offshore waters and scattered widely at sea during most or all the year.

D. M. Neale identified ten white-breasted, wedge-tailed shearwaters seen on the equator at 78°E on 7 July 1958 as the pale phase of P. pacificus, previously only recorded in the Indian Ocean as breeding at Shark's Bay, Western Australia; he reported single individuals again the following day at 2°40'S 76°E and on 11 July at 10°S 69°E. What these birds may have been is questionable but it may be noted that white-breasted shearwaters of doubtful identity, thought on that occasion to be the Fluttering Shearwater, Puffinus gavia of New Zealand, have also recently been reported by Shuntov (1968) in the Indian Ocean off north-west Australia during the SE monsoon of 1967. They might possibly be the White-faced or Streaked Shearwater Calonectris leucomelas of the North Pacific, which visits the Malacca Strait and has reached Ceylon. It would be surprising to find them in the Indian Ocean in July, but the North Pacific storm-petrels also occur there then.

Puffinus l'herminieri   Audubon's Shearwater

These were reported to breed with the Wedge-tailed Shearwaters at the same season in 1960, and were also seen with them off Diego Garcia on 9 July 1958 and west of Eagle Island on 22 Oct. 1963. There are fewer records of them at sea than with the last species, but these are also widely scattered. Mitchell saw one at 3°48'S 65°01'E on 12 Jan. 1961, and three with other birds over shoaling fish at 3°55'S 70°25'E next day; Bailey saw one at 15°00'S 67°29'E on 15 April 1964, and Harrison one at 6°00'S 76°15'E on 30 Oct. 1959. It may be remarked that in contradistinction to the Wedge-tailed Shearwater this species shows much geographical variation and often appears to have a prolonged or continuous breeding season elsewhere, so that both the characters of the Chagos population, which does not appear to have been collected yet, and its breeding behaviour particularly merit investigation.

Pterodroma sp.   Gadfly petrels

A number of isolated records of dark or white-breasted petrels from widely separated parts of the tropical Indian Ocean appear to be referable to gadfly petrels of the genus Pterodroma. This includes numerous species known to breed or winter widely in the tropical parts of other oceans (Murphy and Pennoyer 1952). Their numbers are now often greatly reduced by predators introduced by man to their island breeding stations, and they may be elusive even where they have escaped them (Bourne, 1965). Three medium-sized petrels reported by Bailey from the Chagos area in June 1964 among other records appear to belong to this class:

1. A bird with dark upperparts and underwing but a white breast, seen at 0°06'S 65°13'E on 18 June, also thirty petrels brown above and white below with a dark underwing and bill seen by J. Branegan at 10°S 69°E on 11 July 1958, and possibly another slaty grey above with a dark underwing, a white breast, a short stubby tail, and a flapping, gliding flight low over the water, reported by P. P. O. Harrison further west (3°S 59°30'E, 28 July 1964) might all be the Soft-plumaged petrel, which has been recorded further south (Bailey 1968), or the pale phase of the Trinidade Petrel, Pterodroma arminjoniana. This is so far only

known to breed in very small numbers on Round Island off Mauritius in the Indian Ocean, although it is widespread along the southern border of the tropics in other oceans, but there usually has a mottled underwing. These birds could also have been the Phoenix Petrel Pterodroma alba or the Tahiti Petrel Pterodroma rostrata of the tropical Pacific, which are similar with dark underwings. Of these four species, it is notable that the Trinidade and especially the Phoenix Petrels breed on low islands very like the Chagos group in the tropical Pacific, whereas the Tahiti Petrel prefers the mountains of high islands like the Seychelles; the absence of these three species from the central Indian Ocean is frankly surprising, and it seems possible that colonies may have been exterminated in the past, or so seriously reduced that they have been overlooked.

2. Birds with dark upperparts and underwing margins but a white centre to the underwing and breast (3°43'S 67°24'E, 21 June) and also three seen by Harrison further west (3°S 54°E, 29 July) and another seen by Gill (1967) even further west beyond the Seychelles (5°23'S 48°08'E, 1 June) all described in much the same words except that Harrison mentions that they were the size of a Wedge-tailed Shearwater with a swooping, soaring type of flight, resemble Barau's Petrel Pterodroma baraui although two of the observers apparently exclude the possibility. Barau's Petrel was recently discovered on Réunion, where it appears to be a summer breeder (Jouanin and Gill 1967); its very close ally, the Juan Fernandez Petrel Pterodroma externa, is a strong northward migrant in the Pacific (King, 1970), and it seems likely that Barau's Petrel migrates north in the Indian Ocean too, and is responsible for a number of confusing records there.
3. A uniformly dark bird with an erratic flight distinct from that of the next two species seen at 12°52'S 67°21'E on 28 June might be the Great-winged Petrel Pterodroma macroptera, which however is large and usually stays far south. It might also be the dark phase of the Trinidade Petrel, or the long lost Réunion Petrel Pterodroma aterrima recently rediscovered on that island and which may itself be a dark phase of the Tahiti Petrel (Jouanin, 1970).

Bulweria bulwerii and Bulweria fallax Bulwer's and Jouanin's Petrels

These are two closely-related medium to small dark brown petrels that differ mainly in size. Bulwer's Petrel, which is smaller and breeds in the summer in the northern subtropical Atlantic and Pacific, has been collected once in the Indian Ocean, immediately to the north of the Chagos group on Gan on 23 Aug. 1958. It seems possible that it is not uncommon among the smaller dark petrels that frequent the area (Bailey et al. 1968). Jouanin's Petrel, which is substantially larger and has not yet been found breeding, seems likely to do so somewhere along the south coast of Arabia in the summer. It has also been collected as far south as Malindi, Kenya, in December, and reported at 8 1/2°S 58°E in July (Jouanin 1957; Bailey 1966, 1968). However, the full distribution of the two species remains somewhat obscure because they have to be distinguished not only from each other but also from the larger dark shearwaters and gadfly petrels and the smaller dark storm-petrels, and until very recently few observers realised that the majority of these species might occur anywhere near the area. In consequence, many records can only tentatively be allocated identifications, as follows:

Harrison identified a Jouanin's Petrel at 5°23'S 66°52'E on 26 Jan. 1960, and also reported some small-medium, chocolate brown petrels with a paler shade on the wing at 4°56'S 66°21'E the same day which may have been either Bulwer's Petrels or storm-petrels.

Bailey identified a Jouanin's Petrel at 0°06'S 65°13'E on 19 June 1964, other possible ones near the equator at 67°E next day and at 7 1/2°S 67 1/2°E on 22 April, and five dark petrels about ten inches long that could again have been either Bulwer's Petrels or storm-petrels at 10°S 67 1/2°E on 20 April. Pocklington saw three small all-dark petrels at 7°54'S 70°00'E, on 18 May 1965 and another at 5°04'S 66°25'E, three days later.

Harrison saw two medium-sized dark petrels at 15°40'S 77°20'E on 6 Oct. 1955, and two more with very pointed wings flying in a rather erratic way at 6°49'S 67°26'E two days later which might very well have been B. fallax.

Pocklington (in Bailey et al. 1968 and in litt.) saw dark petrels of two sizes in a mixed flock of birds feeding at 6°15'S 71°E west of Eagle Island on 22 Oct. 1963 which may have been the two species of Bulweria.

Oceanodroma matsudairae and O. (Leucorhoa) monorhis, Matsudaira's and Swinhoe's Storm-petrels.

These are another pair of medium to small brown storm-petrels with paler wing-coverts which differ from the last two mainly in having forked rather than wedge-shaped tails. They have both so far only been found breeding in the north-west Pacific, but wander into the Indian Ocean, where Matsudaira's Storm-petrel has been recorded mainly along the equator and Swinhoe's Storm-petrel in the Arabian Sea (Bailey et al. 1968). A closely allied form with a white rump, Leach's Storm-petrel O. leucorhoa has also been reported twice in the Indian Ocean area recently (Lapthorn et al. 1968), but not in the central part yet, though it is likely to occur there as well. As in the last case, identifications can only be tentative at present, as follows:

Gill (1967) saw a large bird at 11°47'S 74°43'E on 19 April 1964, and Bailey (Bailey et al. 1968) another at 1°51'S 67°47'E on the 25th when he also saw a smaller bird on the water at 0°03'S 67°37'E; he had seen another at 0°05'S 67°40'E two days before. Pocklington recorded one at 5°04'S 66°46'E on 21 May 1965. Bailey saw three large birds at 0°07'S 65°41'E on 18 June 1964, and another with a smaller one near the equator at 67°E next day; Harrison also noted a small, all-dark storm-petrel at 6°49'S 67°26'E on 8 Nov. 1955.

Oceanites oceanicus Wilson's Storm-petrel

This species breeds in the far south and migrates north in all oceans. Bailey collected one at 13°39'S 67°41'E on 17 April 1964, and saw another at 7 1/2°S 67 1/2°E five days later, and again at 1°28'S 67°24'E on 20 June. Odling-Smee recorded a number of storm-petrels in the Chagos area in July and Aug. 1964. Harrison also reported several storm-petrels in July 1958 and Sept. 1957. Pocklington (1967a) saw the last in a mixed flock of seabirds feeding at 6°15'S 71°10.5'E west of Eagle Island on 22 Oct. 1963.

Pelagodroma marina White-faced Storm-petrel

In the Indian Ocean area, this species breeds off south-west Australia and at least in the past in the St. Paul-Amsterdam group, and also migrates north across the equator in winter. Greaves saw a doubtful bird at 6°S 70°E on 14 March 1957, Neale three six miles north of Diego Garcia on 9 July 1958, Harrison one at 12°32'S 74°41'E on 17 July 1958, and Odling-Smee two birds of this species or the next group at 0°25'S 76°08'E on 16 July 1964.

Fregetta tropica and F. grallaria Black- and White-bellied Storm-petrels

These are a complex closely-related group breeding on subantarctic islands and wintering in the tropical parts of all oceans. The Black-bellied Storm-petrel breeds relatively far south, on Kerguelen and the Crozets in the Indian Ocean area, and normally has a dark line down the centre of the white breast, though this may be entirely white, and proportionately long tarsi and toes. The White-bellied Storm-petrel breeds further north and has been collected at sea off the St. Paul-Amsterdam group in the Indian Ocean area, and normally has a white breast (though this may be dark in at least one Pacific population) and porportionately short tarsi and toes. What appears to be an intermediate, possibly hybrid, population occurs on Gough Island in the South Atlantic (Bourne, 1962). The breast markings are hard to see at sea, and which species occurs most commonly in the Indian Ocean has been disputed, though the Black-bellied Storm-petrel certainly occurs rather widely (Bailey, 1968). Pocklington saw two members of the group twice at 8°29'S 66°55'E and 7°54'S 70°00'E on 17 and 18 May 1965, and thought that the second two at least were white below. Two other possible records are listed under the preceding species. Bailey had a clear view of the dark line down the breast of a Black-bellied Storm-petrel at 5°43'S 67°26'E on 22 June 1964, and saw another member of the group at 11°04'S 67°18'E five days later.

Phaethon aethereus Red-billed Tropic-bird

This species breeds in the eastern Pacific and Atlantic with an isolated population in the Arabian Sea. It has been recorded several times in the Bay of Bengal and reported with inadequate evidence in the South China Sea, but its status in the last two areas is still obscure. Neale reported one on the equator at 78°E on 7 July 1958; he was familiar with the species in the Arabian Sea, and mentions the red bill.

Phaethon rubricauda Red-tailed Tropic-bird

This species appears to be characteristic of the trade-wind areas of the central and western Pacific and southern Indian Ocean. Loustau-Lalanne (1962) writes that it was seen around the three inhabited atolls in late 1960, and that Gadow and Gardiner (1907) reported it breeding (in point of fact, this was the next species). However, Pocklington (1967a) was also informed by residents on Diego Garcia that it occurred fairly commonly in the north-west of that atoll, so that it seems likely it does breed. Harrison saw a tropic-bird "with a dark tail" at 5°23'S on 26 Jan. 1960, another at 2°12'S 72°12'E on 29 Oct. 1964, and Bailey a bird of this species at 12°52'S 67°21'E on 28 June 1964. However, it appears to be much less common at sea than the White-tailed Tropic-bird.

Phaethon lepturus White-tailed Tropic-bird

On Diego Garcia in July 1905, the Percy Sladen Trust Expedition were shown a pair nesting in a Pisonia tree which they had been using for some years. Loustau-Lalanne saw the species around the three inhabited atolls in Nov.-Dec. 1960, and Branegan saw it off Diego Garcia again on 9 July 1958. It appears to be the commonest of the tropic-birds found widely scattered over surrounding seas, but more to the north than the south, with a total of some twenty reports of birds identified as this species, two in March, three in April, four in June, ten in July (eight from Odling-Smee), and one in November. Taking all records of tropic birds from between 65-80°E together, 24 come from the area between 0-5°S, nine from between 5-10°S, and five from between 10-15°S with suggests that there is a definite concentration of records in the vicinity of the equator, though possibly more at the time when the southern equatorial current moves north with the development of the southerly monsoon than when the counter-current becomes established during the northern winter. So far there are no reports of the distinctive yellow race P. l. fulvus which breeds on Christmas Island and was recorded at sea north-west of Australia (Pocklington 1967b, Shuntov 1968) so that they likely must disperse to the east.

Sula abbotti Abbott's Booby

Mitchell reported two possible birds of this highly distinctive species, apparently never previously recognized at sea far from the breeding stations, at 3°55'S 70°25'E on 13 Jan. 1961. There is still a substantial population of about 5,000 birds nesting on Christmas Island to the east, although it is now threatened by phosphate mining which already led to the extermination of the other known colony on Assumption to the west (Nelson, 1971). It seems possible that the species may also once have bred on the Chagos group, which occupies an exactly intermediate position and was originally covered by the tall forests utilised by this species for breeding, but if so it was lost following the destruction of the forests. It might be useful if the subfossil deposits likely to exist on some of the islands could be searched for evidence of its past occurrence, especially since consideration might be given to the reintroduction of the species to the Chagos group or Assumption if its position becomes more seriously threatened on Christmas Island.

Sula dactylatra   Blue-faced Booby

Bailey recorded one immature bird at 1°42'S 67°38'E on 26 April 1964, another possible one at 6°20'S 67°26'E on 22 June 1964, and a third at 7°50'S 67°22'E next day, and Odling-Smee two at 4°30'S 73°12'E on 18 July 1964. While adults usually stay fairly close to the breeding colonies, young birds are sometimes found at sea far from land (Bailey 1968; King 1970) and the birds recorded may be wanderers from distant colonies to the east or west, although it will be surprising if this booby is not found to breed locally.

Sula sula   Red-footed Booby

G. C. Bourne (1886) collected an adult in the white phase on Diego Garcia so that the "gannets" he reported to be hatching their eggs at the south end of the island in Sept. 1885 were likely this species. Pocklington (1967a) saw parties of up to fifty between Egmont Atoll and Eagle Island in October 1963 and May 1965, and J. Frazier found a colony on Nelson Island in July 1970, so that there are probably still a number of colonies in the uninhabited islands although this booby has not been reported from the inhabited ones in recent years. There are also five records of the occurrence of up to ten birds within 250 miles north-west of the islands, including a white individual seen by Mitchell (3°55'S 70°25'E, 13 Jan. 1961), five seen by Greaves (6°20'S 68°20'E, 2 April 1967), an immature examined on board by Bailey (5°03'S 67°25'E, 21 June 1964), four and then ten recorded by Salwegter (1°54'S 70°52'E, 8 Nov. 1968), one of which stayed on board overnight, and three and then ten which he saw at 6°17'S 67°19'E next day.

Measurements of the white adult male collected by Bourne and the brown bird examined by Bailey are: wing 377, 372 mm, tail 210, ca. 260 mm, culmen 78, 84.5 mm, tarsus 34, 36 mm; the brown bird weighed 1,000 g and had renewed the inner primaries, while the 5th was half grown, the outer four and two under wing coverts were old, and there were a mixture of old and new feathers in the tail. It vomited flying fish and an Ommastrephid squid, thought by Dr. Malcolm Clark to belong to the genus Symplectoteuthis. The feet were deep pink, the bill bluish-lilac, with the end of the lower mandible dark brown and the gape pink, and the iris was bluish. Dr J. B. Nelson informs me the appearance agrees with that of an immature bird of the white phase.

Sula leucogaster   Brown Booby

This species was first recorded by Loustau-Lalanne who saw it around all three inhabited atolls in Nov.-Dec. 1960, and said that it was reported to breed from December to March on Coin de Mire island, Peros Banhos, and Nelson Island. Frazier found a colony on the latter island in July 1970. Mitchell reports two or three from 3°55'S 70°25'E on 13 Jan. 1961, and Salvegter one which stayed on board overnight at 1°54'S 70°52'E on 8 Nov. 1968. It would appear that while the other boobies predominate out to sea, this is the common species among the islands, as it is among the Maldives and Laccadives to the north (Phillips 1963).

Fregata minor and *F. ariel* Greater and Lesser Frigate-birds

The precise status of the two frigate-birds is uncertain, but both certainly occur and probably breed in the Chagos area. Bourne was informed on Diego Garcia that they bred but not at the season when he was there; he collected an immature male on 29 Sept. 1885 which is almost exactly intermediate between the two species in appearance; measurements: wing 559 mm, tail 355 mm, culmen 92 mm long and 27 mm wide at base. The Percy Sladen Trust Expedition were informed that the birds breed on Nelson Island and have eggs and young in December and January, and Frazier saw Greater Frigate-birds displaying there in July 1970, while Loustau-Lalanne saw Lesser Frigates elsewhere throughout the inhabited islands, and especially at Yéyé Island, Peros Banhos, and West Island, Diego Garcia, in December 1960, though he did not find them breeding. Among a number of other records from among the islands, Branegan saw Greater Frigate-birds off Diego Garcia on 9 July 1958, Odling-Smee a male Lesser Frigate among a dozen birds over West Island there in July-Aug. 1964.

As with the boobies and to a lesser extent the tropic-birds, the frigates have been reported more frequently at sea between 65-80°E to the north than to the south, with twelve records between the equator and 5°S, five away from the islands between 5-10°S, and only one south of 10°S. Most pelagic records were not identified to species, and one is referred with confidence and two doubtfully to each of the two species. G. S. Willis saw two possible Greater Frigates at 4°26'S 73°18'E on 7 March 1950, Bailey one male Lesser and four birds with white breasts at 00°50'S 67°40'E on 27 April 1964, Pocklington a male Lesser at 7°54'S, 70°00'E on 18 May 1965, Odling-Smee a possible Lesser Frigate at 00°40'S 74°E on 17 July 1964, Harrison another at 2°29'S 63°30'E on 9 Oct. 1955, Palmer two Greater Frigates at 5°55'S 76°20'E on 13 Sept. 1968, and Mitchell two possible ones at 5°02'S 79°26'E on 6 Nov. 1960. Ozawa and Seno (1966) record that during transects along the 78°E meridian in Dec. 1962 and 1963 frigates were seen circling over flocks of Sooty Terns feeding above skipjack tuna shoals on four days while they were crossing the counter-current area.

Ardea cinerea (?) Grey Heron

Vanhoffen (1901) saw a large grey heron, presumably *Ardea cinerea*, feeding on the reef at Diego Garcia on 23 Feb. 1899.

Butorides striatus albolimbatus   Little Green Heron

G. C. Bourne collected a pair on Diego Garcia on 22 Sept. and 28 Oct. 1885, now in the British Museum (Natural History), and Vanhoffen two more on 24 Feb. 1899, described by Reichenow (1900) as an endemic race, and now in the Berlin Museum. The Percy Sladen Trust Expedition found young birds on Petit Coquillage, Peros Banhos, in June 1905, where the birds were eating terns' eggs and young, and they collected four specimens which cannot be traced. Hartman also collected a pair on Coin du Mire there on 25 Oct. 1957, now in the Peabody Museum of Natural History, Yale University, and Fehlmann took three more on Diego Garcia in June 1967, which have been reassessed by Ripley (1969), who considers them very similar to B. s. javanicus of Ceylon and Java, but with more olive on the side of the throat, a character which becomes more pronounced in B. s. degens of the Seychelles. Loustau-Lalanne and other recent visitors confirm that on the inhabited atolls the species is still common both along the shore and inland.

Dr. G. Mauersberger has recently been good enough to examine the type and an immature male and reports that they are distinctly paler below than twelve adult B. s. javanicus, with the green gloss on the crown, back, and wings slightly weaker and less golden, the elongated back feathers paler and greyer rather than greenish, and the light rims to the wing feathers slightly wider than in freshly-moulted B. s. javanicus, not pure white though not as buff as some of the latter (though one from Malacca in 1853 also has white edges). This description agrees well with my own notes on the two specimens in the British Museum (Natural History), which I thought slightly paler and greyer with less green and more marked pale feather edges above and slightly paler below than B. s. javanicus. They show an early stage of the trend towards pale coloration found more markedly in B. s. albidula and especially semi-albinistic B. s. didi (Phillips and Sims 1958) in the Maldives to the north, and B. s. crawfordi and B. s. rhizophorae on Assumption and the Comoros to the west, as already pointed out by White (1951). I am inclined to wonder whether Dr. Ripley may have been misled by the heavier markings of the females already remarked by Benson (1960) in his evaluation of the Chagos birds. I find their wing measurements much the same, and they compare with those of the other races mentioned as follows:

Race	Origin	Specimens	Wing: range and mean, mm
javanicus	SE Asia	3 males, 3 females	175-193 (180)
albolimbatus	Chagos	type, immature male taken with it, male and female (?) in British Museum (Nat. Hist.)	174,169 (174) 176, 171
albidula	S. Maldives	3 males, 3 females	164-176 (167)
didi	N. Maldives	3 males, 3 females	165-174 (170)
crawfordi	Assumption, Aldabra	3 males, 1 female (Benson, 1967)	157-161 (159)
rhizophorae	Comoros	range of 16 (Benson 1960)	170-180 ?

From the inadequate information available I conclude that B. s. albolimbatus is an intermediate form doubtfully distinguishable from B. s. javanicus of the mainland in one direction and B. s. albidula of the southern Maldives in the other, of mild interest because it shows a barely perceptible development of the trend towards pale coloration and small size found in the populations of a number of the smaller Indian Ocean islands.

Bubulcus ibis   Cattle Egret

Saunders (1886) reports that G. C. Bourne found it a rare visitor during the north-west monsoon, and collected a male of the Asiatic form B. i. coromandas on Diego Garcia in September 1885. The species does not appear to have been reported again until Loustau-Lalanne (1962) recorded it as introduced to the same island from the Seychelles in 1955, and with an established colony of 27 nests at Point Est in December 1960. It has been reported in similar terms by most subsequent visitors while Pocklington found it breeding in May 1965. This population presumably belongs to the disputed race B. i. seychellarum (Salomonsen 1934, Vaurie 1963, Dawson 1966, Benson 1971), which is said to have a white throat like the nominate race from the west but reddish plumes in the breeding season like B. i. coromandas from the east, and to be somewhat small. The situation clearly deserves further investigation, but it seems possible that as with the more westerly Indian Ocean populations of the last species, the peculiar characters of the island populations may result from hybridisation between strays of both Asiatic and Ethiopian origin.

Francolinus pondicerianus   Grey Francolin

The Chagos group may be covered by the general statement by Gadow and Gardiner (1907) that this species has been introduced to many Indian Ocean islands; otherwise it was first reported from Diego Garcia by Loustau-Lalanne in 1960. A species of francolin was encountered there again by Odling-Smee in 1964.

Numida (meleagris ?)   Guinea Fowl

A species of guinea fowl was reported on Takamaka, Fouquet, and Anglaise Islands in the Salomon group by The Percy Sladen Trust Expedition in 1905, but Loustau-Lalanne failed to find it in 1960.

Gallus gallus   Domestic fowl

Chickens have been reported to run wild on the Ile Poule in the Peros Banhos group, but the character of the population and its recent welfare do not appear to be recorded.

Gallinula sp.?   Moorhen

Loustau-Lalanne was informed that a moorhen occurred on Diego Garcia and Salomon atolls in Dec. 1960, and it was reported again to Odling-Smee on Diego Garcia in July-Aug. 1964, but it has not been identified yet. While the Common Moorhen Gallinula chloropus has colonised many islands throughout the world, the White-breasted Waterhen Amaurornis phoenicurus from the adjacent coast is widely resident in the Maldives to the north, with a local race which shows much white, A. p. maldivus, on North and South Malé atolls (Phillips and Sims 1958), so that it might be this species which occurs, and the population might moreover be a distinct one.

Arenaria interpres   Turnstone

Collected on Diego Garcia by G. C. Bourne on 22 Oct. 1885, who reported that it occurred in flocks of twenty or thirty, and again in similar terms by visitors to all the islands at any time of year since then. Two were collected again on Diego Garcia by Fehlmann in June 1967. This species is even said to have been found breeding in the past (Farquhar, 1900).

Charadrius squatarola   Grey Plover

The Percy Sladen Trust Expedition obtained an immature bird on Peros Banhos and saw others on Salomon atoll in June 1905, and Loustau-Lalanne saw several more on the Ile du Coin, Peros Banhos, in Nov.-Dec. 1960.

Numenius phaeopus   Whimbrel

Collected on Diego Garcia by G. C. Bourne in 1885, who found it common but shy, and again by Vanhoffen in Feb. 1899. Loustau-Lalanne found it on all three inhabited atolls in Dec. 1960, feeding under the palms, Odling-Smee saw one on Middle Island, Diego Garcia, in July-Aug. 1964, and Fehlmann collected one there in June 1967.

Numenius arquata   Common Curlew

Loustau-Lalanne reports one shot on Diego Garcia in Dec. 1960.

Crocethia alba   Sanderling

Loustau-Lalanne saw two on Diego Garcia in Dec. 1960.

Calidris testacea   Curlew Sandpiper

G. C. Bourne collected a male on Diego Garcia in Sept.-Oct. 1885, and reported it was "tolerably common." The specimen is in winter plumage and advanced wing moult, but still retaining the outer three old primaries. The Percy Sladen Trust Expedition obtained one on Salomon atoll in May 1905, and Pocklington saw one fly over the Atlantis II off Eagle Island on 22 Oct. 1963.

Dromas ardeola   Crab Plover

G. C. Bourne shot one on Diego Garcia in Sept.-Oct. 1885, and reported it was common, but shy; the specimen is in moult, with new feathers in the mantle but still retaining the old outer three or four primaries. It was collected there again by Vanhoffen on 24 Feb. 1899. The Percy Sladen Trust Expedition were informed it bred in December in burrows on Peros Banhos: this species does nest in burrows but there could also have been some confusion with the shearwaters that nest there then. It was found to be common on Diego Garcia, and one was seen on Ile du Coin, Peros Banhos, by Loustau-Lalanne in Dec. 1960.

Catharacta skua   Great Skua

Bailey saw a rather dark bird at 12°00'S 67°27'E on 19 April 1964, and Mitchell a possible bird in the distance at 3°48'S 65°01'E on 12 Jan. 1961. Occasional individuals are found considerably further north in the Indian Ocean.

Sterna sumatrana   Black-naped Tern

G. C. Bourne found them common at Diego Garcia and collected one on 9 Oct. 1885. The Percy Sladen Trust Expedition found eggs on broken trunks of Tournefortia trees and the leaf bases of coconuts on Yéyé Island, Peros Banhos, in June 1905; where Hartman also collected a pair on the Ile du Coin on 25 Oct. 1957; Loustau-Lalanne found them present on Yéyé, Longue and Petit Coquillage Islands but not breeding in Dec. 1960. Odling-Smee found them numerous around Middle Island, Diego Garcia, in July-Aug. 1964, among other recent reports of their continued presence in the lagoon there.

Sterna fuscata   Sooty Tern

Finsch (1887) found them breeding in vast numbers, estimated as of the order of 100,000, in a bare area in the centre of a thicket on Diego Garcia on 9 July 1884; they had eggs and were reported to start breeding about June and leave by November. The following year G. C. Bourne found eggs still present there on 17 September and took a female on 8 October; however, they were being severely persecuted at this time despite attempts by the Manager, Henry Spurs, to conserve them, and these may have been repeated layings. The birds appear to have deserted this atoll soon afterwards, though Branegan reported dark-backed terns (identified as Bridled Terns Sterna anaethetus, which are otherwise unrecorded, and possibly this species ?) offshore on 9 July 1958. The Percy Sladen Trust Expedition failed to find them anywhere in the group in May-July 1905, but Hartman collected a male on the Ile du Coin, Peros Banhos, on 25 Oct. 1957, and Loustau-Lalanne found several thousand with groups of hundreds starting to lay on Grand Coquillage, Yéyé and Longue Islands in December 1960. Pocklington (1967a) also saw many off Eagle Island on 22 Oct. 1963. Loustau-Lalanne reports that the main breeding season was considered locally to start with the south-east monsoon in May and to last till July or August, with a second breeding season from November to February, but the available evidence is not entirely compatible with this, and it seems possible that the season may vary locally or from year to year, or that the birds may breed more often than once a year, as for example they do where they nest every 9.6 months on Ascension or twice a year in the central Pacific (Ashmole, 1963).

This species is very widespread at sea in flocks which often run into hundreds and exceptionally thousands, and as remarked by Bailey (1968) their distribution varies in a confusing way. They have been recorded somewhere in the area considered during most months of the year, though the numbers reported on individual voyages vary considerably, from reports of continuous views of flocks to complete blanks. When the records are considered as a whole, it is notable that few were reported in the area over the southern equatorial current south of 10°S and east of 70°E, notably by the Japanese expeditions which carried out transects along the 78° meridian in December 1962 and 1963. They found the birds concentrated over the equatorial counter-current further north where they were feeding over shoals of skipjack tuna (Ozawa and Seno 1966). Gill (1967) also saw few south of the Chagos group during a transect along the 75°E meridian in April 1964, whereas further west Bailey (1968) saw flocks scattered all along the 68°E meridian in April and June 1964, though the numbers seen in the central part of the area increased in June. Harrison, Palmer and others also have records of flocks on either side of the Chagos group in July, and they and other observers noted several more in September, October and November.

Because Bailey remarks on the absence of records of young birds in the well-populated breeding areas to the west, and none have been reported around the Chagos group either, it may be worth drawing attention to one bird moulting out of winter plumage photographed by Price when it came on board at 1°10'N 79°30'E far from land to the north-east on 14 Aug. 1966 (Bourne, 1970). This occurrence suggests the possibility that western Indian Ocean Sooty Terns may spend their immature period further east in the way that western Atlantic ones breeding on the Dry Tortugas off Florida have now been shown to spend their youth in the Gulf of Guinea to the south-east (Robertson, 1969).

Thalasseus bergii Crested Tern

G. C. Bourne collected an immature male in fresh plumage at Diego Garcia on 9 Oct. 1885, but did not find them common. Neale and Pocklington have seen them there again on 9 July 1968 and 19 May 1965, and Odling-Smee thought the Lesser Crested Tern *T. bengalensis*, otherwise unrecorded, might also have been present in July-Aug. 1964. The Percy Sladen Trust Expedition collected several birds at Peros Banhos in May-June 1905, and found two or three pairs occupying trees on Ile Lubine, Egmont Atoll, in June; Loustau-Lalanne saw a bird in Salomon lagoon in Dec. 1960, but breeding has not been proved yet.

Anous stolidus   Brown or Common Noddy

Finsch found these nesting with Sooty Terns on Diego Garcia on 9 July 1884, and estimated that there were about a tenth as many, or perhaps 10,000. G. C. Bourne also found them nesting there on 15 Sept. the following year, and took a female on 2 October. He comments that many were nesting in trees so it seems possible he encountered Lesser Noddies as well. Vanhoffen observed flocks fishing over an area of sea swarming with the copepod Poulellida on 22 Feb. 1899, the day before arriving at Diego Garcia from the north, and also found the birds nesting in the palms there. Dr. G. Mauersberger reports that the two skins he collected on 24 February have fresh primaries, old central tail-feathers, and new growing outer ones. In June 1905 the Percy Sladen Trust Expedition found the birds nesting both on the ground and in trees and with eggs and young on Petit Coquillage, Peros Banhos, and nesting in trees on Egmont Atoll but they were informed that it was not the main breeding season on Peros Banhos. Loustau-Lalanne also found noddies nesting both on the ground and in the trees on West Island, Diego Garcia, and Grand and Petit Coquillage, Longue and Yéyé Islands, Peros Banhos, with both eggs and young in Nov.-Dec. 1960. He was informed that there are two main breeding seasons, the main one from May to August with another from December to February. A number of other visitors have also found the noddies breeding on the three small islands at the mouth of Diego Garcia lagoon in the period from May to August, while Pocklington saw many off Eagle Island on 22 Oct. 1963, and Mitchell a large flock at sea at 3°55'S 70°25'E on 13 Jan. 1961, in much the same area where they had been noted in February by Vanhoffen.

Anous tenuirostris   Black or Lesser Noddy

This species was apparently overlooked among the Common Noddies by the earlier visitors, but Vanhoffen collected a male on Diego Garcia on 24 Feb. 1899, and the Percy Sladen Trust Expedition found it breeding in trees alongside the Common Noddies on Petit Coquillage, Peros Banhos, in June 1905, where Hartman also collected a male on the Ile du Coin on 25 Oct. 1957. Loustau-Lalanne found it breeding in trees alongside the Common Noddies on the lagoon islets of both Diego Garcia and Peros Banhos in Nov.-Dec. 1960, and several other visitors have recorded occasional birds or flocks at Diego Garcia since then. G. S. Willis also saw a possible bird at sea at 6°43'S 74°42'E on 8 March 1956, but like the Common Noddy it does not seem common far from land.

Gygis alba   White or Fairy Tern

This species has been found breeding on Diego Garcia by most visitors, including Finsch in July 1884, G. C. Bourne in Sept.-Oct. 1885, Vanhoffen in Feb. 1899, the Percy Sladen Trust Expedition in July 1905, Loustau-Lalanne in December 1960, Pocklington in May 1965 and Stoddart in July 1967. It nests in trees on all the islands. The Percy Sladen Trust Expedition found it on Petit and Grand Coquillage, Yéyé and Longue Islands in June 1905, and Loustau-Lalanne on the Ile du Coin in December 1960 at

Peros Banhos, where it has also been found nesting on the ground. It has been reported to breed throughout the year. It does not appear to have been recorded far out at sea in this region.

Streptopelia picturata chuni   Madagascar Turtle Dove*

The status of this species is uncertain. Pigeons are mentioned among the supplies available on Egmont Atoll in the first half of the 19th century (Horsburgh, 1842) though they do not appear to have been reported there since then. Neither Finsch (1887) nor G. C. Bourne (1886) found them on Diego Garcia, but the former mentions that when Captain Baudissin from his ship visited the island he saw a number of pigeons at Point Marianne, which seemed likely to have been introduced from Mauritius or Madagascar. Presumably this was the species eventually collected among some low bushes by Vanhoffen on 24 Feb. 1899, and described by Reichenow (1900) as a new race of the Madagascar Turtle-dove, a species already widely distributed by both natural and artificial means among the islands to the west of Chagos, and differing mainly from the nominate Madagascar form in its darker coloration. Thereafter it does not appear to have been noticed again until Loustau-Lalanne found it well distributed on Diego Garcia, and apparently largely parasitic on man, feeding at the copra driers, in December 1960, when he found a nest with one young. It has since been recorded by most visitors, and Fehlmann obtained two specimens, now in the Smithsonian Institution, on 13 June and 5 July 1967.

The three females so far available have recently been discussed by Benson (1970), who agrees that they are rather dark and concludes that they might be either a hybrid population combining characters of the races S. p. picturata of Madagascar and the darker form S. p. comorensis of the Comoros. The latter might have been introduced when the island was first colonized with slaves imported from East Africa in the late 18th and early 19th centuries. But possibly the Diego Garcia population

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* The two specimens of Turtle Dove, Streptopelia picturata chuni (Reichenow) collected by Fehlmann and Payet on Diego Garcia in 1967 impress me on reexamination (Feb. 1971) as being a valid endemic race. In size they are identical to S. p. saturata (wing 160-162) from the Amirante group of islets south of the Seychelles and some 1300 miles west of the Chagos Archipelago. They differ, however, in lighter color, thus approaching typical picturata of Madagascar. The likelihood of this population being a hybrid one with the smaller rostrata of the Seychelles seems remote (contra Benson, 1970), and as the species is widely distributed in the western Indian Ocean islands and divided into some seven other subspecies, it seems credible to believe that chuni is indeed an endemic island population.--S. Dillon Ripley

might be the result of recent evolution of typical birds imported from Mauritius. Clearly the study of more specimens including males is still needed, as well as the investigation of their further evolution.

Geopelia striata Barred Ground-dove

Loustau-Lalanne reports that this species, already found feral on a number of other Indian Ocean islands, was first introduced to Diego Garcia from the Seychelles in 1960, and that 14 were present at Point Est by December that year. Pocklington saw one in May 1965, and wondered whether they were successful, but Fehlmann was still able to collect six in June 1967.

Acridotheres tristis Indian Mynah

This species, also introduced to many Indian Ocean islands, was found to be common on Egmont Atoll by the Percy Sladen Trust Expedition as early as 1905, but has apparently only reached Diego Garcia recently, according to one report in 1953. It was not noticed by Loustau-Lalanne in Dec. 1960, but was already considered to be the commonest land-bird by Odling-Smee in July-Aug. 1964, while Stoddart also found noisy flocks of forty to sixty everywhere in June 1967.

Passer domesticus House Sparrow

This is the only passerine mentioned by the Percy Sladen Trust Expedition as occurring on Peros Banhos and Salomon in 1905, and they were informed that it had been introduced from Mauritius. In December 1960, Loustau-Lalanne found that it was still the commonest land-bird on both atolls and was told that they breed throughout the year, but could not confirm this.

Foudia madagascariensis Madagascar Fody

This Madagascar species, also widely introduced to Indian Ocean islands and to St. Helena in the Atlantic from Madagascar, was first noticed on Diego Garcia by Finsch on 9 July 1884, who found it common, with most birds in the green eclipse plumage though a few cocks were beginning to show the scarlet breeding dress. G. C. Bourne obtained a male with a red head on 30 September the following year which closely resembles the allied species *Foudia eminentissima* in appearance, but the bill is short and the wing small for that species so it seems likely that it is actually *F. madagascariensis* in mid-moult. It was collected again on Diego Garcia by Vanhoffen in 1899, but does not appear to have been noticed by the Percy Sladen Trust Expedition in June-July 1905, possibly because birds in eclipse dress were mistaken for sparrows. Hartman next collected four males, three in breeding dress and one just starting to assume it, on the Ile du Coin, Peros Banhos, on 23 Oct. 1957, while Loustau-Lalanne found it the commonest land-bird on Diego Garcia but outnumbered by House Sparrows on Peros Banhos and Salomon in Nov. and Dec. 1960. He was informed that the males assume breeding dress from

Oct. to May, and found eggs, about two months later than in the Seychelles; he found 47 clutches of two, four of three and one of four eggs, an average clutch size of 2.1 compared to an average of 2.7 for sixteen clutches in the Seychelles (Crook, 1961). Subsequently, Odling-Smee and Stoddart have each noticed single males coming into breeding dress in July and August in 1964 and 1967.

Other migrants

Loustau-Lalanne saw flocks of ducks on the barachois Sylvain of Diego Garcia in Nov.-Dec. 1960. Seven species of duck have been recorded in the Maldives, and the Garganey *Anas querquedula* have even reached Rodriguez far to the south (Vinson, 1947).

The Percy Sladen Trust Expedition recorded a "snipe" on Diego Garcia in July 1905, and like Bourne twenty years before were informed that raptors, and also crows, pigeons and hirundines, occurred during the northerly monsoon. They saw at least two species of the latter, probably the Swallow *Hirundo rustica* and House Martin *Delichon urbica* in May-June 1905. Loustau-Lalanne also saw several hirundines, possible House Martins, on Peros Banhos and Salomon atolls in December 1960. At sea Elkington (1929) noticed a hawk seize a small white bird, and later two parrots *Kakatoe tenuirostris* escape from his ship and fly away towards the Chagos group 145 km away at 6°59'S 69°02'E on 15 April 1929. Later (Elkington 1930) he saw two small grey and white finch-like landbirds fly by his ship at 2°24'S 73°08'E on 23 Oct. 1929. There seems little doubt that with further study the islands would be found to receive much the same type of stray migrants as the Maldives to the north, which have a list of between ninety and a hundred species (Phillips, 1963), though the numbers would be smaller because of the greater distance from the mainland.

E. Discussion

The Chagos group occupy a strategic position, not only militarily but ornithologically. They are isolated in the remotest possible position in the tropical Indian Ocean, in a situation lying in the path of both landbird vagrants from three directions, the east, north and west, and seabird migrants from four, the north and south and dispersing east and west along the equatorial current systems. They provide a major breeding station for pelagic seabirds and an interesting potential site for colonisation by landbirds. It is one of the numerous unpublicized tragedies of insular ornithology that their natural history was not investigated before major changes had resulted from human colonisation of the larger islands, and another may result from further careless developments on the still comparatively unspoilt lesser islands if strict attention is not paid to conservation during the expansion of military facilities on Diego Garcia.

At the present time the information is insufficient to provide a full account of the ornithology of the group, and in the preceding attempt to assess the character of its avifauna there has had to be a strong speculative element. This is regrettable but necessary. The evidence is still inadequate to draw many general conclusions, but it may be useful to comment on some of the main points arising if only because they provide useful indications of the directions in which it might be desirable to carry out more work. The birds are probably best considered under two main headings, landbirds and seabirds.

1. The landbirds

It would be rather surprising if the original dense forests of the larger islands held no terrestrial landbirds, probably including at least one passerine, a dove, and perhaps a flightless rail. Since they were probably richly fertilized by seabird guano, and it is clear that at the present time the archipelago still receives a fair number of stray vagrants from the north during the northern monsoon, and quite likely others from the east when the south-east trades replace it, it seems possible that there was once quite a rich landbird community, comparable to that of Christmas Island further east (Gibson-Hill 1948). If so, it would appear to have been largely or entirely wiped out with the destruction of the native forests and the introduction of mammalian predators, with the possible exception of the "waterhen," which might still prove to be an interesting endemic form comparable to the flightless rail of Aldabra, and of course the weak local race of little Green Heron, perhaps the most widespread and locally variable of all Indian Ocean island birds.

Whatever the original landbird community may have been, it seems highly probable that with the exception of the waterhen and heron it now consists entirely of human introductions. At least two widespread Malagasy forms, the fody and turtle-dove, were apparently already present when the first ornithologist, Finsch (1887) arrived in 1884, and the second shows local peculiarities of a simple kind. However it seems rather less probable that these reached the islands naturally with the weak westerly winds that sometimes extend across the Indian Ocean in the vicinity of the equator during the northern winter than that they were imported by man together with the bulk of the first human colonists and such distinctive food-supplies as giant tortoises in the days of the slave-trade from East Africa (Ingham, 1962, and references quoted by Benson, 1970), possibly via Mauritius, the Comoros, or the Seychelles. Subsequently the next wave of introductions, notably the House Sparrow, appear to have come from the seat of government in Mauritius, while recently another group including the Ground-dove and Cattle Egret have been introduced from the Seychelles following the addition of the group to the British Indian Ocean Territory, administered from Mahé.

It is notable that whatever the fate of any original landbirds may have been they were confronted with the destruction of their habitat and the introduction of such predators as rats, cats, and hogs, all of which appear to have been widespread by the middle of the 19th century (although Finsch noticed no rats on Diego Garcia in 1884, so that their introduction by vessels coaling there in the 1880s might explain the extermination of the terns at that time), the more recent introductions have often been extremely successful at least in the first instance. The fody is clearly extremely numerous on Diego Garcia although Loustau-Lalanne (1962) reports it is outnumbered by the House Sparrow where that species is also present as on Salomon and Peros Banhos. This is possibly an interesting example of the effects of competition between species with a similar ecology which deserves further study. The Mynah was also extremely common on Egmont in 1905, and has increased explosively following its introduction to Diego Garcia within the last twenty years. The doves are apparently also fairly successful in Diego Garcia, but there is unfortunately little information about the larger ground birds such as the moorhen, francolin, guinea fowl and feral chickens. The success of these introduced birds could also provide an interesting study, especially in comparison with the situation on the numerous other islands of the Indian Ocean area where they have also been introduced (Watson et al. 1963), and in relation to their effect on other elements in the island ecosystem including endemic plants and invertebrates.

Meanwhile, Loustau-Lalanne (1962) provides a few important indications of their ecology, including a list of plants whose flowers or seeds are eaten by the birds, and potential hazards, notably introduced mammals, Little Green Herons, which eat eggs and young birds, and sticky Pisonia seeds. It is notable that the fody and ground-dove, whose original area of origin presumably lies further south in the region of Madagascar, have so far been found breeding only in the southern summer, whereas the cosmopolitan House Sparrow is reputed to breed throughout the year, which might be one of the factors giving it an advantage over the fody where they occur together. So far the Little Green Heron, which is apparently of Asiatic origin, has only been found with young in the northern summer, while the cosmopolitan Cattle Egret has been seen at the nest sites in both December and June (Loustau-Lalanne 1962; Pocklington 1967), but it is notoriously unwise to draw conclusions about the breeding of water-birds from scanty evidence. However, as far as the evidence goes, it appears at the moment that local breeding seasons agree mainly with those found elsewhere, southern forms nesting in the southern summer, northern ones in the northern summer, and cosmopolitan ones continuously. It remains to be seen whether local factors also influence these breeding-seasons.

It may be noted that the two poorly-studied but clearly weak hypothetical endemic races show a simple type of geographical variation in conformity with trends widely established on other Indian Ocean islands, the Little Green Heron being slightly smaller and paler than the mainland population, and the Turtle Dove darker than the Madagascar one. The significance of these variations, if they exist, seems doubtful, and that of the Turtle Dove at least seems to have arisen very recently as the species was probably introduced within the last two hundred years only.

They deserve study in a wider context, and meanwhile it is satisfactory to be able to remark that both forms appear to be well established and unlikely to be harmed by any reasonable foreseeable developments.

2. The seabirds

The islands clearly have a rich seabird community, including both the breeding species and migrants from elsewhere. At the present time the breeding population is only known to include common pan-tropical species, but it has only been investigated superficially so far, and further examination of the outlying islands and subfossil deposits might yield evidence for the presence at least in the past of a variety of other more unusual species such as members of the protean gadfly petrel genus Pterodroma or the remarkable endemic tropical seabird community now only found further east on Christmas Island. Abbott's Booby Sula abbotti in particular may once have bred on the Chagos group. If it or any other scarce species does by any chance survive on outlying islands in the Chagos group, there is a very urgent need for conservation of the population in view of the many threats now arising to affect more accessible seabird colonies elsewhere.

Meanwhile, if we analyse the known breeding seabird community, it appears rather poor in species feeding inshore such as some of the terns, but rich in more pelagic species, some of which such as the Sooty Tern were clearly at one time extremely numerous, although they have now been either much reduced or driven to the less accessible outer islands. Observations during the International Indian Ocean Expedition, notably by the Japanese participants (Ozawa and Seno 1966) suggest that these pelagic species may feed largely to the north in the vicinity of the equatorial counter-current when it is well-developed at the end of the northern winter, which is also reported to be the main breeding season at least in the northern islands. Further south on Diego Garcia the terns were however found breeding at the opposite season of the year in the last century, and they may be exploiting instead the southern equatorial current when it extends north across the equator past the islands to become the monsoon drift during the period of onset of the SW monsoon in the Arabian Sea.

The precise oceanographic phenomena giving rise to the clearly substantial food-supply supporting these, at least originally, vast seabird communities are still unclear, but it could be as at other stations near the equator in the Pacific (Ashmole and Ashmole, 1967) and elsewhere, largely the descent of tropical water in regions of turbulence around the islands and in areas of convergence along the boundaries of the equatorial counter-current, resulting in an accumulation of floating food-organisms, in sharp contrast to the upwelling which results in a high marine productivity along the lee shores of the land-masses. In this connection, it is perhaps worthy of note that the rather distinct seabird community of Christmas Island, including two endemic species and a very well-marked race, Abbott's Booby Sula abbotti, the Christmas

Frigate-bird Fregata andrewsi and the Golden Tropic-bird Phaethon lepturus fulvus, may have evolved adaptations to exploit an equally distinct local phenomenon, a local area of upwelling to the east, south of Java and Sumbawa during the south-east monsoon (Wyrtki 1962, Cushing 1969) which appears to form the special feeding-area of the tropic-bird at least (Pocklington 1967b, Shuntov 1968). This might explain why these birds are not found further west, except for Abbott's Booby's occurrence in the past in a potentially similar area of upwelling north of Madagascar.

While the breeding seabird community of the Chagos islands may or may not be found to include additional species on further investigation, it seems extremely probable that more species are likely to be found as visitors offshore, either on migration between breeding and wintering areas in higher latitudes to the north and south, or passing the period of immaturity and between breeding-seasons in the high marine productivity regions in the vicinity of the equator. These may well include more northern skuas and terns (Stercorariidae and Sternidae) then have been suggested yet, and additional petrels such as the White-faced or Streaked Shearwater Calonectris leucomelas from the North Pacific, already known to winter commonly around the East Indies, and especially gadfly petrels of the genus Pterodroma, with strays of a wide variety of other species from the south. It is still unclear to what extent visitors already reported offshore, let alone any possible additions, occur there primarily as regular visitors over long periods, or merely as passing through on migration. It seems likely that the Chagos group may lie in the path of at least two important streams of migration, of Wilson's and "Fregetta" Storm-Petrels (Oceanites oceanicus and Fregetta spp.) north from the Southern Ocean to the northern coasts of the Indian Ocean, and of Flesh-footed Shearwaters (Puffinus carneipes) and White-faced Storm-petrels (Pelagodroma marina) which breed off south-west Australia and winter in the Arabian Sea. Other species such as the Oceanodroma storm-petrels which enter the Indian Ocean from the Pacific (Bailey et al. 1968) may also tend to pass through the area in numbers following the equatorial counter-current. Therefore the birds occurring at sea may also repay more detailed study in the future.

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18. SETTLEMENT AND DEVELOPMENT OF DIEGO GARCIA

D. R. Stoddart

A. Discovery

The islands of the Chagos Archipelago were probably discovered and named by Portuguese navigators sailing from the Cape of Good Hope to Goa in the first two decades after Vasco da Gama pioneered the route in 1498; but it was more than two hundred years from their discovery before the positions of the Chagos and other islands were reasonably determined. Clusters of islands probably representing the Chagos appear on Alberto Cantino's world map of 1502; but though Addu Atoll at the southern end of the Maldives was clearly marked on Joan Martines's chart of 1578, the islands to the south remained schematic (Bagrow 1964, Skelton 1958). Generally navigators sought to avoid the maze of islands and short steep seas of the Great Chagos Bank, which had no trading importance compared with the factories of India and, later, the colonies of the Mascarenes. The standard histories of the Indian Ocean contain little but conjecture for this early period (Toussaint 1961).

The Mascarene Islands, which had been discovered in 1505, were not permanently settled until the seventeenth century, and the Ile de France itself (Mauritius) was not formally annexed by France until 1717. During the century after 1734, when Mahé de la Bourdonnais became governor of the Ile de France and Bourbon (Réunion), the French systematically explored the islands to the north, from time to time clashing with the English. The first major voyage of discovery was that of Lazare Picault, who visited Peros Banhos Atoll in the _Elisabeth_ in 1744. Picault's journals have not been published in full, though parts are available (Fauvel 1909). British ships visited the Chagos islands in 1719 (_Stranger_) and 1728 (_Grantham_), and Diego Garcia itself in 1745 and 1755 (_Pelham_ and _Mary_, respectively). Growing rivalry between France and England led to a reappraisal of the value of these remote islands. In September 1769 a more thorough survey was made of Diego Garcia by the French ships _L'Heure du Berger_ (Chevalier Grenier) and _Vert Galant_ (Lt La Fontaine), and in 1770 La Fontaine made the first survey of the Diego Garcia lagoon. He reported that "a great number of vessels might anchor there in safety; but the principle object is wanting: for though it is covered with woods, it is not provided with fresh water" (quoted by Scott 1961, 68; Unienville 1838, 182). These observations, together with those of the Abbe Rochon (1793) and of the hydrographer D'Après de Mannevillette (1775), led to a much more detailed understanding of the topography of the

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central and western Indian Ocean (Figure 33), which is reflected in charts from about 1780 onwards (e.g. Grant 1801).

The dangers associated with navigation in these seas are vividly illustrated by the fact that the hydrographer James Horsburgh was himself wrecked on Diego Garcia in the Atlas on 30 May 1786. "The charts on board were very erroneous in the delineation of the Chagos Islands and Banks," explained Horsburgh (1809, 132), "and the commander trusting too much to dead reckoning, was steering with confidence to make Ady or Candy (which do not exist) for a new departure, being in their longitude nearly, by account, and bound to Ceylon; but, unfortunately, a cloud over Diego Garcia prevented the helmsman from discerning it (the officer of the watch being asleep) till we were on the reef close to the shore; the masts, rudder, and everything above deck, went with the first surge; the second lifted the vessel over the outer rocks, and threw her in toward the beach."

B. Early Settlement

The French did not try to settle on Diego Garcia, and the first attempt to do so, in 1786, was by the English, who wished to use the atoll as a victualling station. Six shiploads of soil were sent from Bombay by the East India Company, in the hope of growing vegetables and cereals, but the experiment was a failure. Documents concerning the planning of this expedition by the Bombay Council, including a diary kept by the leader, R. Price, on Diego Garcia between 29 April and 24 September 1786, are preserved in the Bombay Secretariat Record Office (Secret Department, Vols. 33A, 1-77; 34, 532-890; 35, 10-11, 133-139, 195-215; 36, 395-7; 39, 177-208, 223-4, 327-47; 288, 1-185). By the time the French heard of the attempted settlement, and sent the frigate Minerve from Mauritius to deal with it, the English expedition has withdrawn. Magon de Médine on arrival formally reasserted the French claim to the atoll. The French made no settlement, and again the English returned, Lt Archibald Blair of the East India Company Marine making a survey in 1786.

French settlement began in the late 1780s, when a M. Le Normand was authorised by Depuit de la Faye to settle at Diego Garcia and to supply coconuts to the Ile de France. In 1793 this was taken a step further, when M. Lapotaire was given permission to establish a factory at Diego Garcia to export copra and oil rather than whole nuts to the Ile de France. He began by taking two ships, each with 25-30 men, and slaves, to the atoll: and in 1794 he exported 900 veltes of oil (about 1350 gallons or 6100 litres). A few years later he was joined by brothers named Cayeux in the same business.

Thie profitable enterprise attracted others, however. Two new factors, Blevec and Chépé, appeared, making oil in a very wasteful way. In 1808 Lapotaire petitioned the captain-general of the Ile de France with new proposals. He suggested that the two sides of the atoll be allotted to him, and the southern part to Cayeux. No other factors would be allowed. He also proposed the prohibition of oil manufacture on the atoll, on the ground that it provided too great temptation to the English; instead, copra would be sent to mills in the Ile de France. On 26 April 1809, however, the captain-general gave Blévec and Chépé authority to exploit the eastern part of the atoll, while at the same time prohibiting oil manufacture. These grants were subject to cancellation on failure to replant coconuts, and the concessionaires were also to be responsible for the care of any lepers sent to Diego Garcia from the Ile de France. It had been intended that these lepers would live only on the small islets, but this was not adhered to. The population of the atoll at this time totalled 275, including 37 lepers (Moreau 1827).

C. The Plantations under the English

On 3 December 1810 the Ile de France capitulated to the English, and although at the treaty of Paris in 1814 several territories, including Bourbon, reverted to France, this did not apply to the Ile de France and its dependencies (including Diego Garcia), which remained under British Administration (Treaty of Paris, 30 May 1814, Article 8; proclamation in Mauritius 15 December 1814). The coconut concessions on Diego Garcia continued, but the English policy of ending the slave trade and finally (1839) of abolishing slavery led to problems in the plantations. Discontent at Diego Garcia among both slaves and lepers led to the appointment of the first government agent, M. Le Camus in 1824. In addition to administration, he was concerned to provide pilotage for visiting ships, and also with the construction of a lazarette on one of the small islands. New surveys were carried out at this time, by Col. E. A. Draper, who mapped Lapotaire's concession on the west side in detail (1824), and by W. and C. T. Hoart in 1824-5 (Figure 34). Camus served for five years, and in 1830 was given Lapotaire's concession as a reward. In 1837 Commander Moresby made the first full hydrographic survey of the atoll; some of his observations were used by Darwin (1842) and others were published anonymously (Anon. 1845).

In 1859 Commissioners (Lt H. Berkeley, Mr. J. Caldwell) were appointed by the Mauritius Government to report on conditions in the island dependencies, and in 1864 a district magistrate was appointed for the islands, visiting Diego Garcia the same year. Conditions must have been prosperous at this time, for the present plantation buildings, including the large manager's house, were being built at East Point. The population of Diego Garcia in 1851 totalled 334, and 1861 554 (males 417, females 137).

In 1865 the Government gave the concessionaires the opportunity to change their holdings from jouissance, essentially a right of usufruct subject to revocation, to a holding in perpetuity on cash payment of two shillings per velte of oil produced, based on the 1864 output: the production of oil had clearly been resumed at some time following the 1809 prohibition. In 1864, the output at Diego Garcia was as follows:

East Point	34 000 veltes	(51 000 gallons)	232 000 litres
Marianne	20 000 veltes	(30 000 gallons)	136 000 litres
Minni Minni	12 000 veltes	(18 000 gallons)	82 000 litres
Total	66 000 veltes	(99 000 gallons)	450 000 litres

These figures seem extremely high: at about 24 lbs of copra per velte of oil, representing about 75 nuts, it indicates a total yield of nearly five million nuts. Assuming 800 nuts to the acre, i.e. not particularly intensive or well-managed plantations, this would indicate that almost the whole area of the atoll (6250 out of 7488 acres) was being cropped for coconuts. These rough calculations simply indicate the order of magnitude of the operations at this time. Under the new administrative arrangements, the government retained the right to resume up to two acres in each property for any government purpose. The powers of magistrates for the island dependencies were defined in 1872, and in 1875 the first regular magistrate's tour was made by E. P. Brooks (Brooks 1876). The total Diego Garcia oil production of 66 000 veltes in 1864 compared with 13 500 on Salomon, 26 000 on Peros Banhos, 11 870 on Egmont, and 8 000 on Eagle (Lane 1956b, 671-3).

The three estates on Diego Garcia were amalgamated in 1883 under the Société Huilière de Diégo et Péros. James Spurs, the company manager at East Point, who later went to Aldabra, was a remarkably capable and enlightened man. He had strict regulations over liquor consumption, and ran his plantations in a benevolent if despotic manner. His labourers were expected to collect, dehusk and break 500 nuts a day, and the women to scoop out 1200 shells a day. There were hospital buildings on each of the estates.

D. The Coaling Stations

In 1881 the Orient Steam Navigation Company gave up its coaling station at Aden and surveyed Diego Garcia as an alternative. The Company operated twelve ships on the England to Australia run, and in 1882 it opened the first coaling station on Diego Garcia. The London company of G. Lund opened a second coaling station in the same year: it had only two cargo ships plying between England and Australia, but proposed to sell coal to any ship which called. Both Orient and Lund began at East Point. Orient employed James Spurs, who had resigned as manager for the Société Huilière, as their agent on the atoll, and imported both Somali and European labour. Lund appointed G. Worrell as local agent, and used local labour when required. The coal stocks were kept in hulks anchored off East Point and Minni Minni, and Orient also had yards on shore at East Point. At the time of the Magistrate's visit in 1883 there was a stock of 15,000 tons of coal at the atoll, two-thirds of it belonging to Orient. The target of the operators was to fuel 180 ships a year, each turning around in 24-68 hours; passengers were not allowed to go ashore.

The following year, 1884, Orient moved from East Point. Its hulks were anchored closer to the lagoon entrance, at Barton Point. The Company leased two of the small islets, Middle Island for Spurs as agent, and East Island for labour. Already there were considerable labour troubles, and also problems arising from the passage of large emigrant ships, many of whose passengers managed to get ashore. Ivanoff Dupont, the magistrate, was kept busy with incidents (Scott 1961). In November 1885 a police post had to be established at Minni Minni, consisting of two officers and six men, to keep order, but there was constant squabbling between the Mauritius Government and London over payment of the costs involved. With the British Government unwilling to pay, the Mauritius Government finally revoked the arrangement. G. C. Bourne gives an interesting insight into the nature of the labour problems during his visit in 1886: "Mr. Leconte told me that on his arrival on the island three years ago, he found the Negroes in a most insubordinate condition, and that within a month of his landing, his verandah was besieged by a body of thirty men, armed with knives and bludgeons, who declared that they would not leave the place until they had taken his life. Luckily for him they were as cowardly as they were insolent, and he was able to keep them at bay by presenting a revolver, until he had succeeded in reducing them to a more reasonable state of mind" (Bourne 1886b, 389-390).

The coaling stations again focussed attention on the strategic value of Diego Garcia, for the first time since the East India Company's foray in 1786. In February 1884 Lund made a proposal to the Mauritius Government for a mail service from Mauritius to Colombo, linking at Diego Garcia with the frequent Cape to Australia services, thus bringing mail to Mauritius much more rapidly than directly from the Cape. But the direct Cape-Mauritius service had just been renewed and Lund's proposal was not taken up. If it had, the strategic importance of the atoll would have been more apparent. The interest of the Imperial Government was great enough, however, for H.M.S. Rambler under Commander the Hon. F.C.P. Vereker, R.N., to make the first thorough hydrographic survey of the northern half of the lagoon in 1885. Vereker's survey, with Moresby's more general survey of the southern lagoon, remains the basis of the published charts.

In spite of its turbulence, the coaling station period was a brief one. In 1888, after only six years' operation, which had proved unprofitable, the Orient Company ceased using Diego Garcia and sold its facilities to Lund. James Spurs left the atoll and went to Aldabra. It is not known how long Lund continued working, but by 1900 Diego Garcia was once again simply a supplier of coconut products.

E. The Twentieth Century

After the withdrawal of the coaling stations, the atoll reverted to a plantation economy. The buildings at East Point were renewed, and a chapel added in 1895. Later a church and a jetty with light railway were added, and East Point emerged as the main commercial centre of the atoll.

The buildings at Minni Minni, Middle Island and East Island were abandoned and are now in ruins or have disappeared. Pointe Marianne is little more than an outstation of East Point, where all processing is carried out, and the large manager's house at Marianne has disappeared. Figures for oil production given by Bergne in an unpublished manuscript dated 1900 are remarkably similar to those of 1864:

Plantation	Lessee	Oil production, galls.	Litres
East Point	M. Liénard	50-60 000	227-273 000
Pointe Marianne	M. Levieux M. Liénard	30-35 000	136-164 000
Minni Minni	M. Margery	16-20 000	73- 91 000

But in spite of this apparent stability, the industry was about to undergo a major technological change. In 1903 the Government of Seychelles introduced copra platforms into the islands to dry copra by a combination of sun and artificial heat, and by about 1910 copra was the main coconut product exported from the islands to Mauritius. The "Oil Islands", as the Chagos group had been known, were oil islands no longer. It is not known when exactly the change occurred at Diego Garcia, but presumably it was at about the same time as on other Indian Ocean islands (Dupont 1938). Wiehe (1939) gives a detailed account of the operation of the coconut plantations and of copra production on Diego Garcia, Peros Banhos and Salomon immediately before the Second World War: at this time the atoll was yielding about 5.3 million nuts a year. In 1967 the copra production was 707 tons, half the total for the British Indian Ocean Territory. This must represent a yield of at least 4.5 million nuts, and suggests that the annual production has not greatly changed over the last century.

Diego Garcia had brief notoriety during the early months of the First World War. In 1899 the German warships Bismarck and Marie had anchored in the lagoon, and two days after they left the British heavy cruiser Hampshire arrived with the Empress of Russia, which entered the lagoon (Hoyt 1967): the powers were clearly interested in oceanic anchorages. When war broke out the German cruiser Emden was in the Indian Ocean, and during its pursuit by English warships called at Diego Garcia on 9 October 1914 to coal and clean its bottom. At this time the local inhabitants were unaware that war had been declared. The Assistant Manager "came into the wardroom and made very good practice with the iced whisky and soda. For us the conversation became interesting from the moment that we recognised that this manager and the inhabitants had no idea that there was a war on in the world" (Hohenzollern 1928, 133). Battle damage to the ship was explained as having been caused by storms; the ship took on a large live pig, fish and fruit in return for wine and whisky, and it left on 10 September shortly before English warships arrived. The Emden was finally caught and destroyed at Cocos-Keeling on 9 November 1914.

The strategic value of the atoll again became apparent during the Second World War. Following the Japanese attack on Colombo in April 1942 and heavy British naval losses in the central Indian Ocean, it was decided to develop Addu Atoll in the Maldives, previously used as a refuelling station and anchorage, as a military base (Roskill 1956, 25). Diego Garcia became one of a number of places used as fuelling and minor operational bases for naval craft and flying boats (Kirby 1958, 58; Roskill 1956, 33), and defended by six-inch guns. A wrecked Catalina still lies on the beach at East Point, but the military interest was short-lived and the installations were in decay at the time of Ommanney's visit in 1948 (Ommanney 1952, 233). Several books by Thompson (1946, 1949, 1956) give a largely fictional account of the atoll in war-time.

In 1965, Diego Garcia, together with the rest of the Chagos Archipelago, was detached from the administration of Mauritius and incorporated in the new British Indian Ocean Territory. An agreement was entered into between the United Kingdom and the United States in 1966, under which either party could have the use of any part of the Territory for military purposes for not less than fifty years. H.M.S. Vidal under Captain C. R. K. Roe, R.N., made a detailed hydrographic survey of the entire lagoon in 1967. Military use of the atoll had been comtemplated for many years, and Bourne (1886b, 391) made the following comment after his visit eighty years ago: "I have even heard that it is proposed to protect the island by some sort of fortification, but how this is to be done, and of what use it would be to fortify an island 10 feet high, which might be completely commanded by a ship sailing outside of it, I am at a loss to know".

F. Introduction of animals and plants

There is little documentary evidence of the introduction of plants and animals to Diego Garcia, though from the beginning of the sixteenth century it was general practice to land sheep, goats, cattle, and even rabbits and hares on uninhabited islands in the Indian Ocean to provide a future food supply. Some introduction of plants probably took place in 1784 when the ship-loads of soil were brought from Bombay. By the end of the eighteenth century pigs and dogs were being bred in the islands for export, and bees and poultry had been introduced (Findlay 1882). Donkeys had been imported into the Chagos Archipelago and other islands by the 1840s to work the oil mills. There is an early description of these animals on Agalega (Leduc 1897-1906; Scott 1961, 145-146), where they "appear to thrive well ... and breed very fast" (Anon, 1845, 479).

Moresby in the late 1830s recorded maize, tobacco, cabbages, "greens", sweet potatoes, onions, carrots, turnips, "leaks", garlic, "and all the common vegetables cultivated in India, with limes and citrons" (Anon, 1845, 480). He also noted that "pompions and plantains grow wild and are of good flavour", and that cotton was widespread. Moresby was responsible for introducing *Artocarpus* to the Archipelago: "Of the bread-fruit tree, when Captain Moresby first visited these islands, they had none; but he brought about thirty young plants from Ceylon, which succeeded well, as also did the Malabar yam" (Anon, 1845, 480).

Bourne in 1886 found bananas, custard apples, bitter oranges and a few other tropical fruits in the gardens at East Point, Minni Minni and Pointe Marianne. According to him attempts to introduce potatoes and vegetables had been defeated by rats.

In addition to donkeys and rats, there were pigs and poultry in abundance in Moresby's time, together with feral cats (Anon, 1845). "Among the occupations of these Negroes was the feeding of swine, with which the dwellers on many of these islands lived in terms of considerable intimacy" (Anon. 1845, 483).

In 1967 donkeys were seen, generally in groups of 3-12, near the northwest point, south of East Point, along the southeast side, and south of Pointe Marianne. The population may number over one hundred, and individuals are occasionally shot for food. Rats are extremely numerous and are seen constantly during daylight running upon coconut trunks: There is a bounty of three cents a rat for each body produced. A similar bounty thirty years ago brought in more than thirty thousand rats a year (Wiehe 1939, 23). Chickens, cats and dogs are plentiful in the settlements.

Weeds and cultivated plants have been described in Chapters 11 and 12, and introduced insects, particularly the rhinoceros beetle Oryctes rhinoceros, in Chapter 14.

G. Conservation

Little attention has been paid at Diego Garcia to conservation: the atoll has simply been used as a supplier of coconut products, and to a lesser extent of dried fish and turtles, for Mauritius. Both the Green and Hawksbill turtle used to nest here in some numbers: the Hawksbill from December-March, and the Green at all seasons. The early settlers found the frigate birds, boobies, noddies, terns, herons and tropic birds to "breed on these islands. ... (They) are considered good eating; the feathers, too, make excellent bedding" (Anon. 1845, 483).

The first practical conservation measures were taken by James Spurs, when manager in the 1870s. He forbade the killing of sea birds, turtles and cipaye (Birgus) on his estate, to prevent any decline in numbers. As a dependency of Mauritius until 1965, the conservation legislation of that Colony applied to Diego Garcia, but in the absence of enforcing authority or of any clear need for conservation it is unlikely that much attention was paid to it. The main statutes affecting conservation in the Chagos islands were the Exportation of Plumage Birds Ordinances 1914 and the Wild Birds (Protection) Proclamation 1939, each with a schedule of birds. The Lesser Dependencies Importation of Animals statute 1933 prohibited the import of any mammal, bird, fish, reptile or living insect in the Chagos islands. Other Mauritius conservation legislation is relevant only to the Mascarenes proper (Lane 1946a, 1946b).

Following the creation of the British Indian Ocean Territory in 1965, its Commissioner took powers by Ordinance 2 of 1968 to make regulations for the protection and preservation of wild life in the Territory. These powers are intended not only to cover interference with animals but also "any change or alteration" in an animal's environment. Regulations under this Ordinance (S.I. No. 11 of 1968) have prohibited the taking of Green Turtle throughout the Territory, and also the possession or sale of any turtle products, from 13 August 1968.

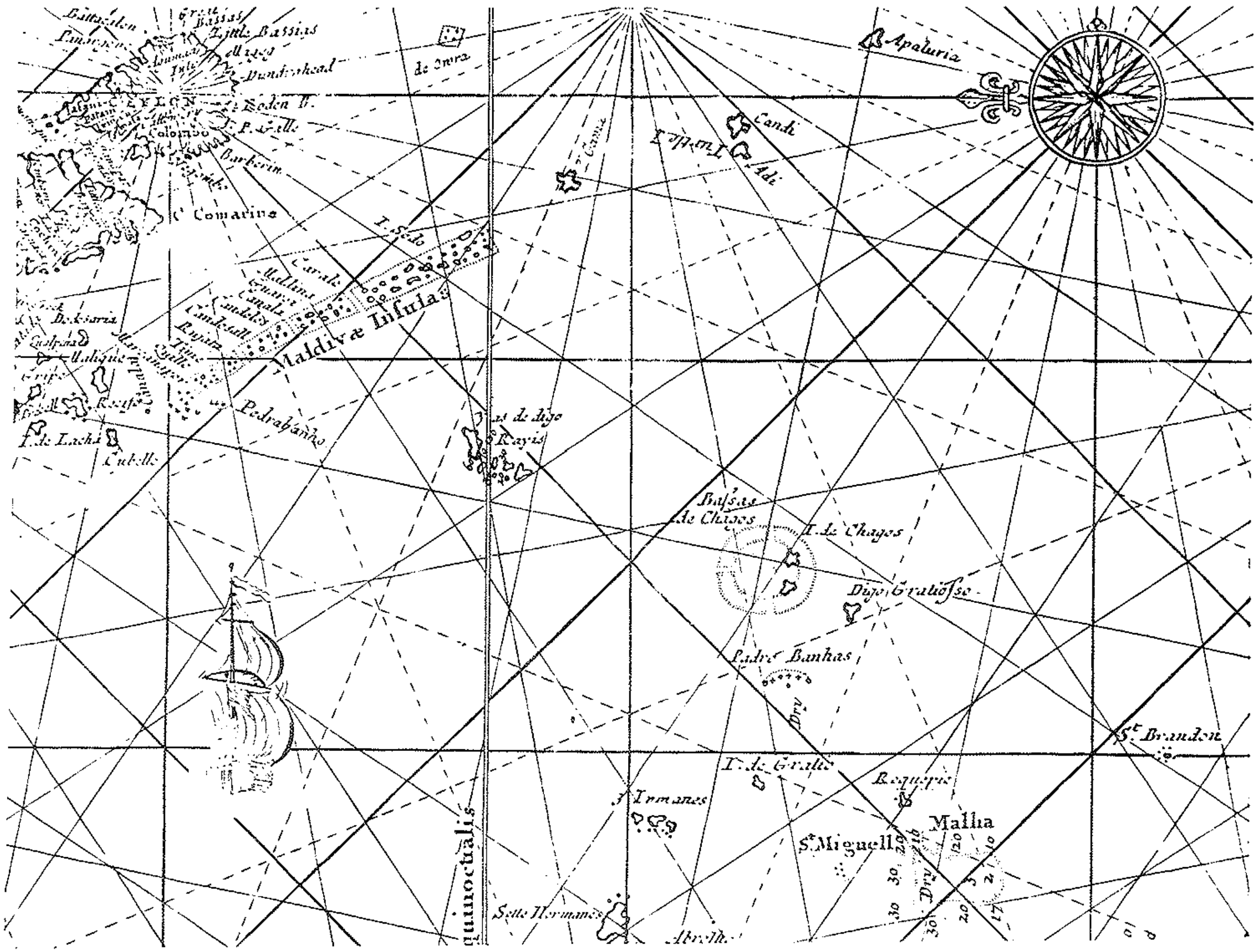


Fig. 32. The Chagos Archipelago and neighbouring islands, from The English Pilot (1755).

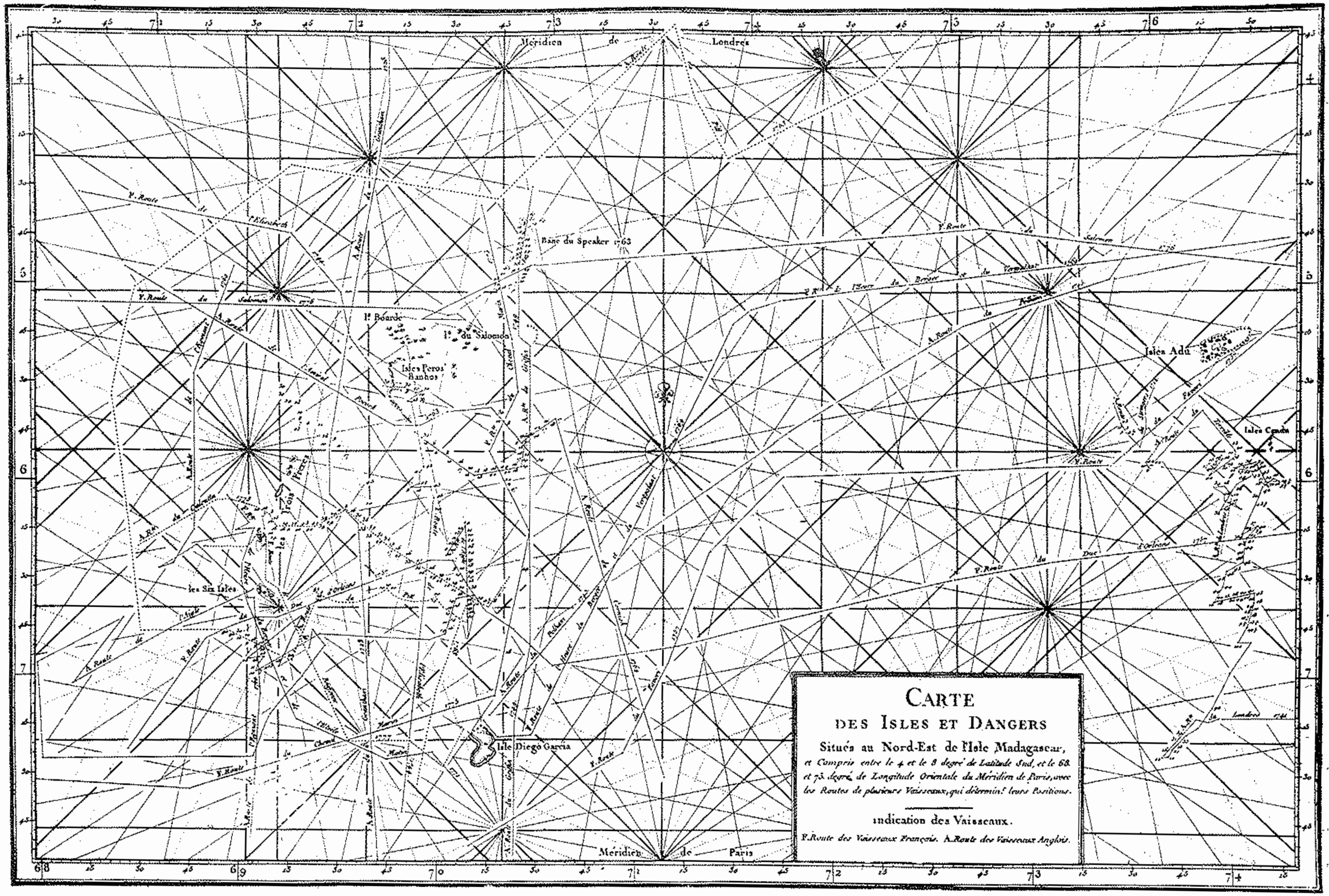


Fig. 33. The Chagos Archipelago and neighbouring islands, showing eighteenth century exploratory voyages, from the Neptune Oriental of D'Après de Mannevillette (1775).

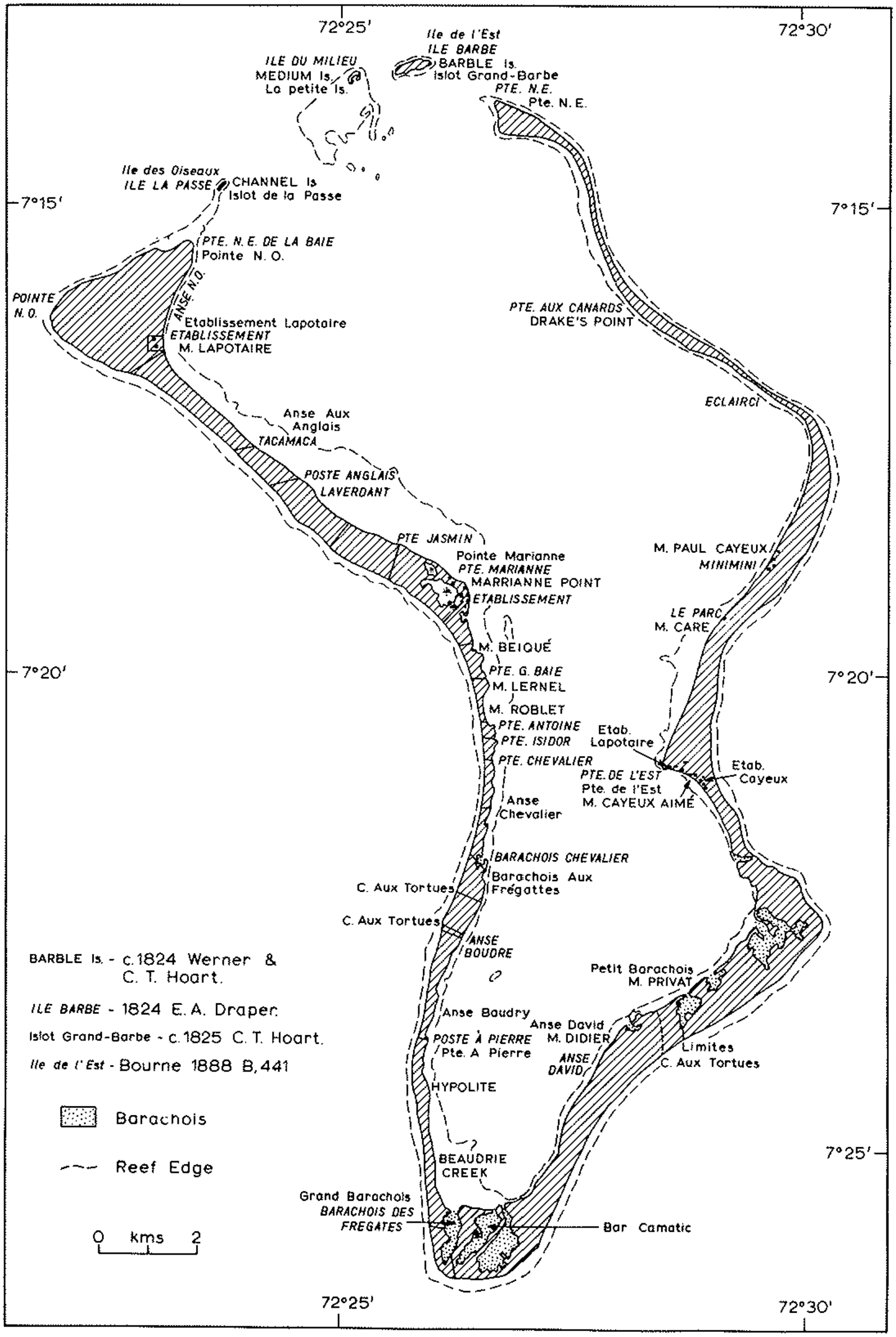
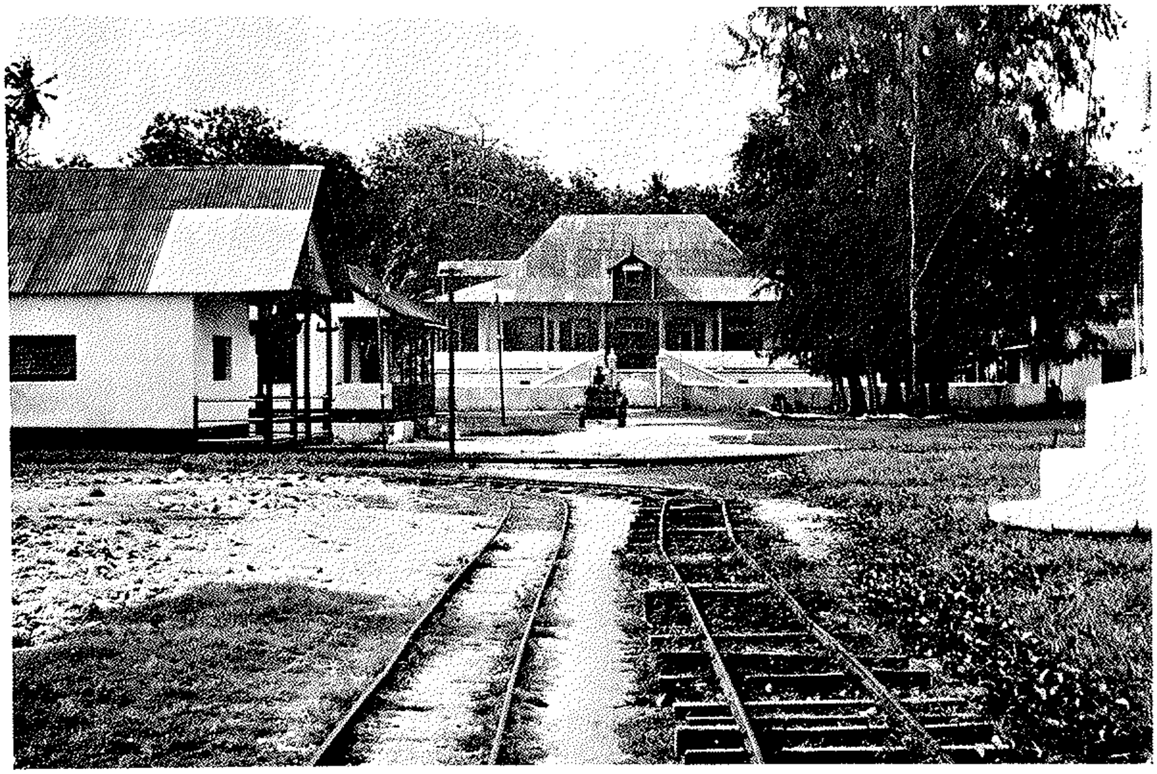
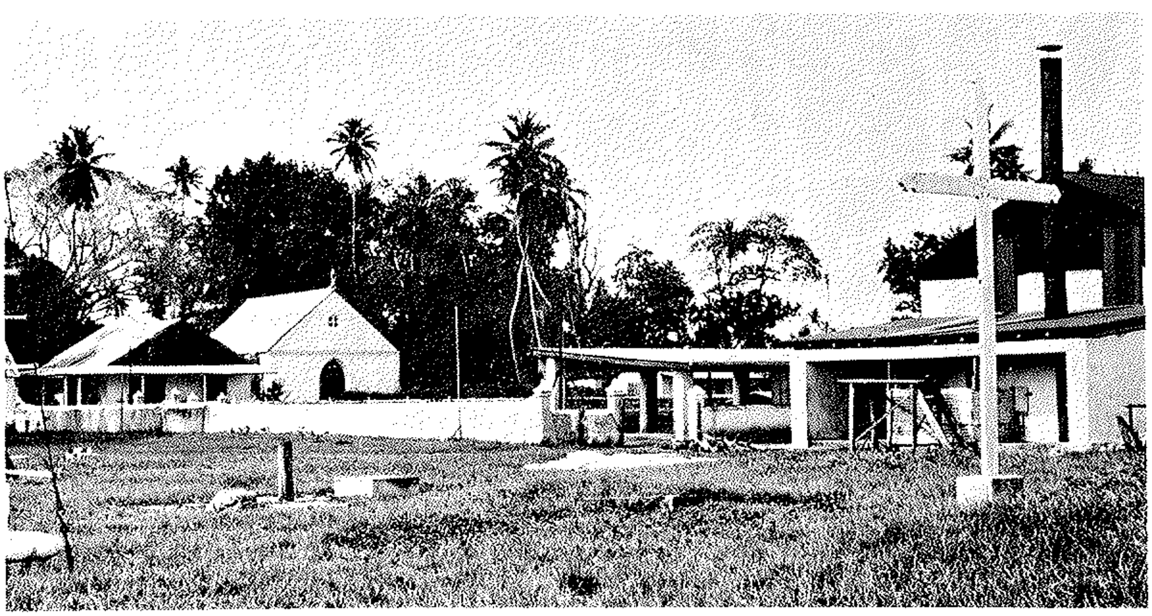


Fig. 34. Place names and topography of Diego Garcia on the maps of Draper (1824), Hoart and Hoart (c. 1824), and Hoart (c. 1825), and according to G. C. Bourne.



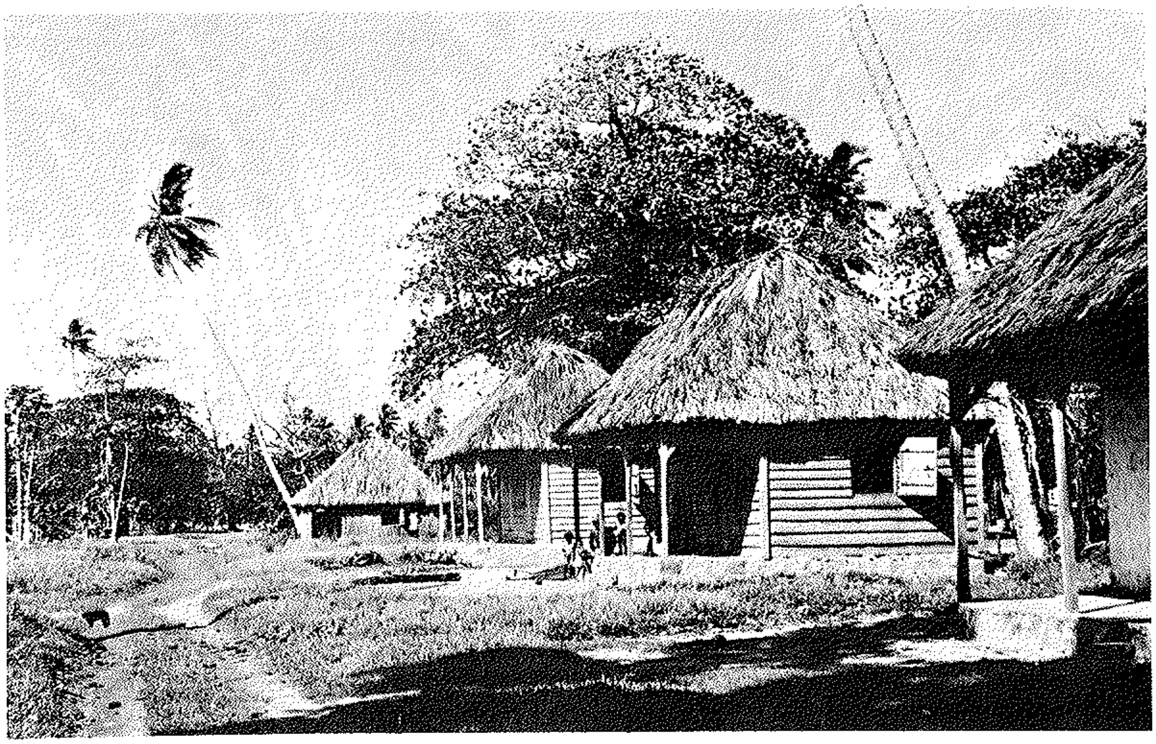
43. The Manager's house and other buildings at East Point: compare a similar photograph in Chun (1903). The railway leads to the jetty

44. Copra-drying sheds and the church at East Point



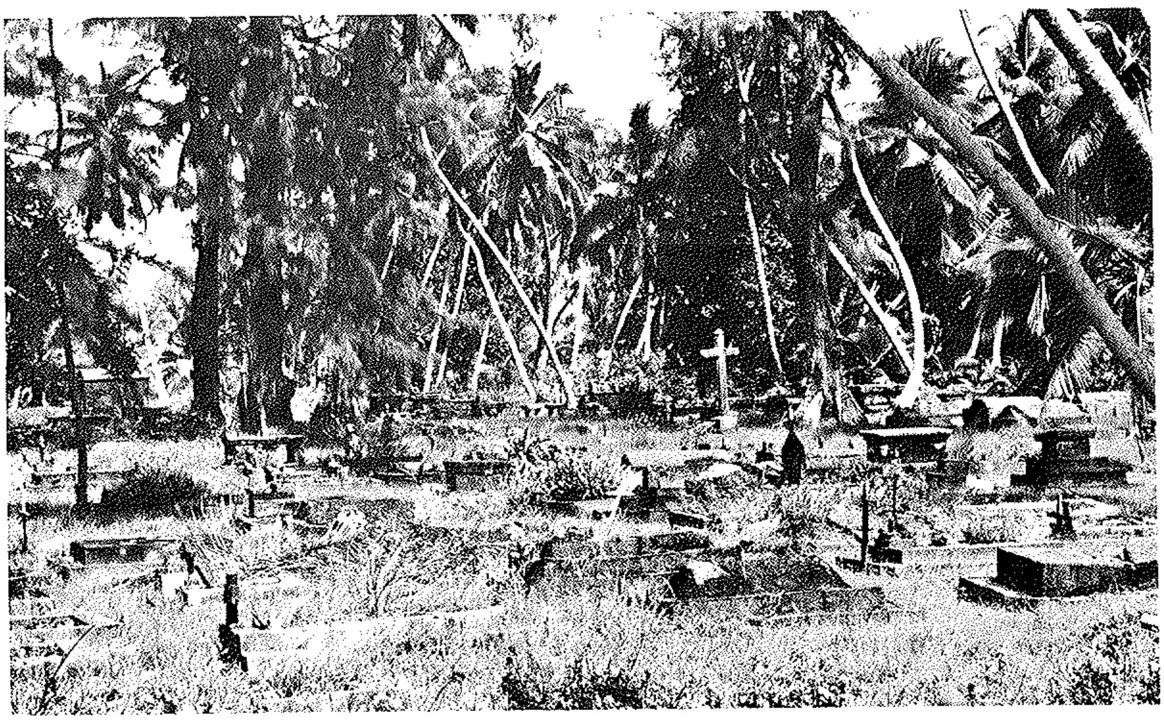
45. Motorable road through coconut plantations between East Point and Minni Minni

46. Ruined buildings seen through an avenue of old *Ficus* trees at Minni Minni



47. Labourer's houses at Pointe Marianne village

48. The cemetery at East Point



49. The disused cemetery, with a massive _Ficus_ tree, at Pointe Marianne

50. Wild donkeys in coconut plantations southwest of Barachois Maurice

19. BIBLIOGRAPHY OF DIEGO GARCIA

D. R. Stoddart

Items in this bibliography containing specific references to Diego Garcia are marked with a single asterisk*. Items containing references to other Chagos islands or to the Chagos archipelago generally, without specific mention of Diego Garcia, are marked with a double asterisk**. The Bibliography also contains a number of items to which reference has been made in the text but which do not deal either with the Chagos islands or with Diego Garcia, and these are left unasterisked. The main bibliographic sources on the Chagos Archipelago are as follows: general, historical, public records, maps - Toussaint and Alphonse (1956); historical - Scott (1961); climate - Wallace (1963); geography and ecology - Sachet and Fosberg (1955). There is also much of relevance in my own bibliographies of the Maldive Islands (Stoddart, ed., 1966) and of Aldabra (Stoddart 1967). This bibliography is probably reasonably complete for items of geographical and ecological nature; only select historical items are included, however, and no attempt has been made to scan published official and unpublished archival records, a guide to which is included in the bibliography by Toussaint and Alphonse (1956).

** Ackroyd, J. H. 1876. Report of the Acting Police and Stipendiary Magistrate of the smaller Dependencies of Mauritius upon his visit to three of those Dependencies (Coëtivy, Eagle Island, Salamon Islands). Port Louis.

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