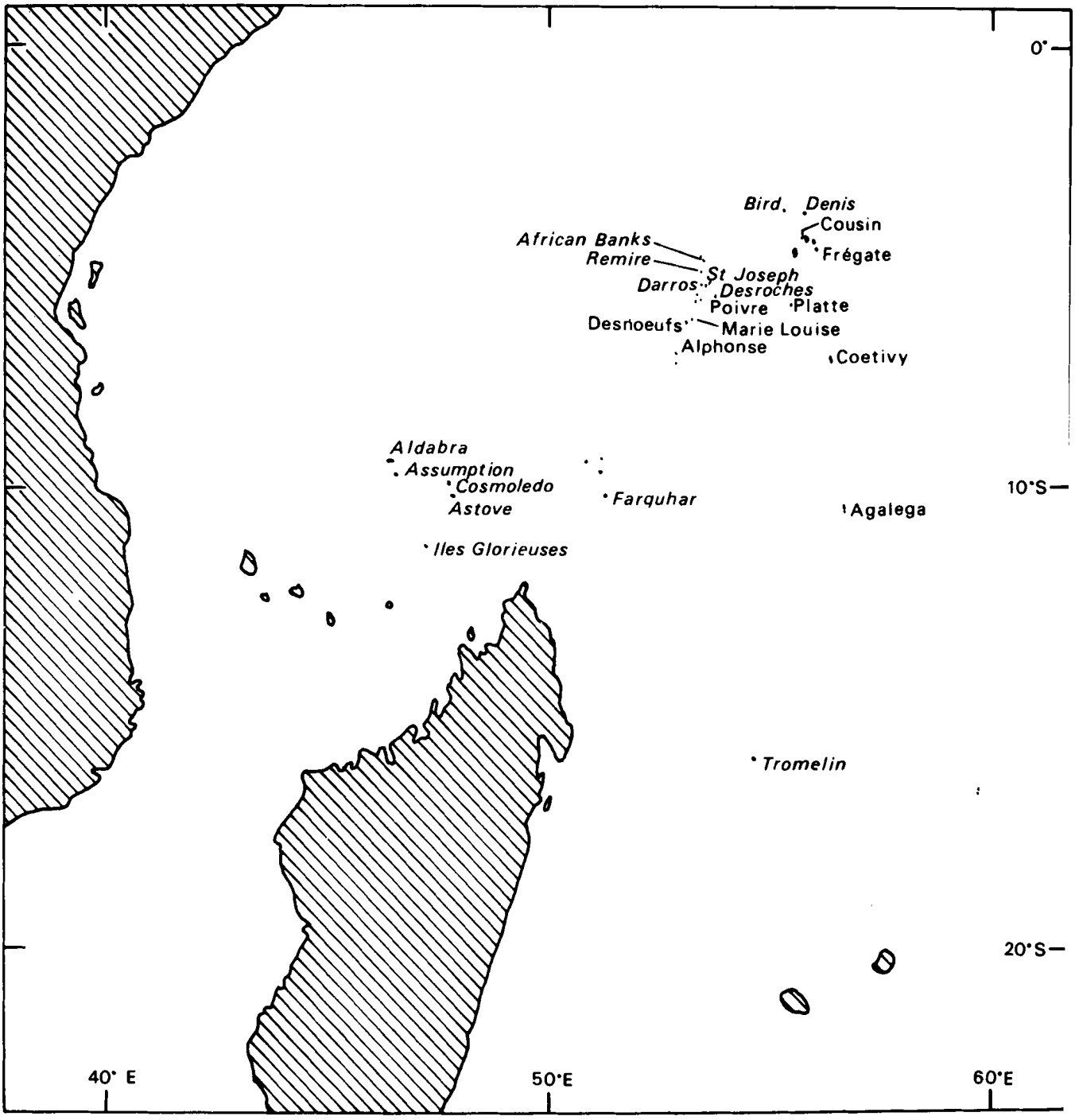

Figure 1. Western Indian Ocean islands. Islands named in Roman script are considered in this Bulletin, those in italic script have been treated in previous papers in this series.

FLORISTICS AND ECOLOGY OF WESTERN INDIAN OCEAN ISLANDS

1. INTRODUCTION

by D. R. Stoddart

At the time that the Royal Society of London and the Smithsonian Institution began studies of the marine and terrestrial ecology of western Indian Ocean coral reefs and islands, in 1966, this was one of the least known sectors of the world's reef seas. Only the sketchiest information was available for most of the islands between Madagascar and Seychelles (Stoddart 1967), and much of that dated from the early years of the century.

Since then, research has been concentrated at the Research Station built by the Royal Society at Aldabra Atoll in 1968-70, and operated since 1980 by the Seychelles Islands Foundation. The early summary accounts of Aldabra ecology (Stoddart, ed. 1967; Westoll and Stoddart, eds. 1971) have been greatly expanded, particularly with regard to the terrestrial fauna and flora (Stoddart and Westoll, eds. 1979). *The Flora of Aldabra and neighbouring islands* (Fosberg and Renvoize 1980) provides a critical account of the plants found on many of the western Indian Ocean coral islands as well as on the raised-reef islands of the Aldabra group itself, and replaces the earlier *Field Guide* of Wickens (1975). The origins and distributions of the western Indian Ocean island floras have been examined by Renvoize (1971, 1975, 1979), while on a smaller scale S. H. Hnatiuk (1979b) has applied island-biogeographic theory to the floras of small islets within the Aldabra lagoon. The role of dispersal mechanisms, germination and fertilisation has been studied at Aldabra by S. H. Hnatiuk (1978, 1979a), Wickens (1979a, 1979b) and Woodell (1979), though so far there have been few studies of other aspects of the land plants, such as genetics and physiology (Lewis 1975, R. J. Hnatiuk 1980).

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Much attention has also been given to vegetation studies at Aldabra. Fosberg's (1971) original classification of the vegetation has been examined by Hnatiuk and Merton (1979a, 1979b), and numerical techniques applied to the Mixed Scrub community by Newbery and Hill (1981). The mangroves have been studied by Macnae (1971), and the intertidal communities by Potts and Whitton (1980). Gillham (1977a, 1977b) has studied the effects of seabirds on vegetation, both at Aldabra and at Cosmoledo. Aldabra is, of course, the only remaining island in the western Indian Ocean to have retained its native population of Giant Tortoises, though many other islands had similar populations until about 150 years ago (Stoddart and Peake 1979). The effects of tortoise grazing on vegetation has been studied by R. H. Hnatiuk *et al.* (1976) and Merton *et al.* (1976). More recently Gibson and Phillipson (1983a, 1983b) have investigated primary productivity, with particular reference to tortoise grazing, while Gibson *et al.* (1983) have examined the response of vegetation to exclusion of tortoises in experimental plots.

Parallel with the Aldabra studies, every opportunity has been seized to expand our knowledge of other western Indian Ocean islands, both within and outside the Republic of Seychelles. In addition to data on land birds and seabirds, particular attention has been given to the flora, with the aim of establishing a basic knowledge of the distribution and composition of insular floras of vascular plants. In an earlier issue of the Bulletin, *Coral islands of the western Indian Ocean* (Stoddart, ed. 1970), floristic lists and much other information were presented for Assumption, Astove and Cosmoledo (elevated islands in the Aldabra group) (this information was revised in the *Flora of Aldabra*); Remire, Desroches and African Banks (coral islands in the Amirantes); and for Farquhar Atoll and Tromelin. Subsequently similar data have been provided for D'Arros and St Joseph in the northern Amirantes (Stoddart, Coe and Fosberg 1979), and for Bird and Denis Islands on the Seychelles Bank (Stoddart and Fosberg 1981).

In the present Bulletin, new information is presented on several more western Indian Ocean islands. These include the small granitic islands of Cousin and Frégate in the central Seychelles; the coral islands of Poivre, Marie-Louise, Desnoeufs and Alphonse in the southern Amirantes; the coral islands of Platte and Coetivy on the Seychelles Bank; and the two large isolated coral islands of Agelega. Figure 1 shows the location of these islands, and also of those previously examined in this series of island reports associated with the Royal Society, Smithsonian Institution, and Seychelles Islands Foundation research programme.

The final paper presents new information on rainfall variability on Aldabra itself, extending the analyses provided by Stoddart (1971), Stoddart and Mole (1977), Stoddart and Walsh (1979), Farrow (1971), and R. J. Hnatiuk (1979).

A substantial amount of floristic information is now available on the raised-reef and coral islands of the western Indian Ocean. A

preliminary analysis of it has been made by Stoddart and Fosberg (in press), and a more substantial review, including the central and eastern Indian Ocean coral islands, is in preparation. It is, however, appropriate to note that information is still required on the flora and vegetation, as well as on other aspects of the terrestrial ecology, for islands such as St Pierre, Providence, Cerf, St Francois, Bijoutier, and the islands in the Mozambique Channel.

Acknowledgement

We thank the Department of Lands and Surveys, Mahe, Seychelles, for permission to base Figures 2, 4, and 7-12 on photomaps prepared by the Directorate of Overseas Surveys.

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2. NATURAL HISTORY OF COUSIN ISLAND

by F. R. Fosberg

Cousin Island is one of the relatively tiny and less well known of the Seychelles Archipelago. It was known to be the home of several of the rarer species of endemic land birds of the Seychelles, and to protect these from possible extermination, the International Council for Bird Preservation bought the island in January, 1968. It is now maintained as a sanctuary where all indigenous birds are given complete protection.

I was invited by Professor W. H. Thorpe, Chairman of the British Section of the Council, to visit the island and make a preliminary reconnaissance of the vegetation, to aid in handling any management problems that might arise. Fortunately it was possible to combine a visit to the Seychelles with an already-arranged trip to Ceylon, and through the courtesy and cooperation of the U. S. Air Force, to secure transportation to the Seychelles on the weekly amphibian plane that then serviced the Satellite Tracking Station on Mahé, largest island of the group. I wish to express the appreciation of the Smithsonian Institution, as well as my own gratitude for this indispensable help. I also wish to acknowledge the courtesy and helpfulness of the Pan-American Airways personnel and the others connected with this plane service and with the Satellite Tracking Station facilities, particularly Major Martin M. Manion and Capt. J. M. Smith, U.S.A.F., then commander and administrative officer of the Station. I wish, also, to thank Dr. S. Dillon Ripley, Secretary of the Smithsonian Institution, for suggesting that I accept Dr. Thorpe's invitation to visit the island to carry out this reconnaissance.

The vegetation map of Cousin Island, fig. 2, is adapted from the map by A. W. Diamond in the Cousin Island Nature Reserve Management Plan, and published by permission, for which I am grateful.

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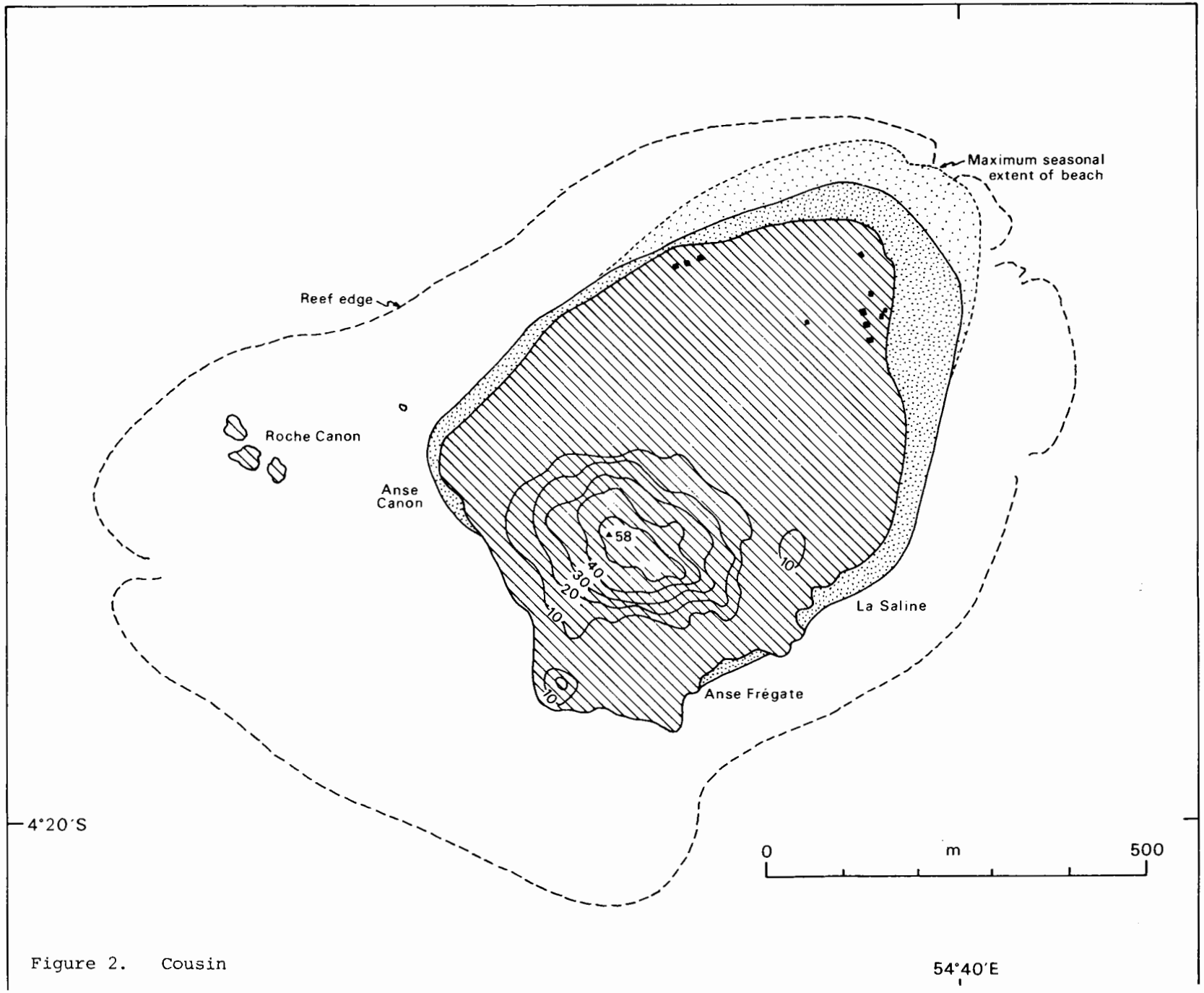

Figure 2. Cousin

My stay on Mahé, as well as travel to Cousin were enormously facilitated by a number of local residents of Victoria, Mahé, particularly Mr. J. F. G. Lionnet, then Director of the Department of Agriculture, Seychelles Govt., and his staff, especially Mr. S. M. Savy, Mr. Philippe Loustau-Lalanne, and Mr. R. M. Mason. Mr. Malcolm Penny, then resident ornithologist on the island, and his local staff, went to great pains to arrange my visit and make it comfortable, as well as introducing me to the island. Mr. Kantilal Jivan Shah, local intellectual and scientific enthusiast in Victoria, Mahé, extended hospitality and many courtesies.

I stayed on Cousin Island from noon, Jan. 21, 1970 to the morning of January 26, during which time I visited most parts of the island and collected 142 numbers of vascular plants, as well as 2 fungi.

This paper is a revised version of a report prepared for the International Council for Bird Preservation in 1970. The report was submitted to them in its original, preliminary form, especially lacking final identifications of a number of plant species, and has been in use by them since. Although much further work has been done on Cousin, especially by the series of managers stationed there by the ICBP, no further information has been made available to me, nor have any corrections or criticisms of the report been received. As the island is an important one for the survival of several endangered bird species, it seems desirable to publish this description of the island as it was in 1970, seen through the eyes of a non-ornithologist.

GEOLOGY AND GEOGRAPHY

Cousin is irregular in shape, roughly isodiametric, covers 68 acres and has an extreme elevation of 58 m. A little less than half is occupied by a granite outcrop, the remainder is flat and just above sea level, and is called locally the "plateau". The plateau has a surface of soft phosphatic sand-stone with superficial sand and humus accumulations up to a few cm deep, or deeper where cavities are filled. This surface has been artificially roughened by the local practice of digging large pits in the phosphatic rock for planting coconuts, with piles of broken cobbles between the pits.

Judging by the character of the rock, white particles in a brown matrix, and the present abundance of both young Pisonia trees and fish-eating birds, this phosphatic layer is unquestionably a beheaded Jemo soil (Fosberg 1954). The normal "mor" humus A-horizon has been largely lost by decomposition without renewal since the Pisonia forest was cleared and coconuts planted. The thickness of the phosphatic hard-pan layer here is striking. Holes excavated in it to a depth of one meter are common. It is not clear whether these penetrated through the layer, as they are partly filled with debris and no time was available to clean one out.

The granite hill is a ridge trending WNW-ESE. The slopes vary from a gentle smooth "glacis" (local name for bare smooth rock slopes) to ledges, crags and vertical cliffs. An unusual feature is the presence of

obvious channel erosion, "lapies"-like or "rillenstein"-like fluting. This is not nearly so striking here, however as on nearby Cousine Island, or on certain cliffs on Silhouette Island, second highest of the Seychelles. On the summit ridge of this granite hill is some flat rock surface, broken by sharp ridges and monoliths.

At the north base of the granite hill, where it meets the phosphatic hard-pan layer, is an elongate depression extending across the island. In its central portion, near the well that supplies the drinking water for the island, this depression is deep enough to hold standing water and mud. Eastward toward the coast it becomes more abrupt, straight-sided. Westward it is more shallow and slopes in from both sides.

South of the granite hill around the coastal indentation called Anse Frêgate is a much smaller flat area than that forming the north half of the island. Piggott (1968) implies that this has a Jemo soil, as has the north half, and Baker (1963) indicates both areas as phosphatic sandstone. Time was not available to check this adequately here, but certainly some phosphate is exposed. A depression containing a small mangrove swamp extends the length of this flat area, but not immediately against the base of the hill. On this south side the basal slopes of the hill are much more gentle, less abrupt than on the north side, although the upper slopes are steep and cliff-like. Along the beach of the eastern end of Anse Frêgate is a conspicuous line of fossil beach-rock, reaching almost a meter higher than present beach level.

The "plateau" is partly lined, at the top of the beach, by a low sandy beach ridge, especially along the northwest and south and southeast sides. A broad sand flat forms a lobe projecting from the east side of the island and used as the landing, which is through the surf. The beach is very steep and falls off sharply into water several meters deep.

On the west side of Cousin rises a rugged clump of granite rocks, separated at high and medium tides from the island by about 100-150 m of water. At low spring tides a ridge of boulders is exposed, connecting the rocks with the shore. This is washed by waves from both directions. The rocks are called Roche Canon. They are of a hard granite similar to that on the island.

FAUNA

Birds are plentiful and very tame. Many fairy terns, Gygis alba, and occasional bos'n birds, Phaëthon lepturus, were nesting. Both noddies, Anous stolidus and Anous tenuirostris, were present in some numbers, as well as sooty terns, Sterna fuscata.

Of shore birds only turnstones, Arenaria interpres, and whimbrels, Numenius phaeopus, were identified with any confidence. The Cape barn owl, Tyto alba, was seen several times. What appeared to be a dimorphic egret, Egretta dimorpha, was seen once along the north coast, but this identification is not certain.

Ground doves, Geopila striata, were present in considerable numbers. The local and the introduced Madagascar subspecies of Streptopilia picturata have hybridized, according to Malcolm Penny, and a hybrid swarm of individuals ranging from almost black, or dark gray, to rich brownish red on head and back has replaced the local Seychelles turtle-dove on the island.

Both the native Seychelles weaver, Foudia seychellarum, and the Madagascar "cardinal," Foudia madagascariensis, occur in numbers on the island, but without seeming to interfere with each other. They are extremely tame, freely entering houses and foraging without obvious fear of man. Several Seychelles brush warblers, Bebrornis seychellensis, occupied territories in and immediately around the house in which we stayed at the north-east corner of the island for the first day or two of our visit, being almost equally bold and familiar as the fodies. However, after several days of human presence in the house they had retired to working in trees and bushes some yards away and seldom approached the building.

Fortunately no rats seem to have reached the island. Information received from Malcolm Penny after my return from the island indicated the presence of feral rabbits.

Lizards are, next to the birds, the obvious vertebrates to be seen. Skinks (Mabuya spp.) occur in great numbers generally. Two or three species of gecko, a large gray one (Gehyra sp.?), a smaller gray one (young of large one?), and a smaller bright green one (Phelsuma madagascariensis) are frequently seen, the gray ones especially at night in the houses.

Insects are also plentiful. Both day- and night-flying mosquitoes are troublesome in the thick vegetation out of reach of the wind, and to some extent in the houses. "Blister beetles" are attracted to lights at night and may be a bother. A small species of ant occurs in great numbers. Termite nests of some size, cylindric, up to 0.5 m tall, are seen here and there.

ORIGINAL VEGETATION

As on all the Seychelles, as well as most islands everywhere, the vegetation of Cousin Island has been profoundly altered since the arrival of man. Sauer (1967) has drawn a partial picture of this history for the group as a whole. To the best of my knowledge no records exist of what the original vegetation of Cousin was like. Summerhayes, in his list of the flora of the Seychelles (1931), mentions only one species from Cousin. This, significantly, is Pisonia grandis.

The presence of a prominent and continuous bed of brown "Jemo" soil hardpan over the entire flat area of the island and the very common occurrence of small Pisonia grandis trees in the present vegetation, with what is known of the origin of the Jemo Soil Series (Fosberg 1954) make it possible to say with some confidence that the original vegetation of

the flat area was solid Pisonia forest. In all likelihood this was a dense forest with a high continuous canopy, to as much as 30 m, with massive pale soft-wood trunks, possibly up to several m diameter; there was no undergrowth or ground vegetation, except in the peripheral zone on and just back of the beach ridges. On the beach ridges there may well have been a lower, dense thicket of Cordia subcordata, Guettarda speciosa, Morinda citrifolia, and possibly locally, Thespesia populnea, tangled with Canavalia cathartica, and lined, on the outside, by a dense fringe of Scaevola sericea and Suriana maritima. On the sand at the top of the beach was probably a mixture of Ipomoea pes-caprae, Sporobolus virginicus, Boerhavia repens, and possibly Lepturus repens.

The swampy area at Anse Frégate may well have been occupied by a mangrove swamp with Avicennia marina and Thespesia, as at present, but probably with much larger and better formed trees. Other mangrove species could possibly have been present.

Reconstruction of the possible original vegetation of the granite hill with any reliability is impossible on the basis of my present knowledge. On the basis of what is known of the original vegetation of the Seychelles as a whole it is probable that the hill was much more completely forested than at present. Areas now lacking soil may have reached this condition by continued cutting of trees and burning since the arrival of man. The Ficus species still present there in numbers, the Calophyllum inophyllum, and the Euphorbia pyrifolia and Phyllanthus casticum were certainly normal components of the lowland forest of granite areas, as still seen in the relict at La Réserve, on Silhouette. Pisonia and Morinda may well have also been components of this, as well as species no longer present.

In all likelihood the sparse vegetation at present on Roche Canon, of Sporobolus virginicus, Boerhavia repens, Ipomoea pes-caprae, Portulaca oleracea, and Achyranthes aspera may be relatively unchanged from that originally present. Two minor species, Acrostichum aureum, present in one deep crevice, and a small colony of Lagrezia oligomeroides, may have been there for a long time, or may be recent arrivals by wind or bird transport. White tailed tropic-birds now nest on the rocks.

One statement of interest can be made with assurance. The Pisonia forest which occupied the "plateau" was certainly the home of vast numbers of sea-birds. The thick layer of phosphatic rock covering this area could not have been formed otherwise. The present conspicuous but relatively small tern populations could not likely have brought about such massive phosphatization even over long periods of time.

EXISTING VEGETATION

A determining fact in the nature and pattern of the present vegetation of the island is that coconuts have been planted wherever it was possible that they might grow. They are now found over the entire flat area of the island except the beach ridges and the swampy ground at Anse

Frégate, and on the slopes of the hill wherever there is a substantial pocket of soil, almost to the summit. The more recent planting on the "plateau" has largely been in pits a meter or so deep dug in the phosphate rock.

It is not now known whether any effort was made to keep the undergrowth cleared, but it is probable that this was done to some extent on the "plateau", especially toward the east and north sides, as here the Morinda, Pisonia, Neisosperma and other tree saplings are not large. Fairly large understory trees of these species, as well as Calophyllum, and shrubs of Phyllanthus found toward the base of the granite hill suggest that there may have been less clearing out of brush in that area, at least in recent years.

The canopy of coconut crowns, while reasonably complete, is rather irregular and not dense. An understory of Morinda, Pisonia, Carica papaya, occasional Ficus nautarum, Calophyllum, Ricinus, Neisosperma, and, near the base of the hill, other species, is conspicuous and locally dense. The Carica is especially common and of all ages. Its fruit, while very small, is quite sweet and palatable. A dense herbaceous layer, 1 to even 2 meters tall is found throughout this forest. It includes Achyranthes aspera, Amaranthus dubius, Kalanchoe pinnata, Asystasia multiflora, Nephrolepis multiflora, and, in a local area of a few acres in the northeast part, Mirabilis jalapa. Along trails and near dwellings other species are common in the forest, such as Synedrella nodiflora, Cyperus kyllingia, Portulaca oleracea, Stenotaphrum micranthum, Digitaria spp., Eragrostis tenella var. insularis, Phyllanthus amarus, Euphorbia hirta, Acalypha indica, Vernonia cinerea, Eleusine indica, Cyperus ligularis, Turnera ulmifolia and others, mostly exotic weeds.

Along the north base of the hill, where a depression extends across the island, generally moist, and in places with mud or standing water, the forest is generally more luxuriant and many cultivated exotic species have been planted, mostly in small numbers. These include Mangifera indica, Annona squamosa, Annona muricata, Artocarpus altilis, Coffea arabica, Eugenia aquea, Manihot esculenta, Dioscorea alata, Moringa oleifera, Colocasia esculenta, Averrhoa bilimbi, Bambusa vulgaris, Musa sapientum, Persea americana, Citrus sp., Cucurbita moschata, Capsicum frutescens, Quisqualis indica and Alocasia macrorrhiza. Only the last three have shown much tendency to become naturalized and to spread. Certain weeds, in addition to those noted above, are found in this wet area. These include Panicum maximum, Cyperus polystachyos, Ludwigia octovalvis, Cyperus sp., Commelina diffusa, Panicum (Cyrtococcum) patens and Heliotropium indicum.

At its western end, this depression becomes broad and shallow and is covered by a forest of Pisonia, not, however, of very large trees. A similar forest, but much mixed with Morinda, Calophyllum and Carica, as well as some coconuts, is found near, but not at, the eastern end of the depression. The eastern end is occupied by a thicket of low Thespesia with a few Avicennia shrubs in the bottom of a shallow ravine where it reaches the back of the beach.

The mangrove depression at Anse Frégate is narrow at the east end and filled with a row of very bushy Avicennia. Westward it broadens and becomes dominated by Thespesia, likewise not very tall. The Thespesia, where growing in the wet area of the swamp, produces exposed arching roots which may possibly serve as pneumatophores. The pneumatophores of the Avicennia are the usual slender, vertical "upside-down roots", produced in numbers over an area of even broader radius than that of the crown of the tree. Around the margins of the depression are masses of the large, leathery fern Acrostichum aureum, up to 1.5 or even 2 m tall. Otherwise the only subordinate layer of vegetation is a locally prominent stand of Avicennia seedlings a few cm tall.

Back of the mangroves, in addition to coconuts, is an irregular thicket of Morinda, Pisonia and Scaevola, tangled with Canavalia and Ipomoea macrantha, with one small patch of Phyllanthus acidus.

Inside the beach ridges along most of the north and east coasts of the "plateau" and south of the mangrove at Anse Frégate is an open zone, under the coconuts, with very sparse undergrowth or none, only a few scattered shrubs of Morinda, Pisonia, Neisosperma and Carica, but with dense herbaceous growth varying from Achyranthes, Amaranthus and Asystasia a meter tall to a much lower mosaic of Boerhavia repens, Sporobolus virginicus, and Stenotaphrum dimidiatum, all in relatively pure stands, with local patches of Catharanthus roseus, Stachytarpheta jamaicensis, Abutilon indicum, Gossypium hirsutum, Dactyloctenium aegyptium, Panicum (Brachiaria) sp., and scattered individuals of Turnera ulmifolia, Datura metel, Ricinus communis, and Cassia occidentalis. The dense areas of Boerhavia repens are of interest in that where crowded, the Boerhavia instead of being very prostrate and elongate, has shorter ascending stems with fewer inflorescenses and denser foliage. This zone is said to have resulted from the pasturing of hogs by the previous owner. It seems very likely to grow up soon to undergrowth similar to that farther inland in the coconut forest if all disturbance is removed.

On the beach ridge, which extends around the "plateau" with gaps only in and near the dwelling areas, is an interrupted row of giant old Casuarina trees, up to 30 m tall, buttressed at base, laying down a carpet of "needles" which locally seems to discourage, somewhat, the normal herbaceous layer. Between and under these is generally a "hedge" or low thicket of Scaevola and Suriana. Here and there are a very few fairly large Guettarda trees. Toward the west end, and especially in a fairly large gap in the Casuarina, the beach ridge is covered by a dense thicket, up to 4-5 m tall, of Cordia subcordata, Pisonia grandis and Scaevola sericea. A similar thicket, mainly Pisonia and some Scaevola occupies the south end of the beach ridge on the east coast. Here the Casuarina trees form a small grove, extending a few meters inland, rather than only a row at the top of the beach. The Casuarina is not reproducing itself except very locally where otherwise unvegetated beach sand, in full sun, supports stands of seedling Casuarina and/or Scaevola.

On the outer slopes of the beach ridges and outer edges of the sand flats where there are no ridges, Sporobolus virginicus, Boerhavia repens

and Ipomoea pes-caprae tend to spread down onto the top of the beach, or onto berms or terraces formed on them. The rhizomes of Sporobolus growing toward the sea send up characteristic straight rows of shoots. The elongate stems of Boerhavia here spread in a very prostrate manner from root crowns. The Ipomoea forms loose mats which locally extend back onto the sand flats where the beach ridge is lacking.

A few trees, lacking elsewhere, such as Hibiscus tiliaceus, Spondias purpurea and Barringtonia, are planted around dwellings along these coasts.

The vegetation of the granite area is much more varied and locally diverse, and patterns are less obvious and are difficult to define. The species are predominantly indigenous and, with the exceptions of Morinda citrifolia and Pisonia grandis, among trees, and Achyranthes aspera, Asystasia sp., Nephrolepis multiflora, and Ipomoea pes-caprae, are not those which have much importance in the "plateau" vegetation.

The gentler lower slopes are mostly wooded with a low mixture of Morinda and Pisonia, with some Ficus nautarum and Ficus sp., Calophyllum, Euphorbia pyrifolia and Phyllanthus casticum, with, of course, planted Cocos nucifera. On the lower west slopes Pandanus balfourii is locally abundant or even dominant, and elsewhere Calophyllum may be dominant. A patch of Fourcraea foetida is found on a rather low gentle slope on the northwest corner of the hill. Locally Passiflora foetida is abundant, climbing in bushes. On the south side Panicum (Cyrtococcum) sp. is abundant in patches with Asystasia. In open scrub and forest there is frequently a dense ground layer of Nephrolepis multiflora.

The lower east slopes of the hill are gentle, and have scattered Pisonia and Morinda, but are mainly open and completely dominated by Achyranthes. The slopes end in alternating bare rock ridges and sandy coves. The coves have Pisonia, Cocos, and Casuarina trees and small sand flats or storm beaches covered by Ipomoea pes-caprae, Achyranthes, and Asystasia, with small clumps of herbs such as Fimbristylis cymosa, Cleome viscosa and Cenchrus echinatus. There is little Scaevola or Suriana here.

On the middle west slopes is an area dominated by planted Eucalyptus camaldulensis, reaching 20 or more meters in height. Elsewhere the middle slopes are either ledgy and jointed, and support an open growth of Ficus nautarum, Morinda, Calophyllum, and a very few small Casuarina, or they are smooth "glacis" or bare rock, with little soil except in crevices and pockets. Here are occasional Euphorbia pyrifolia. A few slopes on the north side are covered by a blanket of Coleus subfrutectosus. Sedges of several species occur in crevices and pockets. Clumps and patches of Panicum maximum are also found here, and Nephrolepis multiflora in crevices and accumulations of soil.

The higher slopes, where they are not steep, bare "glacis" or cliffs, have irregular clumps of Ficus nautarum, Pandanus balfourii and Calophyllum, with a herbaceous layer of Asystasia and Nephrolepis, or especially on steeper southwest slopes, a rather dense scrub of Euphorbia pyrifolia, with Nephrolepis.

Near the top of the hill, on the southwest side especially, are relatively flat areas covered by a tall dense scrub or scrub forest of Euphorbia pyrifolia, Phyllanthus casticum, Ficus nautarum and Pandanus balfourii, choked beneath with Nephrolepis up to 2 m deep. Here are the highest coconuts, a few small trees. Openings in this scrub are dominated by Fimbristylis cf. consanguineus.

The summit ridge, little higher than this flat area, has sparse vegetation, where any at all. Where some sand has accumulated in longitudinal grooves is, surprisingly, Ipomoea pes-caprae, with Achyranthes, a little Cenchrus echinatus, Fimbristylis spp., wisps of Panicum maximum, and scattered bushes of Euphorbia pyrifolia.

The vegetation of Roche Canon was mentioned above as possibly being in approximately its original condition. Most of the rocks are bare, but locally on the larger peak are thick masses of Sporobolus virginicus, and Achyranthes aspera, and lesser mats of Boerhavia repens. A little Portulaca oleracea grows around the edges of these mats, and also in sheltered spots on the smaller peak. Here it reaches a gigantic size, up to 0.7-0.8 m tall. On top of the smaller peak, in sheltered crevices, are a few plants of Lagrezia oligomeroides, possibly brought on the feet of seabirds from far-away Aldabra. Otherwise, except for a tiny tuft of Acrostichum in a deep crevice, the rocks are completely bare.

MANAGEMENT OF VEGETATION

As is well shown by the history of the Seychelles, vegetation can be profoundly changed by the activities of man. This has happened in the past to the vegetation of Cousin, resulting in the confused patterns described above.

All vegetation is intrinsically dynamic, that is, it constantly changes to some extent, even if left to itself. Long established natural vegetation tends to change only slowly or fluctuate about internal equilibria. This situation is altered, even naturally, by severe storms, volcanic eruptions, lightning fires, landslides, and other catastrophic events, as well as by changes in animal populations, and perhaps rarely, by plant diseases. Wherever man has gone he has accelerated change and upset existing equilibria, usually in a haphazard, unplanned and destructive manner. The result is that any vegetation that has been influenced by man tends to be in a state of relatively active change. Such change goes on, once the disturbance has been effected, regardless of what man does from then on. He can influence the direction of the change but he finds it difficult, if not impossible, to maintain precisely the status quo. Attempts to do so, if even moderately effective, require the expenditure of very considerable effort and constant attention. Guided change, on the other hand, may require relatively little effort, if it is in the direction of the existing trend in any situation. If the desired change is contrary to such trends, it may require large expenditures of effort indeed, and with no assurance of success.

Carrying out policies intended to influence, in whatever manner, the processes of change in vegetation is commonly called vegetation management. Hence, it is impossible to recommend any form of management until appropriate policies have been established to further the objectives of the Cousin Island Preserve. Certain alternatives may be discussed and possible consequences pointed out. It must be noted that my familiarity with Seychelles vegetation and the Seychelles environment is limited to what could be learned in two weeks, so any suggestions should be accepted with due caution.

Reasonable alternative management paths that might be followed fall roughly into four sorts. Granting effective protection from outside influences, they are (1) non-interference, allowing present trends to continue without active efforts to direct, accelerate, or retard change; (2) the deliberate introduction of additional plant species; (3) the deliberate elimination or reduction of species now present, presumably the exotics; (4) attempts to alter (or "ameliorate") in some manner the physical or biological environment. These will be discussed briefly in order.

1. As pointed out above, change in the vegetation is going on and will continue. Allowing present trends to continue is certainly the easiest and least expensive policy that could be adopted. It would be presumptuous to assume that I know what all of these trends are, or what their immediate or ultimate outcome will be. However, one or two things seem likely.

As suggested above, the relatively open zone around the "plateau" inside the beach ridge is very likely to grow up in a short time to resemble the thicker undergrowth farther inland. Since the Casuarina does not seem to be reproducing very effectively, and since several windthrown trees were noticed, it is likely that over a period of many years the stately row of giant Casuarina will be replaced by a few localized thickets or groves of this species and occasional isolated trees. The beach ridge hedge and thickets will likely become taller and, at least on the beach side, denser, and may occupy areas not now covered by woody plants. A strip of Scaevola seedlings now to be seen in front of the resident scientist's house represents the initiation of such vegetation in one place where it is now absent.

It seems most likely that the understory in the coconut plantation on the "plateau" will in time thicken and greatly increase in height, eventually replacing the coconuts. The papaya, now so abundant, will disappear, except possibly around dwellings and along the more established paths. The ultimate result, a long time from now, will probably be the reestablishment of the Pisonia forest that originally occupied the area. This course could be changed, over a very long time, by the development of a Neisosperma forest, which, in the Central Pacific atolls, seems capable of replacing the Pisonia forest completely. It is not known if this could happen in the western Indian Ocean. The former existence of extensive Pisonia forests here suggests that such replacement is at least not inevitable. The replacement of the coconut forest by Pisonia is

contingent on continued complete harvest of the coconut crop, as at present. If the nuts are allowed to lie on the ground and germinate an impenetrable thicket of young coconut palms will result, probably crowding out everything else in time, unless one or other of the existing coconut pests reaches the island and alters the situation, which would be rather likely, sooner or later.

Change in the vegetation on the granite hill would seem to be rather slow. Soil is absent in many areas and thin in most others. The granite weathers very slowly, and humus breaks down rapidly under tropical conditions. The trend will doubtless be toward the spread of forest and the increase in stature and density of the forest now there, but the process will certainly be slow. Fire could set it back drastically. The presence of the Eucalyptus grove no doubt increases the probability of fire.

The composition of the vegetation in the depression at the north base of the granite hill will probably change rapidly, with some of the planted species dying out as a result of competition, the effects of scale insects and mealy bugs, or simple unsuitability in an increasingly densely forested environment. Which species will persist is hard to know, but at present three -- Quisqualis indica, Alocasia macrorrhiza and Capsicum frutescens seem to be on the increase, and Manihot esculenta, at least, seems on the way out.

2. There seems little use in discussing the introduction of additional species. There are a great many thousand available, and no one has any reliable information on theprobably consequences of introducing any of them. There is always a strong possibility that introduction of any species without its natural enemies will result in an uncontrolled increase, which is usually disastrous for some or many existing species. The end result is likely to be impoverishment, rather than enrichment of the habitat. However, it is likely that species will be introduced, either accidentally or deliberately. People seem to have a missionary zeal in this direction that is not influenced by reason, past bad experience, or good advice. One can only recommend against ill-considered introductions and hope the plants die if they are brought in.

3. The eventual elimination of at least certain of the exotics now present will probably be advisable. This should not be hasty or ill-considered. It should be undertaken only after a full understanding of the relationships of the birds to the plants in question is achieved. Elimination of any species should, also, only be considered after it is determined, possibly by experiment, what of the existing species present will fill the niche vacated.

The only species that I would venture to propose for elimination would be the Eucalyptus, and possibly the Cenchrus, and these only after a careful study of their role in the present situation.

These remarks do not, of course, apply to permitting the disappearance of species by natural causes. A species on its way out will

likely go, unless a determined effort is made to save it. This should probably only be made if it should be found that one of the birds for which the Reserve was set up is dependent on the threatened plants.

4. Alterations of the habitat are likely to be both difficult and expensive if done rationally and carefully. Likewise the consequences are not fully predictable. Fertilization, the application of pesticides, changing drainage patterns, thinning of vegetation, selective reduction of a particular species, erecting wind-breaks are all possible alterations. There is no pressing reason to undertake any of these, and past experience elsewhere has shown that unanticipated results and side-effects are likely. It is suggested that only after the fullest consideration of all aspects, and for the most pressing reasons, should any such course be adopted.

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SYSTEMATIC LIST OF PLANTS

All collection numbers are Fosberg's. Plant names preceeded by an asterisk are those regarded as introduced by man into Cousin.

POLYPODIACEAE

Acrostichum aureum L.

Sparingly at edges of mangrove swamp at Anse Frêgate (52090). One tiny clump in deep crack on Roche Canon (52080).

Nephrolepis multiflora (Roxb.) Jarrett

Very common to abundant everywhere except on beach ridges and sand flats. Especially abundant on granite slopes (52159).

Polypodium scolopendria Burm. f.

Rare, seen only in depression near well, on base of tree (52110), and on stone wall of tortoise pen (52097).

PANDANACEAE

Pandanus balfourii Martelli

Common on slopes and top of granite hill (52092, 52093).

GRAMINEAE

*Bambusa vulgaris Wendl.

Two clumps in depression near well (52106); undoubtedly planted.

*Cenchrus echinatus L.

Small colonies on top of granite hill (52160) and on beach at east end of granite hill (52188). Possibly brought by birds.

*Dactyloctenium ctenoides (Steud.) Bosser

Common generally except in densest forest, especially just back of beaches (52177).

Digitaria horizontalis Willd.

Here and there along paths in edges of forest (52066).

*Digitaria radicosa (Presl) Miq.

One patch seen at northeast corner of island near path (52175), and occasionally near dwellings (52101).

*Eleusine indica (L.) Gaertn.

Occasional clumps and patches along trails and near dwellings (52098).

Enteropogon sechellensis (Baker) Dur. & Schinz

General but not abundant in open places (52172).

*Eragrostis tenella (L.) Beauv.

Very rare, found once in path near dwelling on north coast (52167).

Eragrostis tenella var. insularis Hubb.

Occasional in and along paths (52095, 52176).

*Panicum maximum Jacq.

Abundant in standing water in depression near well (52105), common here and there on granite hill, occasional elsewhere. Panicles used by local people to make brooms.

*Panicum (Brachiaria) miliformis Presl

Common along trails and near dwellings, northeast part of island (52072).

Panicum (Cyrtococcum) patens L.

Abundant on lower slopes of granite hill, and especially at Anse Frégate (52050), occasional elsewhere.

Sporobolus virginicus (L.) Kunth

Abundant around all coasts, on rocks and sand flats, forming a dense sod (52032); on Roche Canon (52078) forming deep masses.

Stenotaphrum dimidiatum (L.) Brongn.

Locally abundant on sand flats along coasts (52033).

Stenotaphrum micranthum (Desv.) Hubb.

Common in small patches in coconut plantation on phosphate rock, especially along paths (52099).

CYPERACEAE

Bulbostylis barbata C.B.Cl.

Occasional in rock crevices and soil pockets on and near top of granite hill (52060, 52055, 52140).

Cyperus distans L.f.

In wet places, as in depression near well (52104).

Cyperus dubius Rottb.

Scattered generally, nowhere seen abundant (52062).

*Cyperus kyllingia Endl.

Common in forest along paths (52061), sparingly elsewhere.

Cyperus ligularis L.

Generally but sparingly distributed principally in open and semi-open places (52119).

*Cyperus polystachyos Rottb.

Very sparingly distributed, especially along paths (52087).

Cyperus polyphyllus Vahl

Generally but sparingly distributed in open and semi-open places (52058).

Fimbristylis cymosa R. Br.

One tiny colony back of beach at east end of granite hill (52186). A giant form.

Fimbristylis cf. consanguineus Kunth

Common on and near top of granite hill in depressions and crevices in rock (52059, 52054).

PALMAE

*Cocos nucifera L.

Planted everywhere where there is sufficient soil. The nuts are harvested as they fall.

ARACEAE

*Alocasia macrorrhiza (L.) Schott

Naturalized abundantly in and near depression along the north base of granite hill (52181).

*Colocasia esculenta (L.) Schott

Planted locally in mud of depression near well (52115).

COMMELINACEAE

*Commelina diffusa Burm. f.

Very abundant in depression, north of granite hill (52118), also at Anse Frégate. Seldom seen flowering.

BROMELIACEAE

*Ananas comosus (L.) Merr.

Solitary plants or small clumps at several places, as on granite slopes above well (52164).

LILIACEAE

*Crinum asiaticum L.

Two clumps just back of beach near dwellings (52184), not flowering.

*Furcraea foetida (L.) Haworth

Small patch on slopes near northwest base of granite hill (52135).

*Hymenocallis littoralis (Jacq.) Salisb.

Several clumps in edges of forest near dwellings (52171), not flowering.

DIOSCORACEAE

*Dioscorea alata L.

One vigorous plant in depression at foot of granite hill west of well (52126), not flowering.

MUSACEAE

*Musa sapientum L.

Planted abundantly in depression at north base of granite hill (52108).

CASUARINACEAE

Casuarina equisetifolia L.

A single interrupted row of large old trees on beach ridges almost around the island (52168), locally in one or two places forming small groves. Reproducing in only one or two places on bare sand.

MORACEAE

*Artocarpus altilis (Park.) Fosb.

Two small trees planted in depression at north base of granite hill (52133).

Ficus avi-avi Bl.

One small tree seen on east side of tortoise pen, northeast of well (52143), sterile.

Ficus nautarum Baker

Very common on granite hill (52142, 52154), occasional elsewhere.

Ficus aff. thoningii Bl.

Occasional to common on slopes of granite hill (52084, 52134), rare elsewhere, as at Anse Frégate.

NYCTAGINACEAE

Boerhavia repens L.

Very abundant everywhere on flats back of beaches (52145, 52146), occasional elsewhere at low elevations, also on Roche Canon (52077).

*Mirabilis jalapa L.

Very common in an area within the coconut plantation in from the north coast (52180).

Pisonia grandis R. Br.

Generally common, locally abundant on "plateau" (52063), extending somewhat up on the granite slopes. Undoubtedly formed solid forests over lowlands in pre-human time, judging by the extent of the phosphatic soil and hard-pan of the Jemo series.

AMARANTHACEAE

Achyranthes aspera L.

One of the most ubiquitous plants on the island, especially abundant back of beach ridges and in coconut plantation, but found generally at all elevations; an especially vigorous form of the species (52173).

*Amaranthus dubius Mart. ex Thell.

Found generally at low elevations, especially common near houses and paths (52034) but well distributed even in the dense coconut forest.

Lagrezia oligomeroides (C. H. Wright) Fosberg

One tiny colony on Roche Canon (52075), not seen elsewhere, nor is there any published record from the Seychelles. Very similar to, if not identical with, the plant common on Aldabra.

AIZOACEAE

Mollugo oppositifolia A. DC.

One small colony in dry depression at Anse Frégate near edge of mangrove swamp (52086).

PORTULACACEAE

Portulaca oleracea L.

Very generally distributed except in densest forest and on top of granite hill, especially abundant along paths (52120), very large plants on Roche Canon (52079).

ANNONACEAE

*Annona muricata L.

Several trees planted in depression at north base of granite hill, near well (52111).

*Annona squamosa L.

Commonly planted along depressions at north base of granite hill (52123), fruiting abundantly.

LAURACEAE

*Persea americana Mill.

One tree bearing fruit, planted near well in depression at north base of granite hill (52128).

CAPPARIDACEAE

*Cleome viscosa L.

A few dwarfed plants in crevices on summit of granite hill (52052) and a small colony back of beach at east end of granite hill (52185).

MORINGACEAE

*Moringa oleifera Lam.

One or two trees planted in depression at east base of granite hill (52131).

CRASSULACEAE

*Kalanchoe pinnata (Lam.) Pers.

Very abundant almost everywhere in lowlands (52109), especially on old stone walls and in small openings in woods.

LEGUMINOSAE

*Adenanthera pavonina L.

One tree on northwest slope of granite hill not far below top (52162).

Caesalpinia bonduc Roxb.

A single seedling at top of beach at east end of granite hill (52187), not seen elsewhere.

Canavalia cathartica Thou.

Very common, climbing in trees over most of western half of island (52138).

*Cassia occidentalis L.

Common in open and semi-open places, especially near dwellings (52069).

*Sesbania cf. cannabina (Retz.) Roxb.

Common at Anse Frêgate (52051), seen once or twice elsewhere near dwellings.

*Vigna unguiculata (L.) Walp.

Planted in garden around dwelling (52100).

OXALIDACEAE

*Averrhoa bilimbi L.

Several trees in depression at north base of granite hill (52112), fruiting.

RUTACEAE

*Citrus aurantifolia (Christm.) Swingle

Seen but not collected on lower north slope of granite hill, rare.

*Citrus sinensis (L.) Osbeck

Oranges said to be present but not seen on this visit.

*Citrus "calamondin" ?

Occasional near well at base of north slope of granite hill (52124), fruit resembling a lime but not sour ("Bigaradier").

SURIANACEAE

Suriana maritima L.

Locally common on beach ridges (52065).

EUPHORBIACEAE

*Acalypha indica L.

Very common along trails and around dwellings (52070) in open and semi-shade.

*Euphorbia hirta L.

Common along paths (52122), around dwellings, and in open spots generally.

*Euphorbia prostrata Ait.

One small colony in path near dwelling (52148) at northeast corner of island.

Euphorbia pyrifolia Lam.

Common on granite hill, dominant in scrub near top (52056, 52053, 52136, 52155, 52156, 52157).

*Euphorbia thymifolia L.

Local in path along north coast near dwellings (52030).

*Manihot esculenta Crantz

One poor plant in depression at north base of granite hill, doubtless planted (52127).

*Phyllanthus acidus (L.) Skeels

A few trees at Anse Frégate (52089), well inland, large one probably planted, smaller ones spontaneous.

*Phyllanthus amarus Schum.& Thonn.

Common along paths and in openings near dwellings (52082, 52121).

Phyllanthus casticum Willem.

Common on slopes of granite hill, very common near top, less so in coconut plantation not far from base of hill (52031, 52129, 52158).

*Ricinus communis L.

Generally common in lowlands, especially near paths and in semi-open places (52165).

ANACARDIACEAE

*Mangifera indica L.

Two or three trees planted near well in depression at north base of granite hill (52113).

*Spondias purpurea L.

One tree at manager's house on east coast (52183).

MALVACEAE

*Abutilon indicum (L.) Sweet

Local along path on north coast near dwellings (52068).

*Gossypium hirsutum L.

Here and there along paths in semi-open areas, especially near dwellings along north coast (52073).

*Hibiscus tiliaceus L.

One small clump near dwelling on north coast (52170).

*Sida acuta Burm. f.

A few plants near dwellings on east coast (52094).

Thespesia populnea (L.) Sol. ex Correa

Abundant in and around mangrove swamp at Anse Frégate (52085) and at east end of depression at north base of granite hill; a form with rather large pyriform fruit.

GUTTIFERAE

Calophyllum inophyllum L.

Common on slopes of granite hill (52141), uncommon elsewhere.

TURNERACEAE

*Turnera ulmifolia L.

Common in edges of coconut plantation, especially near northeast corner of island (52035).

CARICACEAE

*Carica papaya L.

Abundant in coconut plantation, especially in more open areas (52096).

PASSIFLORACEAE

*Passiflora foetida L.

Common on lower slopes of granite hill (52083, 52151).

*Passiflora suberosa L.

Occasional in edges of coconut plantation, on back slopes of beach ridges, and on semi-open sand flats near coasts (52169).

CUCURBITACEAE

*Cucurbita moschata Duch.

Planted in and near depression at north base of granite hill (52163), also near dwellings.

*Momordica cf. charantia L.

Planted in garden at manager's house, trained up on trellis, large fruit hanging through trellis; not collected.

COMBRETACEAE

*Quisqualis indica L.

Well established in depression at north base of granite hill (52132).

*Terminalia catappa L.

One tree seen but not relocated, probably near well; possibly an error in identification.

LECYTHIDACEAE

*Barringtonia asiatica (L.) Kurz

One small tree at manager's house on east coast (52182).

MYRTACEAE

*Eucalyptus camaldulensis Dehnh.

Abundantly planted on middle slopes of west end of granite hill (52137, 52150).

*Eugenia aquea L.

One large tree planted at well, north base of granite hill (52114), fruiting freely.

ONAGRACEAE

*Ludwigia octovalvis (Jacq.) Raven

Common in standing water and mud in depression at north base of granite hill (52116).

UMBELLIFERAE

*Centella asiatica (L.) Urb.

One small colony near well, in depression at north base of granite hill (52107).

APOCYNACEAE

*Catharanthus roseus (L.) Don

Well established here and there in lowlands, especially in semi-open areas and groves back of beach ridges (52147).

Neisosperma oppositifolia (Lam.) Fosb. & Sachet

Occasional in lowlands, especially on flats just back of beach ridges (52067).

CONVOLVULACEAE

Ipomoea pes-caprae (L.) R. Br.

Common to abundant on beach ridges and sand flats along coast (52189), also on granite hill on open rock slopes and summit (52161), also on Roche Canon (52076). The form seems intermediate between ssp. pes-caprae and ssp. brasiliensis.

Ipomoea macrantha R. & S.

Common on south coast, at Anse Frégate (52049), and back of beaches at east end of granite hill.

Ipomoea cf. venosa R. & S.

Occasional on slopes of granite hill, on low granite area west of Anse Frégate (52091) and near dwelling inland from east coast (52103). A curious abnormal form with deeply lobed corolla was collected on the west slope of granite hill (52152).

BORAGINACEAE

Cordia subcordata Lam.

Common generally on beach ridges (52064).

*Heliotropium indicum L.

Very rare in wet depression near well at north base of granite hill (52117). This is an unusually glabrous form of this normally hirsute, widespread weedy species. There are various specimens from Indian Ocean localities intermediate in hairiness between this and the coarser more hirsute ordinary forms.

Tournefortia argentea L. f.

One small bush at top of beach on north coast (52174).

VERBENACEAE

Avicennia marina L.

Common in mangrove swamp at Anse Frégate (52048) and local at east end of depression at north base of granite hill.

*Stachytarpheta jamaicensis (L.) Vahl

Common back of beach ridges in semi-open areas and around dwellings (52074).

LABIATAE

Coleus subfrutectosus Summ.

Locally very abundant on lower north slopes of granite hill, completely covering some rock slopes (52057).

SOLANACEAE

Capsicum frutescens L.

Locally common in depression at north base of granite hill (52125), occasional elsewhere in lowlands along paths and near dwellings.

*Datura metel L.

Common near dwellings, especially along east coast (52190).

*Nicotiana tabacum L.

Two or three plants seen in garden near manager's house.

*Solanum melongana L.

Sparingly planted in gardens and around dwellings (52144).

ACANTHACEAE

Asystasia multiflora Klotzsch

Very abundant generally (52153, 52166).

*Justicia gendarussa Burm. f.

One tiny colony at Anse Frégate (52088).

RUBIACEAE

*Coffea arabica L.

A few trees planted in depression at north base of granite hill (52130).

Guettarda speciosa L.

A very few scattered trees on beach ridges and flats behind beaches (52178).

*Hedyotis corymbosa (L.) Lam.

Very local in paths, both on phosphate rock and on granite (52081, 52139).

Morinda citrifolia L.

Very common everywhere (52179), an important component of most woody vegetation.

GOODENIACEAE

Scaevola sericea Vahl

Locally abundant along beach ridges (52047), tending to form a tall hedge on ridge, or fringe seaward of other vegetation.

COMPOSITAE

*Synedrella nodiflora (L.) Gaertn.

Locally common along paths and near dwellings (52102).

*Vernonia cinerea (L.) Less.

Common along paths (52071), near dwellings and in open weedy places.

ADDENDUM TO SYSTEMATIC LIST

Information on changes in the flora has been provided from several Cousin Island Research Station scientific administrators' reports and from Technical Report No. 16, by G. M. and H. V. Bathe, since the above version of the plant list was prepared. The following species may be added to the list on the basis of these notes. I have not seen the specimens supporting these observations.

Lemna sp. (Lemnaceae)

Common in The Pond.

*Saccharum officinarum L. (Poaceae)

Planted in depression, N. E. base of Granite Hill.

*Haemanthus multiflorus Martyn (Liliaceae, s. l.)

Persisting around abandoned house back of N. shore.

*Peperomia pellucida (L.) H.B.K. (Piperaceae)

Found around paths on Parve Plateau[1]; said to be native but surely not, as this is an American species.

*Gliricidia sepium H.B.K. (Fabaceae)

Planted near house.

*Euphorbia tirucalli L. (Euphorbiaceae)

Near houses.

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[1] Apparently the "plateau," flat north half of island.

Hibiscus surattensis L. (Malvaceae)
(as H. swattensis, a name not listed in Index Kewensis).

Found in S. E. end of depression at base of Granite Hill.

Rhizophora mucronata Lam.

In coastal brackish water on south and east coasts.

Many miscellaneous notes on the vegetation occur in these reports. They should be collected together and summarized for publication after a period of years, as trends of change may be established.

In the account of the fauna, above, I inadvertently omitted mentioning the presence of five giant tortoises, presumably brought from Aldabra Island, confined in an enclosure surrounded by a low stone wall. I was not able to learn how long they had been there, but the enclosure was obviously not new. The tortoises seemed in good health but were not successfully breeding. The enclosure was located on the "plateau" between the dwellings and the depression at the foot of the granite hill.

Figure 3. Cousin: vegetation. From *Cousin Island Nature Reserve Management Plan 1975-79,* by A. W. Diamond (London: International Council for Bird Preservation [British Section]), Appendix 4. Key:

1. Tall herbs on flat sandy coast. Characteristic species *Passiflora suberosa, Boerhavia repens.*

2. Herbs on rocky coast. *Asystasia* sp., *Ipomoea pes-caprae.*

3. Open woodland regenerating through coastal tall herbs; intermediate between types 1 and 4.

4. Closed woodland on plateau, regenerating through coconut plantation. *Morinda citrifolia, Pisonia grandis, Phyllanthus casticum.*

5. Tall closed plateau woodland. Taller and more open (ground layer) than type 4. *Ficus nautarum* replaces *Phyllanthus casticum.*

6. Low-lying woodland near the coast, subject to tidal inundation. *Avicennia marina, Thespesia populnea, Ipomoea macrantha.*

7. Mature *Pisonia* forest. *Pisonia grandis,* some *Morinda citrifolia.*

8. *Eucalyptus* plantation. *Eucalyptus camaldulensis.*

9. Closed *Euphorbia* scrub. *Euphorbia pyrifolia, Nephrolepis multiflora.*

10. Tall herbs on the top and southwest slopes of the hill. *Nephrolepis multiflora.*

11. Herbs on the northeast slopes of the hill. *Cyperus polyphylla, Cyperus ligularis.*

12. Groves or individual trees of *Casuarina equisetifolia.*

13. *Ficus* grove. *Ficus nautarum, F. reflexa, F. avi-avi.*

14. Open *Pisonia* regenerating through dense *Asystasia* sp. under *Cocos nucifera.*

15. Very varied vegetation, almost entirely planted, in the depression at the foot of the hill; on deep soil, much of it under standing water according to rainfall. Not sampled.

16. Bamboo.

17. Not sampled.

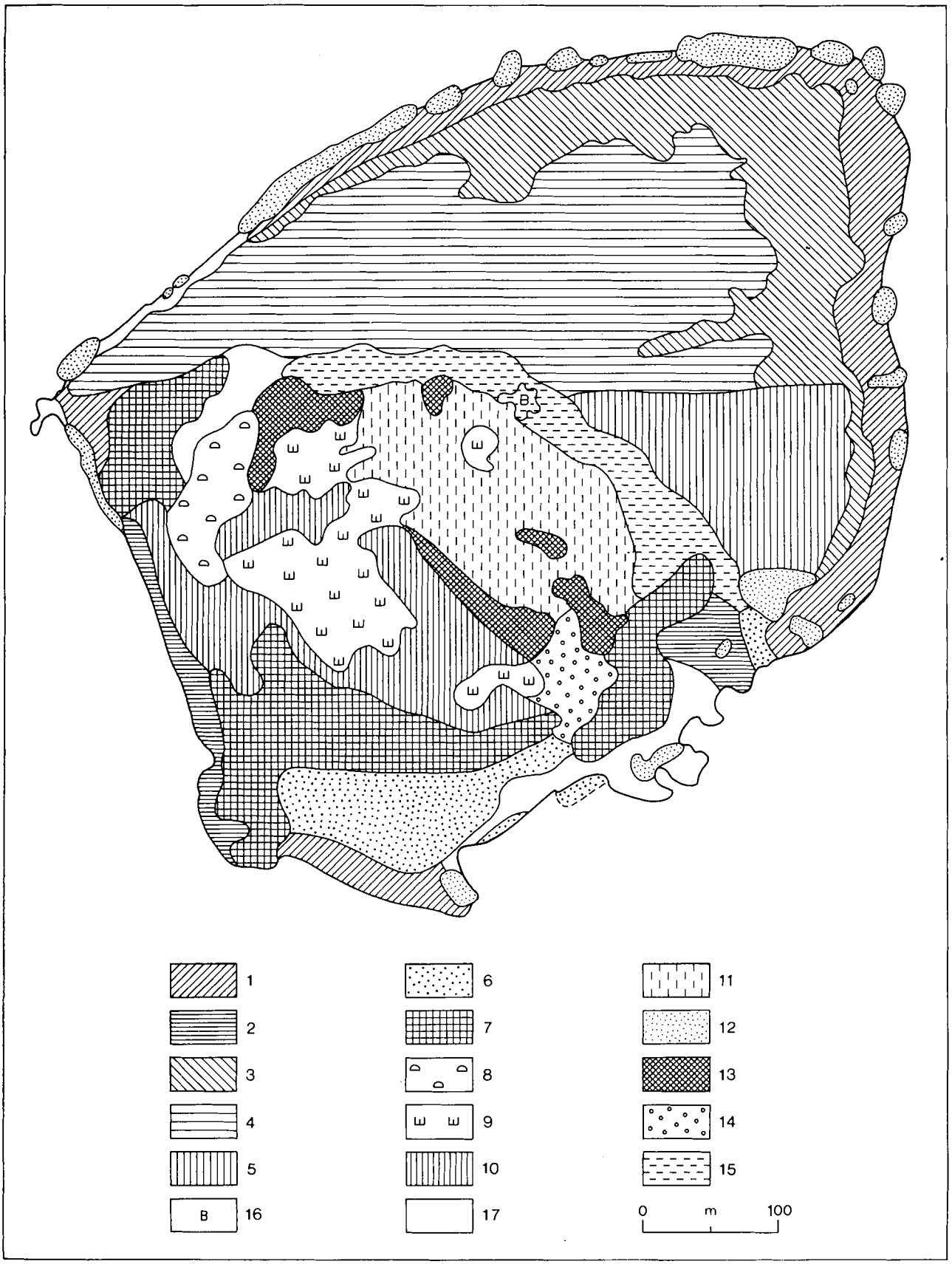

Figure 3. Cousin Island, vegetation types. Adapted, by permission, from map by A. W. Diamond.

3. VEGETATION OF FRÉGATE ISLAND, SEYCHELLES

by S. A. Robertson and D. M. Todd

Introduction

Frégate Island is the most easterly of the islands which comprise the Seychelles Group in the western Indian Ocean. It is one of the smaller islands in the group, and has been run as a private estate since the first permanent settlement was established early in the nineteenth century. All of the original vegetation has been cleared over the years so that a variety of crops could be planted, and the island's flora is now dominated by introduced species.

Ann Robertson made several visits to Frégate Island in 1978 to collect plants and was able to compile a preliminary list for the island which included those collected by Jeffrey in 1962 and Procter in 1972. David Todd spent some time on the island in 1981 and 1982, participating in an International Council for Bird Preservation project to study the Seychelles Magpie Robin and to eradicate feral cats, and was able to add to the plant list and to describe and map the vegetation types. We have combined our records and information to provide a brief history of the island and a fairly comprehensive plant list.

Frégate Island

Frégate (Figure 4a) is a low, rocky island of about 202 ha, rising to a height of 125 m above sea level. Its two hills are composed mainly of aplite, unlike the other granite islands of the group. Although aplite weathers rapidly to produce a deep and fertile, though bouldery, soil layer, large areas of bare rock remain on the island. In the north-east and the west are two areas of flat, low-lying land, locally called 'plateaux', which have a combined area of about 26 ha. On these coastal plateaux, there are rich, phosphatic soils of the Jemo series, which indicate that the island once supported large colonies of breeding

Atoll Research Bulletin No. 273: 39-64, 1983.

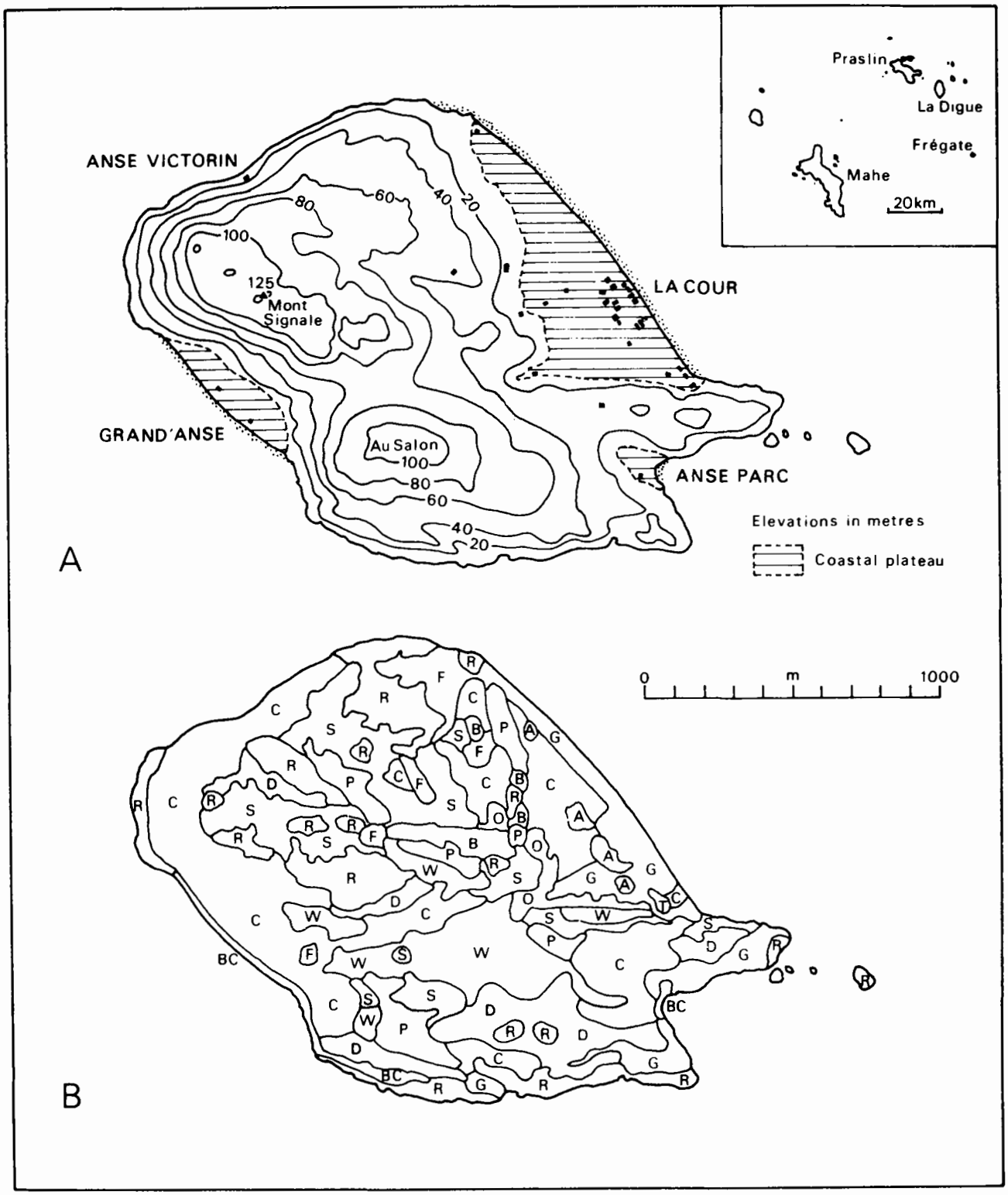

Figure 4. Frégate. A: topography. B: vegetation.

seabirds, while Shioya type soils are found behind the beach crests (Piggott, 1968). Even though Frégate experiences the same seasonal weather patterns as the other islands in the group, it attracts far less rain than the larger and higher islands. The limited records suggest that the rainfall is approximately 1250 mm per annum, about two-thirds of that in coastal areas of Mahé (Watson, 1978).

The early history of Frégate is very poorly documented. The island was apparently first settled by pirates early in the eighteenth century, but, though some of the stone walls and enclosures which they built still survive, they had abandoned the island before the French started to explore the group. In 1774, Lazare Picault, on his second voyage to the Seychelles from Mauritius, anchored off Frégate, but was unable to land. It was at this time that the island was given the name 'Ile aux Frégates', presumably after frigate birds seen in the vicinity. Apart from a brief period in 1801, when one of the Jacobin terrorists, who had been deported from France after an attempted assassination of Napoleon, and three slaves were marooned on Frégate (Lionnet, undated), the island remained uninhabited until 1813 at least. In that year, the island officially came into the ownership of the Savy family, although there is a reference to "Lieutenant Savy de Frégate" as early as 1785 (Fauvel, 1909). By 1851, the number of people resident on island had risen to 60, and subsequent census reports indicate that the population has since fluctuated, reaching a peak of 118 in 1947, before dropping to its present total of less than 25.

In 1787, Malavois, the Commandant of the Seychelles, described Frégate as being covered by timber trees of poor quality and lacking coconuts and other palms. However he did consider that the island might be suitable for the cultivation of rice and maize (Fauvel, 1909). There are no records of the early exploitation of the island, but by 1868, there were fields of rice and large mango trees, and bananas were grown. However, the major crop was sugar cane, and between 20,000 and 30,000 gallons of high-quality rum were produced each year. A few sheep were also kept on the island (Wright, 1868). A few years later, another visitor noted a flourishing vegetable garden and a number of Madagascar cattle in addition to the fields of sugar cane (Pike, 1872). Twenty years later, plantations of coconuts had been added to those of sugar cane (Guérard, 1891). Coconut palms have since been widely planted, even in the most marginal of habitats, and sugar cane has all but disappeared. Judging by their present abundance, cashew trees must also have been extensively cultivated at one time, while groves of citrus trees were established along the base of the hill behind the main plateau. The presence of a patch of cotton suggests that this too may have been grown commercially at some stage. More recently, efforts were made to establish a series of vanilla plantations, but they failed partly due to the presence of a fungal parasite. However, the sandragon trees planted to support the vanilla vines have thrived and now form a distinctive vegetation type. At present, the major crops are coconuts, from which copra is prepared, and, to a lesser extent, bananas and oranges. Cattle, pigs and chickens are kept on the plateaux.

Since the island was first settled, all of the indigenous vegetation has been cleared over the years to make way for man's crops. The result has been that an overwhelming proportion of the plant species now found on Frégate have been introduced by man, and that these species now dominate the vegetation. The disappearance of native plant species and the spread of introduced ones may have been helped by the presence of Javan Rusa Deer *Cervus timoriensis* (although these died out sometime in the 1950s), House Mice *Mus musculus*, and such birds as Indian Mynahs *Acridotheres tristis* and Madagascan Fodies *Foudia madagascariensis*.

Vegetation Types

The present vegetation of Frégate consists of a mosaic of different types dependent both on the nature of the underlying substrate and the period since the area was either last cleared or planted by man. There are few areas with what could be termed a climax vegetation. Because of this, it is almost always impossible to find clear boundaries between vegetation types. Despite this, thirteen vegetation types were recognised and are summarised below. Figure 4b indicates boundaries which are both subjective and approximate.

BC. Beach crest : hedges of *Scaevola sericea* survive along the tops of the beaches at Grand' Anse and Anse Parc, though the one on the main plateau at La Cour has been largely destroyed; with *Ipomoea pes-caprae* and *Sporobolus virginicus*, and in places *Casuarina equisetifolia*, *Guettarda speciosa* and *Colubrina asiatica*.

R. Rock : in the cracks and depressions in the large expanses of bare rock grow such plants as *Cyperus dubius*, *Panicum maximum*, *Pennisetum polystachyon*, *Furcraea foetida*, *Premna obtusifolia*, *Ficus benghalensis*, *F.nautarum*, *F.reflexa*, *Chrysobalanus icaco* and *Anacardium occidentale*.

G. Grassland : areas with a low growth of grasses, sedges and herbs with only occasional trees or shrubs; on the main plateau, a wide range of species including *Cynodon dactylon*, *Digitaria horizontalis*, *Lippia nodiflora*, *Sida* spp., *Stachytarpheta* spp., *Cassytha filiformis*, *Ipomoea obscura*, etc. are found; on the south coast in areas exposed to salt spray *Stenotaphrum dimidiatum* occurs with *Ipomoea pes-caprae* and some *Acrostichum aureum*.

F. Fatak grassland : areas dominated by *Panicum maximum* with occasional *Cocos nucifera* and other emergent trees, and in some areas a low growth of *Chrysobalanus icaco*.

D. *Chrysobalanus* scrub : *Chrysobalanus icaco* with a canopy at about 2 or 3 m with occasional emergent *Cocos nucifera*, *Anacardium occidentale* and *Ficus benghalensis*. The *Chrysobalanus* may have been planted to halt erosion.

S. Mixed scrub : areas with varying proportions of *Panicum maximum, Chrysobalanus icaco* and *Anacardium occidentale,* always with a very broken canopy often at less than 7 m, though with emergent species; with a wide range of other species including *Cocos nucifera, Cinnamomum zeylanicum, Strychnos spinosa, Asystasia gangetica, Citrus* spp., *Albizia lebbeck, Mangifera indica, Ficus benghalensis, Terminalia catappa* and *Furcraea foetida*.

W. Mixed woodland : areas with a higher and more complete canopy than 'S', usually with *Anacardium occidentale* as the dominant species, but including many other tree species such as *Ficus benghalensis, Cocos nucifera, Adenanthera pavonina, Albizia lebbeck, Hevea brasiliensis, Eucalyptus* sp., etc. Breaks in the canopy allow some growth of *Chrysobalanus icaco, Dracaena angustifolia, Nephrolepis biserrata* and *Polypodium scolopendria*.

C. Coconut plantation : areas with complete, or almost complete, canopy of *Cocos nucifera*. Where the canopy is incomplete, the undergrowth may resemble vegetation types 'G', 'F', 'D', or 'S'; in areas on the main plateau, the coconuts have been underplanted with *Musa* spp., *Carica papaya, Citrus* spp. and *Persea americana*.

O. Citrus plantation : areas planted with *Citrus* spp., most commonly *C.aurantium,* and including other species such as *Cinnamomum zeylanicum, Artocarpus heterophyllus* and *Jatropha curcas,* and where the canopy is broken, a ground flora resembling 'G'. A small area of *Coffea canephora* growing under *Albizia lebbeck* and *Cananga odorata* has been mapped with this type.

A. Breadfruit woodland : mature *Artocarpus altilis* growing on the main plateau, with occasional *Heritiera littoralis, Cocos nucifera, Calophyllum inophyllum* and *Mangifera indica,* with *Averrhoa bilimbi, Annona reticulata* and *Coffea canephora* around the fringes.

T. *Terminalia* woodland : small stands of *Terminalia catappa* growing at southern end of the main plateau with partial ground cover of *Maranta arundinacea*.

P. Sandragon woodland : even-aged stands of *Pterocarpus indica,* originally planted as supports for *Vanilla planifolia;* those on the pleateau include a few *Artocarpus altilis, Terminalia catappa* and *Thespesia populnea,* whereas those up the hill have occasional *Anacardium occidentale*. There is little or no ground cover.

B. Bamboo : *Bambusa vulgaris* grows down the course of the main seasonal stream on the island, with occasional *Ficus benghalensis, Mangifera indica* and *Albizia falcata*.

List of plants

Collectors' names and numbers in the following list refer to specimens deposited in the Herbarium of the Ministry of Agriculture, Mahe, Seychelles. Sight records by Robertson and Todd are also indicated. No attempt was made to record all the ornamental species growing around houses, but those found further afield have been included in the list. Commonly-used Creole and English names have also been given.

ACANTHACEAE

Asystasia gangetica (L.) T. Anders. — Manz Tou
Robertson 2681

AIZOACEAE

Glinus oppositifolius (L.) DC. — Gro Lavervenn
Todd 13

AGAVACEAE

Agave sisalana (Perr. ex Engl.) Drumm. & Prain — Lalwa, Sisal
Todd, sight

Dracaena angustifolia Bak. — Sandel
Robertson 2670

Furcraea foetida (L.) Haw. — Lalwa, Mauritius Hemp
Robertson 2656

AMARANTHACEAE

Achyranthes aspera L. — Serzan
Todd 44

Alternanthera sessilis (L.) R. Br. — Anbalaz, Bred Malabar
Procter 4158
Robertson 2467, 2715

Amaranthus dubius Mart. ex Thell. — Payater
Todd 15

Cyathula prostrata (L.) Bl.
Robertson 2689

ANACARDIACEAE

Anacardium occidentale L. — Kazou, Cashew
Robertson 2666

Mangifera indica L. — Mang, Mango
Robertson, sight
Todd, sight

Spondias dulcis Park. — Frisiter, Golden Apple
Todd, sight

ANNONACEAE

Annona muricata L. — Korosol, Soursop
Todd, sight

Annona reticulata L. — Ker-d-bef, Ox-heart
Robertson, sight
Todd, sight

Annona squamosa L. — Zat, Custard-Apple
Robertson, sight
Todd, sight

Cananga odorata DC. — Langila, Ylang-Ylang
Robertson, sight
Todd, sight

APIACEAE (UMBELLIFERAE)

Centella asiatica (L.) Urb.
Todd, sight

Daucus carota L. — Karot
Robertson, sight

APOCYNACEAE

Alstonia macrophylla Wall. — Bwa Zonn
Todd, sight

Catharanthus roseus (L.) G. Don — Rozamer, Saponer, Madagascar Periwinkle
Todd, sight

Plumeria acuminata Ait. — Prensipann, Frangipani
Todd, sight

Plumeria rubra L. — Prensipann, Frangipani
Todd, sight

ARACEAE

Alocasia macrorrhiza (L.) Schott — Vya
Todd, sight

Caladium bicolor (Dryand.) Vent.
Todd, sight

Colocasia esculenta (L.) Schott — Larouy, Cocoyam
Robertson, sight
Todd, sight

ARALIACEAE

Polyscias pinnata J. R. and G. Forst.
Todd 27

ARECACEAE (PALMAE)

Areca catechu L. — Koko Pak, Areca Palm
Robertson, sight
Todd, sight

Cocos nucifera L. — Koko, Coconut Palm
Robertson, sight
Todd, sight

Lodoicea maldivica (J.F. Gm.) Pers. — Koko-d-Mer, Coco de Mer
Todd, sight

ASCLEPIADACEAE

Calotropis procera (Ait.) Ait.f.
Robertson 2731

Cryptostegia grandiflora R. Br.
Robertson 2732

Sarcostemma viminale R. Br. — Lyann san Fey
Robertson 2742

ASTERACEAE (COMPOSITAE)

Ageratum conyzoides L.
Todd 53

Emilia sonchifolia (L.) DC.
Robertson 2644

Melanthera biflora (L.) Willd.
Todd 58

Synedrella nodiflora (L.) Gaertn.
Robertson 2672

Vernonia cinerea (L.) Less. Gerivit
Robertson 2676

BIGNONIACEAE

Tabebuia heterophylla (Lindl.) Miers Kalis-d-pap
Todd, sight

BOMBACACEAE

Ceiba pentandra (L.) Gaertn. Lawet, Kapok
Todd, sight

BORAGINACEAE

Heliotropium indicum L. Lerb Papiyon
Procter 4248
Robertson 2735

Tournefortia argentea L.f. Bwa Taba
Todd, sight

BRASSICACEAE (CRUCIFERAE)

Brassica chinensis L. Sou-d-sinn
Todd, sight

Nasturtium officinale R. Br. Kreson, Water Cress
Robertson, sight

BROMELIACEAE

Ananas comosus (L.) Merr. Zanana, Pineapply
Robertson, sight
Todd, sight

CAPPARIDACEAE

Cleome viscosa (L.) DC. Pisat-d-sinn
Todd 20

Cleome gynandra L.
Jeffrey 1173
Todd, sight

CARICACEAE

Carica papaya L. Papay, Pawpaw
Robertson, sight
Todd, sight

CARYOPHYLLACEAE

Drymeria cordata (L.) Willd.
Todd 14

CASUARINACEAE

Casuarina equisetifolia L. Sed
Robertson, sight
Todd, sight

CHRYSOBALANACEAE

Chrysobalanus icaco L. Prinn-d-frans, Coco-plum
Robertson 2700

CLUSIACEAE (GUTTIFERAE)

Calophyllum inophyllum L. Takamaka
Todd sight

COMBRETACEAE

Lumnitzera racemosa Willd.
Todd 37

Terminalia catappa L. Badamye, Indian Almond
Todd, sight

COMMELINACEAE

Commelina sp. Lerb Koson
Todd, sight

CONVOLVULACEAE

Ipomoea batatas (L.) Lam. — Patat, Sweet Potato
Robertson, sight

Ipomoea macrantha Roem. & Schultes — Gro Patat Koven
Todd, sight

Ipomoea obscura (L.) Ker-Gawl
Todd 10

Ipomoea pes-caprae L. — Patatran Rouz, Beach Morning Glory
Todd, sight

CUCURBITACEAE

Cucumis melo L. — Melon-d-frans, Melon
Robertson, sight
Todd, sight

Cucumis sativus L. — Kokn, Cucumber
Robertson, sight
Todd, sight

Cucurbita moschata (Duch. ex Lam.) Duch. ex Poir. — Ziromon, Pumpkin
Robertson, sight
Todd, sight

Trichosanthes cucumerina L. — Patol, Snake Gourd
Robertson, sight
Todd, sight

CYPERACEAE

Cyperus aromaticus (Ridl.) Mattf. and Kük. — Lerb Zonyon
Robertson 2683

Cyperus compressus L. — Lerb Zonyon
Procter 4213
Robertson 2729

Cyperus dubius Rottb. — Lerb Zonyon
Procter 4161
Robertson 2661

Cyperus kyllingia Endl.
Kyllinga monocephala Rottb.
Robertson 2699

Cyperus ligularis L. — Lerb Sent Mari
Procter 4175

Cyperus polystachyos (Rottb.) Beauv. — Lerb Zonyon
Robertson 2663

Cyperus rotundus L.
Robertson 2723

Fimbristylis complanata (Retz.) Link — Barb Anri
Robertson 2669

Fimbristylis dichotoma (L.) Vahl
Robertson 2695

Fimbristylis spathacea Rottb.
Procter 4151
Robertson 2643, 2725

Remirea maritima (L.) Aubl.
Robertson 2727

EBENACEAE

Diospyros discolor Willd. — Manbolo
Todd 23

EUPHORBIACEAE

Acalypha indica L. — Lerb Sat
Robertson 2716

Euphorbia hirta L. — Zan Rober
Robertson 2641

Euphorbia pyrifolia Lam. — Tangen, Bwa-dile
Jeffrey 1179
Robertson 2658

Euphorbia thymifolia L. — Trenas
Robertson 2724

Hevea brasiliensis Muell.-Arg. — Kaoutsou; Rubber
Todd, sight

Jatropha curcas L. — Piyondenn
Robertson 2711

Manihot esculenta Crantz — Manyok, Cassava
Robertson, sight
Todd, sight

Pedilanthus tithymaloides (L.) Poit. — Bwa Malgas
Todd, sight

Phyllanthus amarus Sch. & Thonn. — Kiraneli Blan
Robertson 2713

Phyllanthus urinaria L. — Kiraneli Rouz
Robertson 2714

FABACEAE (LEGUMINOSAE)

Abrus precatorius L. — Reglis
Robertson 2680

Acacia confusa Merr.
Procter 4172

Adenanthera pavonina L. — Lagati, Bead Tree
Todd, sight

Albizzia falcata (L.) Book. — Albizya
Todd, sight

Albizia lebbeck (L.) Benth. — Bwa Nwar
Robertson 2720

Caesalpinia bonduc (L.) Roxb.
Robertson 2738

Caesalpinia pulcherrima (L.) Swartz — Zegret, Pride of Barbados
Todd 24

Canavalia cathartica Thonn. — Pwa Maron
Robertson 2649

Canavalia rosea (Sw.) DC.
Jeffrey 1186

Cassia occidentalis L. — Kaspyant
Robertson 2692

Centrosema pubescens Benth.
Robertson 2744
Todd 31

Crotalaria pallida Ait.
Procter 4160
Todd 16

Crotalaria retusa L.
Robertson 2684

Delonix regia (Hook.) Raf. — Flanbwayan
Todd, sight

Desmodium canum (Gm.) Sch. & Thell. — Pti Tref
Robertson 2660

Desmodium triflorum (L.) DC. — Pti Tref
Robertson 2660

Indigofera suffruticosa Mill. — Lendigo
Procter 4173
Robertson 2694

Leucaena leucocephala (Lam.) de Wit
Todd, sight

Mimosa pudica L. — Sansib
Robertson 2698

Pithecellobium unguis-cati (L.) Benth. — Kanpes
Todd 49

Pterocarpus indicus Willd. — Sandragon
Robertson 2737

Sophora tomentosa L.
Robertson 2726

Tamarindus indica L. — Tamaren, Tamrind
Todd, sight

Tephrosia noctiflora Boj. ex Baker
Jeffrey 1176
Procter 4159
Robertson 2673

Teramnus labialis (L.f.) Spreng.
Robertson 2647

GOODENIACEAE

Scaevola sericea Vahl — Veloutye
Robertson 2653

HERNANDIACEAE

Hernandia sonora L. — Bwa Blan
Robertson, sight
Todd, sight

LAMIACEAE (LABIATAE)

Coleus sp. — Grobon
Robertson 2675

Leucas lavandulifolia Sm.
Procter 4154
Robertson 2644

Ocimum basilicum L.
Todd, sight

LAURACEAE

Cassytha filiformis L. — Lyann san Fen
Robertson 2682

Cinnamomum zeylanicum Blume — Kanel, Cinnamon
Robertson 2667

Litsea glutinosa (Laur.) C. B. Rob. — Bwa Zwazo
Todd 21

Persea americana Mill. — Zavoka, Avocado
Robertson, sight
Todd, sight

LECYTHIDACEAE

Barringtonia asiatica (L.) Kurz — Bone Kare
Robertson, sight
Todd, sight

LILIACEAE (sensu lato)

Crinum amabile Ker-Gawl ? — Lis
Todd, sight

MALVACEAE

Abutilon indicum (L.) Sweet — Lerb Herison Blanc
Todd 26

Abutilon mauritianum (Jacq.) Medic
Procter 4156
Todd, sight

Gossypium hirsutum L. — Koton, Cotton
Todd 39

Hibiscus abelmoschus L. — Zanbret
Todd 2741

Hibiscus mutabilis L. — Biskis, Hibiscus
Todd, sight

Hibiscus tiliaceus L. — Var, Tree Hibiscus
Todd, sight

Sida acuta Burm.f. — Lerb Dir
Robertson 2748, 2691

Sida pusilla Cav.
Jeffrey 1180
Todd, sight

Sida rhombifolia L. — Lerb Dir
Robertson 2651, 2749

Sida stipulata Cav. — Lerb Dir
Robertson 2747

Thespesia populnea (L.) Sol. ex Correa — Bwa-d-roz
Todd, sight

Urena lobata L.
Robertson 2650

MARANTACEAE

Maranta arundinacea L. — Larourout, Arrowroot
Todd 59

MELIACEAE

Melia azederach L. ? — Lila
Robertson 2690

Swietenia macrophylla Jacq. — Mahogany
Todd, sight

Xylocarpus granatum Koen. — Pasyans, Cinese Puzzle Nut
Todd, sight

MORACEAE

Artocarpus altilis (Park.) Fosb. — Fri-a-pen, Breadfruit
Robertson, sight
Todd, sight

Artocarpus altilis (Park.) Fosb. var. — Rima, Breadfruit
Robertson, sight
Todd, sight

Artocarpus heterophyllus Lam. — Zak, Jackfruit
Todd, sight

Ficus avi-avi Bl.
Todd 28

Ficus benghalensis L. — Piltiplyan, Banyan
Robertson 2668

Ficus nautarum Bak. — Lafous Gran Fey
Todd, sight

Ficus reflexa Thunb. — Lafous Pti Fey
Robertson 2657

MORINGACEAE

Moringa oleifera Lam. — Bred Morong, Horse Radish Tree
Todd, sight

MUSACEAE

Musa spp. — Banann Sen Zak, Gabou, Minyon, Kare
Todd, sight

MYRTACEAE

Eucalyptus sp. — Kaliptis
Todd, sight

Eugenia javanica Lam. — Zamalak, Java Apple
Robertson, sight
Todd, sight

Eugenia malaccensis L. — Pom, Pomerac
Robertson, sight
Todd, sight

Psidium littorale Raddi — Gouyav (Rouz), Chinese Guava
Todd, sight

Psidium littorale Raddi var. *lucidum* Degener — Gouyav (Zonn)
Todd, sight

NYCTAGINACEAE

Boerhavia sp. — Patat Koven
Jeffrey 1181
Todd 32

Bougainvillea glabra Choisy — Vilya
Todd, sight

ONAGRACEAE

Ludwigia erecta (L.) Hara — Lerb Lamar
Robertson 2648

ORCHIDACEAE

Vanilla mexicana Mill. — Lavany, Vanilla
Todd, sight

OXALIDACEAE

Averrhoa bilimbi L. — Bilenbi
Robertson, sight
Rodd, sight

Oxalis corniculata L.
Robertson 2717

PANDANACEAE

Pandanus balfourii Martelli — Vakwa-d-rivyer
Todd, sight

Pandanus utilis Bory — Vakwa Sak
Todd, sight

PASSIFLORACEAE

Passiflora foetida L. — Pok-pok, Bonbon Plim
Robertson 2697

PEPEROMIACEAE

Peperomia pellucida (L.) HBK. — Lerb Glase
Jeffrey 1174
Todd 51

POACEAE (GRAMINEAE)

Axonopus compressus (L.) P. Beauv.
Robertson 2665

Bambusa vulgaris Schrad. — Banbou
Todd 11

Chloris barbata Sw.
Robertson 2739

Coix lachryma-jobi L. — Zob, Job's Tears
Todd 54

Cynodon dactylon (L.) Pers. — Gazon Sovaz
Procter 4157, 4250

Dactyloctenium ctenoides (Steud.) Bosser — Lerb Touloulou
Robertson 2722

Dendrocalamus giganteus Munro ? — Banbou Zean
Robertson 2749a
Todd 18

Digitaria horizontalis Willd.
Robertson 2685

Digitaria timorensis (Kunth.) Bal. — Gazon Lave
Procter 4170

Eleusine indica (L.) Gaertn. — Pat-d-poul
Robertson 2696

Enteropogon sechellensis (Bak.) Dur. and Schinz — Lerb Diri
Robertson 2466

Eragrostis ciliaris (L.) R. Br.
Procter 4169

Eragrostis tenella (L.) Beauv. var. *insularis* Hubb. — Lerb Touterel
Robertson 2743

Lepturus radicans (Steud.) Camus
Jeffrey 1182

Panicum brevifolium L. — Gazon banbou
Robertson 2640

Panicum maximum L. — Fatak
Jeffrey 1175
Robertson 2686

Panicum subquadriparum Trin.
Robertson 2719

Panicum sp. near *umbellatum* Trin.
Procter 4153
Robertson 2693

Paspalidium geminatum (Forsk.) Stapf
Procter 4174
Robertson 2645

Paspalum conjugatum Berg.
Robertson 2671

Paspalum scrobiculatum L.
Procter 4171
Robertson 2664

Pennisetum polystachyon (L.) Schult. — Ma Tant
Robertson 2688

Pennisetum purpureum Schum. — Lerb Letefan
Todd, sight

Saccharum officinarum L. — Kann, Sugar Cane
Todd, sight

Setaria barbata (Lam.) Kunth — Lerb Banbou
Procter 4162
Robertson 2642

Sporobolus virginicus (L.) Kunth
Procter 4150
Robertson 2740

Stenotaphrum dimidiatum (L.) Brongn.
Robertson 2679

Vetiveria zizaniodes (L.) Nash
Robertson 2734

POLYPODIACEAE (sensu lato)

Acrostichum aureum L. — Fouzer Manglye
Todd, sight

Nephrolepis biserrata (Swartz) Schott — Fouzer Taba
Robertson 2674

Pityrogramma calomelanos (L.) Link
Todd, 12, 19

Polypodium scolopendria Burm.f. — Kapiler
Todd 56

Vittaria ensiformis L.
Todd, sight

PORTULACACEAE

Portulaca oleracea L. — Kourpye
Robertson 2728

PSILOTACEAE

Psilotum complanatum Sw. — Pti Sed
Robertson 2745

RHAMNACEAE

Colubrina asiatica (L.) Brong. — Bwa Savan
Todd, sight

RUBIACEAE

Coffea canephora Pierre ex Fröhner — Kafe, Robusta Coffee
Robertson, sight
Todd, sight

Guettarda speciosa L. — Bwa Kase
Todd, sight

Hedyotis corymbosa L.
Jeffrey 1183
Procter 4166
Robertson 2736

Hedyotis macrophylla DC.
Jeffrey 1177
Todd 30

Mitracarpum verticillatum Vatke
Robertson 2662

Morinda citrifolia L. Bwa Torti
Robertson 2659

RUTACEAE

Citrus aurantiifolia(Christm.) Swing. Limon, Lime
Todd, sight

Citrus aurantium L. Zoranz Mozambik, Bigarad, Gro Bogarad, Seville Orange
Todd, sight

Citrus hystrix DC Kavava
Todd, sight

Citrus limon(L.) Burm.f. Sitron, Lemon
Todd, sight

Citrus paradisi Macf. Panplemous, Grapefruit
Todd, sight

Citrus reticulata Blanco Mandarinn, Tangerine
Todd, sight

Citrus sinensis (L.) Osbeck Zoranz Po Finn, Sweet Orange
Todd, sight

SAPINDACEAE

Cardiospermum halicacabum L.
Robertson 2468

SCROPHULARIACEAE

Scoparia dulcis L.
Robertson 2712

Striga asiatica L. Lerb Dife, Lerb Diri
Procter 4163
Robertson 2733

SOLANACEAE

Capsicum annuum L. Piman Salad, Sweet Pepper
Robertson, sight

Capsicum frutescens L. — Piman, Chillie
Todd, sight

Datura metel L. — Fler Pwazon
Robertson 2730

Physalis peruviana L. — Pok-pok
Todd, sight

Solanum indicum L. — Brenzel maron
Todd, sight

Solanum lycopersicum L. — Tomat, Pomdamou, Tomato
Robertson, sight
Todd, sight

Solanum melongena L. — Brenzel, Eggplant
Robertson, sight
Todd, sight

Solanum nigrum L. — Bred Marten
Procter 4149
Robertson 2718

STERCULIACEAE

Heritiera littoralis Ait. — Bwa-d-tab
Todd, sight

STRYCHNACEAE

Strychnos spinosa Lam. — Kalbasye
Robertson 2646

TILLIACEAE

Triumfetta rhomboidea Jacq.
Procter 4168
Robertson 2677

TURNERACEAE

Turnera ulmifolia L. — Koket
Robertson 2654

VERBENACEAE

Lippia nodiflora (L.) Michx.
Todd 47

Premna obtusifolia R. Br. Bwa Siro
Robertson 2655

Stachytarpheta indica (L.) Vahl Zepi Ble
Robertson 2678

Stachytarpheta jamaicensis (L.) Vahl Zepi Ble
Robertson 2687

Tectona grandis L. Tek, Teak
Todd, sight

Vitex trifolia L.
Todd, sight

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4. BIOLOGICAL HISTORY OF AGALEGA, WITH SPECIAL REFERENCE TO BIRDS AND OTHER LAND VERTEBRATES.

by A.S. Cheke and J.C. Lawley

Introduction

The twin islands of Agalega lie at 10°25'S, 56°40'E in the western Indian Ocean, about 560 km south of Mahé (Seychelles), 990 km north of Mauritius and 700 km east-north-east of Diego Suarez (Madagascar). They were discovered in 1509 by the Portuguese Diego Lopez de Sequiera (Scott 1961), and first appeared on a map in 1517, labelled Ilha do Gale (Fauvel 1909). Scott's book, *Limuria*, is the only comprehensive history of the exploration and settlement of Agalega, though the important compilation by Leduc (1848), and the books of Lionnet (1924) and Dussercle (1949) are also useful. Scott took pains to lay to rest various earlier theories as to the discoverer, discovery date, and origin of the islands' name. The often accepted association with 'Galego', nickname of the mariner João (=Juan) de Nova, appears to be invalidated, as the actual account of the discovery explains how the long low islands were nicknamed *Baixos do Gale* (Galiass Banks — a galiass being a long low sailing galley) (Scott, 1961).

After two centuries of obscurity, Agalega was rediscovered by the French ship *Rubis* in 1758 (Scott 1961). Fauvel (1909) credited the rediscovery to the *Charle* and the *Elisabeth* in 1742, but Scott considered their itinerary very doubtful). The islands became a dependency of the then Ile de France, and remain to this day part of the State of Mauritius. The island was colonised from Mauritius in 1808 (Scott 1961).

Agalega is currently run by the Outer Islands Corporation, a consortium of government and commercial interest, represented by a Manager, who apart from exploiting the copra, has administrative and judicial powers as government representative. There are however periodic visits by police and judicial officers three times a year when

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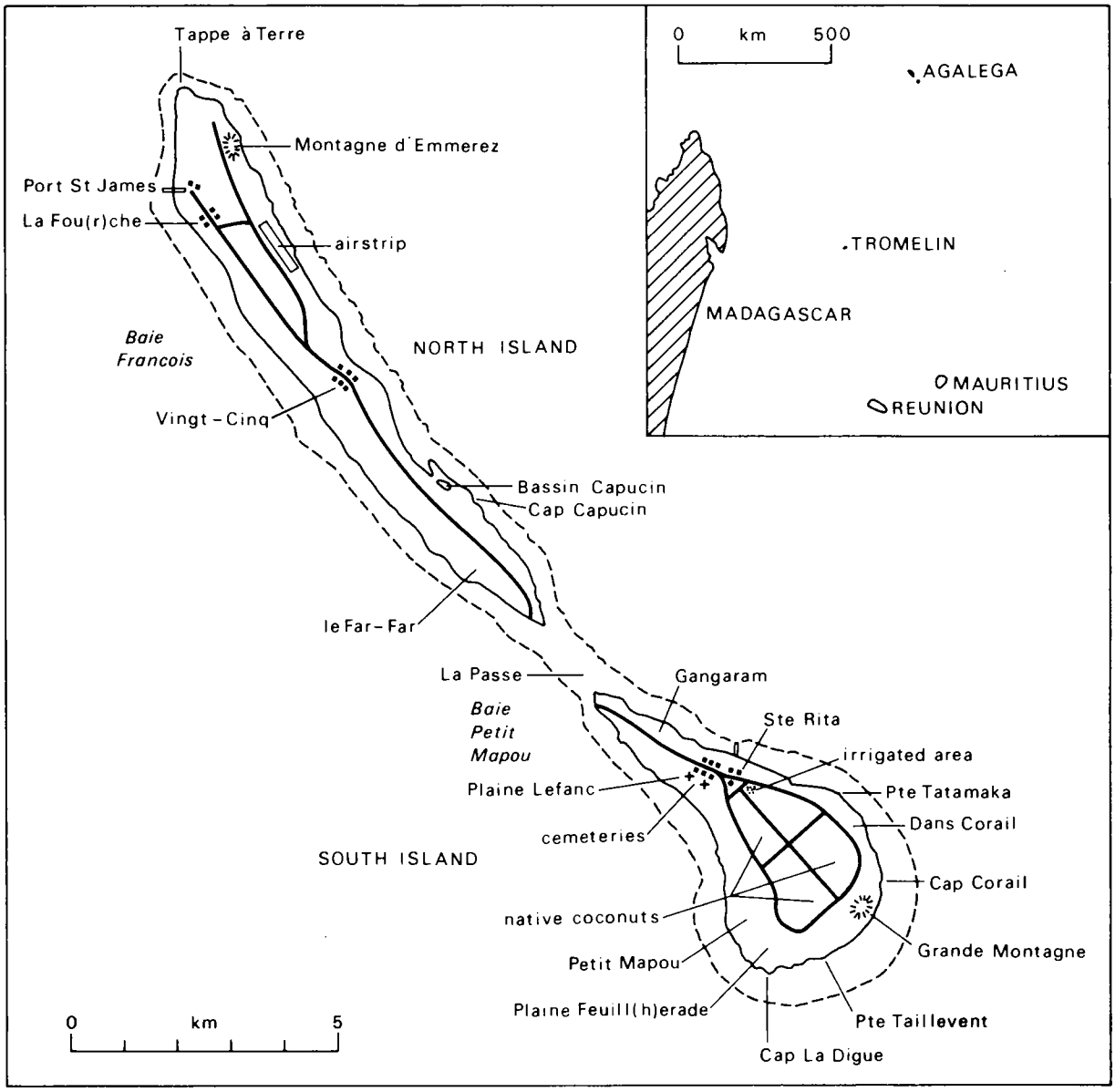

Figure 5. Agalega

the trading vessel *Mauritius* calls, and much is left over to await these visits. The only other visits are those of yachts sailing in the Indian Ocean. The human population, around 425 in 1961, had fallen to 200 by 1974 (*L'Express*, Mauritius, 7.7.74), and further to about 150 in 1978.

History of exploration and study

Of all the islands in the western Indian Ocean, Agalega has been the most neglected by scientists. There has never been a full geological survey, and neither the Percy Sladen Expeditions (early 1900s) nor any ship of the International Indian Ocean Expedition (1963-4) ever went there. The only bird list previously published dates from the 1830s (Leduc 1848; often reprinted, e.g. Watson, Zusi & Storer 1963), and likewise the only list of plants (Bojer 1835). Auguste Leduc's collections of molluscs and cryptogams remain the only significant ones from the islands (Poisson 1954, Montagne 1841). No adequate map exists, and no aerial photographs have been flown (search by Cheke in both the Mauritius Survey Department and the UK Ministry of Defence).

After the activity of the 1830s it was a century before the islands were again visited by a scientist, Rivaltz Dupont in 1934. Since then visits have been somewhat more frequent although very little has been published. The gaps can partly be filled from incidental observations by other, non-scientific, visitors; for such a little frequented island their contribution is substantial. All sources from which we have taken biological information are listed in Table 1.

Contact with Agalega was initially from Mauritius, and later also with the Seychelles (Scott 1961). It is not clear at what time connections with the latter became regular, but probably before 1830 to judge by the presence of a coco-de-mer (*Lodoicea*) nut on the Bojer-Leduc list (Leduc 1848; a collection of objects from Agalega: see below, under Birds, for dating). British naval vessels, on Indian Ocean patrols to prevent illegal slave trading in the Seychelles, called regularly in the early 1830s (Lionnet 1924, Scott 1961), and merchant captain F. Liénard was collecting in the Seychelles and Agalega in the 1830s (see *Rapports Annuels* and *Procés-Verbaux* of the Société d'Histoire Naturelle de l'Île Maurice). There is no evidence of any direct contact at any time with Réunion or Madagascar, but the possibility that the islands were known to and used by 17th and 18th century pirates cannot be ruled out, though no traces have been reported.

In an earlier paper Cheke (1975) stated that he and John Procter were preparing for publication a review of the literature, a detailed description of the islands, and a survey of the present distribution of plants and animals. John Procter's death (*Oryx* 15:129 (1979)) has most unfortunately removed the detailed botanical element of this review: he was going to write up the flora in full, using the unpublished collections of Dupont, Mamet and Wiehé as well as his own specimens and notes. It is to be hoped that his MSS will be deposited in a place

accessible to future students of Agalegan botany. We only intend here to give a very general survey of the vegetation and its history, while Fosberg *et al.* (this issue) have compiled a plant list to appear at the same time.

Scientific names used in this paper follow Fosberg *et al.* (this issue: plants), Morony, Bock & Farrand (1975: birds), Wermuth & Mertens (1977: Chelonians), Cheke (in press a: lizards) and Mamet (1978: insects). Local names are those recorded by us (but see Bailey 1971 and Cheke 1982a). We have throughout spelt the name of the islands' first colonist as he spelt it himself in his report (Rozemont 1809), not 'de Rosemond' as written by many other authors.

Geological History

Some notes on the structure and origin of Agalega have been published by Leduc (1841) and Dupont (1936), but there has been no formal survey. Leduc, who knew the island before man had seriously altered the vegetation, argued that the land surface had only been emerged some 600 years (i.e. since ca.1200-1250). He based his evidence primarily on the apparent age of trees and their distance from the shore — assuming the first seeds were washed up and each generation was able to move further inland only at a limited rate. Scott (1961) supported his view on the grounds that the Portuguese originally termed Agalega a bank (*baixos*) rather than an island, suggesting, according to him, that there may have been little or no vegetation in the early 1500s. Without stratigraphic evidence there seems no way of evaluating these theories, but one can confirm from its landform that Agalega is of relatively recent formation. The total absence of land birds before human colonisation (Rozemont 1809) suggests the same, as does the relatively undeveloped stage of the native vegetation (Bojer 1835).

Agalega (Figure 5) consists of two low-lying islands of consolidated coral debris (platin) separated by a 1.5 km coralliferous channel nearly dry at low tide. Figures for the size of the islands given the literature vary enormously. Those given here are taken by direct measurement from Admiralty Chart No.1881 (1969 printing), and are slightly larger than those previously quoted by Cheke (1975), which were taken from a derivative map. Lionnet (1924) claimed that the then current Admiralty Chart (No.2299) showed North Island as much too long and narrow, and himself gave a map showing a stouter shape, perhaps based on Bouffé (1913). Mamet (1978), without giving sources, gave in the text the total land area as 44 sq.km, over double the value we obtained from the current Admiralty Chart; likewise his figure for the maximum width of North Island is 2.4 km, as against 1.6 km; measurements taken from his map, however, agree with ours. Note that Renvoize (1975), in a paper comparing the floras of Indian Ocean coral islands, gave the land area as only 4 sq.km; his figure for the number of plants recorded was also too small by an order of magnitude.

On the chart North Island is long and narrow, 12.4 km by 1.6 km, while South Island is pear-shaped, measuring 6.6 km by 3.6 km. The

Table 1. Scientific studies at Agalega

Date	*Visitor and study*	*Reference*
1758	Island sighted by the *Rubis*, co-ordinates established.	Fauvel (1909, Dussercle (1949) Scott (1961)
1785	De Richery (on the *Maréchal de Castries*). Vegetation described from offshore.	Leduc (1848), Froberville (1848), Dussercle (1949)
1785-90	Ships sent in search of tortoises.	Froberville (1848), Dussercle (1949)
1790-1802	Unsuccessful attempts at settlement.	Leduc (1848), Dussercle (1949)
1808-9	Caillou (de) Rozemont. General observations; survey of coconuts and agricultural potential.	Rozemont (1809), Dussercle (1949)
1823, December	C.T. Hilsenberg. Brief botanical and zoological notes. Remarks on coconut cultivation.	Hilsenberg (1823)
1824	Anon. ('A.Lec...'). General remarks.	Anon (1828), Leduc (1848)
1824	Werner & C.T. Hoart. General remarks and agricultural observations. Also a map surveyed by Hoart.	Werner (1824); Toussaint & Adolphe (1956) for map details.
1827-1839	Auguste Leduc. Observations on vegetation, growth rates of trees; collections of birds, invertebrates, plants; notes on human ecology in the islands, etc.	Desjardins (1831), Leduc (1841), Montagne (1841), Leduc (1848), Lionnet (1924), Dussercle (1949), Poisson (1953), Scott (1961) etc.
1831, February	Capt. Trotter (on H.M.S. *Curlew*) collected an ibis.	Desjardins (1832)
1835, Apr.-Jun.	Wencelaus Bojer. Complete plant list. Notes on birds, game.	Bojer (1835), Bouton (1846), Vaughan (1958)[1]
1837, June	Capt. Laplace (on *l'Artémise*). General remarks.	Laplace (1841-54)
1838, June	C. Anderson. General remarks; birds, game agriculture.	Anderson (1838)

Table 1 continued:

1842	Capt. Liénard brought a living *tortue* to Mauritius.	Bouton (1846)
ca.1875	Feuillerhade. Collected birds' eggs.	Newton (1883)
1883	I. Dupont. General remarks.	Dupont (1883)
1889	A. Boucherat. General remarks; birds, game, agriculture.	Boucherat (1890)
1889-1903	G. Lionnet. General remarks; birds, game, coconut crabs, rats, agriculture (his book also contains more recent information from other sources; Dussercle (1948:51) gives Lionnet's dates).	Lionnet (1924)
1891, September	*Mathilde* wrecked; rats introduced.	Lionnet (1924), Dussercle (1949)
1893	Gabriel Lincoln. General remarks; birds, game.	Lincoln (1893), Lionnet (1924)
1912-13	G. Bouffé. Agriculture (his report contains the only reasonable map of the interior of the islands).	Bouffé (1913)
1934	Rivaltz Dupont. Topographical observations and general remarks. Plants collected (now in Mauritius Herbarium, Réduit).	Dupont (1936)
1935-48	Roger Dussercle. General remarks; birds, rats, agriculture.	Dussercle (1949)
1955, May	Raymond Mamet. Insects and plants collected (latter preserved in the Mauritius Herbarium).	Mamet (1978)
1955, September	Sir Robert Scott. General remarks, birds, game, agriculture.	Scott (1961)
1961	Octave Wiehe. Plants collected (in Mauritius Herbarium)	-

Table 1 continued:

1972, April	John Procter. Plants collected (duplicates are in the Mauritius Herbarium; location of main collection unknown). Probably also general faunal notes.	-
1974, June 8, 26-28	Anthony Cheke. Birds; lizards collected; general observations on vegetation and other fauna.	Cheke (1865, 1982a,b); This report.
1976, July 19-20	D.R. Stoddart and M.J. Coe. Geology and flora.	Fosberg, Sachet & Stoddart, this issue.
1978, November 5-6	Jonathan Lawley. Birds; lizards collected.	This report; Cheke 1982b

1. Bojer wrote numerous papers in which Agalegan plants are mentioned; see Vaughan (1958) for a full bibliography.

total land area is 21 sq.km (North Island: 11.7, South Island: 9.3; map tracings cut out and weighed).

The two islands are surrounded by a fringing reef enclosing a very narrow lagoon (25-100 m wide) with no natural passes. At the current landing place, Port St. James (North Island), the reef comes to within a few metres of the shore, and a pass has been blasted out. The size and structure of Agalega appears to be comparable with that of Coëtivy, 315 km to the north, discussed by Gardiner & Cooper (1907). Agelega appears however to be of younger formation than Coëtivy, which has a shallow shelf to the west and a broken fringing reef.

Inside the lagoon the islands are bounded throughout by a sandy beach about 20-30 m wide, a few feet higher above sea level than the interior, and vegetated on the inland side. At the south-east of South Island there are coastal dunes (Grande Montagne) rising to some 7 m or so in height, and higher ones (Montagne d'Emmerez; 15 m according to Dussercle (1949)) towards the north-east of North Island. Inland of the beach and dunes is very flat terrain composed of consolidated coral sand (platin) with a sandy surface, or, in certain areas, soil. Depressions fill with water during the rainy season, especially the large area in the centre of South Island where the coconuts (see below) are densest. Dupont (1936) considered this area to be below sea level. There is permanent water (brackish) at Bassin Capucin (North Island; Patel 1974) and (fresh) in the ditches surrounding the company's garden at Ste.Rita (South Island).

Superficial phosphate rock associated with *Pisonia grandis* occurs near the north end of North Island as a typical Jemo Series cemented layer. Guano has been intermittently exported from Agalega on a small scale. According to the *Annual Reports* of the Customs (later Customs and Excise) Department, Mauritius, this amounted to 4 tons in 1934, 350 tons in 1935, 385 tons in 1936, 235 tons in 1937, 366 tons in 1938, 50 tons in 1947 and 465 tons in 1952, a total of 1855 tons. Lincoln (1939) gave the following phosphate determinations, quoted by Hutchinson (1950, p. 294):

29.5% P_2O_5, of which 28.9% is soluble in neutral citrate and 74.5% in 2% HNO_3

25.8% P_2O_5, of which 27.6% is soluble in neutral citrate and 58.9% in 2% HNO_3

24.5% P_2O_5, of which 23.3% is soluble in neutral citrate and 63.6% in 2% HNO_3.

A sample of the cemented layer collected by D.R. Stoddart in 1976 has been analysed by X-ray fluorescence, and gives the following composition (Stoddart and Scoffin 1983, p. 370):

SiO	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	Total
0.30	0.02	0.00	0.26	68.64	0.28	0.00	0.01	0.00	29.35	98.22

Climate

A meteorological station has been maintained on South Island for some years, and rainfall data are published in *Meteorological Observations and Climatic Summaries for Mauritius*. A scatter diagram of monthly rainfalls for the period 1947-1966 was provided by Stoddart (1971a), and this is revised with the addition of data for the years 1967-1971 in Figure 6. The average annual total for the 25 years of available data is 1706 mm, with extremes of 2458 mm in 1951 and 1290 mm in 1956 (Table 2). Most rain falls during the first part of the hot season (December-February) but it continues wet through May. Agalega is about at the southern limit of the Northwest Monsoon, experiencing variable but often northerly winds (bringing the rain) from November to April. During late May to October the drier Southeast Trades dominate the weather.

Agalega lies just within the zone of tropical storms; cyclones are irregular, but can be just as devastating as those further south. Although there was only one bad cyclone during the nineteenth century (in 1833: Lionnet 1924), there have been five severe storms since 1900, in 1911, 1922, 1933, 1950 and 1952 (Dussercle 1949, Scott 1961, *contra* Mamet 1978). In the period 1939-1970 three weaker storms also passed over the island and another eleven passed close by (Davy 1971).

For an account of the climate of Agalega, see Newnham (1949).

Vegetation and agriculture

The earliest account of the vegetation, given by de Richery on the *Maréchal de Castries* in 1785, described the island from close inshore: "the shores appeared to be covered with a lawn of attractive green; at a very short distance inland it was easy to distinguish a forest of coconut palms laden with nuts..." (Froberville 1848, Dussercle 1949; Cheke's translation). Rozemont (1809) spent eight months on the island when only a handful of unsuccessful attempts to settle had been made (Scott 1961) and had presumably not altered the vegetation. He described the vegetation as follows: "These islands appear at first sight to be covered in coconut palms, but they are in fact not so, except down the middle in a strip that follows their [the islands'] direction and which occupies only 3/4 of their length [Dussercle (1849) has "2/5"]. There exists in these islands only one kind of spongy wood, of the variety of *bois blanc* [*Hernandia sonora*]; it grows amongst the coconuts but not elsewhere. One also finds there a species of false *badamier* [?*Guettarda speciosa*; *badamier* is *Terminalia catappa*] which grow high enough but which do not become thick. All these trees are worthless wood and can only serve for making wattle huts. The other trees are *mapoux* [*Pisonia grandis*] and *veloutiers* [*Tournefortia argentea* and *Scaevola sericea*]. ... There is only one kind of grass, a nasty little Bermuda-grass ["*chiendent*"] which grows in the rainy season and which disappears completely when it is dry. The spiny Bermuda-grass [?*Stenotaphrum* sp.] that we have here (at the Isle of France [=Mauritius]) grows there too." (Rozemont 1809, Dussercle 1949; Cheke's translation).

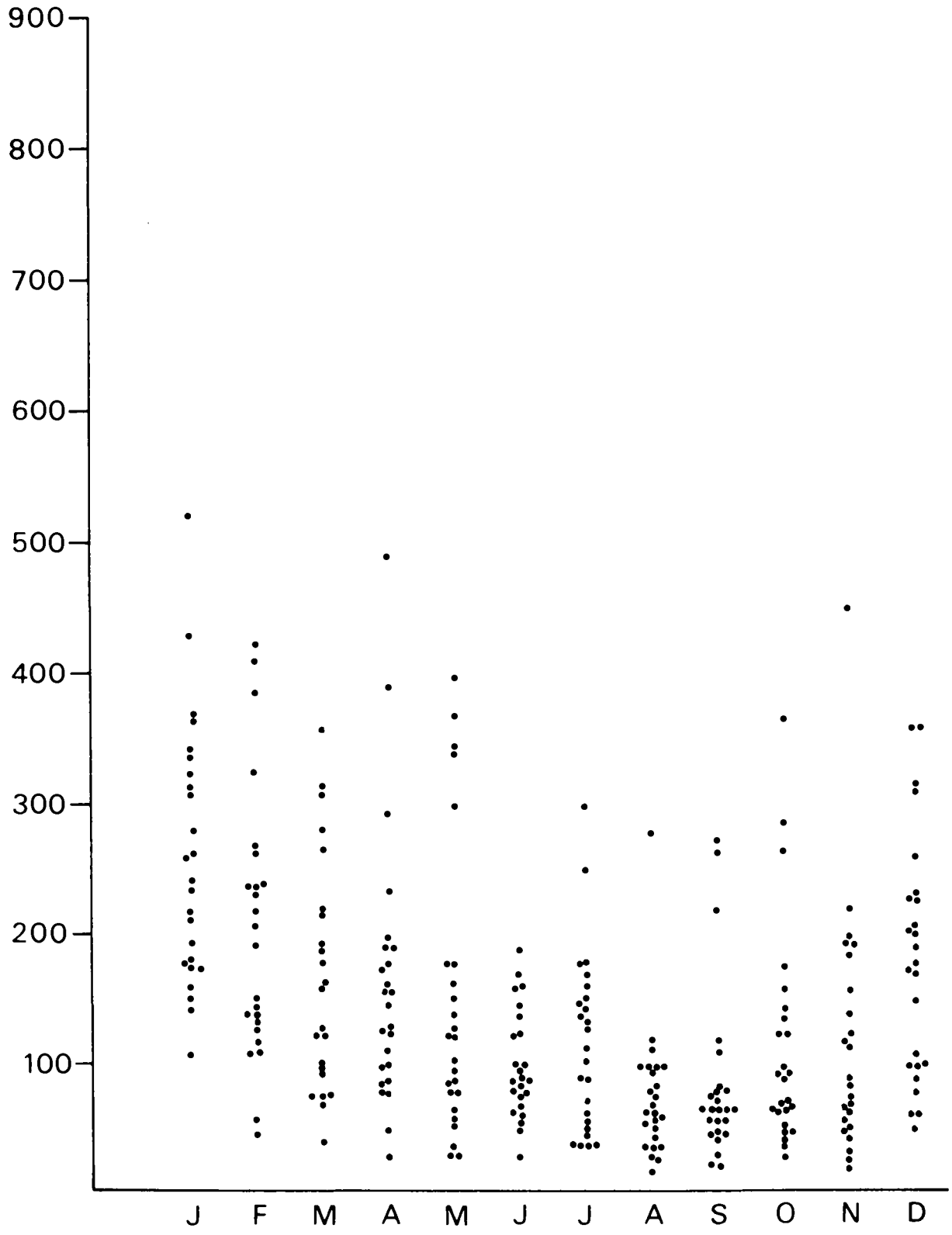

Figure 6. Monthly rainfall on Agalega 1957-1971

Table 2. Temperature and rainfall at Agalega

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average temperature °C[1]	27.3	27.3	27.6	27.5	26.9	25.7	25.0	24.9	25.3	25.9	26.6	27.1	26.4
Average rainfall mm	256	204	163	160	146	96	113	72	82	108	110	198	1706
Maximum rainfall	519	418	358	385	394	185	292	272	268	362	446	843	2458
Minimum rainfall	105	47	38	29	35	27	32	14	21	23	13	60	1290
Number of rainy days (>1 mm)[2]	17	17	15	14	13	13	15	12	11	12	12	15	166

[1] Data for 1951-1970 only; maximum and minimum figures not available

[2] Data for 1951-1970 only

Since there is no evidence of any landings prior to the 1780s, it seems most probable that coconuts are native, as is presumed for the Seychelles (Sauer 1967). The rest of the vegetation is typical of recently emerged low coral islands (e.g. Stoddart 1971b, Renvoize 1975), albeit depauperate in such typical species as *Pemphis acidula* and *Thespesia populnea*.

The botanist Charles Hilsenberg visited the island for two or three days in December 1823, but apart from coconuts, only mentions *Tournefortia, Scaevola, Suriana,* a *Cyperus* and a *Portulaca* in his account (Hilsenberg 1823).

The island was visited twice in 1824. One visitor (Anon 1828) reported 'wild lemon trees' and "those other palms which give birth to that remarkable fruit, representing the image of two thighs, and called 'Nois matoire' or coco-de-mer [*Lodoicea maldivica*]". Perhaps some nuts had been brought from the Seychelles and were growing. A coco-de-mer nut was included amongst products of the island sent to Bojer in 1831 (Leduc 1848, Lionnet 1924), but Bojer (1835) did not include the palm in his plant list. The other visitor, Werner (1824) from Mauritius, laid more emphasis on the shrubby vegetation than Rozemont, stressing that the "greatest part of the island is overrun with the *veloutier* [*Tournefortia*] and *manioc* [*Scaevola*] trees,[2] and which is the greatest source of fertility, for when it is required to plant a certain piece of ground with maize, these shrubs are cut down and burnt, which produces enough soil to have two or three crops from the same piece of land, after which it is allowed to remain for three years, when it will be fit to cultivate again." He continues: "The natural produce of the island is cocoa [sic] nuts, the trees run is [sic] a vein for nearly the whole length of the islands, in a kind of marsh.... The South island contains 2144 acres, and the coco plantation takes up nearly 1050 acres. The North island contains 4736 acres, but the vein of coco trees is so very irregular that no estimation could be formed as to the space of ground they covered. There is very little wood on the island, the only varieties are the *bois blanc* [*Hernandia*], Mango wood [?*bois mangue,* a term for *Ochna* sp. on Aldabra (C Gibson, pers. comm.) though this seems unlikely] and a little takamaka [*Calophyllum inophyllum*]".

Bojer's visit in 1835, the last by a botanist for 136 years, was very fruitful. In addition to general impressions, he compiled a list of about 150 plant species he found on the islands (Bojer 1835), of which some 30-35 appear to be native. Little had changed since 1824, apart from some progress in coconut planting and horiticulture. Among native plants of particular interest he noted the climbing fern *Stenochlaena tenuifolia* (known then as *brède Andingue,* and eaten),

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[2] 'manioc tree' is a translation (by Werner) of *bois manioc,* i.e., in Mauritius, *Scaevola*; '*manioc*' alone in Mauritian French would of course be cassava *Manihot utilissima,* but the context here clearly indicates *Scaevola*.

patches of *Suriana maritima* amongst the fringing band of *veloutier*, and large specimens of *Pisonia grandis*. Bojer's plant list was also reproduced in Leduc (1848) and Lionnet (1924), and his general remarks, in part, by Dussercle (1949).

Over the next century the main vegetation changes appear to have been the extension of coconut plantations at the expense of the *veloutier*, with clearance of species growing amongst the palms (e.g. *Pisonia* and *Hernandia*). Details of the expansion of plantations, made possible by digging holes for each nut in the platin, can be found in Bouffé (1913), Lionnet (1924) and Dussercle (1949). *Casuarina equisetifolia* (*filao*) was introduced by Leduc in 1828 (Leduc 1841), and was used for timber and as a windbreak for a long time thereafter. Dussercle (1949) noted the existence in 1948 of a belt of *Casuarina* almost all the way round the islands, and a large plantation at the south end of South Island. The cyclones of 1950 and 1952 apparently devastated the *Casuarina* (Scott 1961), and little attempt has been made since then to replant on any scale.

During the 19th century both cocoa *Theobroma cacoa* and citrus fruits *Citrus* spp. were developed as important crops, but were both eventually defeated by pests. Dupont (1883) reported nearly 4000 cocoa trees destroyed by 'borers', and Boucherat (1890) wrote of "the total destruction of the lemon and orange trees which grew on the island owing to the presence of a kind of insects known there by the name of "Pous Blancs" [*Icerya seychellarum*]"; this pest has since been controlled by the introduction of the ladybird *Rhodolia chermesina* (Mamet 1978).

Both islands are surrounded by a belt of *veloutier* growing on the upper part of the beach. The dominant species is *Scaevola sericea*, but there is some *Tournefortia, Suriana, Pisonia grandis* and rather more *Guettarda*, especially on the east coast of North Island. The crest of the dunes at the south end of South Island is largely vegetated with *Suriana*, with *Scaevola* to seaward.

North of the settlement at St. James there is a copse of *Hernandia sonora*. Around the same settlement are clumps of breadfruit *Artocarpus altilis*, and scattered *Calophyllum* and *Terminalia catappa*. The rest of North Island consists largely of coconut plantation with a ground layer of grass, *Kalanchoe pinnata* and the parasite *Cassytha filiformis* (*liane sans fin*). There are some areas more or less dominated by *Casuarina*, and individuals of this species, and also *Pisonia*, scattered throughout the coconuts. On the east side the belt of *Scaevola* is up to 200 m wide, though a long stretch between St. James and Vingt Cinq has been cleared to make an airstrip. Neither of us at the time of our visits was aware of the brackish pool Bassin Capucin, but the photograph in Patel (1974) shows it to be surrounded by grassy dunes with *Casuarina*, and to have mangroves *Rhizophora mucronata* growing in it. We saw no obvious trace of surviving native coconuts on North Island.

The vegetation of South Island is dominated by the large mass of native coconuts (*coco bon dieu*) growing at very high density in an oval depression in the centre of the island. This was dry at the time of Cheke's visit (June), but it floods in the rains, presumably forming a brackish swamp as the principal species in the ground layer is the mangrove fern *Acrostichum aureum*; also abundant is a thelypteroid fern that Cheke noted in 1974 as a *Cyclosorus*.

Around the central wild coconut area and to the north of it are coconut plantations, but towards the south of the island there are patches of *Casuarina* (in the east) and *Terminalia catappa* (south and west); *Casuarina* also lines the eastern beach north of Ste. Rita. There is an open grassy area inland of Grande Montagne in the South-east. One of the more remarkable characteristics of South Island (less marked on North Island) is the growth of normally epiphytic pteridophytes on the ground. *Langue de boeuf* (*Asplenium nidus*) is common under *Terminalia*, while *Psilotum nudum* is frequent on old stumps and tussocks in swampier areas. Under the native coconuts, and to a lesser extent outside them, are areas with an understorey of *Morinda citrifolia* (*bois torti*). The climbing fern *Stenochlaena tenuifolia* that so attracted Bojer still grows commonly in parts of South Island, especially in the southern part of the wild coconut patch. The area around the 'capital', Ste. Rita, is planted with a variety of exotic vegetation — vegetables in the company's garden, bananas *Musa* sp., *flamboyants Delonix regia*, breadfruit, papayas *Carica papaya*, cocoa *Theobroma cacao*, *Citrus* spp. etc. The nearby cemeteries are dominated by *Casuarina*.

Since the island was nationalised in 1975 the total population has declined to about 150, and human pressure on the environment as a whole has significantly diminished as a result. By 1978 many coconuts were being left unharvested, and allowed to run to seed in many areas. The irrigation scheme near Ste. Rita was completely neglected, and as a result there are now several acres of lush wetland. The area under *Casuarina* is expanding too, particularly on South Island where there are new large areas of untouched woodland.

Finally we should mention that the 'bois blanc' accidentally referred to by one of us earlier (Cheke 1975:42) as *Hibiscus tiliaceus* was of course in fact *Hernandia sonora*, though both species are probably present and are in fact recorded by Mamet (1978).

History and present status of land vertebrates and sea turtles

Reptiles

Geochelone gigantea — Giant Tortoise; *torti*[3]

Stoddart & Peake (1979) cited Froberville (1848) as authority for the presence of "a few land tortoises there in 1785", and suggested they had been landed from a passing ship. In fact Froberville used the non-specific word 'tortue', and those actually found on the island (as opposed to what had been hoped for following de Richery's report) were almost certainly sea turtles. There is no unequivocal reference in the literature to land tortoises; the large living 'tortue' brought to Mauritius by Liénard in 1842 (Bouton 1846) was also no doubt a turtle.

In 1974 Cheke was told by an old *Îlois* whose name he didn't obtain (but subsequently referred to as *Bonhom*, old man), that there had been a good number of tortoises present, but that "the Seychellois had eaten them", the last ones having survived until about 12 years previously. As Scott (1961) pointed out, all evils are blamed on "the Seychellois", so this explanation should not be taken too literally. Mr Paul Moulinié confirmed to Cheke the sometime presence of these animals, saying he thought they had been brought in some fifty years previously (i.e. ca. 1925); source stocks are available in the Seychelles and Mauritius. Bonhom said he never saw any young, so presumed they never bred successfully; this may have been due to feral cats and pigs. It is slightly odd that Dussercle (1949) made no mention of any tortoises.

Pelusios sp. — Terrapin; *supap*

Terrapins, presumably of this genus, were reported to Cheke as occurring in pools and swamps. These animals are possibly native, but more likely to have been introduced from Diego Garcia or the Seychelles where three species have recently been recognised (Bour 1983).

Chelonia mydas — Green Turtle; *torti*

Turtles seem never to have been particularly common. Rozemont (1809) commented that "the sea turtle is not very abundant there, the structure of these islands, surrounded everywhere by reefs, forming a barrier that they cannot cross" (Cheke's translation). Turtles are mentioned as occurring in small numbers by most subsequent writers. Dussercle (1949) wrote that they were decreasing due to human predation,

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[3] Creole names are given in the orthography used in Cheke (1982a) devised by Philip Baker for a dictionary of Mauritius Creole (in prep.). Names given were collected on the island unless bracketed: round brackets indicate a name taken from the Agalega literature, square brackets the presumed name (= usual Mauritius or Seychelles name).

though Scott (1961) reported that about two dozen were turned every year in the mid-1950s. Small numbers were still reported in 1974. Agalega's beaches are long enough, and the human population small enough, for turtles still to be able to land without necessarily being detected.

Eretmochelys imbricata Hawksbill Turtle; *care*

Lionnet (1924) and Dussercle (1949) are the only authors to mention hawksbills, the latter saying they were found "quite often" and used to make tortoiseshell trinkets.

Phelsuma borbonica agalegae Day Gecko; *lezar*

First described (Cheke 1975) as a new species, but later (Cheke 1982b) reduced to an endemic race of the Réunion day gecko. Hilsenberg (1823) was the only author to mention lizards. The geckos are abundant on coconut palms on both islands, up to five individuals per tree, the total population running into hundreds of thousands (Cheke 1975).

Gehyra mutilata House Gecko; *lezar (gri)*

Common, though much less so than the day gecko, on both islands; specimens collected by Cheke are deposited in the British Museum (Natural History). Occurs in houses and on palms and other trees. Eggs found by Cheke in June 1974 were laid cemented together in pairs under bark, in crevices etc. It was presumably introduced from Mauritius (Cheke in press, a).

[*Hemidactylus frenatus*] [House Gecko]

This species has not been recorded from Agalega, although its presence would be likely on biogeographical grounds (Cheke in press, a). Cheke saw and photographed a gecko on a tree on North Island which appeared to be this species, but the picture is not clear enough for a certain identification.

Birds

Agalega was a major seabird station in the 19th century, and most authors commented on the immense numbers of nesting birds, especially 'goelettes' (Sooty Terns). A list of birds by W. Bojer with notes on breeding etc. by A. Leduc was included in Leduc (1848) and reprinted by Lionnet (1924) and, less completely, by Gibson-Hill (1952) and Watson, Zusi & Storer (1963). As recently as 1978, Feare reported the status of boobies on Agalega as 'unknown', although the seabird colonies are known to have been destroyed deliberately by fire in 1943 (Dussercle 1949). Apparently after his seabird wardens had been threatened and birds massacred, the then manager, Volcy Monnier, set fire to the Plaine des Oiseaux (near Montagne d'Emmerez, North Island) to solve the problem once and for all — and succeeded, thus depriving the islanders of a traditional source of food. The eggs used also to be exported to

Mauritius (Scott 1961). The frigates and boobies probably disappeared before the 20th century (see systematic list).

Newton (1883) referred to seabird eggs collected in the 1870s by the then island manager M. Feuillherade, as representing "all well-known species". As he did not name them we do not know if frigates and boobies survived to this date. Newton also failed to specify the identities of the small birds which "had most undoubtedly been introduced by man's agency". These eggs are not included in the brothers Newton's collection preserved in Cambridge (Cheke, pers. obs.).

There appear to have been two phases in the introduction of land birds to Agalega: game birds, and Madagascar Turtle Doves (if not native), brought in by the first settlers, followed by passerines and Zebra Doves after August Leduc's arrival in 1827. In this context it should be noted that the original Bojer-Leduc bird list (Leduc 1848, Lionnet 1924) included a number of species that were overlooked by Jean Vinson when he transmitted it to Gibson-Hill (1952); these birds are likewise absent from Watson, Zusi & Storer (1963). These last two derivative references will not be cited further except to clear up certain confusions. Dupont (1883) reported that the management intended to introduce insectivorous birds "such as 'oiseaux blancs' [*Zosterops borbonica*], 'oiseaux bananes' [*Foudia rubra*], and 'oiseaux manioc' [*Z.chloronothos*]" to control pests; this appears never to have taken place.

The most notable existing member of the avifauna is the Glossy Ibis, occurring in the Indian Ocean otherwise only on Madagascar. The population is now very small and endangered (Cheke 1978).

Indian Ocean creole bird names and their origins are discussed at length in another paper (Checke 1982a).

Puffinus sp. Shearwater; *fuke*

Bonhom reported to Cheke that an all-dark 'fouquet' nested all over the island during the north wind (i.e. Nov.-April). This is presumably *Puffinus pacificus*. The only previous mention of a shearwater from the island is by Bouton (1846) listing some of the genera of birds given by Bojer to the Natural History Society of Mauritius. The list includes the genus '*Procellaria*'. It is strange that, if really common, such a notoriously edible bird (the chick) should not have been mentioned by Leduc or visitors to the island.

Phaethon rubricauda Red-tailed Tropic-bird; *payanke* [*ruz*]

Former breeder, referred to by Dussercle (1949) as present up to the destruction of the seabird colony in 1943. Leduc (1848, Lionnet 1924) gave laying dates as August and September, on sand under scrub (i.e. *veloutier*) by the sea; such a brief breeding season seems improbable in view of the very extended seasons found in Mauritius (Gill *et al.* 1970, Temple 1976) and the Seychelles (Prŷs-Jones & Peet 1980).

Mr Hervé Sylva reported to Cheke that his wife had once seen a *payanke*, and Lawley was likewise told of their occasional occurrence. The species could not be determined.

Sula sula Red-footed Booby; *fu*

Former breeder, evidently once numerous. Leduc (1848) described the ease with which 20 or 30 could be killed in a few minutes by attracting them to a handkerchief attached to a pole. There are no later records. 'Fous' were also noted by Rozemont (1809), anon.(1828) and Bojer (1835). Leduc (1848, Lionnet 1924) reported laying throughout the year: single eggs in crude nests on *Pisonia* (Bojer-Leduc list) or up "trees and coconut palms" (text). On Aldabra, at about the same latitude, breeding occurs throughout the year with peaks of laying in November, January, March and August-September (Diamond 1971).

There is an undated specimen presented to Bojer in the Naturhistorisches Museum in Vienna (H. Schifter *in litt.* to Cheke). It is erroneously cited as from Mauritius by Hartlaub (1877) on the basis of its current label. The accessions register, however, reveals that the original label stated it was from Agalega (photocopy transmitted by H. Schifter).

Bonhom reported to Cheke that a kind of *fu*, black all over with a white belly, was occasionally seen. This would appear to be the Brown Booby *S.leucogaster*, but dark phase *S.sula* and immature *S.dactylatra* cannot be ruled out.

Fregata sp. Frigate-bird; (*fregat*)

Former breeder, species undetermined. Recorded by Rozemont (1809), anon (1828), Bojer (1835) and Leduc (1848, Lionnet 1924), but not thereafter. Leduc stated that, like the Red-footed Booby, they nested throughout the year, laying one egg in *Pisonia* (Bojer-Leduc list) or "trees and coconut palms" (text); anon (1828) also referred to nests in coconuts. On Aldabra, although there are young in the nest throughout the year, laying is confined to the period June-December (Diamond 1971), and the pattern is similar at St. Brandon, the nearest colony to the South (Staub & Guého 1968).

Ducks; *Sarsel*

Bonhom reported to Cheke that *sarsel* were seen occasionally. These are likely to be either White-faced Tree Ducks *Dendrocygna viduata* or Garganey *Anas querquedula*, the two ducks which most regularly visit the Seychelles (C.J. Feare & R.P. Prŷs-Jones, pers. comm. to Cheke).

Ardeola ibis Cattle Egret; [*madam patoñ*]

Stated by Guérin (1940-53), writing in 1941, to be an occasional visitor to Agalega. This seems likely enough, although Guérin gave no supporting evidence, and no one mentioned Cattle Egrets to us as having been seen on the islands.

Butorides striatus Little Green Heron; *gas*

Recorded by Leduc (1848, Lionnet 1924) and Dussercle (1949). Leduc reported clutches of a single egg in bushes, and that the birds ate mice, small birds and also 'fished' on the shore. Bojer's specimens, examined by Desjardins in the 1830s, are mentioned by Oustalet (1897). The clutch size for this species in Mauritius (Staub 1976) and the Seychelles (Benson & Penny 1971, Penny 1974) is normally two or three, though often only one young is reared (Cheke, pers.obs., Benson & Penny, *loc.cit.*); Leduc may have assumed a single egg from observations of single chicks.

Not a very numerous bird today. In 1974 Cheke saw two birds on North Island, none on South Island; in 1978 Lawley saw several birds on South Island, particularly around the abandoned irrigation scheme, but none on North Island.

Heron sp.

An unnamed tall wading bird, apparently a large heron, was described to Cheke by Bonhom as an occasional visitor.

Plegadis falcinellus Glossy Ibis; *telinga, tarañga*

First recorded by Werner (1824) under the same name, *telinga,* as is current today. There is no information in the literature on numbers, until Scott (1961) reported an estimated 200 in 1950, with a decline by the time of his visit in 1955. Dussercle (1949) listed the ibis amongst other 'ordinaire' (i.e. everyday, common) birds, and it was clearly considered fairly numerous by Lincoln (1893). Guérin (1940-53), who appears to have had contacts on the islands, wrote in 1940 that ibises were "not numerous".

Leduc (1848, Lionnet 1924) reported laying in September and October in nests in bushes; by contrast Bonhom told Cheke that the birds nested up coconuts during the north wind — i.e. November onwards. Leduc gave the clutch as two; Bonhom three, rearing 2-3 young ("ugly, grey with a white head"). As many as three pairs are said to nest together in a single palm, building generally on an inflorescence, and constructed with fresh green coconut leaves. Lawley however found a presumed ibis nest 20 ft up in a mature *Casuarina*. It was roundish, messy and about 30 in. in diameter. It was constructed of tightly packed twigs and other material, and apparently virtually impenetrable from below by the local tree-climbing rats; the nest did not appear to be occupied. He was told by locals that they had seen similar nests deep in the casurina forest.

As far as we can determine only three specimens of the Agalega ibis have ever been collected; two by August Leduc for Bojer in 1830 (Desjardins 1831, Leduc 1848, Lionnet 1924), and one by Captain Trotter of H.M.S. *Curlew* the year after (Desjardins 1832). Two of these specimens formed part of the Desjardins museum in Port Louis, but have since vanished. The Glossy Ibises now in the Mauritius Institute

(which took over the Desjardins Museum) were shot in Mauritius in the 1930s (Guérin 1940-53). As this population has presumably been isolated for a long time on Agalega it would be most interesting to examine birds at close hand to see if any differentiation has taken place.

The creole name *telinga* is not, as Dussercle (1949) asserted, a "Malagasy name for the black ibis", but an old creole name for Indians now known as Telegu (Cheke 1982a). The bird was no doubt named after the skin colour of the Indians, in the same way as the Common Noddy, *makwa*, was named after members of the Mozambican Maccoa (or Macoua) tribe (Cheke, *loc.cit.*).

The current status of the ibis, now confined to South Island, is precarious. Cheke saw a pair and isolated individuals in 1974, though five were seen together by Bonhom one morning during his visit, and a group of 12 had recently been seen. These groups were seen in the irrigated vegetable garden near Ste. Rita. On the basis of local reports Cheke estimated a maximum population of about 20 (Cheke 1978). In 1978 Lawley saw a total of eight birds, all in the area of open grassland in the south-east and was given reports of regular sightings around Ste. Rita (irrigated area and cemetery). The total population was again estimated as about 20.

Cheke was told in 1974 that the young were good to eat, and that eggs and young were shaken out of coconut trees. Lawley heard of birds(?adults) being killed by children. The reduced human population in recent years may have allowed the ibis numbers to stabilize somewhat, but the decline since the 1950s has been precipitous. Proper protection is clearly necessary if the populations's survival is to be assured (Cheke 1978).

Birds seen by Lawley were foraging on the surface on dry ground; Bonhom recported to Cheke that they fed on cockroaches and 'worms' (*ver*). The fondness for the irrigated area suggests that they also seek aquatic food.

[*Threskiornis aethiopica*] [Sacred Ibis]

Newton (1888), in error for the Glossy Ibis, listed '*Ibis bernieri*' the Madagascar race of the Sacred Ibis as occurring on Agalega; Guérin (1940-53) repeated the mistake, assuming that Newton had recorded the bird as an accidental visitor.

Margaroperdix madagascariensis Madagascar Partridge; *perdri* [*kay*]

'Perdrix' were first mentioned by Hilsenberg in 1823, though Hartlaub(1877) was the first to assign them to a particular species. He referred them, without citing any evidence, to the Madagascar Partridge. Carié (1904) supported Hartlaub's assertion, adding that in Mauritius the species was known as *Caille d Agaléga*. Later, the same author (Carié 1916) reported that cats, introduced to destroy rats (which had arrived in 1891 (Lionnet 1924)), had wiped out the partridges. Lionnet

(1924) attributed the loss of game animals to feral hunting dogs, released in 1897; by ca.1911 (see below, under *Paroaria,* for dating) partridges were said to be declining fast (Lionnet, 1924). The dogs were apparently later controlled by shooting, but evidently too late to save the game birds and hares.

We are unaware of any specimens existing to confirm that the partridge on Agalega was indeed *Margaroperdix,* though there is no reason to doubt Carié's identification. The stock presumably came from Mauritius, where the species, now extinct, was perhaps still common around 1820 (Cheke in press b).

Dussercle (1949) mentioned a 'recent' re-introduction of 'perdrix' to North Island subsequent to their extirpation by dogs [or cats?], but the species involved this time is more likely to have been *Francolinus pondicerianus,* the only partridge in Mauritius to survive the introduction of the mongoose *Herpestes edwardsii* (Carié 1916, Staub 1976). Scott (1961) reported 'partridges' around Montagne d'Emmerez (North Island) in 1955.

Cheke was told in 1974 by P. Moulinié and Bonhom that partridges still occurred on North Island, but neither of us saw or heard any, so their identity remains in doubt.

Gallus gallus Feral chicken; (*pul maroñ*)

Feral chickens were first noted by Hilsenberg (1823), and then by most authors up to and including Lincoln (1893). They may have been devastated by the feral dogs and cats around the turn of the century. Neither Lionnet (1924) nor Dussercle (1949) mentioned feral fowl, and Scott (1961) stated there were none in 1955.

One of the last birds Cheke saw on the island in 1974, in the copse north of St. James (North Island), was a cock that flushed at 150 yards and flew off. Such behaviour is hardly typical of domestic chickens. Unfortunately it was by then too late to ask the locals whether feral chickens were present.

Numida meleagris Guinea Fowl; (*peñtad*)

Guinea Fowl were first reported by Hilsenberg (1823); Lincoln (1893) was the last to do so. They presumably shared the fate of the partridges and chickens after the escape of hunting dogs in 1897. Earlier in the century they were always referred to as very abundant, Leduc (1848) allowing the islands' labourers to hunt Guinea Fowl (and wild chickens) but not the partridges and hares.

Reference to 'peacocks' by Boucherat (1885) and Lincoln (1893) seems likely to be due to a mistranslation into English of 'pintade'; both were Mauritians whose first language would have been French, not the English they used for preparing their reports. Lincoln, however, did also refer to 'Guinea fowls'.

Plover sp.

Bouton (1846) used the genus '*Aedicnemus*' (sic) for one of the bird species from Agalega presented by Bojer to the Natural History Society of Mauritius in 1844. This was presumably a plover, perhaps the Grey Plover *Pluvialis squatarola* or the Greater Sand Plover *Charadrius leschenaultii*; Desjardins, Bouton's predecessor as secretary of the Society, used the name '*Oedicnemus*' for the latter in 1832 (Oustalet 1897). Either species is to be expected, as both occur in Mauritius (Staub 1976) and the Seychelles (Penny 1974).

Numenius phaeopus Whimbrel; *korbizo*

First mentioned by Werner (1824), and regarded by most subsequent visitors as a game bird of quality. Leduc (1848, Lionnet 1924), evidently unaware of the Whimbrel's migrations, remarked that he had been unable to find its nest and thus presumed it must be elsewhere than Agalega. As there is no mention of seasonality by visitors, it appears that birds are present throughout the year. Scott (1961) reported a flock of several hundred 'curlews' at the north point of North Island in September 1955.

As might be expected this Palaearctic species was scarce in June 1974 (Cheke), a few being seen on both islands, with a maximum of 12 in south South Island. By contrast in November 1978 the species was common on both islands both inland and near the shoreline (Lawley). More were seen singly amongst the trees in coconut plantations than anywhere else.

Arenaria interpres Turnstone; *zalwet*

First mentioned in the Bojer-Leduc list, as '*Strepsilus*' (sic), *alouette* and *Tourne-pierre* (Leduc 1948, Lionnet 1924). 'Alouettes' or 'larks' are often mentioned by visitors, but the name could also apply to other species of small waders (Cheke 1982a). Bojer's specimens, examined by Desjardins in the 1830s, are mentioned by Oustalet (1897).

Scattered individuals and small groups seen both in June 1974 (Cheke) and November 1978 (Lawley), both inland and on the coast.

Calidris alba Sanderling; *kavalye*

Cheke saw one on the airstrip (North Island). Children at Ste. Rita described a small white shorebird known as *kavalye* (='cavalier') that was presumably this species, though the name is applied in the Seychelles to the much larger Crab Plover *Dromas ardeola* (Penny 1974, Cheke in press, b).

[*Sterna anaethetus*] [Bridled Tern]

Listed by Gibson-Hill (1952) and Watson, Zusi & Storer (1963), but not acceptable for reasons given below under *Anous tenuirostris*.

Sterna fuscata Sooty Tern; *golet, (yeye)*

Formerly bred in huge numbers. Lincoln (1893) referred to "acres of ground... covered with eggs and birds" and Lionnet (1924) said it was possible, during the season, to "collect thousands [of eggs] every day". Dussercle (1949) described the firing of the colony in 1943, since when the birds have never returned.

Leduc (1848, Lionnet 1924) described the breeding season as follows: "Birds of passage. They come and lay an egg on the sand in July and August, and leave again in February". This statement was accepted uncritically by Gibson-Hill (1952) and Watson, Zusi & Storer (1963), despite the known fact that the incubation and fledging period in the Sooty Tern is only three months and that nesting is highly synchronised (e.g. Feare 1976). Later authors reported laying in September-October (Lincoln 1893), extending to November (Lionnet 1924) — so I presume Leduc meant that the birds *arrived* in July or August *in order to lay, later,* an egg on the sand... This is in keeping with the total period of presence, and the stages of the breeding season at Aride Island in the Seychelles (Warman & Todd 1979), though the season apparently started four months later in the year at Agalega.

Sooty Terns were common offshore (South Island) in June 1974 (Cheke).

Anous stolidus Common or Brown Noddy; *(makwa), k'lek, maryan, mandria*

The only past mention is in Leduc (1848, Lionnet 1924) both in the 'Bojer-Leduc list' and in the text. The name 'maka' (list) or 'macoua' (text) is diagnostic for this species (Cheke in press, b), although the islanders no longer distinguish the two noddies today. Leduc reported laying in May and June in bushes (list) and "trees and coconut palms" (text). This noddy may have been less common than the *mariannes* (*A.tenuirostris*) which Bojer (1835) referred to as darkening the sky; his visit was in April and May (Vaughan 1958) before the Sooty Terns had returned. It is not clear to what extent the two noddies suffered from the destruction of the seabird colony, but none now nest on North Island.

The creole name *mandria* (=*mandreñ*) is unique to the oil islands[4] of Agalega and the Chagos (Cheke 1982a). The French *mandrin* means a mandrel, presumably recalled by the bird's long pointed beak.

Birds were seen flying inland in June 1974 (Cheke, South Island) but only offshore in November 1978 (Lawley). P. Moulinié told Cheke that they nested.

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[4] Agalega and the islands of the Chagos group are known in Mauritius as the 'oil islands' after their principal product, coconut oil. As they were much of the time controlled by the same company there was regular movement of people from one to the other (Scott 1961), hence the shared creole names.

A.tenuirostris Lesser or Black Noddy; *maryan, k'lek, mandria*

Details from Leduc (1848, Lionnet 1924) are the same as for the Common Noddy, but it is this species that Bojer (1835) claimed was in such numbers as to darken the sky.

Some confusion has arisen in the literature (Gibson-Hill 1952, Watson, Zusi & Storer 1963) because of Bojer's use of the scientific name '*Sterna antarctica*' for the 'marianne' in the 'Bojer-Leduc list' (Leduc 1848, Lionnet 1924). Gibson-Hill, followed by Watson *et al.*, assumed the species was the Bridled Tern *S.anaethetus antarctica*; had they known anything of Indian Ocean creole bird names they would have realised that 'marianne' could only refer to *Anous tenuirostris* (Cheke 1982a). Where Bojer got his name '*antarctica*' from we do not know; he left the 'maka', which Gibson-Hill interpreted correctly, as '*Sterna* species'. Guérin (1940-53) cited both Bridled Tern and Lesser Noddy for Agalega, but gave no sources.

In June 1974 Cheke saw birds flying inland on South Island and also a few sitting in the daytime on coconut fronds. P. Moulinié told Cheke they bred, and Cheke's observations confirm that this is likely. No birds were seen on North Island. Lawley did not record any Lesser Noddies in November 1978.

Gygis alba Fairy Tern; *gagari*, ("goelette blanche")

Mentioned only by Leduc (1848, Lionnet 1924), Dussercle (1949) and Scott (1961). Leduc noted laying in May and June: "no nest, place their egg on a branch". Some birds were incubating and others feeding young in late June 1974 (Cheke; South Island). Seasonal breeding seems unlikely given the all-year round breeding in the Seychelles (Penny 1974) and St. Brandon (Staub & Guého 1968), although there is a summer (Oct.-Dec.) peak in the latter islands. Not being colonial this species may not have suffered from the destruction of the seabird colony, but is likely to have experienced predation from tree-living rats *Rattus rattus* since their introduction in 1891 (see below).

The onomatopaeic creole name *gagari* is unique to the oil islands of Agalega and the Chagos (Cheke 1982a).

Fairy Terns were common on South Island in June 1974 (Cheke) and in November 1978 (Lawley). Neither of us saw any on North Island.

[*Columba livia*] [Feral pigeon; [*pizoñ*]]

The original Bojer-Leduc list (Leduc 1848, Lionnet 1924) includes at the end a few birds "not represented by specimens", amongst which was 'pigeon de voliere', i.e., presumably, this species. The suggestion is that they were feral, but this is not certain. There are no feral pigeons present today, nor were they mentioned by any nineteenth-century writer other than Leduc.

Streptopelia picturata Madagascar Turtle Dove; (*pizoñ*) *ramye*

'Pigeons', presumably this species, were noted by Hilsenberg (1823) and listed amongst the game of the island by many subsequent visitors. Boucherat (1885) used the term 'Dutch Pigeon'; the name *pigeon hollandais,* normally signifying *Alectroenas* spp., was sometimes used in Mauritius at that time for *Nesoenas mayeri,* also known as the *gros ramier* (Cheke 1982a), a bird somewhat resembling *S.picturata.* The impression from earlier visitors is that this dove was common in the nineteenth century, but Guérin (1940-53), writing in 1940, reported a subsequent population crash as follows:

"Madagascar Turtle Doves were very numerous at Agalega; a few years ago they nested in the coconut plantations which they enlivened by their plaintive and monotonous cooing. But following a cyclone which caused damage in the island [1933 ?], the number declined rapidly, and these birds have today become very rare. It has also been reported to me that the islanders, who appreciate the taste of their flesh, contributed substantially to their reduction, killing them with blows from sticks, profiting, for this act, the moment when the birds landed on lumps of pressed coconut (poonac) of which they are very fond" (Cheke translation). Presumably the storm-weakened and starving birds risked the proximity of men to reach food. The species has never recovered.

Assuming they were introduced, the doves on Agalega appear to have differentiated in the 160 or so years they have been there. Guérin (*loc.cit.*) described birds recently received from Agalega as "a little smaller than those in Mauritius, and having a slightly darker plumage" (Cheke translation). Cheke noted in 1974 that the birds were darker than Mauritian examples on the back, and had a more or less green (instead of purplish) gloss. The head was grey like the Mauritian birds (Malagasy race, *S.p.picturata;* Rountree et al. 1952) and unlike the Seychelles or Aldabra races (Penny 1974), whose head is dark, like the mantle. On the basis of this differentiation *Streptopelia picturata* might appear to be native to Agalega, though in view of Rozemont's (1809) categorical statement that in 1808 there were no landbirds present, it is more likely to be an introduction.

The turtle dove is scarce on Agalega today. Cheke saw only three or four during several hours wandering on North Island in 1974; Lawley saw none there in 1978. Neither of us say any on South Island, though P. Moulinié told Cheke that there were some there. This bird may be extinct or nearly so. Any seen by future visitors should be studied closely for plumage characteristics, and any dead ones found saved for study. The reasons for its failure to recover after the 1933 cyclone are unknown.

Geopelia striata Zebra Dove; *tutrel, turtrel*

The Zebra Dove is first mentioned, as 'tourterelle' in the full version of the Bojer-Leduc list (Leduc 1848, Lionnet 1924), and in Leduc's text. Leduc presumably arranged for this species, and the

various passerines, to be introduced shortly after his arrival in 1827, as the list appears from internal evidence to date from before Bojer's visit in 1835. Bojer is known to have received a collection of birds from Leduc in 1830 (Desjardins 1831), and it is probably these which are catalogued in the subsequently famous list.

Zebra Doves are common today on both islands, shunning only the *Scaevola* thickets. They are conspicuous around the settlements and along tracks. Cheke saw a newly fledged juvenile on South Island on 27.6.74.

Apus sp. Swift

While aboard the *Mauritius* off St. James on 28 June 1974, waiting to sail, Cheke watched a swift fly over the ship and on southwards down the coast of North Island. It was noted as "a largish black swift with a white rump and forked tail; paler throat; belly a little paler than back". The tail shape sketched at the time (outer feathers incurved giving a barrel shape in silhouette) was immediately reminiscent of the East African *A.horus,* but not any other species familiar to the observer. On geographical grounds, Feare (1979) considered the bird more likely to be *A.pacificus,* but Brooke & Steyn (1979)argued that *A.horus* was in fact equally probable as it is a partial migrant, and many southern populations are on the move in June.

['Larks']

The 'larks' mentioned by Boucherat (1890), Lincoln (1893) and Scott (1961) are small waders. The creole name *zalwet,* or in local French *alouette,* is derived from metropolitan French *alouette de mer,* and never refers to *Alaudidae,* which do not occur in the Mascarenes, Seychelles or other small Indian Ocean islands (Penny 1974, Cheke 1982a).

Terpsiphone bourbonnensis Mascarene Paradise Flycatcher

Included, as 'gobe-mouches de l'Île de France', complete with a page reference to Buffon (1770-86), in the full version of the Bojer-Leduc list (Leduc 1848, Lionnet 1924). Presumably introduced by Leduc from Mauritius ca.1827-30 (quite a feat!), but subsequently died out.

Zosterops chloronothus Mauritius Olive White-eye

Included in the full version of the Bojer-Leduc list (Leduc 1848, Lionnet 1924), in the same way as the flycatcher, with page reference to Buffon, and Buffon's name '*cherie* [sic, =*cheric*] ou oeil blanc'. Also presumably introduced from Mauritius and died out.

Paroaria coronata Red-crested Cardinal; *koñde* 'Cardinal du Brézil'

Cheke's discussions with the then (1974) managing director Paul Moulinié illustrate the danger of relying on hearsay to establish dates of biological events (cf. also the land tortoises, above). Moulinié said that this species had been deliberately introduced some "twenty

years" before. The literature establishes however that they were certainly already present and common in 1948 (and probably 1935; Dussercle 1949) and indeed rather earlier, as Guérin (1940-53), writing in 1940, reported their introduction as "twenty or so years ago". Lionnet (1924) cited an unknown sea captain as 'recently' telling M Henri Robert "editor of the *Revue Agricole*" that no more 'cardinals du Brézil' were to be seen (not true, as it turned out). Robert was editor of a *Bulletin Agricole* from 1911-13 (Toussaint & Adolphe 1956), which was probably the date of this exchange (the *Revue Agricole* was suspended from 1902 to 1922, and Robert was never the editor (Toussaint & Adolphe, 1956)). Thus the birds were clearly established before 1911, a date somewhat anterior to 1954! Guérin (1940-53) supposed they had escaped from a cage on a ship passing Agalega. Whether they were introduced deliberately or not is impossible now to establish, but this species was certainly a popular cage-bird in the Mascarenes from at least 1855 onwards (to judge by the numbers offerred to the natural history museum in St. Denis (Réunion); Cheke, pers.obs. of the museum accessions register). Guérin (1940-53) ascribed to the bird the beneficial trait of eating unwelcome beetle larvae: *gons* parastising coconut palms and nuts, and *moutoucs* feeding on copra and poonac. P. Moulinié (pers.comm. to Cheke) reported that these birds had been exported as cage birds to Mauritius in the past, and that they were formerly common on both islands.

In 1974 there were only two birds surviving, living around the houses at Vingt-Cinq (North Island), and locals told Cheke that they bred occasionally, but that the fledged young always 'disappeared'. P. Moulinié (pers.comm. to Cheke) said there had been only two for six years (i.e. since 1968), but the people at Vingt-Cinq suggested there had been three adults and a juvenile more recently than that. There were still two birds at Vingt-Cinq in November 1978 (Lawley), which may or may not have been the same individuals as in 1974.

This unique wild population of this South American bird is clearly about to die out. One can only speculate as to why this bird was so successful for 40-50 years, but then failed; there was clearly no human persecution, and competition with other introduced seed-eaters seems unlikely as they seem to have been introduced about the same time.

Serinus mozambicus Yellow-fronted Canary; *serẽn*

Included in the full Bojer-Leduc list (Leduc 1848, Lionnet 1924) with a page reference to Buffon under the names "*Oiseau du Cap,* dit *serin de Mozambique* ou *Canari du Cap*". Presumably introduced by Leduc ca.1827-30. Not mentioned by any other author except Guérin (1940-53).

Common today on both islands, favouring especially areas of *Casuarina,* feeding on the seeds. Cheke also noted feeding on *Pisonia* seeds on North Island.

Estrilda astrild Waxbill; (*bengali*)

Said by Guérin (1940-53), writing in 1940, to have been introduced to Agalega where it had difficulty establishing itself. It presumably eventually failed, as it is no longer present today.

Padda oryzivora Java Sparrow; (*kalfat*)

Mentioned by a sea captain to Henri Robert (ca.1912) as amongst the species that had died out (Lionnet 1924). This is the only reference to the Java Sparrow on Agalega.

Passer domesticus House Sparrow; (*mwano*)

Also mentioned by the sea captain to Robert (Lionnet 1924); there was apparently at that time a single surviving male. This is the only reference to the presence of sparrows on Agalega.

Foudia madagascariensis Madagascar Fody or Cardinal; *kardinal*

Scott (1961) is the only visitor to mention *cardinals*, though Guérin (1940-53), writing in 1940, recorded the species from Agalega. It was presumably introduced relatively recently, probably in the late nineteenth century with the Java Sparrows and House Sparrows.

The Cardinal occurs today throughout both islands, but is commoner on North Island and is especially numerous in the extensive *Scaevola* thickets there (Cheke). Males were in breeding plumage in July 1974 (Cheke) and November 1978 (Lawley).

Acridotheres tristis Common Mynah; *marteñ*

Presumably introduced by Leduc, ca.1827-30, as it occurs in the full Bojer-Leduc list under the name martin (Leduc 1848, Lionnet 1924). It may have declined early this century, as a sea-captain reported to Henri Robert (ca. 1912) that mynahs were no longer to be seen (Lionnet 1924). Guérin (1940-53), writing in 1940, Dussercle (1949) and Scott (1961) considered mynahs common, so they evidently recovered fairly rapidly. The decline or disappearance of many birds around 1912 may have been due to the severe cyclone in 1911.

Mynahs are abundant today on both islands. Cheke saw a bird carrying nest material on 28.6.74.

Mammals

[Chiroptera; bats]

Cheke watched for, but failed to see, any bats; none have ever been recorded from the islands.

Lepus sp. Hare; *liev*

Hares were first reported by Hilsenberg (1823), presumably having been introduced as game animals by the first settlers, as there were none in 1808 (Rozemont 1809). They thrived (several authors) until 1897 when feral dogs attacked all game (Lionnet 1924); around 1912 they were said to be getting daily rarer (captain to Robert; Lionnet, 1924). Dussercle's account (1949) suggests that hares died out completely, and had to be re-introduced, and that this was done only on North Island. Scott (1961) reported hares in 1955 around Montagne d'Emmerez (North Island).

This species has presumably throughout been the Black-naped Hare *Lepus nigricollis,* the only species in Mauritius (Carié 1916, Cheke in press b). Rabbits are mentioned at one point in the text of Leduc (1848) by Saint-Elme Leduc, the editor, but this seems to have been a case of association, rabbits being thrown in as "rabbits and hares" generally go together in the European mind. There is no suggestion from August Leduc, nor from any visitors, that rabbits *Oryctolagus cuniculus* were ever established on the islands.

Cheke was told by P. Moulinié and Bonhom in 1974 that hares still existed on North Island. Neither of us saw any.

Mus sp. Mouse; (*ti lera*)

Leduc (1848) reported that mice were already present when he arrived (1827), and that they had resisted all efforts to control them (30,000 were killed in 18 months). The only other author to mention them as Laplace (1841-54). They presumably still survive, their depredations overshadowed by those of that later arrival, the rat. The species involved is no doubt *Mus musculus,* the only species in Mauritius (Carié 1916, Cheke in press b).

Rattus rattus Ship Rat; *lera*

Leduc (1848) reported that rats had been introduced in 1832, but that by 1834 they had been eradicated.

In 1891 the supply schooner *Mathilde* was wrecked on the reefs, and its rats colonised the islands (Lionnet 1924, Dussercle 1949), soon to cause havoc to the coconut plantations, up to 25-30% of the crop being lost (Dussercle, 1949). Rat-hunting developed into a major industry for children, up to 60,000 being killed per year for a bounty Dussercle (1949). They are still most abundant.

Dussercle (1949) reported rats living primarily in roofs and in the crowns of coconut palms, behaviour typical of *R. rattus*. There is no evidence that *R. norvegicus* is also present.

Canis domesticus Feral dog; *lisyeñ maroñ*

Reported as prevalent after imported hunting dogs hybridised with

local mongrels in 1897, but said to have been eliminated by shooting (Lionnet 1924, Dussercle 1949). In 1974 P. Moulinié told Cheke that some existed on South Island.

Felis catus Feral cat; *sat maroñ*

Cats were released in the 1890s in an attempt to control rats (Carié 1916, Lionnet, 1924). Feral cats were reported by Scott (1961) in 1955, but were not reported to us in the 1970s; this may have been an oversight.

Sus scrofa Feral pig; *kosoñ maroñ*

Feral pigs were mentioned by Werner (1824) and Leduc (1848) but by no other author, despite the fact that, according to P. Moulinié (pers. comm. to Cheke) they are still common on both islands. Neither of us saw any.

Equus spp. Horses and Donkeys; *suval* and (*burik*)

Although Leduc (1848) imported horses, it appears not to have been until later that feral herds developed. Both feral horses and donkeys are mentioned by Dussercle (1949), but only the former by Scott (1961; South Island only). Only a handful of horses survive today, on South Island.

A note on the coconut crab *Birgus latro*

While writing on Agalega it seems appropriate to clear up an error in the literature about the only other large land animal known from the islands, the Coconut Crab *Birgus latro*. Lionnet (1924) asserted that the crab was introduced in the mid-nineteenth century, on the grounds that it was not mentioned by Bojer (i.e. presumably, Bojer 1835). This view was followed by Dussercle (1949), who added speculative sources for the introduction. However Lionnet overlooked the fact that the Bojer-Leduc list of ca.1830 (Leduc 1848), reproduced in his own book, includes two specimens of *Birgus*, with a short comment by Leduc on their behaviour. Leduc (1848), elsewhere in the text, also states that "*Cipails* (*Birgus latro*), crabs and *Bernard l'ermite* [hermit crabs] are the only crustaceans which live on land" (Cheke translation). Although earlier visitors did not mention them (none mentioned crustaceans at all), there is no reason to suppose the crabs were not native; they would scarcely, as coconut predators, have been introduced deliberately (though admittedly good to eat), and accidental introduction seems unlikely. By the time Dussercle (1949) was writing, Coconut Crabs were scarce and declining, the author commenting in an aside on their culinary excellence. Since then they appear to have died out. Scott (1961) covering the fauna and the islanders' diet in some detail did not mention them, and nothing was heard of them in 1974 or 1978.

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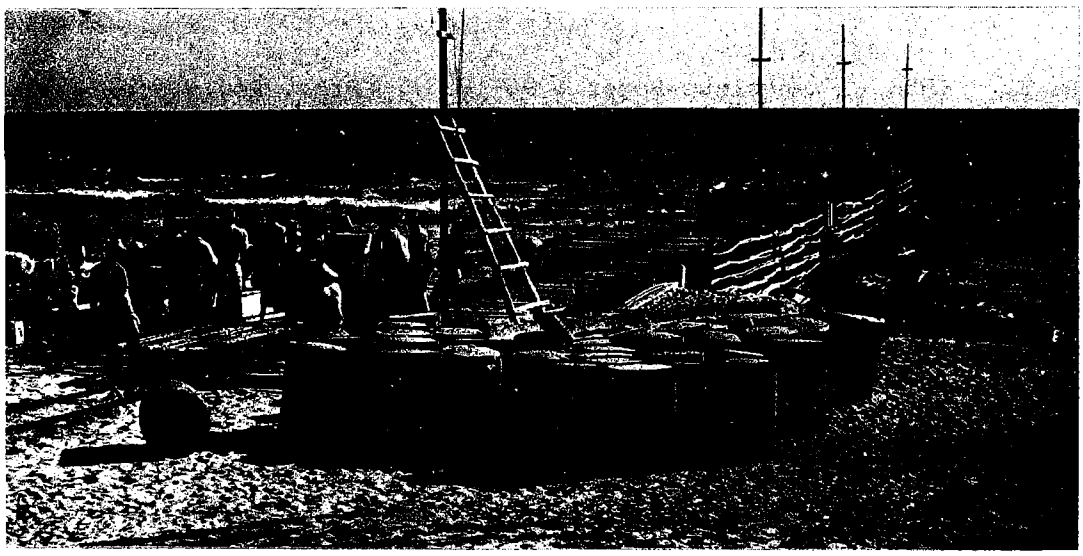

Plate 1. The jetty, Port St James, North Island (A. S. Cheke)

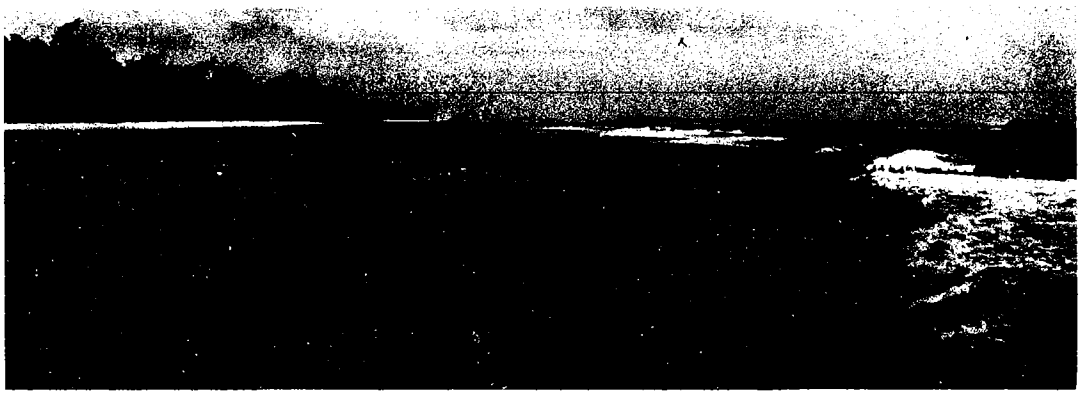

Plate 2. The wreck of the Wajao, off Ste Rita, South Island. Note the *Casuarina* fringe along the shore; looking north. (A. S. Cheke)

Plate 3. The chapel, Ste Rita. Note the large old *Delonix regia* tree (A. S. Cheke)

Plate 4. Two Glossy Ibises *Plegadis falcinellus* on a coconut palm, Ste Rita (A. S. Cheke)

Plate 5. Glossy Ibis on open ground with *Scaevola* thicket behind, November 1978 (J. C. Lawley)

Plate 6. Red-crested Cardinal *Paroaris dominicana* in papaya tree, Vingt-Cinq, November 1978 (J. C. Lawley)

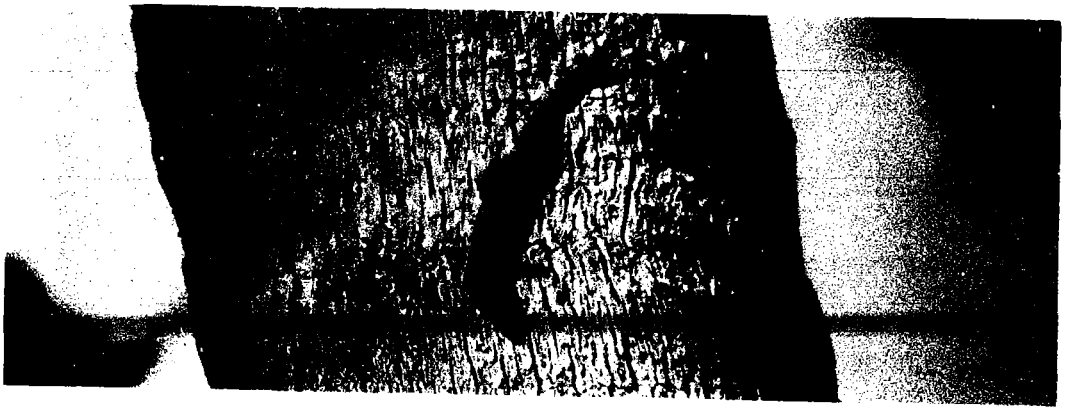

Plate 7. Male day-gecko *Phelsuma borbonica agalegae* on coconut palm trunk, North Island (A. S. Cheke)

Plate 8. Native coconuts, *Scaevola* understory and bare ground, southeast part of South Island, just inland from the coast (A. S. Cheke)

Plate 9. A relatively open patch of the native coconut area in the centre of South Island showing the ground layer of *Acrostichum aureum* and other ferns (A. S. Cheke)

Plate 10. Grande Montagne, South Island, showing *Suriana maritima* on the dunes and a broad belt of *Scaevola taccada* fringing the shore (A. S. Cheke)

Plate 11. *Asplenium nidus* growing on the ground, South Island

Plate 12. *Psilotum nudum* on a grass tussock amongst *Nephrolepis*, South Island (A. S. Cheke)

5. LIST OF THE RECORDED VASCULAR FLORA OF AGALEGA

by F. R. Fosberg, Marie-Hélène Sachet and D. R. Stoddart

Introduction

Agalega is the largest unelevated coral island in the western Indian Ocean (North Island 1170 ha, South Island 930 ha, total 2100 ha), and undoubtedly has the largest flora. However, it has not been, and is not at present, possible to offer any reliable information as to the size and composition of either indigenous or total flora. Until the visits by John Procter in April 1972 and Stoddart in August 1976, little serious collecting had been done there. Bojer collected material in 1835 but few of his specimens seem to be still extant. A systematic search in the herbaria at Paris and Kew would doubtless lead to the discovery of some of his specimens, but this would involve both much time and also a good knowledge of the flora of the region, to yield significant results. Collections made by Dupont in July 1934, by Mamet in May 1955 and by Wiehe in September 1961 are in the Herbarium of the Sugar Industry Research Institute in Mauritius. Stoddart listed these during a visit in 1969, and later Fosberg examined them, but these collections as a whole have not been determined critically. Procter's specimens in the Herbarium of the Ministry of Agriculture, Mahe, Seychelles, are more carefully named though without the benefit of reliably determined collections for comparison, and some identities are thus doubtful.

Except for scattered references to Agalega plants in the general systematic literature, knowledge of the flora has rested on a posthumously published list by Bojer (Bouton 1871), which was obviously not intended by him for publication. This was added to, somewhat, and republished by Capt. J. G. Lionnet in 1924. Both of these lists are so full of misidentifications, misspellings and invalidly published names, often unidentifiable, that it would have been much better if they had never been published and we could start with a somewhat cleaner slate.

Atoll Research Bulletin No. 273: 109-142, 1983.

The present list is designed to account for the extant specimens and all names that we are aware of in published records, together with records cited by A.S. Cheke and J. Lawley in the previous paper and also listed separately by Cheke (pers.comm, 13 September 1980). Where the name or spelling given in a published record differs from that accepted here by us, the original spelling is given in parentheses after the record. Some of the spellings, especially those given by Lionnet, are so incorrect that it is doubtful what was intended. Where there is serious doubt, this is indicated by parenthetical notes. Our own doubful identifications are indicated by queries (?). Synonymy and published misidentifications are cross-referenced.

We are under no illusion, either that this is a complete list, that all names are correct, or that all the species listed are at present members of the flora. Ordinary cultivated vegetables, recorded by Bojer as grown in 1835, are retained in the list even though it is unlikely that many of them were raised with any success.

The present list is not to be regarded as adequate for phytogeographic use. To gather material for a reasonably complete list would require a visit of at least a week or two by a competent collector. Detailed descriptive notes on the vegetation would also be very desirable.

For records of algae, lichens, hepatics and mosses of Agalega, see Montagne (1841, 1844-1846 and 1856).

List of plants

ACANTHACEAE

Asystasia bojeriana Nees
**Stoddart 7262 (US) (S)

AMARANTHACEAE

Achyranthes aspera L. var. *mollis* (Moq.) Townsend
*Bojer 1835
Mamet in 1955 (MAU) (N)
Stoddart 7237 (US) (N)

Aerva sp.
Dupont in July 1934 (MAU)

Alternanthera sessilis L.
Stoddart 7271 (US) (S)

Amaranthus asperus (probably in error for *Achyranthes aspera* L., which see)
Bojer 1835
Lionnet 1924

+*Amaranthus oleraceus* L.
Bojer 1835
Lionnet 1924

+*Amaranthus tricolor* L.
Bojer 1835
Lionnet 1924

Celosia spathulata Bojer
Bojer 1835
Lionnet 1924

+*Gomphrena globosa* L.
Bojer 1835
Lionnet 1924 (as *Gomphryna globosa*)

ANACARDIACEAE

+*Mangifera indica* L.
Bojer 1835
Lionnet 1922, p. 54
Lionnet 1924
Mamet 1978, p. 105

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* Records culled from literature are listed with authors' names not underlined, and with name or spelling used by the author following in parentheses if different from that accepted by us. Bojer records are cited as 1835, when his list was compiled, rather than as 1871, when it was published. Comments on some of these records are added, in parentheses. Lionnet 1924 citations are from pp. 72-76.

** Specimens seen by us are cited with collector's name underlined, followed by his collection number, underlined, or by the year; then followed, in parentheses, by the standard symbols for the herbaria in which they are deposited. The symbol MAHE (for the herbarium of the Department of Agriculture, Victoria, Mahe, Seychelles) is not an official symbol in the Index Herbariorum, ed. 7. In second parentheses, N or S are used for North or South Island, Agalega, where this information is recorded.

+ Introduced species.

+*Spondias dulcis* Parkinson
Lionnet 1924 (as *Spondia dulcis*)

ANNONACEAE

+*Annona reticulata* L.
Bojer 1835 (as *Anona reticulata*)
Lionnet 1924 (as *Anona reticulata*)
Mamet 1978, p. 107

+*Anona squamosa* L.
Bojer 1835 (as *Anona squamosa*)
Lionnet 1924 (as *Anona squamosa*)
Mamet 1978, p. 102

APIACEAE (UMBELLIFER

+*Apium graveolens* L.
Bojer 1835
Lionnet 1924
Mamet 1978, p. 107

+*Apium petroselinum* L.
Bojer 1835 (as *Apium petroselium*)
Lionnet 1924

+*Daucus carota* L.
Bojer 1835
Lionnet 1924

APOCYNACEAE

+*Catharanthus roseus* (L.) G. Don
Bojer 1835 (as *Vinca rosea*)
Lionnet 1924 (as *Vinca rosea*)
Mamet 1978, p. 106 (as *Vinca rosea*)
Stoddart 7287 (US) (S)

Cerbera odollam Gaertn.
Cerbera manghas sensu auct. non L. (probably is *Cerbera odollam* as *C. manghas* is not found in the western Indian Ocean)
Bojer 1835 (as *Cerbera* sp.)
Lionnet 1924 (as *Cerbera* sp.)
Dupont in 1934 (MAU)
Mamet in 1955 (MAU (S: Le Jardin)

Neisosperma oppositifolia (Lam.) Fosberg & Sachet
Dupont AG/15 (MAU)
Mamet in 1955 (MAU) (S)

+*Nerium oleander* L.
Bojer 1835
Lionnet 1924
Stoddart, sight (N)

ARACEAE

Colocasia esculenta (L.) Schott
Bojer 1835 (as *Arum esculentum*)
Lionnet 1924 (as *Arum esculentum*)

Typhonodorum lindleyanum Schott
Mamet 1978, p. 99 (S)

ARECACEAE (PALMAE)

+*Cocos nucifera* L.
de Richery 1785
Rozemont 1809
Prior 1820
Moresby 1822
Hilsenberg 1823
Werner 1824
Bojer 1835
Unienville 1838
Froberville 1848
Lionnet 1924
Mamet 1978, p. 103
Cheke, sight (N, S)
Stoddart, sight (N, S)

+*Lodoicea maldivica* (Gmel.) Pers.
Anon. 1828
Leduc 1848
Lionnet 1924 (as drift seed?)

+*Phoenix dactylifera* L.
Bojer 1835 (as *Phoenix dactilifera*)
Lionnet 1922, p. 54; 1924
Mamet 1978, p. 106

+*Phoenix* sp.
Recorded by Mamet in 1955 as the host for *Asplenium* and *Psilotum* but not collected

ASCLEPIADACEAE

Tylophora laevigata Decne.
Cynanchum mauritianum Bojer ex Decne.
Bojer 1835 (as *Cynanchum mauritianum*)
Lionnet 1924 (as *Cynanchum mauritianum*)

ASTERACEAE (COMPOSITAE)

+*Ageratum conyzoides* L.?
Ageratum coeruleum Bojer (This name is sometimes applied to a Tropical American weed, but there is no reason to think it was ever in Agalega. Bojer probably had a bluish form of *A. conyzoides*)
Bojer 1835 (as *Ageratum coeruleum*)
Lionnet 1924 (as *Ageratum coeruleum*)

+*Bidens pilosa* L.
Stoddart 7246 (US) (N)

+*Bidens pinnata* Bojer
(No such name is recorded as validly published. Bojer possibly had *Bidens pilosa* or perhaps *Dahlia* or *Cosmos*, but there is no way to know which)
Bojer 1835
Lionnet 1924

+*Helianthus annuus* L.
Helianthus major Bojer (no such name has been validly published. Bojer possibly used it for cultivated large-headed *H. annuus*)
Bojer 1835 (as *Helianthus major*)
Lionnet 1924 (as *Helianthus major*)

+*Lactuca andivia* Bojer
(No such name validly published; perhaps the cultivated endive, *Cichorium endivia* L.)
Bojer 1835 (as *Lactuca andivia*)
Lionnet 1924 (as *Lactuca andivia*)

+*Lactuca indica* L.
Bojer 1835
Lionnet 1924

+*Lactuca oleracea* Bojer
(No such name validly published; probably *Lactuca sativa* L.)
Bojer 1835
Lionnet 1924

+*Sigesbeckia orientalis* L.
Bojer 1835 (as *Siegesbeckia orientalis*)
Lionnet 1924 (as *Siegesbeckia orientalis*)

+*Tithonia tegtioides* Bojer
(This name not validly published: could it be *Tithonia tegetiflora* Desf. from Mexico?)
Bojer 1835
Lionnet 1924 (as *Tagetes tageticides*)

+*Tridax procumbens* L.
Stoddart 7283 (US) (S)

+*Vernonia cinerea* (L.) Less.
Mamet in 1955 (MAU) (S)
Stoddart 7274 (US) (S)

BALSAMINACEAE

+*Impatiens balsamina* L.
Bojer 1835 (as *Balsamina hortensis*, an apparently unpublished name)
Lionnet 1924 (as *Balsamina hortensis*)

BIGNONIACEAE

+*Tabebuia heterophylla* (DC.) Britt.
Tabebuia pallida sensu auct. non Miers
Mamet in 1955 (MAU) (S)
Stoddart 7267 (US) (S)

BORAGINACEAE

Borrago indica L. see *Trichodesmia indica* (L.) R. Br.

Cordia subcordata Lam.
Bojer 1835
Mamet in 1955 (MAU) (S)
Stoddart 7240 (US) (N)

Tournefortia argentea L.f.
Hilsenberg 1823
Werner 1824
Bojer 1835
Lionnet 1924
Cheke, sight (N)
Mamet 1978 p. 102
Mamet in 1955 (MAU)(N, S)
Stoddart 7241 (US) (N), 7256 (US) (S)

Trichodesmia indica (L.) R. Br
Borago indica L.
Bojer 1835 (as *Borrago indica*)
Lionnet 1924 (as *Borrago indica*)

BRASSICACEAE (CRUCIFERAE)

+*Brassica chinensis* L.
Bojer 1835
Lionnet 1924

+*Brassica oleracea* L.
Bojer 1835
Lionnet 1924
Mamet 1978, p. 102

+*Brassica pe-tsai* Bailey
Mamet 1978, p. 102

+*Raphanus sativus* L.
Bojer 1835
Lionnet 1924

Sinapis pratensis Bojer
(We do not find that this name has been validly published: perhaps either *Sinapis arvensis* L. = *Brassica kaber* (DC.) Wheeler, or, more likely, *Brassica nigra* L.)
Bojer 1835
Lionnet 1924

BROMELIACEAE

+*Ananas comosus* (L.) Merr.
Bromelia ananas L.
Lionnet 1924, p. 76 (as *Bromelia ananas*)

CANNACEAE

+*Canna indica* L.
Bojer 1835
Lionnet 1924

+*Canna* sp.
Mamet 1978, p. 107

CAPPARIDACEAE

Cleome viscosa L.
Mamet in 1955 (MAU) (N)

+*Cleome gynandra* L.
Gynandropsis pentaphylla (L.) DC.
Bojer 1835 (as *Gynandropsis pentaphylla*)
Lionnet 1924 (as *Gynandropsis pentaphilla*)
Stoddart 7276 (US) (S)

CARICACEAE

+*Carica papaya* L.
Bojer 1835
Lionnet 1924
Mamet, 1978, p. 106
Cheke, sight (S: Ste Rita)
Stoddart 7270 (US) (S)

CASUARINACEAE

+*Casuarina equisetifolia* L.
Bojer 1835
Laplace 1837 (in Froberville 1848)
Leduc 1841 (stated to have been introduced in 1828)
Lionnet 1924
Cheke, sight (N, S)
Stoddart, sight (N, S)
Procter 4189 (MAHE) (S)

CELASTRACEAE

Celastrus nepalensis Steud: see *Pittosporum floribundum* W. & A. (Pittosporaceae)

CHENOPODIACEAE

+*Chenopodium graveolens* Willd.
Bojer 1835 (as *Chenapodium graveolens*)
Lionnet 1924 (as *Chenapodium graveolens*)

+*Spinacea oleracea* L.
Bojer 1835
Lionnet 1924

CHLOANTHACEAE (DICRASTYLIDACEAE)

Nesogenes prostrata Hemsl. (Marais 1980, p. 802, considers this an error in locality for Aldabra)
Radamaea prostrata Benth.
Baker 1877 (as *Radamaea prostrata*)
Justice Blackburn in 1863 (K); Kew negative 5385 held in MAU.

CLUSIACEAE (GUTTIFERAE)

Calophyllum inophyllum var. *takamaka* Fosberg
Werner 1824 (as Takamaka)
Bojer 1835
Lionnet 1924
Cheke, sight (N)
Mamet in 1955 (MAU) (S: Pte Takamaka)
Stoddart 7281 (US) (S), 7292 (US) (S); sight (N)

COMBRETACEAE

+*Terminalia catappa* L.
Bojer 1835
Lionnet 1924
Cheke, sight (S, N)
Mamet 1978, p. 102
Stoddart 7268 (US) (S); sight (N)

COMMELINACEAE

+*Commelina diffusa* Burm.f.
Dupont in 1934 (MAU)

CONVOLVULACEAE

+*Ipomoea batatas* (L.) Lam.
Bojer 1835 (as *Convolvulus batatas*)

Ipomoea macrantha R. and S.
Ipomoea glaberrima Bojer ex Hook.
Ipomoea tuba (Schl.) Don
Bojer 1835 (as *Ipomoea glaberima*)
Lionnet 1924 (as *Ipomoea glaberrima*)
Wiehe 1606 (MAU) (N)

Ipomoea maritima R. Br.: see *Ipomoea pes-caprae* (L.) R. Br. subsp. *pes-caprae*

Ipomoea pes-caprae (L.) R. Br. subsp. *pes-caprae*
Ipomoea maritima R. Br.
Bojer 1835 (as *Ipomoea maritima*)
Lionnet 1924 (as *Ypomoea maritima*)
Mamet 1978, p. 106
Stoddart 7258 (US) (S)

CRASSULACEAE

+*Kalanchoe pinnata* (Lam.) Pers.
Cheke, sight (N)
Stoddart 7243 (US) (S)

CUCURBITACEAE

+*Cucumis acutangulus* L.: see *Luffa acutangula* (L.) Roxb.

+*Cucumis melo* L.
Bojer 1835
Lionnet 1924
Stoddart 7272 (US) (S)

Cucumis muricatus Willd.: see *Cucumis sativus* L.

+*Cucumis sativus* L.
Cucumis muricatus Willd.
Bojer 1835 (as *Cucumis muricatus* and *C. sativus*)
Lionnet 1924 (as *Cucumis mauricatus* and *C. sativus*)

Cucurbita aurantia Willd.: see *Cucurbita pepo* L.

Cucurbita melopepo L.: see *Cucurbita pepo* L.

+*Cucurbita pepo* L.
Cucurbita aurantia Willd.
Cucurbita melopepo L.
Bojer 1835 (as *Cucurbita aurantia* Willd. and *C. melopepo* L.)
Lionnet 1924 (as *Cucurbita aurantia* Willd. and *C. melopepo* L.)

Cucurbita lagenaria L.: see *Lagenaria siceraria* (Mold.) Standl.

+*Lagenaria siceraria* (Mol.) Standl.
Cucurbita lagenaria L.
Bojer 1835 (as *Cucurbita lagenaria*)
Lionnet 1924 (as *Cucurbita lagenaria*)

+*Luffa acutangula* (L.) Roxb.
Cucumis acutangulus L.
Bojer 1835 (as *Cucumis acutangulus* L.)
Lionnet 1924 (as *Cucumis actuangulus*)

+*Sechium edule* (Jacq.) Sw.
Mamet 1978, p. 106

Cyperus comosus Poir. (possibly this but this is one of three homonyms)
Bojer 1835
Lionnet 1924

+*Cyperus compressus* L.
Bojer 1835
Lionnet 1924

Cyperus galagensis C. B. Cl.
Bouton acc. C. B. Clarke 1883 (Bouton's specimen is the type)

Cyperus javanicus Houtt.
Mariscus pennatus (Lam.) Domin.
Mamet in 1955 (MAU) (N)
Wiehe in 1961 (MAU) (N)

Cyperus cf. *kyllingia* Endl.
Dupont AG/23 (MAU)

Cyperus ligularis L.
Mariscus glandulosus Bojer
Bojer 1835 (as *Mariscus glandulosus*)
Bouton, Blackburn acc. C. B. Clarke 1883
Lionnet 1924 (as *Mariscus glandulosus*)
Renvoize 1975
Mamet in 1955 (MAU) (N)
Wiehe 1605 (MAU) (N)
Stoddart 7248 (US) (N)

Cyperus platystachyus Griseb.: see *Cyperus tenuis* sw.

+*Cyperus polystachyos* Rottb.
Pycreus polystachyos (Rottb.) Beauv.
Renvoize 1975 (as *Pycreus polystachyos*)
Stoddart 7269 (US) (S), 7286 (US) (S)

Cyperus rotundus L.
Mamet 1978, p. 105

Cyperus tenuiflorus Rottb.
Blackburn acc. C. B. Clarke 1883

Cyperus triceps Endl.
Kyllinga triceps Bojer
Bojer 1835 (as *Killingia triceps*)
Lionnet 1924 (as *Kellengia triceps*)

Cyperus sp.
Hilsenberg 1823
Bojer 1835
Lionnet 1924

Cyperus tenuis Sw. (a highly improbable record)
Cyperus platystachyus Griseb.
Bojer 1935 (as *Cyperus platystachys*)

Fimbristylis cymosa R. Br.
Fimbristylis obtusifolia Kunth
Renvoize 1975 (as ***Fimbristylis obtusifolia***)
Mamet in 1955 (MAU)

Kyllinga triceps Bojer: see *Cyperus triceps* Endl.

Kyllinga sp.: see *Cyperus* sp.

Mariscus pennatus (Lam.) Domin: see *Cyperus javanicus* Houtt.

Mariscus glandulosus Bojer: see *Cyperus ligularis* L.

Pycreus polystachyos (Rottb.) Beauv.: see *Cyperus polystachyos* Rottb.

Scirpus grossus L.f.

Bojer 1835 (as *Scirpus grossus,* but this species is not otherwise known from Africa or the Western Indian Ocean)
Lionnet 1924

Scirpus sp.
Bojer 1835
Lionnet 1924

EUPHORBIACEAE

Acalypha indica L.
Bojer 1835
Lionnet 1924

+*Breynia disticha* Forst.
Breynia nivosa (Bull.) small var. *roseo-picta* Hort.
Mamet in 1955 (MAU)

Breynia nivosa (Bull.) Small var. *roseo-picta* Hort.: see *Breynia disticha* Forst.

+*Euphorbia hirta* L.
Bojer 1835
Lionnet 1924
Stoddart 7245 (US) (N), 7289 (US) (S)

Euphorbia peplus L.
Mamet 1978, p. 105 (N, S)

Euphorbia prostrata Ait.
Mamet in 1955 (MAU) (S)

Euphorbia serpens Kunth
  Euphorbia serpilifolia Bojer
    Bojer 1835 (as *Euphorbia serpilifolia*)
    Baker 1877
    Lionnet 1924 (as *Euphorbia serpyllifolia*)

Euphorbia serpilifolia Bojer: see *Euphorbia serpens* Kunth

Euphorbia stoddarti Fosberg
    Wiehe 1602 (MAU) (S)
    (The records referred to *Euphorbia serpens* above may belong here)

+*Manihot esculenta* Crants
    Bojer 1835 (as *Janipha manihot*)
    Lionnet 1924 (as *Japnaphat manihot*)
    Mamet 1978, p. 107 (as *Manihot utilissima* Pohl)
    Stoddart, sight (N)

Kirganellia elegans Juss. ex Spreng.: see *Phyllanthus casticum* Willem.f.

Phyllanthus casticum Willem.f.
  Phyllanthus elegans Wall. Cat. (nom. illegit.).
  Kirganellia elegans Juss. ex Spreng.
    Bojer 1835 (as *Kirganellia elegans*)
    Lionnet 1924 (as *Kirganellia elegans*)

Phyllanthus maderaspatensis L.
    Renvoize 1975
    "Bouton" (G-DC). Muell.-Arg. 1866, in DC., *Prodr.* 15(2): 363.
    Dupont AG/Z (MAU)
    Mamet in 1955 (MAU) (N)
    Wiehe 1601 (MAU) (N: Port St James)

Phyllanthus stipulata Bojer (probably *Phyllanthus stipulaceum* Bojer intended)
    Bojer 1835 (as *Phyllanthus stipulata*)
    Lionnet 1924 (as *Phyllanthus stipulatus*)

Phyllanthus sp.
    Mamet 1978, p. 105
    Mamet in 1955 (MAU)
    Proctor 4188 (MAHE) (N)

+*Ricinus communis* L.
    Bojer 1835
    Lionnet 1924
    Mamet 1978, p. 105
    Stoddart 7282 (US) (S)

FABACEAE (LEGUMINOSAE)

Acacia farnesiana (L.) Willd.
  Acacia indica Desv.
    Bojer 1835 (as *Acacia indica*)
    Lionnet 1924 (as *Acacia indica*)

Acacia indica Desv.: see *Acacia farnesiana* (L.) Willd.

Afzelia bijuga (Coleb.) Gray: see *Intsia bijuga* (Coleb.) O. Kitze.

+*Albizia lebbeck* (L.) Benth.
    Bojer 1835 (as *Acacia lebeck*)
    Lionnet 1924 (as *Acacia lebeck*)
    Mamet 1978, p. 105 (as *Albizzia lebbeck*)

+*Arachis hypogaea* L.
    Bojer 1835
    Lionnet 1924

Caesalpinia bonduc (L.) Roxb.
    Stoddart 7261 (US) (S)

+*Cajanus cajan* (L.) Huth.
  Cajanus indicus Spreng.
    Bojer 1835 (as *Cajanus indicus*)
    Lionnet 1924 (as *Cajanus indicus*)

+*Cassia occidentalis* L.
    Bojer 1835
    Lionnet 1924 (as *Cassia accidentalis*)

+*Clitoria ternatea* L.
    Bojer 1835
    Lionnet 1924

+*Delonix regia* (Bojer) Raf.
    Mamet 1978, p. 102
    Cheke, sight (S: Ste Rita)
    Patel 1974, photograph (S)

+*Desmanthus virgatus* Willd.
    Mamet in 1955 (MAU) (S)

Dioclea jacquiniana DC.
  Dolichos ruber Jacq.
    Bojer 1835 (as *Dolichos ruber*)
    Lionnet 1924 (as *Dolichos ruber*)

Dolichos capensis L.: see *Vigna capensis* (L.) Walp.

+*Dolichos lablab* L.
Bojer 1835
Lionnet 1924 (as *Dolichos lablas*)

Dolichos ruber Jacq.: see *Dioclea jacquiniana* DC.

+*Erythrina variegata* var. *orientalis* (L.) Merr.
Erythrina corallodendron Bojer non L.
Erythrina indica L.
Bojer 1835 (as *Erythrina corallodendron*)
Mamet 1978, p. 106 (as *Erythrina indica*)
Stoddart 7266 (US) (S)

Erythrina corallodendron L.: see *Erythrina variegata* var. *orientalis* (L.) Merr.

Intsia bijuga (Coleb.) O. Ktze.
Tamarindus intsia Spreng.
Intsia madagascariensis Bl.
Afzelia bijuga (Coleb.) Gray
Bojer 1835 (as *Intsia madagascariensis*)
Bojer 1835 (as *Tamarindus indicus*)
Leduc 1844
Baker 1877 (as *Afzelia bijuga*)
Lionnet 1924 (as *Tamarindus intsia*)
Procter 4195 (MAHE) (N)

Intsia madagascariensis DC.: see *Intsia bijuga* (Coleb.) O. Ktze.

+*Lens culinaris* Medic.
Lens esculenta Moench
Ervum lens L.
Bojer 1835 (as *Ervum lens*)
Lionnet 1924 (as *Ervum lens*)

Leucaena leucocephala (Lam.) De Wit.
Bojer 1835 (as *Acacia leucocephala*)
Lionnet 1924 (as *Acacia leucocephala*)
Stoddart 7250 (US) (N)

+*Phaseolus vulgaris* L.
Bojer 1835
Lionnet 1924

+*Pisum sativum* L.
Bojer 1835
Lionnet 1924

+*Tamarindus indica* L.
Bojer 1835 (as *Tamarindus indicus*)
Lionnet 1924 (as *Tamarindus indicus*)
Mamet 1978, p. 107 (as *Tamarindus indicus*)

Tamarindus intsia Spreng.: see *Intsia bijuga* (Coleb.) O. Ktze.

Vigna capensis (L.) Walp.
Dolichos capensis L.
Bojer 1835 (as *Dolichos capensis*)
Lionnet 1924 (as *Dolichos capensis*)

GOODENIACEAE

Scaevola sericea Vahl
Scaevola taccada (Gaertn.) Roxb.
Scaevola koenigii Vahl
Scaevola frutescens auct. plus non Mill.
Hilsenberg 1823
Werner 1824
Bojer 1835 (as *Scoevola koenigii*)
Lionnet 1924 (as *Scevola koenigii*)
Mamet in 1955 (MAU) (N, S) (as *Scaevola frutescens*)
Mamet 1978, p. 105 (as *Scaevola frutescens*)
Cheke, sight (N, S)
Stoddart 7239 (US) (N), 7280 (US) (S)

HERNANDIACEAE

Hernandia sonora L.
Hernandia ovigera sensu auct. non L.
Rozemont 1809 (as Bois blanc)
Werner 1824
Bojer 1835
Lionnet 1924
Cheke, sight (N)
Mamet 1978, p. 106
Mamet in 1955 (MAU) (S, N) (as *Hernandia ovigera* L.)
Stoddart 7230 (US) (N), 7234 (US) (N), 7278 (US) (S)

LAMIACEAE (LABIATAE)

+*Leonotis nepetaefolia* R. Br.
Mamet in 1955 (MAU) (S: Le Jardin)

Leucas sp.
Mamet in 1955 (MAU) (S)

+*Thymus hortensis* Bojer (not validly published name; possibly *Thymus vulgaris* L. was intended)
Bojer 1835

LAURACEAE

Cassytha filiformis L.
Bojer 1835
Lionnet 1924
Cheke, sight (N)
Dupont AG/15 (MAU)
Mamet in 1955 (MAU) with *Achyranthes aspera*
Stoddart 7244 (US) (S)

+*Persea americana* Mill.
Mamet 1978, p. 105

LECYTHIDACEAE

Barringtonia asiatica (L.) Kurz
Barringtonia speciosa Forst.
Bojer 1835 (as *Barringtonia speciosa*)
Lionnet 1924 (as *Barringtonia speciosa*)

LILIACEAE (sensu lato)

+*Agave americana* L.
Lionnet 1924, p. 76

+*Allium ascalonicum* L. but sensu auct. usually *Allium cepa* L., which see

+*Allium cepa* L.
Allium ascalonicum sensu auct. non L.
Bojer 1835
Lionnet 1924 (as *Allium ascolonicum* and as *Allium cepa*)

+*Allium porrum* L.
Bojer 1835
Lionnet 1924

+*Allium sativum* L.
Bojer 1835
Lionnet 1924

+*Asparagus officinalis* L.
Lionnet 1924, p. 76

Crinum cf. *augustum* Roxb.
Stoddart 7259 (US) (S)

Furcraea foetida (L.) Haw.
Lionnet 1924, p. 76 (as *Agave foetida*)

Zephyranthes sp.
Mamet 1978, p. 102

MALVACEAE

Abutilon cf. *indicum* (L.) Sweet
  Sida mauritiana Bojer
    Bojer 1835 (as *Sida mauritiana*)
    Lionnet 1924 (as *Sida mauritiana*)
    Mamet in 1955 (MAU) (S) (probably)

+*Gossypium hirsutum* L.
  Gossypium barbadense L.
    Moresby 1822 (as Cotton)
    Bojer 1835 (as *Gossypium barbadense*)
    Lionnet 1924 (as *Gossypium barbadense*)
    Mamet 1978, p. 102 (as *Gossypium barbadense*)
    Stoddart 7251 (US) (N)

+*Hibiscus esculentus* L.
    Bojer 1835
    Lionnet 1924 (as *Hibiscus esculentum*)
    Mamet 1978, p. 106

Hibiscus tiliaceus L.
    Mamet 1978, p. 104, 105

Malva borbonica Willd.: see *Malvastrum coromandelianum* (L.) Garcke

Malva communis Bojer (this name has not been validly published)
    Bojer 1835

+*Malvastrum coromandelianum* (L.) Garcke
  Malva borbonica Willd.
    Bojer 1835 (as *Malva borbonica*)
    Lionnet 1924 (as *Malva borbonica*)
    Leduc in 1839 (G)
    Mamet in 1955 (MAU) (S: Le Jardin)
    Procter 4178 (MAHE) (S)

Pavonia urens Cav.
    Lionnet 1924

+*Sida acuta* Burm. f.
    Stoddart 7273b (US) (S)

Sida mauritiana Bojer: see *Abutilon* cf. *indicum* (L.) Sweet

Sida parvifolia DC.
  Sida vescoana DC.
    Renvoize 1975
    Dupont AG/5 (MAU)
    Mamet in 1955 (MAU) (S)
    Wiehe 1604 (MAU) (N: Port St James)
    Procter 4194 (MAHE) (N), 4184 (MAHE) (S)

Sida pusilla Cav. (This is *Sida spinosa* L. according to *Index Kewensis*, but we do not know what plant Bojer had. Possibly should include *Sida parvifolia* DC.)
Bojer 1835
Bojer 1837
Lionnet 1924

+*Sida rhombifolia* L.
Stoddart 7273b (US) (S)

Sida sp.
Wiehe in 1961 (MAU) (N)
Mamet 1978, p. 105
Procter 4207 (MAHE) (S)

MARANTACEAE

+*Maranta arundinacea* L.
Bojer 1835
Lionnet 1924 (as *Maranta acoudinaces*)

MELIACEAE

+*Melia azedarach* L.
Stoddart 7279 (US) (S)

MORACEAE

+*Artocarpus altilis* (Park.) Fosb.
Lionnet 1922, p. 54 (as Breadfruit)
Cheke, sight (N: Port St James; S: Ste Rita)

Ficus terebrata Bojer (this name is regarded as a synonym of two Brazilian species, but we have no clue to what species Bojer may have applied it)
Bojer 1835
Lionnet 1924

MORINGACEAE

+*Moringa oleifera* Lam.
Hyperanthera moringa Vahl
Bojer 1835 (as *Hyperanthera moringa*)
Lionnet 1924 (as *Hyperanthera moringa*)

MUSACEAE

+*Musa paradisiaca* L.
Bojer 1835
Lionnet 1924
Stoddart, sight (N)

+*Musa pumila* Bojer (we can find no record of publication of this name. Perhaps *Musa nana* Lam. was intended)
Bojer 1835
Lionnet 1924

+*Musa sapientum* L.
Mamet 1978, p. 105
Cheke, sight

MYRTACEAE

Calyptranthes jambolana Willd.: see *Eugenia cuminii* L.

+*Eugenia aquea* Burm.f.
Mamet 1978, p. 105

+*Eugenia cuminii* L.
Calyptranthes jambolana Willd.
Bojer 1835 (as *Calyptranthes jambolana*)
Lionnet 1924 (as *Calyptranthes jambolana*)
Mamet 1978, p. 105 (as *Eugenia jambolana* Lam.)

+*Psidium guajava* L.
Psidium pommiferum L.
Bojer 1835 (as *Psidium pommiferum*)
Lionnet 1924 (as *Psidium pommiferum*)

Psidium pommiferum L.: see *Psidium guajava* L.

NYCTAGINACEAE

Boerhavia bulbosa Bojer (we have not found that this name has been validly published)
Bojer 1835
Lionnet 1924

Boerhavia diffusa L.: see *Boerhavia repens* L.

Boerhavia repens L.
Boerhavia diffusa sensu auct. non L.
Dupont in July 1934 (MAU)
Mamet in 1955 (MAU)
Wiehe in September 1961 (MAU) (N: Port St James)

+*Bougainvillea* sp.
Cheke, sight (S)

Calpidia macrophylla Bojer: see *Pisonia grandis* R. Br.

+*Mirabilis jalapa* L.
Bojer 1835

Pisonia grandis R. Br.
Calpidia macrophylla Bojer
Pisonia macrophylla (Bojer) Choisy
Rozemont 1809 (as Mapoux)
Bojer 1835 (as *Calpidia macrophylla*)
Choisy 1849 (as *Calpidia macrophylla*)
Baker 1877 (as *Pisonia macrophylla*)
Lionnet 1922, p. 37
Lionnet 1924 (as *Calpidia macrophylla*)
Renvoize 1975
Cheke, sight (N)
Mamet 1978, p. 106
Mamet in 1955 (MAU) (S)
Stoddart 7242 (US) (N)

OLEACEAE

+*Noronhia emarginata* Thou.
Lionnet 1924 (as *Nortronia chartaca*)
Dupont AG/11 (MAU)

ORCHIDACEAE

Disperis tripetaloides (Thou.) Lindl.
Dryopeia tripetaloides Thou.
Bojer 1835 (as *Dryopeia tripetaloides*)
Baker 1877 (as *Disperis tripetaloides*)
Lionnet 1924 (as *Dryopea tripetaloides*)

PANDANACEAE

+*Pandanus utilis* Bory?
Bojer 1835
Lionnet 1924

PAPAVERACEAE

+*Argemone mexicana* L.
Bojer 1835
Lionnet 1924

PASSIFLORACEAE

+*Passiflora suberosa* L.
Stoddart 7231 (US) (N), 7263 (US) (S)

PHYTOLACCACEAE

+*Rivina humilis* L.
Rivina laevis L.
Dupont AG/12 (MAU)
Mamet in 1955 (MAU) (N)
Stoddart 7238b (US) (N)

PITTOSPORACEAE

Pittosporum floribundum W. & A.
Celastrus nepalensis Steud.
Bojer 1835 (as *Celestrus nepalensis*)
Lionnet 1924 (as *Celestrus nepalensis*)

PLANTAGINACEAE

+*Plantago major* L.
Dupont AG/6 (MAU)

POACEAE (GRAMINEAE)

+*Cenchrus echinatus* L.
Dupont in 1943 (MAU)

+*Cenchrus mitis* Anderss.
Procter 4196 (MAHE) (N)

+*Coix lachryma-jobi* L.
Bojer 1835 (as *Coix lachrima jobis*)
Lionnet 1924 (as *Coix lachrima*)

Cynodon aristatum Bojer (we have found no valid publication of this name and do not know what Bojer had in mind, possibly a varient of the fcllowing species)
Bojer 1835
Lionnet 1924

+*Cynodon dactylon* Pers.
Bojer 1835
Lionnet 1924
Mamet 1978, 107

Dactyloctenium aegyptium (L.) Beauv. (more likely *Dactyloctenium ctenoides* (Steud.) Bosser)
Bojer 1835 (as *Dactyloctenium aegyptiacum*)
Lionnet 1924 (as *Dactyloctenium aegyptiacum*)
Mamet in 1955 (MAU) (S)

Dactyloctenium distachyum Bojer (This name does not seem to be validly published: see *Dactyloctenium pilosum* Stapf)

Dactyloctenium pilosum Stapf
Bojer 1835 (as *Dactyloctenium distachyum*)
Lionnet 1924 (as *Dactyloctenium distachyium*)
Renvoize 1975

Dactyloctenium sp.
Stoddart 7297 (US) (N)

Digitaria biformis Willd.: see *Digitaria bicornis* (Lam.) R. & S.

Digitaria bicornis (Lam.) R. & S.
Mamet in 1955 (MAU) (S)

Digitaria didactyla Willd.
Mamet 1978, p. 105

Digitaria sp.
Procter 4192 (MAU) (N)

+*Eleusine indica* (L.) Gaertn.
Bojer 1835 (as *Eulesine indica*)
Lionnet 1924
Dupont in 1934 (MAU)
Mamet in 1955 (MAU)

Eragrostis brizoides (L.f.) Schult.
Bojer 1835 (as *Megastachia brizoides*)
Lionnet 1924 (as *Megastachya brizoides*)

+*Eragrostis ciliaris* (L.) R. Br.
Bojer 1835 (as *Megastachia ciliaris*)
Lionnet 1924 (as *Megastachyia ciliaris*)
Dupont in 1934 (MAU)
Stoddart 7232 (US) (N)

+*Eragrostis tenella* (L.) Beauv.
Mamet in 1955 (MAU) (S)

Eragrostis sp.
Procter 4191 (MAHE) (N)

Lepturus repens (Forst.) R. Br.
Bojer 1835 (as *Rottbellia repens*)
Lionnet 1924 (as *Rottbellia repens*)

Megastachia Bojer (Invalidly published generic name: see *Eragrostis* Hort.)

Panicum maximum Jacq.
Mamet 1978, p. 106

Paspalum distichum L.
Procter 4203 (MAHE) (S) (Name supplied by Mrs A. Robertson)

Stenotaphrum dimidiatum Brongn.
Mamet 1978, p. 106

Stenotaphrum micranthum (Desv.) C. E. Hubb
Stenotaphrum subulatum Trim.
Hemsley (1919) citing Baker (1877) (as *Stenotaphrum subulatum*)
Procter 4186 (MAHE) (S) (Name supplied by Mrs A. Robertson)

+*Zea mays* L.
Werner 1824
Moresby 1822 in Horsburgh 1852, p. 171
Bojer 1835 (as *Zea mais*)
Lionnet 1924 (as *Zea mais*)
Mamet, 1978 (S, S)
Cheke, sight (S)

POLYPODIACEAE (FILICES) (sensu lato)

Acrostichum aureum L.
Dupont AG/24 (MAU)
Cheke, sight (S)

Asplenium nidus L.
Bojer 1835
Lionnet 1924
Cheke, sight (S)
Mamet in 1955 (MAU) (S)
Stoddart 7235 (US) (N)

Lomaria grandis Bojer: see *Stenochlaena tenuifolia* (Desv.) Moore

Nephrodium splendens Desv.: see *Nephrolepis biserrata* (Sw.) Schott

Nephrolepis biserrata (Sw.) Schott
Nephrodium splendens (Desv.)
Bojer 1835 (as *Nephrodium splendens*)
Lionnet 1924 (as *Nephrodium splendens*)
Renvoize 1975
Cheke, sight (S)
Dupont AG/21 (MAU)

Nephrolepis hirsutula (Forst.f.) Presl
Stoddart 7236 (US) (N)

Pteris tripartita Sw.
Bojer (K)

Stenochlaena tenuifolia (Desv.) Moore
Bojer 1835 (as *Lomaria grandis*)
Lionnet 1924 (as *Lomaria grandis*)
Cheke, sight (S)
Dupont AG/25 (MAU)

Thelypteris (*Cyclosorus*) sp., probably *Thelypteris interrupta* (Willd.) Iwatsuki
Cheke, sight, 1974 (S)

Polypodiaceae indet.
Dupont in 1934 (MAU)

PORTULACACEAE

Portulaca hispida Bojer (This name does not seem to be validly published; perhaps *Portulaca mauritiensis* was the plant in hand)
Bojer 1835
Lionnet 1924

Portulaca mauritiensis v. Poelln.
Portulaca pilosa sensu auct. non (L.) DC.
Bojer 1837 (as *Portulaca pilosa*)

+*Portulaca oleracea* L. var. *oleracea*
Bojer 1835
Lionnet 1924
Dupont AG/12 (MAU) (S)
Stoddart 7293 (US) (S), 7294 (US) (S)

Portulaca pilosa (L.) DC.: *Portulaca mauritiensis* v. Poelln.

Portulaca sp.
Hilsenberg 1823
Mamet in 1955 (MAU) (S)

PSILOTACEAE

Psilotum nudum (L.) Beauv.
Psilotum triquetrum Sw.
Bojer 1835
Lionnet 1924 (as *Philotum triquetrum*)
Cheke, sight record, 1974 (S)
Dupont AG/22 (MAU)
Mamet in 1955 (MAU) (S)

RHAMNACEAE

+*Ziziphus mauritiana* Lam.
Zizyphus vulgaris Bojer
Zizyphus jujuba sensu auct. non Lam.
Bojer 1835 (as *Zizyphus vulgaris*)
Lionnet 1924 (as *Zizyphus vulgaris*)
Procter 4206 (MAHE) (S)
Mamet 1978, p. 106

Zizyphus vulgaris Bojer: see *Ziziphus mauritiana* Lam.

RHIZOPHORACEAE

Rhizophora mucronata Lam.
Wiehe in 1961, not collected, photograph only (MAU) (N)
Patel in 1974, not collected, photograph only (MAU) (N: Bassin Capucin)

ROSACEAE

+*Rosa indica* L.
Lionnet 1924, p. 76

RUBIACEAE

Guettarda speciosa L.
Guettarda indica Bojer. This name was apparently never validly published.
Bojer 1835 (as *Guettarda indica*)
Bojer 1837
Lionnet 1924 (as *Guettarda indica*)
Renvoize 1975
Cheke, sight (N)
Bojer (K)
Mamet in 1955 (MAU)
Stoddart 7257 (US) (S)

Morinda citrifolia L.
Bojer 1835
Lionnet 1924
Mamet 1936
Mamet 1978, p. 105
Cheke, sight (S)
Mamet in 1955 (MAU) (S)
Stoddart 7233 (US) (N), 7265 (US) (S)

RUTACEAE

+*Citrus aurantiifolia* (Christm.) Swingle
Mamet 1978, p. 105
Stoddart 7275 (US) (S)

+*Citrus aurantium* L.
Bojer 1835
Lionnet 1924 (as *Citreum aurantium*)
Mamet 1978, p. 105 (as *Citrus aurantium* var. *bigaradia* Loisel)

Citrus decumana L.: see *Citrus grandis* (L.) Osbeck

Citrus fusca Lour.: see *Citrus sinensis* (L.) Osbeck

+*Citrus grandis* (L.) Osbeck
Citrus decumana L.
Bojer 1835 (as *Citrus decumana*)
Lionnet 1924 (as *Citrium decumanum*)

+*Citrus limon* (L.) Burm f.
Citrus limonium Risso
Lionnet 1924 (as *Citreum limonium*)

+*Citrus medica* L.
Mamet 1978, p. 106

+*Citrus reticulata* Blanco
Citrus nobilis sensu auct. non Lour.
Lionnet 1924 (as *Citreum nobile*)

+*Citrus sinensis* (L.) Osbeck
Citrus fusca Lour
Bojer 1835 (as *Citrus fusca*)
Lionnet 1924 (as *Citreum fuscum*)

Evodia sp.
Dupont AG/8 (MAU)

SANTALACEAE

+*Santalum* sp.
Procter 4179 (MAHE) (S), 4180 (MAHE) (S)

SAPINDACEAE

Dodonaea viscosa L. var.
Dodonaea triquetra Wendl.
Dupont AG/10 (MAU)
Lionnet 1924 (as *Dodonaea triquetrum*)

+*Litchi chinensis* Sonner.
Lionnet 1922, p. 54 (as *Litchi sinensis*)

Cookilla punctata Lionnet
Lionnet 1924 (we are unable to find that this genus and species have ever been validly published, or to guess what plant Lionnet may have had in mind)

SCROPHULARIACEAE

Campuleia coccinea Hook.: see *Striga asiatica* (L) O. Ktze.

Striga asiatica (L.) O. Ktze.
Campuleia coccinea Hook.
Bojer 1835 (as *Campuleia coccinea*)
Lionnet 1924 (as *Campuleia coccinea*)
Mamet in 1955 (MAU) (N) (var. *hirsuta* Benth.)
Procter 4183 (MAHE) (S)
Stoddart 7229 (US) (N), 7284 (US) (S)

SOLANACEAE

+*Capsicum annuum* L.
Bojer 1835
Lionnet 1924 (as *Capsicum mammum*)
Mamet 1978, p. 106

+*Capsicum frutescens* L.
Bojer 1835
Lionnet 1924 (as *Capsicum frutiscens*)

+*Datura metel* L.
Stoddart 7260 (US) (S)

+*Datura stramonium* L. (Possibly really *Datura metal* but no specimen available)
Bojer 1835
Lionnet 1924

Lycopersicon esculentum Mill.: see *Solanum lycopersicum* L.

+*Nicotiana tabacum* L.
Bojer 1835

+*Solanum lycopersicum* L.
Lycopersicon esculentum Mill.
Bojer 1835 (as *Lycopersicum esculentum*)
Lionnet 1924 (as *Lycopersicum esculentum*)

+*Solanum melongena* L.
Bojer 1835
Mamet 1978, p. 107

+*Solanum nigrum* L.
Bojer 1835
Lionnet 1924
Stoddart 7238a (US) (N) (var. *americanum* Shulz)

+*Solanum tuberosum* L.
Bojer 1835
Lionnet 1924

STERCULIACEAE

Heritiera littoralis Ait.
Mamet in 1955 (MAU) (S: Le Jardin)

+*Melochia corchorifolia* L.
Lionnet 1924

+*Theobroma cacao* L.
Dupont 1883
Cheke, sight (S: Ste Rita)

+*Waltheria indica* L.
Mamet in 1955 (MAU) (S: Le Jardin)

SURIANACEAE

Suriana maritima L.
Hilsenger 1823
Bojer 1835
Lionnet 1922, p. 37; 1924
Cheke, sight (N, S)
Mamet in 1955 (MAU (N, S)
Stoddart 7254 (US) (N)

TILIACEAE

+*Corchorus aestuans* L.
Corchorus near *acutangulus*
Mamet in 1955 (MAU)(S: Le Jardin)

Triumfetta procumbens Forst.f.
Bojer 1835, 1837
Lionnet 1924
Renvoize 1975
Bojer (CGE)
Stoddart 7253 (US) (N)

Triumfetta sp.
Dupont in 1934 (MAU)
Mamet in 1955 (MAU) (S)

TURNERACEAE

+*Turnera ulmifolia* L.
Mamet in 1955 (MAU) (N)
Stoddart 7291 (US) (S), 7296 (US) (N)

URTICACEAE

Pipturus argenteus (Forst.f.)
Urtica alba sensu auct. non Bl.
Baker 1877
Bojer 1835 (as *Urtica alba*)
Lionnet 1924 (as *Urtica alba*)
Le Duc, Bouton, Skottsberg 1932
Renvoize 1975
Dupont in 1934 (MAU) (as Pipturus sp.)
Mamet in 1955 (MAU) (S)
Stoddart 7252 (US) (N)

Urtica alba sensu auct. non Nl.: see *Pipturus argenteus* (Forst.f.) Wedd.

Urticaceae? indet.
Mamet in 1955 (MAU) (S)

VERBENACEAE

+*Lantana camara* var. *aculeata* (L.) Mold.
Mamet 1978, p. 106 (as *Lantana* sp.)
Stoddart 7277 (US) (S)

+*Lippia nodiflora* (L.) Rich.?
Zapania stolonifera Bojer (apparently not validly published)
Bojer 1835 (as *Zapania stolonifera*)
Lionnet 1924 (as *Zanapia stolonifera*)

+*Stachytarpheta jamaicensis* (L.) Vahl
Stoddart 7290 (US) (S), 7295 (US) (N)

Zapania stolonifera Bojer: see *Lippia nodiflora* (L.) Rich.

VITIDACEAE

+*Vitis vinifera* L.
Bojer 1835
Lionnet 1924

ZINGIBERACEAE

+*Zingiber officinale* Roscoe
Bojer 1835 (as *Zinziber officinale*)
Lionnet 1924 (as *Zinziber officiale*)

+*Zingiber zerumbet* (L.) Roscoe
Bojer 1835 (as *Zinziber zerumbet*)
Lionnet 1924 (as *Zinziber zerumbet*)

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6. LIST OF PLANTS COLLECTED ON COETIVY ISLAND, SEYCHELLES

by S. A. Robertson and F. R. Fosberg

Introduction

A visit was made by Robertson to Coetivy Island from 27 February to 3 March 1980. During that time as many parts of the island as possible were visited and a plant collection was made. 99 species were collected and another 22 noted, including crops but not obvious garden ornamentals. Two sets were made, one of which is incorporated in the Herbarium of the Ministry of Agriculture, Mahe, Seychelles, and the other lodged with the Herbarium, Royal Botanic Gardens, Kew, England. The first author is indebted to the Director, Royal Botanic Gardens, and his staff, in particular Mr S. Renvoize, for verifying the identifications. Included in the list are those species noted as occurring on Coetivy by Renvoize (1975); these are indicated by the abbreviation R. Most of them derive from the collections made by Gwynne and Wood (1969). Fosberg has been responsible for checking the nomenclature used, which conforms to that in others of this series of papers. Where these names differ from those used by Robertson (in press), the latter are given as synonyms. Families in the list are arranged alphabetically.

Coetivy (Figure 7) is a large sand cay of about 900 ha, 9.8 km long and 1.6 km wide at its widest point, aligned approximately north-east/southwest. The fringing reef is narrow and the main pass and settlement are slightly south of the mid point of the west coast. Coetivy is about 250 km south-south-east of Mahe and was named after the Chevalier de Coetivy, who sighted it on 3 July 1771. It is run as a coconut plantation.

The island is hedged with the usual beach-crest thicket of *Scaevola sericea*. This varies in width around the island and is greatest on the eastern coast. The northern and eastern parts of the island have the best soils and are covered with tall dense old coconut palms with a lush undergrowth of *Nephrolepis biserrata, Pipturus argenteus* and germinating

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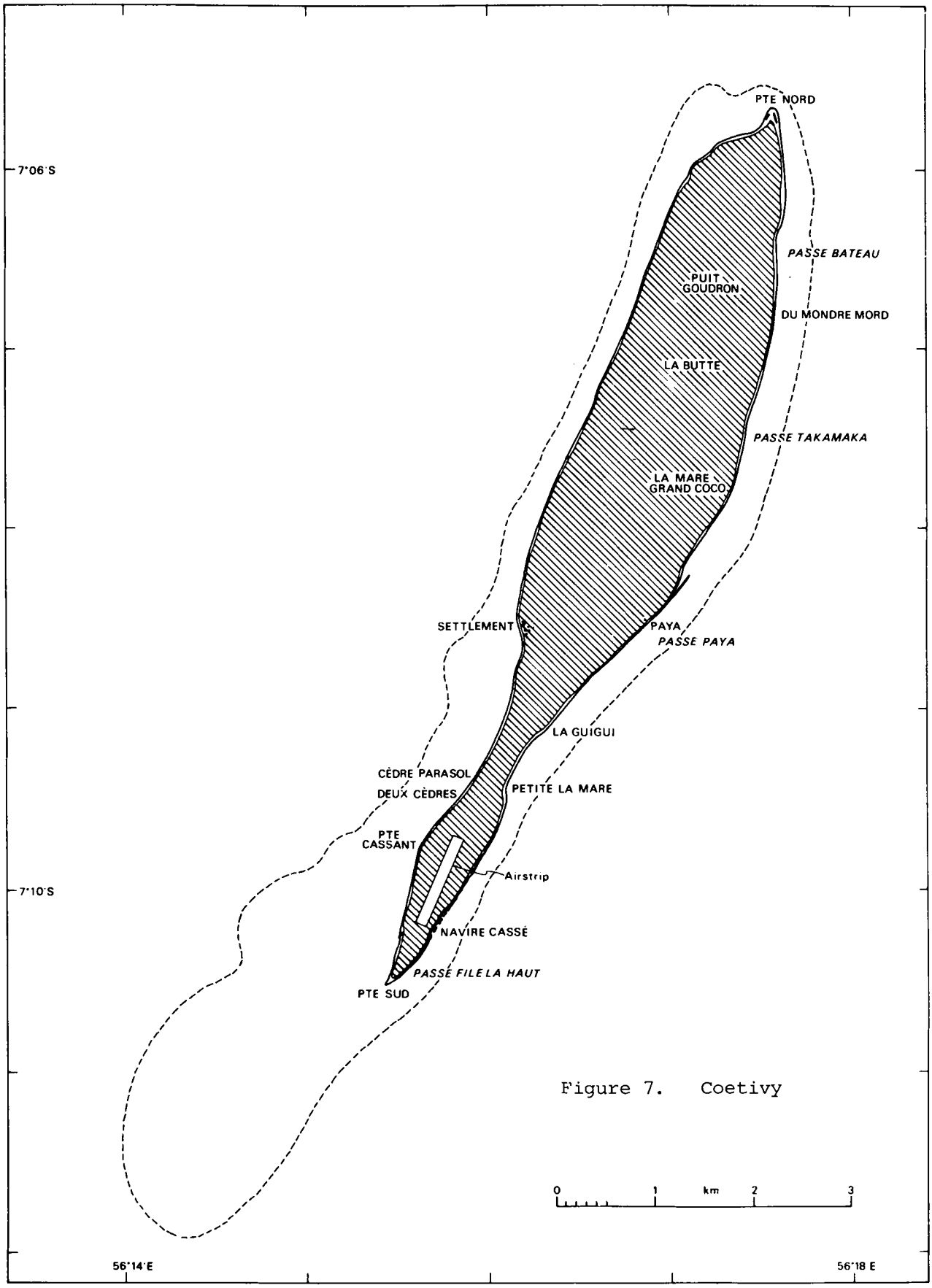

Figure 7. Coetivy

coconuts. The southern and western areas have very poor soil, almost pure sand, with stunted coconuts intermixed with *Scaevola sericea* and the ground sparsely covered with *Fimbristylis cymosa* and *Eragrostis subaequiglumis* tussocks. There were no planted coconuts south of the airstrip, and this area is thickly covered with *Scaevola sericea* and *Cordia subcordata* matted with *Cassytha filiformis* and *Canavalia cathartica*. There are several large dunes, up to 10 metres high, scattered over the island, and some fresh-water marshes, the largest being behind the settlement and reputed in island lore to be bottomless.

Plantations of exotic tree species such as *Tabebuia heterophylla*, *Neisosperma oppositifolia* and *Adenanthera pavonia* have been established in various parts of the island and have self-seeded successfully. *Casuarina equisetifolia* is, however, the most common tree after *Cocos nucifera*.

Of interest were the small herd of feral donkeys which graze the open areas, the frigate bird roosting colony in tall old coconut palms just south of La Butte (the large central dune), and the relative scarcity of land birds. Only Barred Ground Doves, partridges, egrets and migrant European Rollers were seen. There were no skinks but an abundance of grasshoppers, butterflies and day-flying moths.

The first author would like to thank the Government of Seychelles for permission to visit and collect on the island, and the island staff for their hospitality.

List of plants

ACANTHACEAE

Asystasia genetica (L.) T. Anders. ?
Robertson 3155, on imported pile of red soil at settlement

AGAVACEAE

Agave sisalana Perrine
Robertson, sight

Furcraea foetida (L.) Haw.
Robertson, sight

AMARANTHACEAE

Alternanthera sessilis R. Br.
Robertson 3095, marsh behind settlement; R

Amaranthus dubius Mart. ex Thell.
Robertson 3096, settlement

Achyranthes aspera L.
R; not seen by Robertson

ANNONACEAE

Annona squamosa L.
Robertson, sight

APOCYNACEAE

Catharanthus roseus (L.) G. Don
Robertson 3091, settlement

Neisosperma oppositifolia (Lam.) Fosb. & Sachet
Ochrosia oppositifolia (Lam.) K. Schum.
Robertson 3136, La Mare Gran Coco

ARACEAE

Alocasia macrorhiza (L.) G. Don
Robertson, sight

Colocasia esculenta (L.) Schott
Robertson, sight

ARECACEAE (PALMAE)

Cocos nucifera L.
Robertson, sight; over whole island

ASTERACEAE (COMPOSITAE)

Tridax procumbens L.
Robertson 3074, south of airstrip; R

Vernonia cinerea Less.
Robertson 3092, settlement; R

BIGNONIACEAE

Tabebuia heterophylla Britt.
Tabebuia pallida (Lindl.) Miers
Robertson 3153, central area, Chemin Barwills

BORAGINACEAE

Cordia subcordata Lam.
Robertson 3059, south of airstrip

Tournefortia argentea L.f.

Robertson 3182, eastern part on dune; R

CAMPANULACEAE

Hippobroma longiflora (L.) G. Don
Isotoma longiflora Presl
Robertson 3088, settlement; R

CAPPARIDACEAE

Cleome viscosa L.
Robertson, sight, settlement; R

CARICACEAE

Carica papaya L.
Robertson, sight

CASUARINACEAE

Casuarina equisetifolia L.
Robertson 3080, south of airstrip; R

CLUSIACEAE (GUTTIFERAE)

Calophyllum inophyllum L.
Robertson 3119, plantation in nothern part of island; R

COMBRETACEAE

Terminalia catappa L.
Robertson 3138, Chemin Le Parc; R

COMMELINACEAE

Commelina benghalensis L.
Robertson 3141, settlement

CONVOLVULACEAE

Ipomoea macrantha Roem. & Schultes
Robertson 3070, edge of airstrip; R

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers.
Bryophyllum pinnatum (Lam.) Oken
Robertson 3082, between airstrip and settlement; R

CUCURBITACEAE

Momordica charantia L.
Robertson, sight

Trichosanthes cucumerina L.
Robertson, sight

CYPERACEAE

Cyperus aromaticus (Ridl.) Mattf. & Kük.
Kyllinga polyphylla Willd. ex Kunth
Robertson 3100, behind settlement

Cyperus brevifolius (Rottb.) Hassk.
Kyllinga colorata (L.) Druce
Robertson 3106, marsh behind settlement

Cyperus cartilagineus (K. Schum.) Mattf. & Kük.
Kyllinga cartilaginea K. Schum.
R

Cyperus cristatus (Kunth.) Mattf. & Kük.
Kyllinga alba Nees
Robertson 3099, behind settlement

Cyperus dubius Rottb.
Mariscus dubius (Rottb.) Fisch.
Robertson 3079, north end of airstrip

Cyperus erectus (Schumacher) Mattf. & Kük.
Kyllinga erecta Schumacher
R

Cyperus kyllingia Endl.
Kyllinga nemoralis (Forst.) Dandy ex Hutch.
Robertson 3107, garden in settlement

Cyperus ligularis L.
Mariscus ligularis (L.) Urb.
Robertson 3055, south of airstrip

Cyperus maculatus Boeck.
Robertson 3086, behind settlement

Cyperus polystachyos Rottb.
Pycreus polystachyos (Rottb.) P. Beauv.
Robertson 3101, marsh behind settlement; R

Cyperus rotundus L.
Robertson 3104, settlement

Fimbristylis complanata (Retz.) Link
Robertson 3105, marsh behind settlement

Fimbristylis cymosa R. Br.
Robertson 3063, over whole island; R (as *F. dichotoma*)

DIOSCOREACEAE

Dioscorea alata L.
Robertson 3151, northern area

EUPHORBIACEAE

Acalypha indica L.
Robertson 3146, settlement

Euphorbia hirta L.
Robertson 3084, settlement

Euphorbia prostrata Ait. ?
Robertson 3147, settlement

Pedilanthus tithymaloides (L.) Poit.
Robertson 3118, settlement

Phyllanthus amarus Schum. & Thonn.
Robertson 3083, between airstrip and settlement

Phyllanthus maderaspatensis L.
Robertson 3087, settlement; R

FABACEAE (LEGUMINOSAE)

Abrus precatorius L.
Robertson 3157, in imported heap of red soil at settlement

Adenanthera pavonina L.
Robertson 3123, in old fruit garden in northern area

Caesalpinia bonduc (L.) Roxb.
Robertson 3133, near old house at Paya, east coast

Canavalia cathartica Thouars
Robertson 3060, south of airstrip

Cassia occidentalis L.
Robertson 3144, settlement

Delonix regia (Boj.) Raf.
Robertson 3126, in old fruit garden, northern part

Desmanthus virgatus (L.) Willd.
Robertson 3127, in old fruit garden, northern part

Desmodium triflorum DC.
Robertson 3156, on imported heap of red soil at settlement

Leucaena leucocephala (Lam.) de Wit
Robertson 3132, near old house at Paya, east coast

Mimosa pudica L.
Robertson 3158, on imported heap of red soil at settlement

Pithecellobium unguis-cati Benth.
Robertson 3143, settlement

Tamarindus indica L.
Robertson 3150, in old fruit garden, northern part

Vigna unguiculata (L) Walp.
Robertson, sight

GOODENIACEAE

Scaevola sericea Vahl
Robertson 3069, beach crest thicket; R (as *S. taccada*)

HERNANDIACEAE

Hernandia sonora L.
Hernandia nymphaeifolia (Presl) Kubitzki
Robertson 3057, south of airstrip; R (as *H. peltata*)

LAMIACEAE (LABIATAE)

Leonotis nepetaefolia (L.) R. Br.
Robertson 3130, settlement

Ocimum basilicum L.
Robertson, sight

LAURACEAE

Cassytha filiformis L.
Robertson 3064, south of airstrip; R

LECYTHIDACEAE

Barringtonia asiatica (L.) Kurz
Robertson 3103, settlement; R

LILIACEAE (sensu lato)

Crinum macowanii Baker
Robertson 3131, settlement

Yucca sp.
Robertson, sight; ornamental

MALVACEAE

Gossypium hirsutum L.
Robertson 3117, settlement

Malvastrum coromandelianum (L.) Garcke
Robertson 3125, northern lush part near path

Sida pusilla Cav.
Robertson 3077, south of airstrip; R (as *S. parvifolia*

Sida stipulata Cav.
Robertson 3159, settlement

MORACEAE

Artocarpus altilis (Park.) Fosb.
Robertson, sight

Ficus benghalensis L.
Robertson 3120, northern part near old fruit garden

MORINGACEAE

Moringa oleifera Lam.
Robertson, sight

MUSACEAE

Musa spp.
Robertson, sight

NYCTAGINACEAE

Boerhavia repens L.
Robertson 3061, south of airstrip

Mirabilis jalapa L.
Robertson 3129, settlement

ORCHIDACEAE

Vanilla mexicana Miller
Robertson, sight

OXALIDACEAE

Averrhoa bilimbi L.
Robertson, sight

PANDANACEAE

Pandanus utilis Bory
Robertson 3108, behind settlement

PAPAVERACEAE

Argemone mexicana L.
Robertson 3140, settlement

PASSIFLORACEAE

Passiflora suberosa L.
Robertson 3090, behind settlement; R

POACEAE (GRAMINEAE)

Cenchrus echinatus L.
Robertson, 3128, settlement

Cynodon dactylon (L.) Pers.
Robertson 3089, settlement

Dactyloctenium ctenoides (Steud.) Bosser
Dactyloctenium pilosum Stapf.
Robertson 3058, 3065, 3139, southern part on paths; very variable;

Digitaria didactylia Willd.
Robertson 3097, settlement

Digitaria setigera Roth
Robertson 3066, south of airstrip

Eleusine indica (L.) Gaertn.
Robertson 3122, northern lush part on path

Eragrostis ciliaris (L.) R. Br.
Robertson 3071, south of airstrip

Eragrostis subaequiglumis Renv.
Robertson 3072, 3073, common all over the island on poor soil

Eragrostis tenella (L.) P. Beauv.
Robertson 3078, 3112, northern end of airstrip and in north of island; R

Lepturus repens (G. Forst.) R. Br.
Robertson 3054, sand spit at south end of island; R

Panicum maximum Jacq.
Robertson, sight, settlement garden

Panicum subquadriparum Trin.
Brachiaria subquadripara (Trin.) Hitchc.
Robertson 3154, La Mare Gran Coco

Stenotaphrum dimidiatum (L.) Brongn.
Robertson 3085, behind settlement; R

Stenotaphrum micranthum (Desf.) Hubb.
Robertson 3134, La Mare Gran Coco

POLYPODIACEAE (sensu lato)

Acrostichum aureum L.
Robertson 3110, marsh behind settlement; R

Asplenium nidus L.
Robertson 3115, northern area; R

Nephrolepis biserrata (Swartz) Schott
Robertson 3109, behind settlement; R

Polypodium scolopendria Burm.f.
Robertson 3102, behind settlement; R

Pteris tripartita Sw.
Robertson 3135, La Mare Gran Coco; R

PORTULACACEAE

Portulaca oleracea L.
Robertson 3137, east coast north of Paya; R

POTAMOGETONACEAE

Halodule uninervis (Forssk.) Aschers.
R; not seen by Robertson

PSILOTACEAE

Psilotum nudum (L.) Beauv.
Robertson 3094, behind settlement; R

RUBIACEAE

Guettarda speciosa L.
RObertson 3113, north part of island

Morinda citrifolia L.
Robertson 3098, between airstrip and settlement; R

RUTACEAE

Citrus aurantiifolia (Christm.) Swingle
Robertson, sight

SAPINDACEAE

Dodonaea viscosa Jacq.
Robertson 3116, west side of island north of settlement, near old house

SCROPHULARIACEAE

Striga asiatica (L.) Kuntze
Robertson 3062, south of airstrip; R

SOLANACEAE

Datura metel L.
Robertson 3142, settlement

Physalis micrantha Link
Robertson 3145, settlement

Solanum melongena L.
Robertson, sight

Solanum nigrum L.
Robertson 3093, settlement

STERCULIACEAE

Heritiera littoralis Dryand.
Robertson 3149, marsh behind settlement

SURIANACEAE

Suriana maritima L.
Robertson 3067, south of airstrip; R

TILIACEAE

Triumfetta procumbens Forssk.
Robertson 3056, beach crest at south end of island; R

TURNERACEAE

Turnera ulmifolia L.
Robertson 3068, south of airstrip; R

URTICACEAE

Pilea microphylla (L.) Liebm.
Robertson 3121, north part near old fruit garden

Pipturus argenteus (Forssk.) Wedd.
Robertson 3114, north part of island; R

VERBENACEAE

Lantana camara L.
Robertson 3124, north part near old fruit garden

Lippia nodiflora (L.) Rich.
Robertson 3075, south of airstrip; R

Stachytarpheta jamaicensis (L.) Vahl
Robertson 3081, between airstrip and settlement; R

Stachytarpheta urticaefolia Sims
Robertson 3111, settlement

References

Gwynne, M. D. and Wood, D. 1969. Plants collected on islands in the western Indian Ocean during a cruise of the M.F.R.V. "Manihine", Sept.-Oct. 1967. *Atoll Res. Bull.* 134, 1-15.

Renvoize, S. A. 1975. A floristic analysis of the western Indian Ocean coral islands. *Kew Bull.* 30, 133-152.

Robertson, S. A. In press. *The flowering plants of Seychelles: an annotated check list, including Gymnosperms, with line drawings.* St Louis: Missouri Botanical Garden.

7. LIST OF PLANTS COLLECTED ON PLATTE ISLAND, SEYCHELLES

by S. A. Robertson and F. R. Fosberg

Introduction

On 26 February 1980 a visit was made to Platte Island, Seychelles, by the first author, and during the three hours spent there as many plant species were collected as possible. No crop plants or obvious garden ornamentals were taken. Two sets of plants were collected, one of which is incorporated in the Herbarium, Ministry of Agriculture, Mahe, Seychelles, and the other lodged with the Herbarium, Royal Botanic Gardens, Kew, England. The first author is indebted to the Director, Royal Botanic Gardens, and his staff, in particular Mr S. Renvoize, for verifying the identifications. Families in the following list have been arranged alphabetically. The names used have been checked by Fosberg and conform to the usage of others in this series of papers. There the names adopted here differ from those used by Robertson (in press), the latter are given as synonyms.

Platte (Figure 8) is a small sand cay, aptly named, about 125 km south of Mahe, surrounded by an extensive fringing reef. It is about 65 ha in extent and is run as a coconut plantation. There is a small settlement on the west coast with the manager's house and a few guest cottages to the northwest. There is a serviceable grass airstrip aligned southeast/northwest and approximately 900 m long.

The vegetation pattern is similar to that of other sand cays in the Seychelles, with beach crest colonisers *Ipomoea pes-caprae* and *Sporobolus virginicus* backed by a thicket of *Scaevola sericea* and *Guettarda speciosa* which extends slightly into the coconut plantation. A mixture of herbs and small shrubs forms an undergrowth of varying density beneath the palms. The list of plants is certainly incomplete but there are some surprising gaps in it, notably *Stenotaphrum dimidiatum, Morinda citrifolia, Asystasia gangetica* and *Triumfetta procumbens,* all of which are found in the Amirantes to the west and on

Atoll Research Bulletin No. 273: 157-164, 1983.

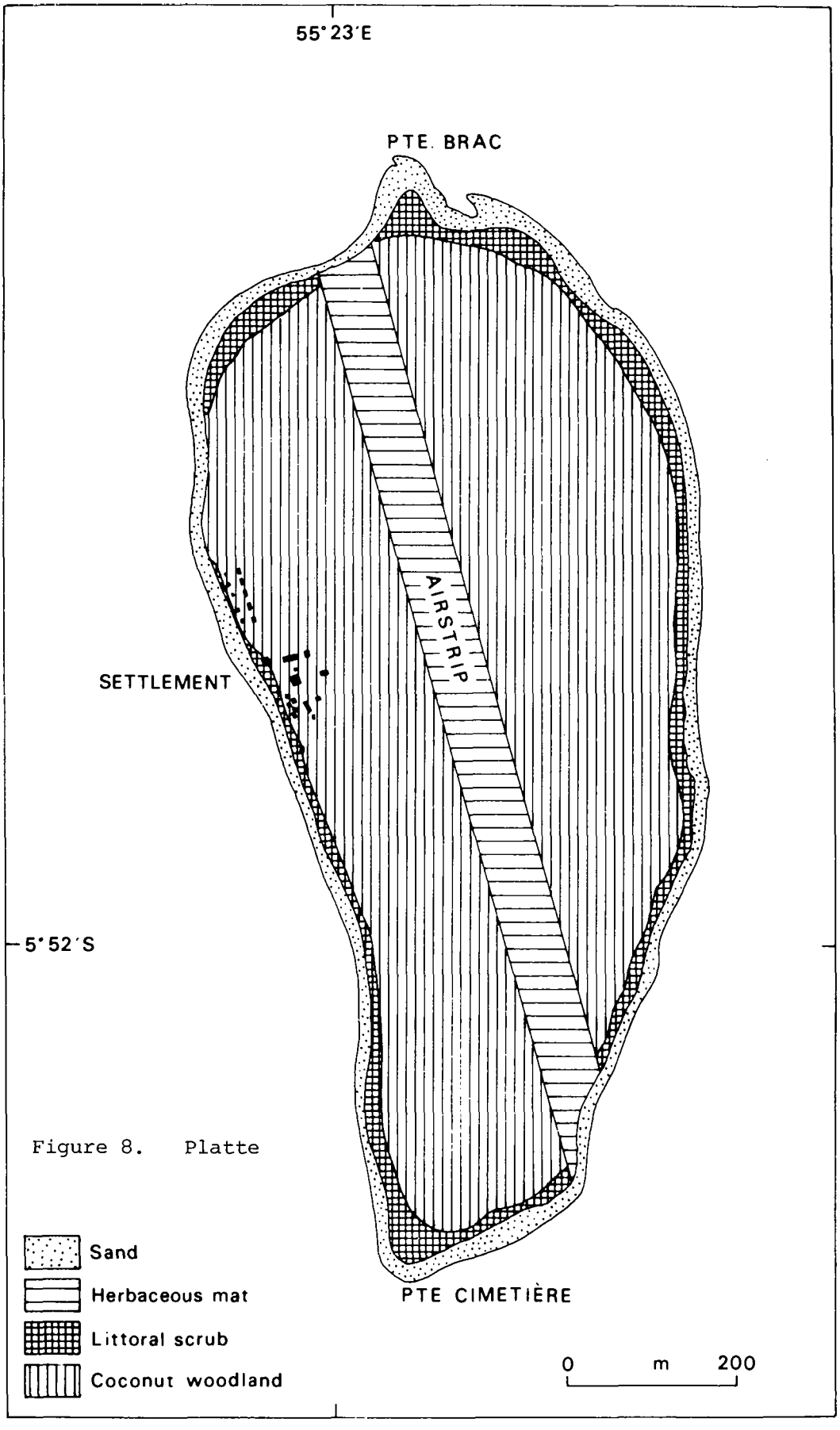

Figure 8. Platte

Coetivy to the south. As far as we are aware this is the first plant collection made from this island.

The first author would like to thank Mr G. Savy for permission to visit Platte and collect plants there, and the Government of Seychelles for assistance in reaching the island.

List of plants

AMARANTHACEAE

Achyranthes aspera L.
Robertson 3021

Amaranthus dubius Mart. ex Thell.
Robertson 3012

APOCYNACEAE

Catharanthus roseus (L.) G. Don
Robertson 3010

ARECACEAE (PALMAE)

Cocos nucifera L.
Robertson, sight

BORAGINACEAE

Cordia subcordata Lam.
Robertson 3050

Tournefortia argentea L.f.
Robertson 3032

CARYOPHYLLACEAE

Drymaria cordata (L.) Roem. and Schultes
Robertson 2998

CASUARINACEAE

Casuarina equisetifolia L.
Robertson 3007

COMPOSITAE

Vernonia cinerea Less.
Robertson 3045

CONVOLVULACEAE

Ipomoea macrantha Roem. & Schultes
Robertson 3036

Ipomoea pes-caprae (L.) R. Br.
Robertson 3029

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers.
Bryophyllum pinnatum (Lam.) Oken
Robertson 3038

CYPERACEAE

Cyperus dubius Rott.
Mariscus dubius (Rottb.) Fisch.
Robertson 3047

Cyperus kyllingia Endl.
Kyllingia nemoralis (Forst.) Dandy ex Hutch.
Robertson 2999

Cyperus ligularis L.
Mariscus ligularis (L.) Urb.
Robertson 3041

Fimbristylis cymosa R. Br.
Robertson 3019

EUPHORBIACEAE

Acalypha indica L.
Robertson 3044

Eurphorbia hirta L.
Robertson 3048

Euphorbia prostrata Ait. ?
Robertson 3011

Pedilanthus tithymaloides (L.) Poit.
Robertson 3041

Phyllanthus amarus Schum. & Thonn.
Robertson 3000

Phyllanthus maderaspatensis L.
Robertson 3026

FABACEAE (LEGUMINOSAE)

Cassia occidentalis L.
Robertson 3008

Leucaena leucocephala (Lam.) de Wit
Robertson 3005

GOODENIACEAE

Scaevola sericea Vahl
Robertson 3053

HERNANDIACEAE

Hernandia sonora L.
Hernandia nymphaeifolia (Presl) Kubitzki
Robertson 3034

LAURACEAE

Cassytha filiformis L.
Robertson 3006

LILIACEAE (sensu lato)

Haemanthus multiflorus Martyn ssp. *multiflorus*
Scadoxus multiflorus (Martyn) Raf.
Robertson 3053

MALVACEAE

Hibiscus tiliaceus L.
Robertson 3003

Sida acuta Burm.f.
Robertson 3009

Sida pusilla Cav.
Robertson 3017

Sida stipulata Cav.
Robertson 3014

NYCTAGINACEAE

Boerhavia repens L.
Robertson 3035

PASSIFLORACEAE

Passiflora suberosa L.
Robertson 3042

POACEAE (GRAMINEAE)

Cynodon dactylon (L.) Pers.
Robertson 3002

Dactyloctenium ctenoides (Steud.) Bosser
Robertson 3037

Digitaria setigera Rotn.
Robertson 3013

Eleusine indica (L.) Gaertn.
Robertson 3016

Eragrostis subaequiglumis Renv.
Robertson 3018

Lepturus repens (G. Forst.) R. Br.
Robertson 3025

Sporobolus virginicus (L.) Kunth
Robertson 3028

Stenotaphrum micranthum (Desf.) C. E. Hubb.
Robertson 3027

POLYPODIACEAE (sensu lato)

Nephrolepis biserrata (Swartz) Schott
Robertson 3023

Polypodium scolopendria (Burm.f.) Copel.
Microsorium scolopendria (Burm.f.) Copel.
Robertson 3022

PORTULACACEAE

Portulaca oleracea L.
Robertson 3033

PSILOTACEAE

Psilotum nudum (L.) Beauv.
Robertson 3020

RHAMNACEAE

Colubrina asiatica L.
Robertson 3004

RUBIACEAE

Guettarda speciosa L.
Robertson 3039

SCROPHULARIACEAE

Striga asiatica (L.) Kuntze
Robertson 3031

SOLANACEAE

Datura metel L.
Robertson 3043

Solanum nigrum L.
Robertson 3015

SURIANACEAE

Suriana maritima L.
Robertson 3030

TURNERACEAE

Turnera ulmifolia L.
Robertson 3046

URTICACEAE

Laportea aestuans (L.) Chew
Robertson 3040

Pipturus argenteus (Forst.) Wedd.
Robertson 3024

VERBENACEAE

Lippia nodiflora (L.) Rich.
Robertson 3001

Stachytarpheta jamaicensis (L.) Vahl
Robertson 3049

Reference

Robertson, S. A. In press. *The flowering plants of Seychelles: an annotated check list, including Gymnosperms, with line drawings.* St Louis: Missouri Botanical Garden.

8. LIST OF PLANTS OF POIVRE ISLAND, AMIRANTES

by S. A. Robertson and F. R. Fosberg

Introduction

A visit was made to Poivre by the first author on the 26 and 27 October 1976, and during these two days as many parts of the two islands (Figure 9) were visited as possible and a plant collection made. 58 specimens were collected and another 26 noted, including crop plants and some garden ornamentals. Two sets were made, one of which was incorporated in the Herbarium of the Ministry of Agriculture, Mahe, Seychelles, and the other lodged with the Herbarium, Royal Botanic Gardens, Kew, U.K. The first author is indebted to the Director, Royal Botanic Gardens, and his staff, in particular Mr S. Renvoize, for verifying the identifications. Noted in the list are those species given as occurring on Poivre by Piggott (1969).

Poivre, named after the famous Pierre Poivre, is part of the Amirantes, 240 km from Mahe, and consists of two islands, Poivre itself (110 ha) and South Island or Ile du Sud (135 ha), with an encircling reef formation. Piggott (1969) gives a good account of the islands as he found them on 26-30 October 1960, with comments on the morphology, soils, ecology and agriculture. Sixteen years later the islands were much as he described them, with the important difference that, the ownership having changed, the agriculture had been greatly improved, with replanting of coconuts, use of fertilisers, more crops being grown, and cattle and pigs kept. There had also been some involvement with tourism.

The first author would like to thank the owners of Poivre, and the managers, Mr F. Huala and Mr A. Bonnelame, for their great assistance and hospitality during the visit.

In the following list families are arranged alphabetically. The names used have been checked by Fosberg and conform to the usage of other papers in this series of papers. Where the names adopted here

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Atoll Research Bulletin No. 273: 165-176, 1983.

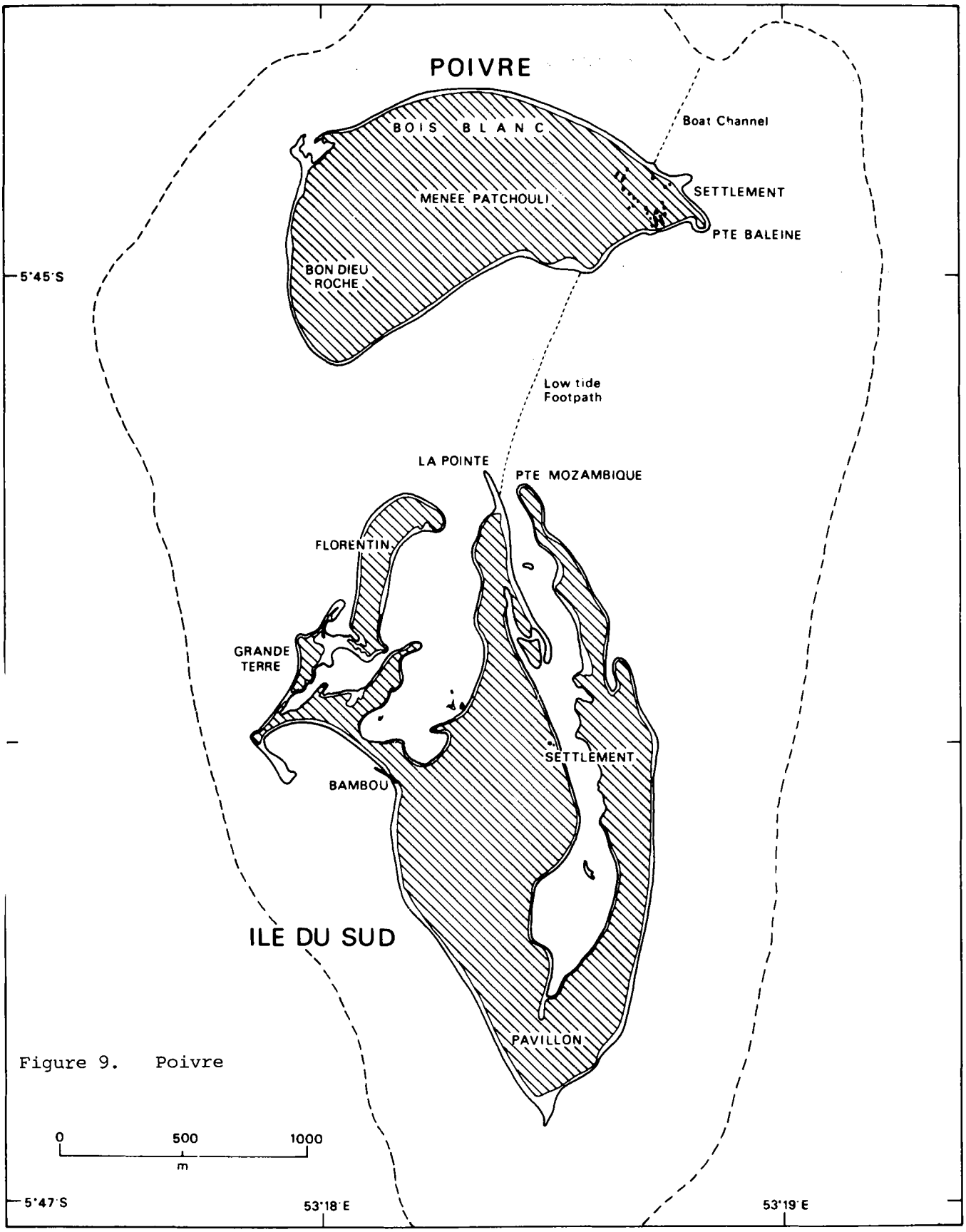

Figure 9. Poivre

differ from those used by Robertson (in press), the latter are given as synonyms.

List of plants

AGAVACEAE

Furcreae foetida (L.) Haw
Robertson, sight

AMARANTHACEAE

Achyranthes aspera L.
Robertson 2344

Amaranthus dubius Thell.
Robertson 2363

ANACARDIACEAE

Spondias dulcis Parkinson
Spondias cytherea Sonn.
Robertson, sight

ANNONACEAE

Annona squamosa L.
Robertson, sight

APOCYNACEAE

Catharanthus roseus (L.) G. Don
Robertson 2335

Plumeria rubra L.
Robertson, sight

ARACEAE

Alocasia macrorrhiza (L.) G. Don ?
Robertson, sight

ARECACEAE (PALMAE)

Cocos nucifera L.
Robertson, sight

BORAGINACEAE

Cordia subcordata Lam.
Robertson, sight

Heliotropium indicum L.
Robertson 2329

Tournefortia argentea L.f.
Piggott, sight; Robertson 2353

CAPPARIDACEAE

Cleome gynandra L.
Robertson 2364

CARICACEAE

Carica papaya L.
Piggott, sight; Robertson, sight

CASUARINACEAE

Casuarina equisetifolia L.
Piggott, sight; Robertson 2384

CLUSIACEAE (GUTTIFERAE)

Calophyllum inophyllum L.
Robertson, sight

COMBRETACEAE

Terminalia catappa L.
Robertson, sight

COMMELINACEAE

Commelina longifolia Lam.
Robertson 2365

COMPOSITAE

Bidens pilosa L.
Robertson 2389

Synedrella nodiflora (L.) Gaertn.
Robertson 2338

Tridax procumbens L.
Robertson 2346

Vernonia cinerea (L.) Less.
Robertson 2374

CONVOLVULACEAE

Ipomoea pes-caprae (L.) R. Br.
Robertson 2341

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers.
Bryophyllum pinnatum (Pers.) S. Kurz
Robertson 2350

CUCURBITACEAE

Cucurbita moschata (Duch. ex Lam.) Duch ex Poir.
Robertson, sight

Momordica charantia L.
Robertson 2373

CYPERACEAE

Cyperus brevifolius (Rottb.) Hassk.
Kyllinga colorata (L.) Druce
Robertson 2372

Cyperus cristatus (Kunth) Mattf. & Kük.
Kyllinga alba Nees
Robertson 2349

Cyperus dubius Rottb.
Mariscus dubius (Rottb.) Fischer
Robertson 2370

Cyperus ligularis L.
Mariscus ligularis (L.) Urb.
Robertson 2340

Fimbristylis cymosa R. Br.
Robertson 2386

EUPHORBIACEAE

Acalypha indica L.
Robertson 2380

Codiaeum variegatum (L.) Blume
Robertson, sight

Euphorbia cyathophora Murr.
Robertson 2356

Euphorbia hirta L.
Robertson 2382

Euphorbia prostrata Ait. ?
Robertson 2376

Manihot esculenta Crantz
Robertson, sight

Pedilanthus tithymaloides (L.) Poit.
Robertson, sight

Phyllanthus amarus Schum. & Thonn.
Robertson 2345

Phyllanthus maderaspatensis L.
Robertson 2352

FABACEAE (LEGUMINOSAE)

Adenanthera pavonina L.
Robertson, sight

Albizia lebbeck (L.) Benth.
Robertson 2375

Canavalia cathartica Thouars ?
Robertson, sight

Cassia occidentalis L.
Robertson 2366

Desmodium incanum DC.
Desmodium canum (J.F. Gmel.) Schinz & Thell.
Robertson 2367

Leucaena leucocephala (Lam.) de Wit
Robertson 2330

Pithecellobium unguis-cati (L.) Benth.
Robertson, sight

GOODENIACEAE

Scaevola sericea Vahl
Piggott, sight; Robertson 2334

HERNANDIACEAE

Hernandia sonora L.
Hernandia nymphaeifolia (Presl.) Kubitski
Piggott, sight; Robertson 2383

LAURACEAE

Cassytha filiformis L.
Robertson, sight

LILIACEAE (sensu lato)

Zephyranthes rosea Lindl.
Robertson, sight

LYTHRACEAE

Pemphis acidula Forst.
Piggott, sight; Robertson 2385

MALVACEAE

Gossypium hirsutum L.
Robertson, sight

Sida acuta Burm. f.
Robertson 2361, 2362

Sida pusilla Cav.
Robertson 2354

MORACEAE

Artocarpus altilis (Park.) Fosb.
Robertson, sight

Ficus benghalensis L.
Robertson, sight

MORINGACEAE

Moringa oleifera Lam.
Robertson, sight

MUSACEAE

Musa spp.
Robertson, sight

NYCTAGINACEAE

Bougainvillea spectabilis Willd.
Robertson, sight

PASSIFLORACEAE

Passiflora suberosa L.
Robertson 2381

POACEAE (GRAMINEAE)

Cenchrus echinatus L.
Robertson, sight

Dactyloctenium ctenoides (Steud.) Bosser
Robertson 2331, 2368

Digitaria horizontalis Willd.
Robertson 2371

Eleusine indica (L.) Gaertn.
Robertson 2332, 2360

Eragrostis subaequiglumis Renvoize
Robertson 2379

Eragrostis tenella (L.) P. Beauv.
Robertson 2347

Lepturus repens (G. Forst.) R. Br.
Robertson 2333

Panicum maximum L.
Robertson, sight

Stenotaphrum dimidiatum (L.) Brongn.
Piggott, sight; Robertson 2377

POLYPODIACEAE (sensu lato)

Asplenium nidus L.
Piggott, sight

Nephrolepis biserrata (Swartz) Schott
Robertson 2351

PORTULACACEAE

Portulaca oleracea L.
Robertson 2339

PSILOTACEAE

Psilotum nudum (L.) Beauv.
Robertson 2342

RHIZOPHORACEAE

Rhizophora mucronata Lam.
Robertson 2359 Piggott, sight

RUBIACEAE

Guettarda speciosa L.
Robertson 2357

Morinda citrifolia L.
Robertson 2387

RUTACEAE

Citrus spp.
Robertson, sight

SCROPHULARIACEAE

Striga asiatica (L.) Kuntze
Robertson 2348

SOLANACEAE

Datura metel L.
Robertson 2336

SURIANACEAE

Suriana maritima L.
Robertson 2358

TILLIACEAE

Triumfetta procumbens Forst.f.
Robertson 2388

TURNERACEAE

Turnera ulmifolia L.
Robertson 2355

URTICACEAE

Laportea aestuans (L.) Chew
Robertson 2337

Pilea microphylla (L.) Leibm.
Robertson 2343

VERBENACEAE

Lippia nodiflora (L.) Rich.
Robertson 2378

Stachytarpheta jamaicensis (L.) Vahl
Robertson 2369

References

Piggott, C. J. 1969. *A report on a visit to the Outer Islands of Seychelles between October and November 1960*. Tolworth: Directorate of Overseas Surveys, Land Resources Division, vi, 122 pp.

Robertson, S. A. In press. *The flowering plants of Seychelles: an annotated check list, including Gymnosperms, with line drawings*. St Lous: Missouri Botanical Garden.

9. LIST OF PLANTS COLLECTED ON ALPHONSE ISLAND, AMIRANTES

by I. A. D. Robertson, S. A. Robertson and F. R. Fosberg

Introduction

On 28 May 1979 Ian Robertson visited Alphonse to investigate the coconut pest situation, and during this visit made a collection of plants. These were given numbers in Mrs Ann Robertson's series and have been deposited in the Herbarium, Ministry of Agriculture, Mahe, Seychelles, or in the Herbarium, Royal Botanic Gardens, Kew. The first author would like to thank the owners of Alphonse for permission to collect. Fosberg has been responsible for checking the nomenclature used, which conforms to that in others of this series of papers. Where the names used differ from those given by Robertson (in press), the latter are given as synonyms. Mrs Robertson thanks the Director and staff of the Royal Botanic Gardens, Kew, for assistance with the identifications.

Alphonse Island (Figure 10) is a sand cay on the northeast rim of an atoll in the southern Amirantes. It has an area of 172 ha.

List of plants

AGAVACEAE

Agave sisalana (Perr. ex Engelmann) Drumm. and Prain
Robertson 2876

Furcraea foetida (L.) Haw.
Robertson 2842

Atoll Research Bulletin No. 273: 177-184, 1983.

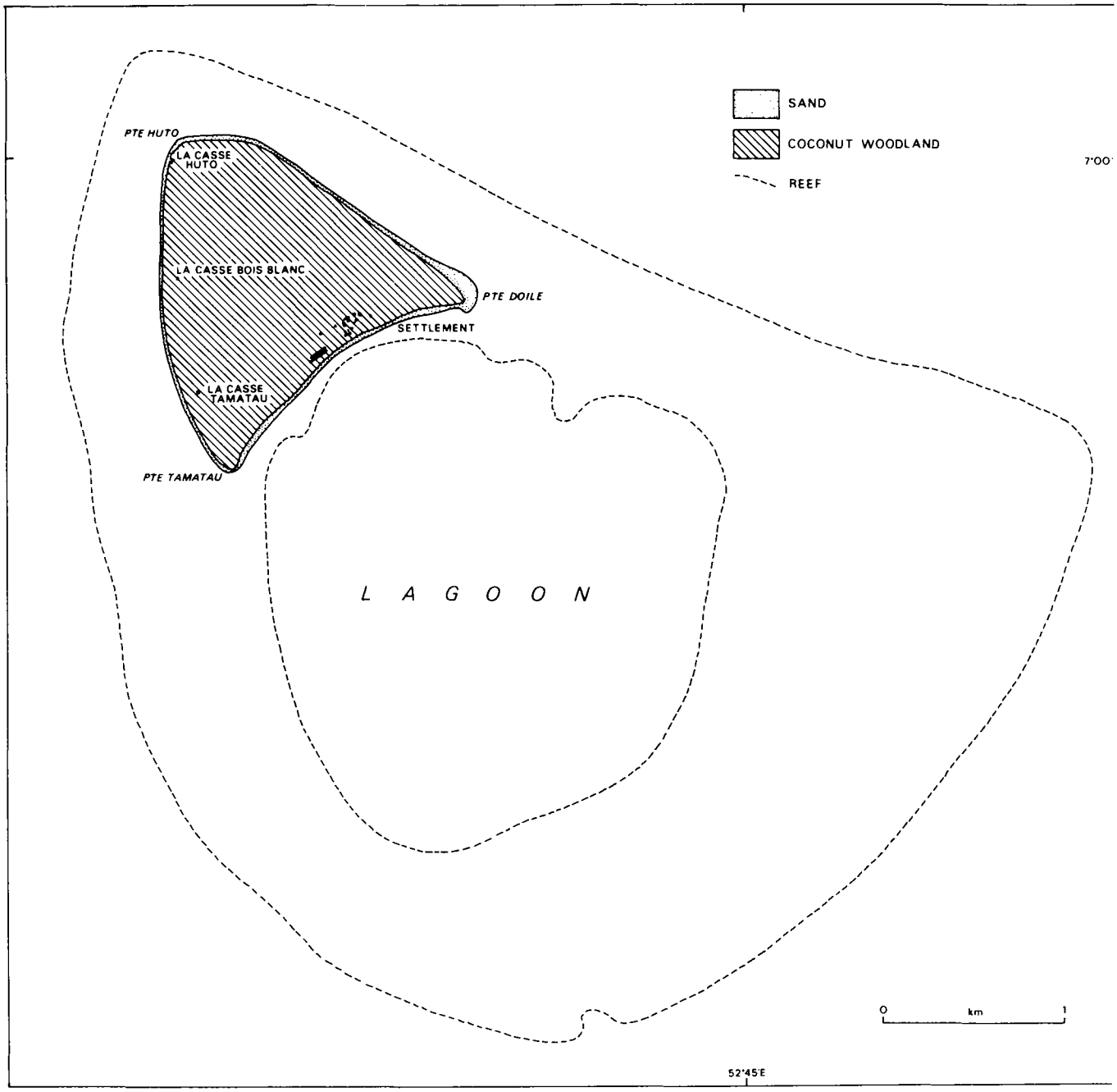

Figure 10. Alphonse

AMARANTHACEAE

Achyranthes aspera L.
Robertson 2866

APOCYNACEAE

Catharanthus roseus (L.) G. Don
Robertson 2829

Neisosperma oppositifolia (Lam.) Fosb. & Sachet
Ochrosia oppositifolia (Lam.) Schum.
Robertson 2840

ARACEAE

Alocasia macrorrhiza (L.) G. Don
Robertson 2889

ARECACEAE (PALMAE)

Cocus nucifera L.
Robertson, sight

ASTERACEAE (COMPOSITAE)

Vernonia cinerea (L.) Less.
Robertson 2849

BORAGINACEAE

Cordia subcordata Lam.
Robertson 2857

Tournefortia argentea L.f.
Robertson 2845

CARICACEAE

Carica papaya L.
Robertson 2824

CASUARINACEAE

Casuarina equisetifolia L.
Robertson 2848

CONVOLVULACEAE

Ipomoea macrantha Roem. & Schultes
Robertson 2823

Ipomoea pes-caprae (L.) R. Br.
Robertson 2850

Ipomoea sp.
Robertson 2825

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers.
Bryophyllum pinnatum (Pers.) Kurz
Robertson 2863

CYPERACEAE

Cyperus aromaticus (Ridl.) Mattf. & Kük.
Kyllinga polyphylla Willd. ex Kunth
Robertson 2890

Cyperus dubius Rottb.
Mariscus dubius (Rottb.) Fischer
Robertson 2887

Cyperus kyllingia Endl.
Kyllinga monocephala Rottb.
Robertson 2886

Cyperus ligularis L.
Mariscus ligularis (L.) Urb.
Robertson 2878

Cyperus rotundus L.
Robertson 2879

Fimbristylis cymosa R. Br.
Robertson 2881

EUPHORBIACEAE

Acalypha indica L.
Robertson 2853

Euphorbia hirta L.
Robertson 2826

Euphorbia prostrata Ait. ?
Robertson 2862

Phyllanthus amarus Schum. & Thonn.
Robertson 2852

Phyllanthus maderaspatensis L.
Robertson 2837

Ricinus communis L.
Robertson 2835

FABACEAE (LEGUMINOSAE)

Adenanthera pavonina L.
Robertson 2841

Cassia occidentalis L.
Robertson 2828

Erythrina variegata L.
Robertson 2838

Sesbania sericea (Willd.) Link
Robertson 2832

GOODENIACEAE

Scaevola sericea Vahl.
Scaevola taccada (Gaertn.) Roxb.
Robertson 2877

HERNANDIACEAE

Hernandia sonora L.
Hernandia nymphaeifolia (Presl) Kubitzki
Robertson 2827

LAURACEAE

Cassytha filiformis L.
Robertson 2873

LECYTHIDACEAE

Barringtonia asiatica (L.) Kurz
Robertson 2834

MALVACEAE

Gossypium hirsutum L.
Robertson 2830

Sida pusilla Cav. ?
Robertson 2839

Sida stipulata Cav.
Robertson 2844

MORACEAE

Ficus nautarum Bak.
Robertson 2858

MORINGACEAE

Moringa oleifera Lam.
Robertson 2888

NYCTAGINACEAE

Boerhavia repens L.
Robertson 2869

PASSIFLORACEAE

Passiflora suberosa L.
Robertson 2831

POACEAE (GRAMINEAE)

Dactyloctenium ctenoides (Steud.) Bosser
Robertson 2843, 2847

Eleusine indica (L.) Gaertn.
Robertson 2860

Eragrostis subaequiglumis Renvoize
Robertson 2882

Lepturus repens (G. Forst.) R. Br.
Robertson 2872

Panicum subquadriparum Trin.
Brachiaria subquadripara (Trin.) Hitchc.
Robertson 2885

Stenotaphrum dimidiatum (L.) Brongn.
Robertson 2867

Stenotaphrum micranthum (Desv.) Hubb.
Robertson 2871

POLYPODIACEAE (sensu lato)

Nephrolepis biserrata (Swartz) Schott
Robertson 2868

Polypodium scolopendria (Burm.f.) Copel.
Microsorium scolopendria (Burm.f.) Copel
Robertson 2865

RUBIACEAE

Guettarda speciosa L.
Robertson 2851

Morinda citrifolia L.
Robertson 2875

SCROPHULARIACEAE

Striga asiatica (L.) Kuntze
Robertson 2859

SURIANACEAE

Suriana maritima L.
Robertson 2846

TILIACEAE

Triumfetta procumbens Forst.f.
Robertson 2864

Triumfetta rhomboides Jacq.
Robertson 2833

TURNERACEAE

Turnera ulmifolia L.
Robertson 2854

URTICACEAE

Laportea aestuans (L.) Chew
Robertson 2874

Pilea microphylla (L.) Leibm.
Robertson 2861

Pipturus argenteus (Forst.) Wedd.
Robertson 2836

VERBENACEAE

Lippia nodiflora (L.) Rich.
Robertson 2870

Stachytarpheta jamaicensis (L.) Vahl
Robertson 2856

Stachytarpheta urticaefolia Sims
Robertson 2855

Reference

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10. ECOLOGY OF MARIE-LOUISE, AMIRANTES ISLANDS

by J. R. Wilson

Introduction

Marie-Louise (6°11'S, 53°08'E) lies at the southern end of the Amirantes 13 km from its nearest neighbour, Desnoeufs, and 280 km southwest of the granitic Seychelles. The island is rougly oval (Figure 11) with a long north-south axis, has a maximum elevation of 9 m although more generally 5-6 m, and an area of 52.6 ha. It is permanently inhabited with a population of c.15 agricultural workers and fishermen based in a small settlement on the west coast above the beach and opposite the only safe anchorage. Perhaps because of its isolation and the difficulty of landing the general natural history of Marie-Louse remains undescribed and the observations presented here, made on 14-15 June 1979 and 10-11 July 1980, are intended to fill this gap.

Geology and soils

The island is believed to be an uplifted cay with calcareous sandstones, overlying and interbedded with gravels, dipping outwards from the centre (Baker 1963, Piggott 1968, 1969). The rock is less well developed in the south which is considered to be of more recent origin. Jemo soils have formed, with a layer of guano above the sandstones which have become phosphatised, but the unconsolidated material has been stripped away and the rock is now exposed over ca 75% of the island surface. Shioya soils occur around the island perimeter. A broad beach is present in the north-west whilst the southern part of the island is generally bounded by low cliffs, giving way to rubbly storm beaches in the east and north.

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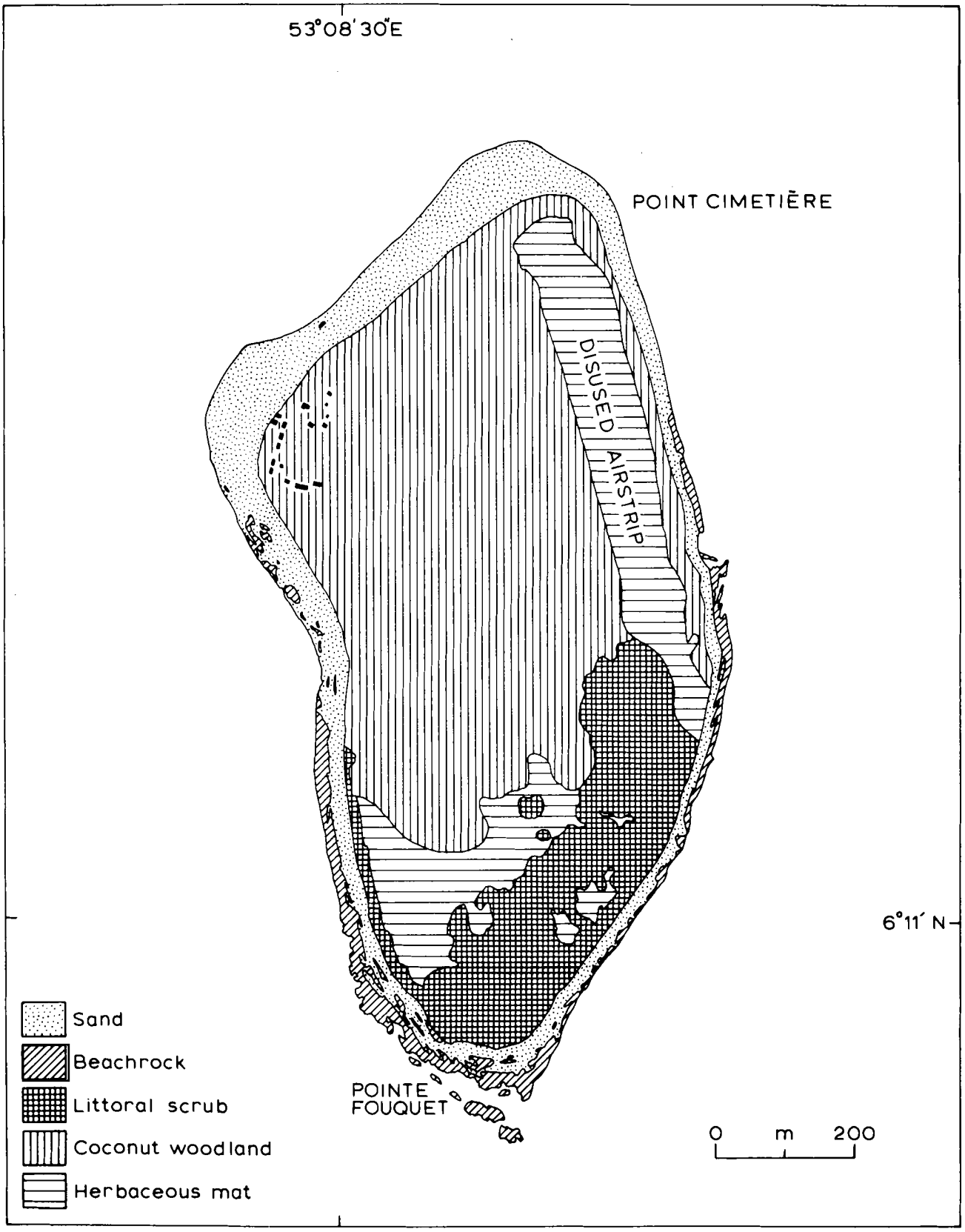

Figure 11. Marie-Louise

Vegetation

Five major vegetation types can be distinguished on the basis of subjective assessment of structure and species content.

Coconut grove community

Cocos nucifera has been planted over the greater part of the island into pits dug through the underlying phosphatic sandstone. Scattered *Hernandia sonora* trees are common throughout the grove which forms a closed canopy at about 12 m. *Morinda citrifolia* and *Carica papaya* are generally abundant in the understory and *Ricinus communis* is locally common. There is a dense and varied ground flora in which *Tridax procumbens, Boerhavia* sp., *Stachytarpheta jamaicensis* and *Passiflora suberosa* are widespread and conspicuous. Towards the airstrip trace in the north and the *Scaevola* thicket in the south the coconuts are more sparse and the canopy becomes more open with a greater proportion of *Hernandia, Morinda* and other trees. These conditions favour *Ricinus* and *Gossypium hirsutum*.

Herb community of open areas

The airstrip trace and an open area to the south of the settlement have been cleared and part of the airstrip is used seasonally for maize cultivation. A dense herb layer develops in which *Tridax* and *Stachytarpheta* are dominant and *Gossypium* forms dense patches.

West facing coastal hedge

The west coast is fringed with tall *Scaevola sericea* and *Tournefortia argentea* with occasional *Casuarina equisetifolia*. *Lepturus repens* and *Boerhavia* sp. underlie the hedge and, to the north of settlement, form a sparse cover on the beach crest. To the south of the beach, *Scaevola* thicket with some *Tournefortia* reaches the edge of the low cliffs, fronted only by a narrow and discontinuous band of low herbs including *Fimbristylis cymosa, Sida parvifolia, Passiflora, Tridax, Boerhavia, Euphorbia prostrata* and *Dactyloctenium* sp.

East facing coastal hedge

The coastal hedge on the east coast is dominated by *Scaevola* which extends back to form a dense thicket (see below). *Guettarda speciosa* is common in the north, with some *Tournefortia*. *Ipomoea macrantha, I.pes-caprae* and *Lepturus* are also present. Further south the *Scaevola* is lower and is mixed with occasional stunted *Tournefortia* and *Casuarina*. A thin and discontinuous band of herbs is found on the cliff edge, dominated by *Fimbristylis* and *Cyperus ligularis* whilst *Sida* and *Stenotaphrum micranthum* are also present. *Euphorbia prostrata* grows on the unstable surface of the cliff face.

Scaevola thicket

The *Scaevola* of the beach hedge extends back to form a dense thicket

from the north east, where it has been partially cut for the airstrip, to the south where it extends right across to the west coast. The thicket reaches a height of 4 m and there is a sparse understorey grasses and herbs.

List of plants

65 species of vascular plants were noted, excluding those under cultivation. The following are all sight records, although specimens were retained for identification in Mahe if a positive identification could not be made at the time. The names used here have been checked by F. R. Fosberg, and conform to those in others of this series of reports.

ACANTHACEAE

Asystasia genetica (L.) T Anders.
(Probably *A. multiflora* Klotzsch or *A. bojeriana* Nees)
Patchily distributed but dominant where present in the coconut grove.

AGAVACEAE

Furcraea foetida (L.) Haworth
Patches, probably originally planted but now abandoned, are found at both ends of the airstrip trace and behind the beach hedge to the south of the settlement.

AMARANTHACEAE

Achyranthes aspera L.
Frequent in the coconut grove and in cleared areas; also occurring under the beach hedge of the northwest coast.

Amaranthus dubius Mart. ex Thell.
Common around the settlement and in the coconut grove.

APOCYNACEAE

Catharanthus roseus (L.) G. Don
Frequent in the coconut grove and cleared areas. Only the white-flowering variety occurs.

Neisosperma oppositifolia (Lam.) Fosb. & Sachet
Frequent within the coconut grove and present in the *Scaevola* thicket.

ARACEAE

Alocasia macrorrhiza (L.) G. Don
Occasional throughout the coconut grove.

ARECACEAE (PALMAE)

Cocos nucifera L.
The dominant species of the coconut grove. Scattered palms are also found within the *Scaevola* thicket but are poor.

ASCLEPIADACEAE

Tylophora asthmatica Wight & Arn.
Recorded by Piggott (1969) as the predominant species in the coconut grove, but not recorded in 1979 and 1980.

ASTERACEAE (COMPOSITAE)

Bidens pilosa L.
Infrequent in the coconut grove.

Tridax procumbens L.
Widespread, being common in the coconut grove and co-dominant with *Stachytarpheta* in cleared areas. It also occurs on the cliff edge of the southwest coast.

BORAGINACEAE

Cordia subcordata Lam.
Present in the coconut grove where palms are thinly distributed, particularly adjacent to the airstrip trace.

Tournefortia argentea L.f.
Common in the coastal hedge on the northern part of the island, but less frequent in the south.

CAPPARIDACEAE

Cleome gynandra L.
Found only around the settlement, on paths and on heaps of guano brought from Desnoeufs.

CARICACEAE

Carica papaya L.
Very common in the coconut grove, forming an open understorey ca. 3 m tall under the palms.

CASUARINACEAE

Casuarina equisetifolia L.
Tall trees along the west coast, and a small grove at the cemetery in the north. Scattered individuals grow along the east coast and particularly behind the *Scaevola* thicket on the edge of the coconut grove.

CLUSIACEAE (GUTTIFERAE)

Calophyllum inophyllum L.
A single tree was located on the inland margin of the *Scaevola* thicket on the east side of the island.

COMMELINACEAE

Commelina benghalensis L.
Present under the coconut grove but patchily distributed.

CONVOLVULACEAE

Ipomoea batatas (L.) Lam. ?
A single plant in the coconut grove, scrambling over blocks of phosphatic limestone rubble.

Ipomoea macrantha Roem. & Schultes
Present in the beach hedge on the north coast and in margins of the coconut grove on the east side of the island.

Ipomoea pes-caprae (L.) R. Br.
Present in the cleared areas but most common on the seaward edge of the coastal hedge on the north and east.

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers.
Frequent but patchily distributed within the coconut grove.

CUCURBITACEAE

Cucurbita moschata (Duch. ex Lam.) Poir
Cultivated around settlement and occasional in the herb layer of the coconut grove.

CYPERACEAE

Cyperus dubius Rottb.
Common in the coconut grove, particularly along paths.

Cyperus ligularis L.
Present as scattered tussocks in the cleared areas but most frequent on the cliff top of the east coast.

Fimbristylis cymosa R. Br.
Dominant on the edge of cliffs on the southeast and southwest coasts.

EUPHORBIACEAE

Acalypha indica L.
Common in the coconut grove, and also present in open areas and under the *Scaevola* thicket.

Euphorbia hirta L.
Abundant in the coconut grove and in open areas.

Euphorbia prostrata Ait.?
Common along paths and in the coconut grove. It also occurs in sparsely vegetated areas and along the cliff edges.

Pedilanthus tithymaloides (L.) Poit.
Two patches were found, one within the settlement and one by the wells in the coconut grove.

Phyllanthus amarus Schum. & Thonn.
Common in the coconut grove, especially along paths, and present in cleared areas.

Phyllanthus sp.
Frequent in the coconut grove; also occurring in open areas.

Ricinus communis L.
Frequent within the coconut grove, becoming more common in open areas.

FABACEAE (LEGUMINOSAE)

Cassia occidentalis L.
Scattered plants within the coconut grove.

Leucaena leucocephala (Lam.) de Wit.
Frequent as scattered bushes under the coconut grove. Tall *Leucaena* dominate a small area to the south of the settlement adjacent to the *Scaevola* thicket.

Sesbania sericea (Willd.) Link ?
Two specimens were found within the coconut grove.

Vigna sp. ?
Uncommon in the coconut grove: only two specimens found.

GOODENIACEAE

Scaevola sericea Vahl
Found around the perimeter of the island where it dominates the coastal hedge and forms a dense thicket covering the whole southern portion of the island. Scattered inliers occur on the margins of the coconut grove and in cleared areas.

HERNANDIACEAE

Hernandia sonora L.
Trees up to 12 m tall are common in the coconut grove, but less frequent in the *Scaevola* thicket.

LECYTHIDACEAE

Barringtonia asiatica (L.) Kurz
Two specimens found, one in the settlement and one in the coconut grove.

LYTHRACEAE

Pemphis acidula Forst.
Described by Baker (1963) as covering the southeast part of the island, presumably in error for *Scaevola*.

MALVACEAE

Abutilon indicum (L.) Sweet ?
Uncommon; found within the coconut grove and in open areas.

Gossypium hirsutum L.
Present in the coconut grove but more common in the cleared areas.

Hibiscus tiliaceus L.
Only one specimen found, on the edge of the airstrip trace.

Sida pusilla Cav.
Found throughout the island, being common in the coconut grove and open areas, frequent along the coast, and present under the *Scaevola* thicket.

Sida sp.
Common in the coconut grove.

MORINGACEAE

Moringa oleifera Lam.
A number of trees have been planted round the settlement.

MUSACEAE

Musa sapientum L.
One patch, within the coconut grove.

NYCTAGINACEAE

Boerhavia spp.
Found throughout the island, being abundant under the coconut grove and in open areas. It occurs along the west coast and under the *Scaevola* thicket, but is not common on the east coast. A white-flowering form predominates, but the pink-flowering type (*B. repens* L. ?) is infrequently found in the coconut grove.

Mirabilis jalapa L.
Frequent around the settlement but uncommon in the coconut grove.

PASSIFLORACEAE

Passiflora suberosa L.
Abundant in the coconut grove, both on the ground and ascending into the bushes. It is also common in open areas, and occurs along both southeast and southwest coasts.

POACEAE (GRAMINEAE)

Dactyloctenium ctenoides (Steud.) Bosser
Sparsely distributed in the coconut grove. Dead grass in the open areas and on the south and east coasts suggests that this species is more abundant at other times of the year.

Digitaria setigera Roth.
Frequent in the coconut grove and present in cleared areas.

Eleusine indica (L.) Gaertn. ?
Frequent in the coconut grove, and also present in open areas and under *Scaevola* thicket.

Eragrostis subaequiglumis Renvoize
Common in the coconut grove where ground cover is sparse, and especially along paths. Also occurs in cleared areas.

Lepturus repens (G. Forst.) R. Br.
Found on the coast around the entire island, and also growing in the *Scaevola* thicket.

Panicum maximum Jacq.
Planted in the settlement and also found in isolated patches within the coconut grove.

Stenotaphrum dimidiatum (L.) Brongn.
Present on the east coast.

PORTULACACEAE

Portulaca oleracea L.
Present in the coconut grove, especially along paths, and infrequent on the east coast.

RUBIACEAE

Guettarda speciosa L.
Common in the coastal hedge of the northeast but not recorded elsewhere.

Morinda citrifolia L.
Very common as low bushes or trees in the coconut grove. Also occurs as scattered bushes in the open areas and in the *Scaevola* thicket.

SOLANACEAE

Capsicum frutescens L.
Three bushes, probably planted, are found in the coconut grove.

Datura metel L.
Present as scattered plants in the coconut grove.

Solanum nigrum L.
Infrequent in the coconut grove.

TURNERACEAE

Turnera ulmifolia L.
Frequent in the coconut grove.

URTICACEAE

Laportea aestuans (L.) Chew
Frequent in the coconut grove.

VERBENACEAE

Lippia nodiflora (L.) Rich
Dominant in one small area close to the settlement, but not recorded elsewhere.

Stachytarpheta jamaicensis (L.) Vahl
Common in the coconut grove and generally co-dominant with *Tridax* in the cleared areas.

Vertebrate fauna

Reptiles

?Gehyra mutilata

A noctural light brown gecko, common in the settlement buildings.

Phelsuma madagascariensis

Common in the coconut grove and beach hedge.

Chelonia mydas Green turtle

A small number are said to breed on Marie-Louise, where suitable beaches extend from settlement to the northern point. One set of pits was found by settlement in 1979 and several traces of earlier visits were evident around the northern point by the cemetary. Two sets of pits were found in 1980, one several months old and one recent. Both were by the cemetary.

Eretmochelys imbricata Hawksbill turtle

Around 15 females are said to land on the island each year between October and February.

Both turtle species are taken whenever opportunity arises.

Birds

Puffinus l'herminieri Audubon's Shearwater

Not seen. Said to occur although not to breed (O. Souris, pers comm.).

Puffinus pacificus Wedge-tailed Shearwater

Two small colonies of c.45 burrows each were found on the east coast and at Point Fouquet, the southernmost tip of the island. Both colonies were situated in open ground on the cliff edge and although no birds were seen some burrows appeared to be in use.

Sula leucogaster Brown Booby

An adult plumaged bird roosted in coastal *Casuarina* on the night of 19 July 1980. An unidentified immature booby passed over the island on the evening of 14 June 1979.

Fregata sp. Frigatebirds

Three immature frigates passed over the island in the evening of 19 July 1980. It was not established if Marie-Louise is used as a roost although this is most likely.

Bubulcus ibis Cattle Egret

Three birds were seen on the airstrip in 1980. The population appears to be small.

Gallus gallus Feral chicken

A number of chickens have gone wild and range through the coconut grove. Their wariness and willingness to fly distinguishes them from the domesticated birds.

Pluvialis squatarola Grey Plover

Present, foraging on the airstrip trace and on the east coast.

Arenaria interpres Turnstone

Common throughout the island and on the coast. The manner in which birds freely perched in dead bushes where ground cover was dense was remarkable.

Sterna anaethetus Bridled Tern

Several hundred birds roost in the *Casuarina* of the west coast but it was not established if breeding took place.

Sterna fuscata Sooty Tern

Sooty terns regularly pass over the island but do not land.

Gygis alba White Tern

Common throughout the island and all stages of breeding observed. The population was estimated at several thousand pairs.

Anous tenuirostris Lesser Noddy

Common, several thousands being estimated as present. Breeding was noted in casuarinas behind the *Scaevola* thicket on the east coast and roosting birds were found throughout the coconut grove.

Anous stolidus Common Noddy

Common, breeding in coconuts throughout the island. With roosting birds, the population was estimated to be in the region of several thousand birds.

Passer domesticus House Sparrow

Common around the settlement but not in the coconut grove. A nest was under construction in the eave of a house in July 1980.

Foudia madagascariensis Madagascar Fody

Very common in the coconut grove and in feeding flocks on the airstrip trace.

Introduced "grey partridge" and quail were recorded as uncommon in 1955 (Ridley and Percy 1958) but neither species, the precise identification of which is uncertain, was seen in 1979 or 1980. Both have probably died out.

Mammals

Mus sp. (?*musculus*) Mouse

Mice are common but there are no rats.

Sus scrofulus Feral pig

A number of feral pigs occur, one being seen in the coconut grove in dense cover. They are extremely wary.

Tursiops truncatus Bottle-nosed Dolphin

Dolphins were seen off settlement beach on both visits.

Land use history

Marie-Louise is government-owned but has been leased and permanently settled since the late 19th century. The first major activity was the exploitation of guano and the island had two co-lessees in 1905 with a total population of 86. One lessee handled the guano extraction and at least 3500 tons were exported in late 1905 alone (Tonnet 1906). By 1906 it was reported that economically workable deposits were exhausted although an estimated 3000 tons remained in 1963 of which 1500 tons could be taken for local use without damaging agricultural potential (Baker 1963). In fact guano has been imported in recent years for agricultural purposes from Desnoeufs.

The second lessee in 1905 was responsible for agricultural development. 800 coconuts and the *Casuarina* on the west coast had already been planted and effort was maintained as holes were dug through the sandstone for further plantings. The wells sunk from chambers excavated under the sandstone beds also probably date from this period. Following the exhaustion of the guano, agriculture and fishing became the sole activities supporting a population of about 20. Sixty years later, Piggott (1969) commented that the estate was neglected and it remained in much the same condition in 1979-80 although pigs, poultry, vegetables, maize, tortoiseshell and saltfish were produced for island use and to augment copra exports. The airstrip trace in the north-east was cut some 10-15 years ago but the work was not completed.

The Island Development Company took the lease of Marie-Louise in 1981 and, given the emphasis placed by government on outer island development and the influx of resources and expertise under the new management, agricultural activity is expected to be intensified in future.

Discussion

The Du Roslan expedition, passing by in 1771 and giving Marie-Louise its name, described the island as well wooded (Fauvel 1908) and the present vegetation is a product of a century of human activity superimposed upon the effects of differing soils and degree of exposure to wind and wind-borne salt. The activity with the most far-reaching ecological impact must have been the guano exploitation involving the removal of any vegetation growing on it and the virtual loss of all top soil, and in 1905 this formerly wooded island was clothed only in small bushes and young coconuts (Tonnet 1906). The subsequent development of the vegetation has been controlled by management as an agricultural plantation.

The flora of Marie-Louise is now unremarkable and, of the 66 plant species noted, 34 are generally considered to be introductions to the Seychelles as cash crops, vegetables, ornamentals, for medicinal purposes or as weeds. This is an over-simplification as some native species are weedy or widely planted and may not have formed part of the original Marie-Louise flora whilst others are of uncertain status but, despite these difficulties in categorisation, a rough analysis of the provenance of the flora can be made:

Vegetation type	*No.native species*	*No.introduced species*	*total*	*% introduced species*
All types	31	34	65	51.5
Coconut grove	24	33	57	58
Cleared areas	9	12	21	57
Coastal hedge,W.	9	3	12	25
Coastal hedge,E.	13	2	15	13
Scaevola thicket	7	1	8	12

If the proportion of introduced species can be taken as an indicator of habitat disturbance, it is evident that the coastal hedge and *Scaevola* thicket have been altered least despite the presence of pits dug under the latter, suggesting cutting back in an effort to increase coconut production. It is likely then that the hedge and thicket are essentially persistent features of the original vegetation although there has been some invasion by hardy weeds, particularly on the more sheltered west coast.

It is also certain that the coastal hedge and its inland extension as *Scaevola* thicket is vital in protecting the coconut grove and, before that, the forest noted in 18th century. This forest must have consisted at least of *Hernandia, Barringtonia, Neisosperma, Morinda* and *Cordia,* and probably of other species incapable of withstanding the combined effects of removal of the guano in which they grew and the subsequent repeated coppicing practiced as an adjunct to coconut cultivation. That the forest was not more widespread is suggested by the difficulty with which native trees establish themselves within the *Scaevola* thicket even though all species concerned are capable of growth in its soils. The critical factor appears to be exposure to salt spray.

The seabirds are perhaps the most interesting ecological feature of the island. Despite the comments of Ridley and Percy (1958) who did not consider Marie-Louise to be a seabird island from the egg cropping viewpoint and recorded Lesser and Common Noddies as breeding in small numbers only, the island actually supports one of the largest concentrations of tree nesting terns in the Amirantes even though the greater number may only roost rather than breed. This population complements the similar concentrations of ground nesting and tunnelling sea-birds in

the other southern Amirante Islands of Desnoeufs, Boudeuse and Etoile. The two noddies are taken for food by the island inhabitants but it is highly unlikely that this activity has any marked effect on the tern populations and only the small colonies of wedge-tailed shearwaters can be considered to be at risk through direct human predation. The important factors maintaining the number of birds on Marie-Louise are the absence of rats and the presence of the coconut grove which provides breeding and roosting sites and would continue to do so even under more intensive management. As already suggested, the existence of the coconut grove is dependant upon the shelter of the beach hedge and *Scaevola* thicket.

There is no real conflict between agricultural development and wildlife conservation interests on Marie-Louise. Indeed, the well-being of the coconut grove is to the advantage of all and the undesirability of the introduction of rats is generally accepted. However, the critical importance of the integrity of the coastal vegetation must be stressed. The removal or reduction of coastal hedge or *Scaevola* thicket to free land for agriculture without the establishment of some other adequate screen such as a *Casuarina* belt would be counter-productive on Marie-Louise and also considerably diminish the species and habitat diversity among the southern Amirantes.

Acknowledgements

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11. ECOLOGY OF DESNOEUFS, AMIRANTES ISLANDS

by J. R. Wilson

Introduction

Desnoeufs (6°14's, 53°02'E) is the southernmost of the Amirantes. It is situated 13 km from its nearest neighbour, Marie-Louise, and 290 km from Mahe in the granitic Seychelles. It is roughly circular (Figure 12) with an area of 39.7 ha and a maximum elevation of 4 m on its slightly raised perimeter. There is one safe landing on the beach in the north behind which a number of huts have been erected to house a workforce of around 30 men stationed on the island each year from May to August to collect seabird eggs. A reserve of 16.6 ha has been established on the western side.

Desnoeufs has received several visits by scientists over the past 25 years. Percy and Ridley (1958) described the natural history in detail and there have been a series of subsequent censuses of the sooty tern colony (Feare 1976, Percy and Ridley 1966, Procter 1970). The geology and soils have also been examined (Baker 1963, Piggott 1968) with particular emphasis on the guano deposits. The observations presented here were made during two visits to the island, during 15-24 June 1979 and 18 July-1 August 1980.

Geology and soils

The island is believed to be an uplifted cay in which sandstone, originally formed as beach rock, spreads outwards in concentric rings from a centre approximately 100 m in diameter (Piggott 1968, 1969). Beachrock formation continues on the shore whilst the older sandstones inland have become phosphatised to varying degrees and on parts of the south coast fragments of this dark brown phosphatised material have been reincorporated in the more recent beds. Unconsolidated calcareous gravels and sands underlie the rock.

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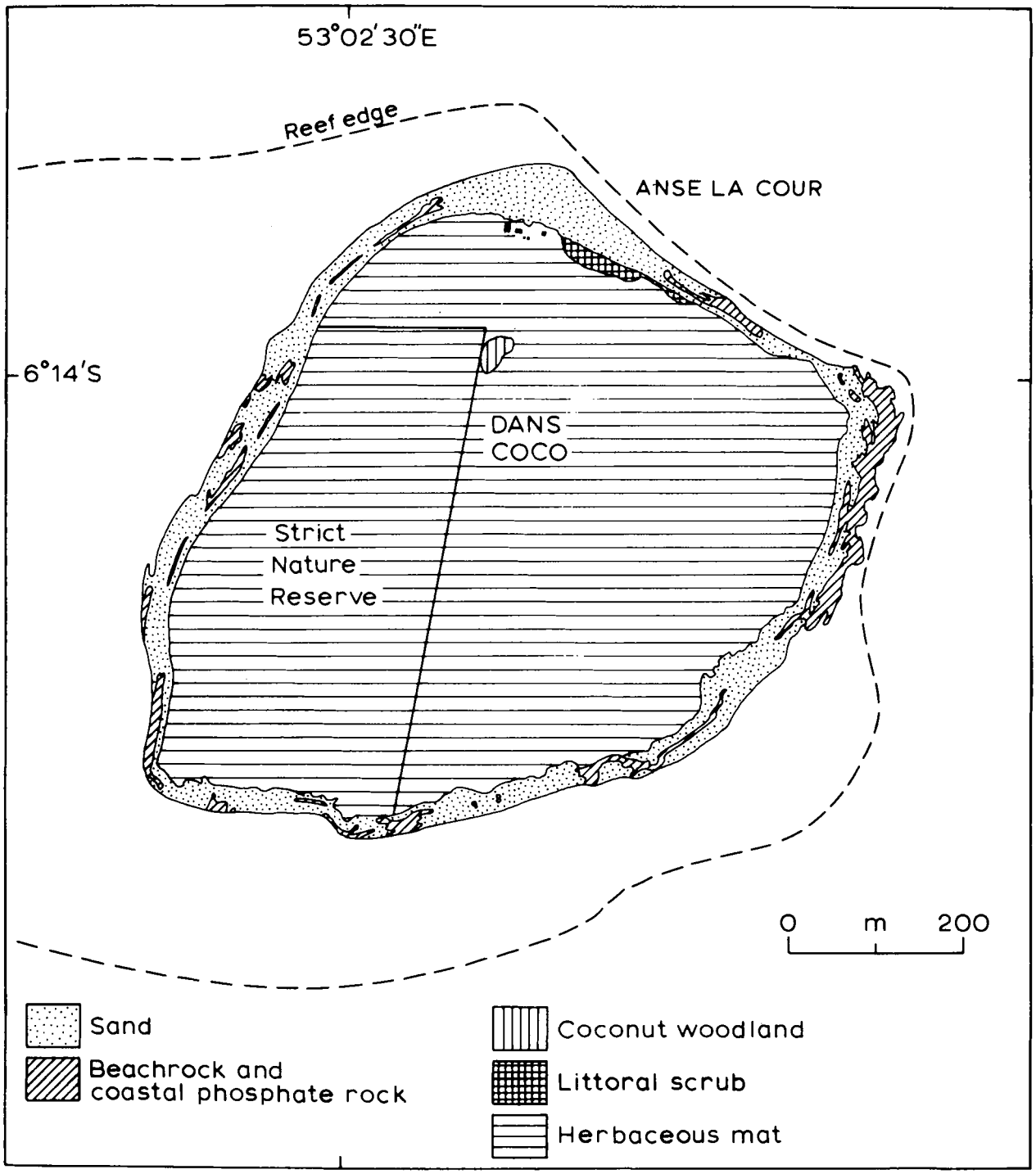

Figure 12. Desnoeufs

The soils are formed from guano and wind-blown sand. Baker (1963) estimated that the average depth of guano was approximately 20 cms but it is not evenly distributed and rock is widely exposed. The guano is the type for the Desnoeufs series soil (Piggott 1968), a richly phosphatic dark brown humus overlying the partially phosphatised sandstone and principally derived from material imported by seabirds with little contribution from the underlying rock. A structureless pink skin occurs on the surface of occupied and abandoned booby colonies.

Windblown sand forms low dunes which are best developed on the northeast and southwest coats whilst on the northwest and southeast, the coasts facing directly into the two prevailing winds, the sands extend further inland and are thinly spread. Farquhar Series soils develop. Typically these consist of a shallow organic horizon grading through to pure sand at about 30 cms (Piggott 1968) but on Desnoeufs they have a particularly high phosphatic content and the organic material is mixed to greater depth because of extensive burrowing by wedge-tailed shearwaters.

Vegetation

The island is generally cothed in coarse herbage although there is a small coconut grove, a single *Hibiscus* tree and a short stretch of coastal hedge. Eight vegetation communities were distinguishable on the basis of structure and species content but it was evident that considerable seasonal changes took place and that the herb communities described here were transient. During the wetter northwest monsoon when the sooty terns are absent the ground vegetation is aid to be luxuriant (O. Souris, pers. comm.) but it dies back over the south east trades between April and September under the combined effects of drought, exposure to salt spray, trampling by seabirds and accumulation of fresh droppings. The vegetation was considerably more open and community boundaries less distinct in late July 1980 than was the case in June 1979 and it has been assumed that these changes are essentially similar each year.

Beach crest community

A discontinuous cover of prostrate species including *Lepturus repens, Portulaca oleracea, Stenotaphrum micranthum, Sida parvifolia, Euphorbia prostrata* and *Boerhavia* sp. occurs on the beach crest. In June the community is generally confined to a strip ca 1 m wide although extending several metres inland in more exposed sites on the south coast. Later in the year it partially spreads into the area opened up by the reduction in cover of the dune community.

Dune community

In June the vegetation of the Farquhar Series soils is dominated by *Stenotaphrum*. To the north it forms a dense sward, also containing *Phyllanthus amarus* and *Passiflora suberosa,* whilst in the south the thinner soils bear a shorter, sparser *Stenotaphrum* sward mixed with *Portulaca, Sida* and *Boerhavia*. Later the *Stenotaphrum* tends to die

back and *Boerhavia* becomes dominant or co-dominant. *Sida* and *Portulaca* remain common.

Dactyloctenium dominated transitional community

Behind the coastal ridge in the north and east lies a belt of soil transitional between the Farquhar and Desnoeufs Series. In June the area is dominated by withering *Dactyloctenium* sp. with scattered *Stenotaphrum, Stachytarpheta jamaicensis, Sida, Cleome gynandra, Portulaca* and *Boerhavia*. As the *Dactyloctenium* dies and becomes matted, *Stachytarpheta* and *Boerhavia* become more frequent.

South coast transitional community

A more floristically diverse variant of the dune community occurs inland along the south coast where the sand mixes with guano. *Stenotophrum* is dominant and *Stachytarpheta* common in June but in July the *Stenotaphrum* dies back and *Boerhavia* and *Portulaca* become co-dominant.

Coastal hedge

A narrow, dense hedge of *Scaevola sericea* about 75 m long occurs along the least exposed section of the north coast. It is interrupted by the settlement buildings.

Sheltered mixed herb community

A mixed herb community grows behind the coastal hedge and extends c.100 m beyond it towards the east. Constituent species include *Phyllanthus amarus, Acalypha indica, Abutilon* sp., *Solanum nigrum, Amaranthus dubius, Stachytarpheta, Datura metel, Catharanthus roseus* and *Dactyloctenium*. These species were all present in June 1979, forming a dense sward up to 75 cm tall. *Phyllanthus* and *Dactyloctenium* were absent in July 1980 and the community was more open with the eastern extension, formerly dominated by *Stachytarpheta*, partially cleared allowing *Amaranthus* to persist and *Portulaca* to become dominant.

Coconut grove

A small coconut grove is found in the centre of the island. In 1979 it sheltered a similar community, with the addition of *Eleusine indica, Colubrina asiatica* and *Alocasia macrorrhiza*, to that found behind the coastal hedge but had been cleared in July 1980. Nevertheless the constituent species of the 1979 flora remained as scattered individuals.

Desnoeufs Soil community

This is not a homogenous vegetation type but a mosaic, the composition of which is seemingly determined by previous concentrations of seabirds, their present distribution, and the clearing activities of the egg collectors. In June 1979 *Stachytarpheta, Cyperus ligularis,*

Portulaca and *Amaranthus* all occurred in monospecific blocks or in mixed communities with occasional *Dactyloctenium, Solanum, Boerhavia* and *Cleome*. These latter species generally grew where the guano was mixed with sand or in small pockets of soil in loose sandstone blocks but *Abutilon, Sesbania* and *Datura* were scattered throughout the area. In July 1980 the vegetation was more open whilst a definite difference had developed between the reserve and the cropped area. The reserve, now densely occupied by breeding sooty terns, was dominated by open *Portulaca* with scattered *Cyperus* and *Boerhavia*. Occasional bushes of *Sesbania* and *Datura* were present but *Amaranthus* persisted only in areas with few nesting birds. *Stachytarpheta* dominated the area by the reserve boundary. In the cropped area *Stachytarpheta* was generally dominant whilst *Boerhavia* and *Portulaca* were common and *Cyperus* formed dense mono-specific blocks. Where the *Stachytarpheta* had been uprooted by egg-collectors, *Portulaca* sparsely covered the open ground.

A single *Hibiscus tiliaceus* tree forms a unique element in the Desnoeufs Soil vegetation mosaic.

List of plants

30 species of vascular plants were recorded after exhaustive search. The following are all sight records, although specimens were retained for verification in Mahe if a positive identification could not be made at the time. The names used here have been checked by F. R. Fosberg, and conform to those in others of this series of reports.

AMARANTHACEAE

Amaranthus dubius Mart. ex Thell.

Dominant or co-dominant with *Portulaca* on Desnoeufs soil, particularly within the reserve, but also found behind the coastal hedge and within the coconut grove. Apparently dies back earlier than *Portulaca*.

APOCYNACEAE

Catharanthus roseus (L.) G. Don

Common behind the beach hedge, in the coconut grove, and in sandy soils behind the dunes of the north coast. Only the white-flowering variety is found.

Neisosperma oppositifolia (Lam.) Fosb. and Sachet

The coastal hedge contains a single shrub which is healthy and fruiting but grows no higher than the surrounding *Scaevola*.

ARACEAE

Alocasia macrorhiza (L.) G. Don

Several yellowed specimens grow in pits on the fringe of the coconut grove.

ARECACEAE (PALMAE)

Cocos nucifera L.

About 30 planted trees form the grove in the centre of the island, and a small number of nuts sprout around the coast.

CAPPARIDACEAE

Cleome gynandra L.

Present behind the dunes on transitional soils or on the Desnoeufs soils proper. In June most frequent as a seedling or dying mature plants in the southern half of the island. Very few seedlings and no mature plants were located in July 1980.

CARICACEAE

Carica papaya L.

Several small plants were found in 1979 growing from seed thrown out from the camp into the lee of the coastal hedge. None remained in July 1980.

CONVOLVULACEAE

Ipomoea macrantha Roem. & Schultes

One plant was found on the dunes of the west coast in 1979 but was not present in the following year.

CYPERACEAE

Cyperus ligularis L.

Two large patches grow on the southwest and northeast of the island on Desnoeufs soil. Isolated tussocks occur elsewhere on the guano but are thinly distributed.

EUPHORBIACEAE

Acalypha indica L.

Frequent under and behind the beach hedge and within the coconut grove.

Euphorbia prostrata Ait. ?
Common on the beach-crest community and on the dunes wherever vegetation cover is discontinuous.

Phyllanthus amarus Schum. & Thonn.
Occasional in the north coast dune community but more frequent in the sheltered mixed herb community and among the coconuts.

FABACEAE (LEGUMINOSAE)

Sesbania sp. probably *sericea* (Willd.) Link
Isolated plants or groups of plants widely scattered over the central part of the island. In June 1979 most were dying back and in July 1980 only ten with living shoots remained.

GOODENIACEAE

Scaevola sericea Vahl
Limited to the coastal hedge on the north coast.

MALVACEAE

Abutilon indicum (L.) Sweet ?
Frequent in the Desnoeufs Soil community, the coconut grove, behind the beach hedge, and in 1980 on the edge of the dunes of the northwest coast. Most plants were dead, even in June.

Sida pusilla Cav.
Common within the dune community and on the beach crest.

Hibiscus tiliaceus L.
A single large tree grows on the Desnoeufs Soil near the centre of the island.

NYCTAGINACEAE

Boerhavia sp.
A white-flowered, fleshy trailing herb, most common on sandy soils around the perimeter of the island but well represented inland by July.

PASSIFLORACEAE

Passiflora suberosa L.
In 1979 two or three vigorous plants scrambled over *Stenotaphrum* in one small area of the dunes on the northwest coast. The following year these plants had spread to cover an area of about 3000 sq metres, and a single specimen was also located on the northeast coast.

POACEAE (GRAMINEAE)

Dactyloctenium ctenoides (Steud.) Bosser

Occurs primarily as a dominant species behind the dunes on transitional soils on the northeast and east sides of the island, but it is also present in the coconut grove and in the dunes of the west coast. Apparently dies back early during the southeast trades.

Eleusine indica (L.) Gaertn.

Most frequent behind the beach hedge and within the coconut grove, but in 1979 occasionally found elsewhere immediately behind the dunes.

Lepturus repens R. Br.

Found in small isolated patches as a primary coloniser of the beach crest, occasionally extending into the dune community behind.

Stenotaphrum micranthum (Desv.) Hubb.

In June *Stenotaphrum* dominates soils around the island perimeter and also inland where isolated patches of windblown sand overlie the phosphatic sandstone. By July it has generally died back but scattered plants still persist.

PORTULACACEAE

Portulaca oleracea L.

Found throughout the island in open areas but apparently suppressed by denser vegetation. It flourishes in those areas with the densest Sooty Tern concentrations, where it is generally dominant or co-dominant with *Amaranthus*.

RHAMNACEAE

Colubrina asiatica (L.) Brongn.

A dense and flourishing mass of bushes with several outliers grows in the coconut grove.

SOLANACEAE

Datura metel L.

Frequent in the coconut grove and in the sheltered mixed herb community but less common elsewhere on Desnoeufs Soil and absent from Farquhar Series soils.

Nicotiana tabacum L.

A single plant was found in the beach hedge in July 1980.

Solanum nigrum L.

Locally common throughout the Desnoeufs Soil area in June, but limited by July to the coconut grove and the shelter of the coastal hedge.

VERBENACEAE

Stachytarpheta jamaicensis (L.) Vahl

The most conspicuous herb on the island, occurring throughout the area of Desnoeufs Soil in dense monospecific patches or dominating in mixed communities, and also growing in soils transitional with the Farquhar Series.

ZYGOPHYLLACEAE

Tribulus cistoides L.

One localised patch consisting of less than ten plants was found in 1979 in the south coast transitional community. Several plants were pulled out by the egg collectors although seed had already been dropped. The site could not be relocated in 1980.

Vertebrate fauna

Reptiles

Hemidactylus sp. (*?frenatus*)

A brown nocturnal gecko common in the camp buildings and also found in the coconut grove under blocks of sandstone.

?Gehyra mutilata

A number of paler, more translucent geckos were seen on the camp buildings in 1980 although they were not recorded in 1979. No specimens were collected and the identification is tentative.

Chelonia mydas Green Turtle

Pits dug by nesting green turtles were divided into three categories according to age. Those that were eroded, partially infilled and invaded by vegetation were estimated as being older than 6 months, those with vegetation starting to invade and with surfaces smoothed to stable gradients were classed as 1-6 months old and those uninvaded by vegetation and with unstable surfaces were considered recent. Groups of pits of similar age were taken to be the result of one visit by a female. On this basis the traces of 48 visits over the past six months remained evident in mid-June 1979 and 5 more landings, probably the efforts of 2 females, took place between 14 and 24 June. Allowing for 4 landings per female in which pits were excavated deep enough to remain evident during our visit, a conservative estimate of 13 females using Desnoeufs over the first half of 1979 is obtained. Peak nesting probably takes place from May-September but laying also occurs at other times of year (Frazier 1976) and simple doubling of the estimate for the first six months gives an extremely rough estimate of an annual breeding population of 26 females. However, no recent pits were found in July 1980 and there were very few pits in the 1-6 months age class, suggesting that the

number of breeding animals can vary considerably from year to year.

Three sandy beaches lacking rock barriers or unnegotiable sand cliffs are present in June/July of which the longest is in the north (c.350 m) where the camp is situated. The remaining two are pocket beaches of 40 and 50 m length in the south east but one is steeply sloping and shingly with no evidence of nesting. However, the distribution of traces of breeding attempts does indicate that sand movements, by obliterating obstacles, allow nesting at some time or another over c.1150 m of shoreline including extensions of the three beaches mentioned above and two additional pocket beaches in the south west. Such sand movements are usually associated with the change in direction of the prevailing wind from the south-east trades to the north-west monsoon and this evidence supports the suggestion of prolonged and probable year-round breeding.

Eretmochelys imbricata Hawksbill Turtle

A turtle seen immediately offshore in 1979 was tentatively identified as this species.

Birds

Puffinus l'herminieri Audubon's Shearwater

A small number were regularly seen at night in the coconut grove where burrows were made by clearing natural holes in the sandstone of soil and debris. No more than 5 birds were noted on any one night in 1979 and 3 in 1980.

Puffinus pacificus Wedge-tailed Shearwater

Several thousand pairs used the island at night in June 1979 and July 1980. Burrows were distributed around the entire perimeter of the island but were densest in the deeper sandy soils on the north east and south west coasts. Any natural or man-made break in the phosphatic sandstone further inland was also exploited and it is possible that the population approaches the maximum the island can support. Breeding is said to occur from November to February whilst June and July is a period of burrow excavation and pairing. Remarkably, the birds may be seen on the ground in the open throughout the day although numbers increase from mid-afternoon onwards.

Sula dactylatra Masked Booby

There are two colonies on the island, one inland in the south western quadrant and a smaller colony in the dunes of the south west coast. 18 nests were found in June 1979 with a maximum count of 45 birds whilst 8 nests and a maximum of 31 birds were noted in July 1980.

On 14 June 1979 the dune colony consisted of 5 nests each with 2 eggs and the inland colony contained 9 nests, one with a clutch of

3 eggs and the remainder with 2. By 18 June the dune colony had increased by 1 nest and the inland colony by 3. A number of eggs hatched in the inland colony on 17 and 18 June by which time it consisted of 6 nests with 2 eggs, 4 with 1 egg and 1 chick, 1 with 2 eggs and 1 chick and 1 with a single chick. On 24 June 1980 the inland colony consisted of 6 nests of which 1 contained 1 egg, 2 contained 2 eggs, 1 held 1 egg and 1 chick, 1 held 2 chicks and 1 contained a single large downy chick (Van Swelm pers.comm.). On 27 July 3 nests were closely brooded and 3 contained single large downy chicks whilst the dune colony consisted of 2 nests of which one was closely brooded and the second contained a large chick.

A regurgitation was recovered from one chick, consisting of 2 semi-digested fish c.20 cm in length.

Sula leucogaster Brown Booby

The maximum number of brown boobies recorded in 1979 was 10, whilst that in 1980 was 8 although an immature bird not included in this count was seen on several occasions. Two nests were located in 1979 of which one contained an egg. A third nest was under construction and all three were within 25 m of one another. A large downy chick was present in July 1980. Loafing brown boobies frequented the vicinity of their nests, both masked booby colonies and a rocky headland on the south coast.

Sula sula Red footed Booby

An adult bird was noted in June 1979 and an immature in July 1980. Both birds roosted overnight in the *Hibiscus*.

Fregata spp. Frigate birds

Immature birds passed over the island each evening in both years and although only one roosting bird was seen in 1979, up to 15 regularly spent the night in the coconuts in July 1980. The species could not generally be determined but a male Greater Frigate (*Fregata minor*) was present in June 1980 (Van Swelm pers.comm) and two Lesser Frigates (*Fregata ariel*) were seen in July.

Bubulcus ibis Cattle Egret

Counts of roosting and foraging birds in 1979 gave a population estimate of 35 individuals and comparable numbers were present the following year. Approximately 20 disused nests were found in the *Hibiscus* in June 1979 and 21 pulli were found in June 1980 (Van Swelm pers.comm.). The birds forage over the entire island except the sea-shore and the contents of 26 pellets showed the prey to be primarily insects although 5 pellets also contained egg membranes and one included unidentified bones. Maggots have been recorded from the stomach of a Desnoeufs bird (Chong-Seng, pers.comm.) and an egret was seen taking a tern chick in July 1980. A small bounty is given for egrets because of their predatory habits and all 21 pulli were destroyed in 1980.

Pluvialis squatarola Grey Plover

Two birds were seen in 1979 and 5 in 1980. All were in non-breeding plumage and foraged exclusively on the shore.

Arenaria interpres Turnstone

Common, foraging on rocky shores and inland in small groups. 213 were counted in one roosting flock in 1979 and comparable numbers were present in 1980. Many birds bore bold facial patterning although none were in full breeding plumage. Turnstone preyed upon unattended sooty tern eggs and approached masked booby eggs if these were exposed after disturbance.

Calidris alba Sanderling

One bird was noted in 1979 and two in 1980. Sanderlings freely associated with turnstone, foraging inland as well as on the shore.

Calidris ferruginea Curlew Sandpiper

A single bird was recorded in 1980, accompanying turnstones and foraging inland.

Tringa nebularia Greenshank

Two birds were present in July 1980, foraging on the shore.

Limosa lapponica Bar-tailed Godwit

Two birds were noted in July 1980, foraging primarily inland but roosting with turnstones on the shore.

Numenius phaeopus Whimbrel

A single whimbrel was seen on the beach on 27 July 1980.

Gallus gallus Feral chicken

Frequently seen in the vicinity of the coconut grove and *Hibiscus*. Chickens were taken sparingly in 1979 but jealously guarded in 1980 although they were suspected of predating seabird eggs.

Thalasseus bergii Crested Tern

Three subadults and one adult were present in June 1979 while 6 were noted in June 1980 (Van Swelm, pers.comm.). Eight subadults were noted on 23 July but numbers rose rapidly thereafter and 28 birds of all ages were seen at the end of the month. The Crested Terns generally foraged in the surf line but also took tern chicks. In both years juveniles were seen unsuccessfully begging from adult birds.

Sterna fuscata Sooty Tern

The massive sooty tern colony is the most remarkable feature of Desnoeufs. Estimates of numbers were derived from egg counts along transects in the reserve and from the daily egg collection over the remainder of the island. The method is described in detail elsewhere (Wilson and Chong-Seng 1979), the only difference between years being that the counts were made in the reserve at the time of peak breeding activity in 1980 but 15 days beforehand in 1979. The 1980 estimate of peak attendance was 769,000 pairs on 11-13 July whilst that for 1979 was 1,195,000 pairs on 3 July. This latter figure relied upon a projection from counts in mid-June and assumed a maximum laying density of 5 nests/sq m throughout the *Stenotaphrum*-free part of the reserve, but, although maximum densities of 4.5 nests/sq m were reached in 1980, the average over the whole reserve was only 2.4 nests/sq m. The number reported at the close of the 1979 season was therefore probably an over-estimate and the actual figure is better taken as lying between 844,800 and 1,195,000 pairs.

The estimates are of the maximum number of breeding pairs based on the island at any one time and are not measures of the total number of pairs which used the island during the entire breeding season. Such an estimate would be complicated by inter-colony movement of breeding birds and was not attempted.

Squid and flying fish up to 12 cm body length, small shrimp-like crustaceans and siphonophores (?*Porpita* sp.) were found amonst the Sooty Tern colony and were assumed to be food items.

The Sooty Terns did not lay on the dunes where Wedge-tailed Shearwaters were common although they were present up to the beach crest on hard substrates. Numbers were generally low in areas dominated by *Stachytarpheta* and *Cyperus ligularis* and no laying took place under the coconut grove. Large numbers of eggs were lost in July 1980 when shallow pools formed after heavy rain. Once these pools dried out the open areas were swiftly recolonised.

Sterna anaethetus Bridled Tern

Two pairs of breeding bridled terns were located in the cropped part of the island in 1980. Both had lain beneath cairns.

Anous stolidus Common Noddy

Common noddies bred throughout the island in both years, forming small colonies in rocky areas around the perimeter of the island and, further inland, on cairns, boulder piles, heaps of herbage uprooted by the egg collectors and in coconut crowns. Noddy nests were counted at the same time as those of the sooty terns and 8400 breeding pairs were estimated in the reserve in July 1980. Assuming the same density throughout the island the breeding population is in the region of 20,000 pairs. One chick was found in mid-June 1979, suggesting laying had begin in mid-May. Eggs and chicks were present in July 1980 but

the ages of the oldest chicks indicated onset of laying at the beginning of June.

Anous tenuirostris Lesser Noddy

Single birds roosted in the coconuts on the nights of 18 June 1979 and 22 July 1980.

Gygis alba White Tern

Two birds were seen offshore on 24 July 1980 and a single bird flew over the island on 26 July.

Foudia madagascariensis Madagascar Fody

A small flock frequented the coconut grove and mixed herb community behind settlement with maximum counts of 6 birds in 1979 and 16 in 1980.

Mammals

Mus sp. (*?musculus*) House Mouse

Mice were common in the camp and consumed eggs held for shipment but their distribution over the island as a whole was not ascertained.

Oryctolagus cuniculus Rabbit

Rabbits were released on Desnoeufs prior to 1900 (Percy and Ridley 1958) and were common in 1979/1980 ranging over the whole island although most frequently around the coconut grove from which they emerged to forage at dusk. At least 20 were taken for food in 1979 and probably more in 1980.

Tursiops spp Dolphins

Schools of dolphins up to 75 strong were commonly sighted offshore. Bottle-nosed dolphins (*Tursiops truncatus*) were definitely present but a second species, smaller and more greyish with a proportionately more slender bill and narrow dorsal fin, was also common and may have been predominant in some groups.

Land use

Desnoeufs is government owned but given out on a single lease with Marie-Louise. It has been held by a succession of private individuals and companies and has been most recently taken over, in 1981, by the Island Development Company.

Guano

The island was first sighted in 1771 by the Du Roslan expedition

but remained uninhabited until it was permanently settled for the exploitation of guano towards the end of the 19th century (Percy and Ridley 1958). This activity ceased around 1910 although the deposits are the largest remaining in Seychelles (Baker 1963). Small shipments of several tons each are still occasionally taken to Marie-Louise for agricultural purposes.

Agriculture

In the first decade of the 20th century Marie-Louise had two lessees of which one developed the agricultural potential of the island in the wake of the guano exploitation (Wilson in prep.) and it is probable that the same system was applied to Desnoeufs although with less success. About 30 coconuts had been planted in 1900 (Ridley and Percy 1958) and rows of pits bear evidence of considerable effort to create a coconut plantation over the entire island whilst the deep wells, substantial turtle pond and remains of paved cart-tracks probably also date from this period. About 300 pigs were free-ranged between 1900 and 1910, subsisting on herbage and eggs, and pigs have occasionally been released outside the birds-egg season since then but not as common practice (O. Souris, pers.comm.). The coconuts are not considered worth collecting but tobacco is sometimes grown over the north-west monsoon and is said to be very successful. Chickens and rabbits are primarily taken for use by Marie-Louise inhabitants but are also shipped to the granitic islands in small numbers.

Seabirds

The seasonal seabird egg collection, taking place between mid-May and early August, is the major commercial activity on the island. This operation has been described elsewhere (Percy and Ridley 1958, Feare 1976) and continues on the same lines with three recent modifications; the close season has been discontinued in favour of establishment of the 16.6 ha reserve, the crates (used as a basic measure of the annual crop) have been reduced in size to take 400 rather than 750 eggs and Department of Agriculture staff monitor the collection on the island each year. 1,037,600 eggs left Desnoeufs in 1979 and 723,700 in 1980, both figures including ca 10 % sent as gifts by the lessee or labourers and not reaching the open market but excluding the consumption on the island itself, estimated to be one crate per day.

Shearwater chicks are cropped annually during February and early March and around 2000, said to be half the total number available, are taken each year for shipment to the granitic Seychelles. It is strongly suspected that both frigates and noddies are taken for food from time to time.

Turtles

Green turtles are captured whenever the opportunity presents itself. Although some animals may have been exported from Desnoeufs in the past all are now consumed on the island. Desnoeufs is generally deserted during the north-west monsoon when breeding hawksbills might be expected.

Discussion

Ecology

Both Marie-Louise and Desnoeufs were described by the Du Roslan expedition in 1771 as being well-wooded and it would be remarkable if these two neighbouring islands of similar geology and comparable size were markedly different in ecology in their pristine condition, although Desnoeufs could have harboured ground-nesting seabirds on its coasts or in clearings inland. The differences today between bleak, open Desnoeufs and Marie-Louise with its overgrown coconut plantations and *Scaevola* thickets must therefore be primarily due to a difference in land-use practice. Certainly the known history of human activity on Desnoeufs and the fact that 40% of its flora is introduced, including the dominant *Stachytarpheta*, suggests profound modification despite the assertion that it is the "the only example of a virtually untouched island in the [Amirantes] group" (Piggott 1963).

It is most probable that the early management of Desnoeufs and Marie-Louise was run on identical lines. At the turn of the century birds' eggs were not an important article of commerce, as the free-ranging of pigs to feed on eggs suggests, and both islands were exploited for guano before being planted up with young coconuts. The difference between the two must have its source here, for the Marie-Louise plantation was successful whilst that on Desnoeufs was not. The likely explanation is that stripping of the vegetation to exploit the guano included, on Desnoeufs, the destruction of the coastal shelter thus allowing salt-laden wind to severely retard regeneration of woody vegetation over the entire island. The open space thus formed would favour expansion of any existing sooty tern colony, creating conditions even less suitable for regeneration and the open vegetation type would be perpetuated after the establishment of birds egg cropping by the practice of annual extensive clearance of ground cover to promote mamximum nesting density in the colony. Thus the predominance of ground-nesting seabirds is itself an artifact, having replaced a largely arboreal breeding avifauna. Under any circumstances Desnoeufs stands as an example of the extreme and often unexpected alteration which can be imposed upon an island ecosystem in a relatively short time-span, in this case around a century, by human management.

The records of the natural history of Desnoeufs collected by Percy and Ridley (1958) and continued by subsequent visitors also gives indication of the turnover of species which is to be expected on the island. It is known that *Cassytha filiformis* had been lost and *Stachytarpheta* established in the early part of the 20th century. *Carica, Tribulus* and *Ipomoea macrantha* were all recorded in 1979 but not the following year whilst *Nicotina* made a perhaps temporary appearance and the marked increase in *Passiflora* may signify expansion of a recent coloniser. Among the birds, Green-backed Heron (*Butorides striatus*)and Lesser Noddy bred in 1955 (Percy and Ridley 1958) but not 1979/80 although the Lesser Noddy still roosts. Crab Plover (*Dromas ardeola*), Great Sand Plover (*Charadrius leschenaultii*) and Mascarene Martin (*Phedina borbonica*) may also be added to the bird list as migrants or vagrants.

Percy and Ridley (1958) remarked upon the crickets in their tent yet made no mention of mice; any comment now on nocturnal nuisances would not make this omission, suggesting the mice too are recent colonists as may be the second gecko species. A continual flux in species composition of the island biota is evident.

Conservation

The conservation value of Desnoeufs lies entirely in its seabirds. The Sooty Tern colony is one of the largest in the world whilst, although their breeding populations are not the most substantial in the Seychelles, the boobies are of note in view of their general decline in the region (Feare 1978). Most importantly, the management of Desnoeufs is directed towards maintenance of its wildlife for economic gain in a durable system coordinating commerce and conservation and, whatever feelings one may hold regarding the trade in birds' eggs, there is no doubt that the disparate interests marshalled behind maintaining the productivity of the Sooty Tern colony act in the general favour of wildlife conservation both on Desnoeufs and, by example and association, elsewhere in Seychelles.

The main means by which conservation is effected is through the establishment of the 16.6 ha reserve in partial response to the most recent recommendations on the management of the egg collection (Feare 1976). The breeding seabirds in the reserve, which include the boobies, remain totally unmolested whilst all eggs laid in the remaining 23.1 ha of the island are taken for as long as it is profitable to do so and at least two Ministry of Agriculture staff are present on the island throughout the collection to ensure the reserve is not violated, to monitor the egg crop and to gather the information from which annual breeding populations may be calculated.

By and large this system works well and the reserve is respected, for although the two wardens may have difficulty in asserting authority when living in isolation with up to 30 egg collectors, the purpose of the reserve in maintaining egg production is generally understood. Potential for problems arise more where the need for control is less well appreciated and the degree of protection which can be afforded to female green turtles and to noddy terns is limited, particularly when the condition of the landing prevents fishing to vary the egg dominated diet of the island workers. However, with noddies at least it is highly unlikely that the limited depredations which take place have an appreciable effect on overall numbers.

These shortcomings apart, the conservation management of the island during the cropping season is fair given the circumstances under which it operates and its essential feature is that it works. The Sooty Tern population has been consistently estimated at between 1.2 and 1.75 million pairs over the past 25 years (Feare 1976, Percy and Ridley 1958, 1966, Procter 1970) with peak laying in June. The 1979 and 1980 seasons were both late and poorly attended, regular occurrences which, taken in conjunction with possible differences in counting technique between observers, do not allow the low census results of

these latter years to be taken as evidence of overcropping.

The landing beach is unusable from late August until the north west monsoon has set in and over this period the island provides totally safe conditions for boobies to rear chicks and for turtles to breed. From mid-October to late May however, the island is unwardened and accessible to boats fishing in the area or from Marie-Louise. Given the traffic in the Amirantes it is quite possible that such visits are frequent although individually of short duration and, in the absence of permanent occupation, the beaches should still provide relatively safe breeding for the small number of turtles that frequent them, thus assisting in maintaining the eagerly sought-after turtle population among the islands. The boobies are more at risk. In 1955 Desnoeufs supportes some 20 Brown Boobies and, between 1955 and 1965, 100-450 pairs of Masked Booby, yet by 1974 only 4 Brown and 21 Masked Booby pairs bred, reduced further in 1976 to 3 Brown and 17 Masked Booby nests (Feare 1978). The observations presented here suggest that the rate of decline, attributed to human predation, is slowing but reports of destruction of boobies continue with both visits by fishermen and oil pollution being blamed. Permanent wardening is not feasible and control over such activity impossible to exert unless there is a fundamental change in attitude towards these birds. Until such time as this might be effected, the only boobies likely to reared successfully on Desnoeufs are those hatched and fledged between May and October, making the recovery of the island population unlikely.

Of other species, the Wedge-tailed Shearwater population appears to be maintaining its numbers and descriptions by Percy and Ridley for 1955 and 1966 apply equally well today despite their recommendation to increase cropping (Percy and Ridley 1966). The Cattle Egrets also seem capable of withstanding the intense persecution recommended by Percy and Ridley and carried out by successive island managers.

The pattern of human activity on Desnoeufs is now well established in a generally satisfactory manner and, whilst further refinement of both wildlife conservation and of the birds' egg trade is desirable and expected, the future management of the island is likely to continue on the same lines as long as care is taken not to increase the crop beyond the sustainable yield of the tern population and that the commerce is maintained.

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12. SPATIAL AND TEMPORAL VARIABILITY OF RAINFALL ON ALDABRA ATOLL

by D. R. Stoddart

Introduction

In spite of the existence of substantial amounts of information on atoll climates in both the Indian and Pacific Oceans, remarkably little attention has been paid to the possible existence of climatic variations within individual atolls. There is a presumption that because of pervasive marine influences, small area, and negligible elevation above the sea, atoll land areas have a sufficiently homogeneous climatic regime (neglecting the effect of different vegetation types on micro-climate) that a single recording station will give an adequate characterisation of atoll-wide conditions. Three observations at least raise doubts about this proposition. One is the generally recognised distinctiveness of windward and leeward situations on atolls in the Trade Wind belts. A second is the sharply limited incidence of individual rainfall events, often generated by single cumulus clouds of smaller-than-atoll size, especially in equatorial regions. A third, known for centuries, is the coincidence of cumulus development with atoll locations.

Rainfall variability on atolls

A study of intra-atoll rainfall variability was made at Enewetak Atoll, Marshall Islands, in 1957-58. The raw data were published by Blumenstock and Rex (1960) but no analysis appeared. The daily observations show wide variability between stations (e.g. 5.28 mm on 13 November 1957 at Enewetak Island compared with 0.06 mm on Engebi Island 38 km away), with some individual monthly totals varying between stations by a factor of up to 2. Nevertheless, over a 5 month period (December 1957-April 1958) the total rainfall at three stations (Enewetak Island, Parry Island, Engebi Island) varied by less than 5 per cent. and over an 11 month period (September 1957-August 1958) total

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rainfall at two of the stations (Enewetak Island and Parry Island, 9 km apart) varied by only 6 per cent.

Longer-term records are available for two stations 5.5 km apart on the western rim of Canton Atoll, Phoenix Islands, for which monthly and annual rainfall data are available for the 16 years 1948-1962 and 1966. Individual monthly totals frequently differ between the two stations by more than 40 per cent (maximum 71 per cent). Few annual totals differ by more than 20 per cent, however, and the annual means for the 16 years of record differ by only 5.5 per cent. Overall there is a correlation greater than 0.9 between all pairs of both monthly and annual records.

Rainfall on Aldabra Atoll

Aldabra Atoll (46°20'E, 9°24'S) is located in the dry southwestern sector of the tropical Indian Ocean (Stoddart 1971). It is a slightly elevated atoll, with a land area of 155 sq km, enclosing a lagoon of similar area, with a limestone rim that reaches a maximum altitude of 8 m and with coastal dunes reaching 15 m above sea level. In consequence of a high tidal range, large areas of the lagoon floor are emersed during low spring tides. The atoll is affected by strong and persistent Southeast Trade winds between April and November, and by weaker and less constant Northwest Monsoon winds for the rest of the year. For all these reasons it might be expected that if climatic differences were to be found on land areas of atolls, they would be exhibited on Aldabra.

A Meteorological Station was established at the Settlement on Ile Picard, on the western side of the atoll, in September 1967. It was subsequently relocated at the Royal Society Aldabra Research Station, 1 km to the south, in 1970. Initially a single daily synoptic observation was made at 0900 hours (GMT +3), but in January 1975 the Station was upgraded to World Weather Watch standards, jointly staffed by the U.K. Meteorological Office, Bracknell, England, and the Royal Society. Three-hourly synoptic observations and daily rainfall records are available from this date. Before 1967 rainfall had been measured at the Settlement by the atoll manager between June 1949 and June 1953 (only one complete year of record: 1192 mm in 1950), and again in 1958 and 1959 (very low figures of 381 and 349 mm). These earlier monthly data are listed by Stoddart and Mole (1977), but because of their dubious reliability they are not considered further here.

Table 1 lists the monthly and annual rainfalls at the Meteorological Station for the 15 years 1968-1982. The mean annual total is 1089 mm, with a minimum of 547 and a maximum of 1467 mm. The scatter diagram of monthly rainfalls in Figure 13 shows the great variability of rainfall at a single site from year to year, and the annual histograms in Figure 14 show the variability in seasonal incidence from year to year. Though the Aldabra record is too short for analysis, it seems likely that the annual totals show substantial cyclical fluctuations from decade to decade, as identified for the granitic Seychelles

(Stoddart and Walsh 1979). There high rainfalls occurred before 1905, between 1923 and 1937, and since 1959, with markedly lower rainfalls during 1905-1922 and 1938-58. The changes are of the order of 500 mm, or 20 per cent, between each period, and all are statistically significant at the 99 per cent confidence level.

Local rainfall variability on Aldabra

Since active research began on Aldabra there has been speculation about the possibility of systematic climatic differences existing between different parts of the atoll. Farrow (1971, 85) discussed these, and provided daily rainfall data for the period 24 September-17 October 1968 at the Meteorological Station and at Passe Houareau (Middle Camp). These indicated day-to-day variability comparable to that already described at Enewetak, though totals were similar over the period of record. Subsequently J. Frazier maintained rainfall records for a total of 221 days between June 1969 and June 1970 at Dune Jean-Louis on the south coast. The total rainfall at the Meteorological Station over this period was 70.5 per cent of that recorded at Dune Jean-Louis, and the number of rain-days 69.5 per cent. Correlation of daily rainfall totals between the two stations was only 0.35, though the mean rainfall per rain-day was very similar. Rain at that period thus fell on more days on the windward than on the leeward coasts (Stoddart and Mole 1977, Table 15).

A systematic effort to study local rainfall variability on Aldabra began in 1973. Between April 1973 and November 1977 thirteen recording stations were established at sites around the atoll (Table 2, Figure 15). They consisted of a plastic 1-gallon container, firmly anchored in soil or rock, with a plastic receiving cylinder. At Middle Camp, however, a standard metal Bradford gauge was installed from the beginning, and similar gauges supplied by the U.K. Meteorological Office replaced the plastic containers at all other sites during 1976-77. To minimise evaporation a small quantity of oil was placed in the gauge to form a film on the water surface; the initial use of coconut oil for this purpose was discontinued because of its attraction to coconut crabs *Birgus latro*. The plastic gauges had to be frequently replaced in the early days on account of being chewed by coconut crabs or deteriorating in sunlight. Ants and rats proved troublesome at some sites. On one occasion the date of a reading was lost when the data card was chewed by a goat.

The gauges were emptied and contents recorded whenever field workers visited the sites. Heavily-used camp sites such as Middle Camp and Cinq Cases thus generated large numbers of closely-spaced records (252 and 161 respectively, with mean time intervals of 12.7 and 19.5 days), but other more remote sites were visited less frequently. On some occasions the capacity of the gauge was less than the amount of rainfall between readings and the gauge overflowed; to some extent, therefore, the data will under-estimate actual rainfall. The frequency of recording declined during 1980-81, and records ceased to be maintained during December 1981-January 1982.

In addition to the main sites a further gauge was installed for a short period adjacent to the main Meteorological Station, to provide a check on the reliability of the method. This site is identified as Station.

The data available thus comprise a series of readings at irregular, variable and non-synchronous times. They were compiled onto standard record cards on site, periodically transcribed at the Aldabra Research Station, and one set of cards returned to London with a duplicate set maintained on the atoll; two cards were lost in this process. A preliminary analysis of records for eight of the sites for periods up to February 1975 has been given by Hnatiuk (1979, 32).

For each station the data of both date of observation and rainfall were then tabulated in cumulative form from an arbitrary origin on 1 January 1973. For stations with gaps in the record new cumulations were started when the record was resumed. Daily cumulative values for each station for the period of record were then generated using a program (INTERPOL), by linear interpolation between each successive pair of records. The interpolated cumulative totals corresponding to the last day of each month for the period of record were used to derive rainfall totals for all months. These were summed to give annual figures. While these calculated monthly totals cannot obviously be equal to actual monthly rainfalls because of the infrequency of the original observations, they do nevertheless provide a basis for comparison both between stations at any time and between months at any station.

Results

Calculated annual totals for all local stations, together with actual annual records at the Meteorological Station, are given in Table 3 and Figure 16. These show substantial differences between successive years at each locality, and also between different sites in the same year. That the temporal variablity is real is indicated by the fact that over the period of this study the annual totals at the Meteorological Station itself varied from 826 to 1467 mm. The differences in annual means between sites is of the same order (minimum of 1098 mm at Middle Camp and maximum of 1567 mm at Anse Var). The level of annual variability is detailed in Table 4 (percentage difference between annual totals at each station and the mean at that station), Table 5 (percentage difference between annual totals at each station and the total for that year at the Meteorological Station), and Table 6 (percentage difference between annual totals at each station and the 15-year mean [1089 mm] at the Meteorological Station). Inspection of these tables shows that the level and distribution of percentage variability in time is very similar to that for variability in space. Tables 7-20 give the interpolated monthly figures and annual totals for each of the sites, together with means based on data for completed calendar years of record. Figure 17 gives histograms of mean monthly rainfall at each station.

These data clearly demonstrate the variability of rainfall in both space and time, as revealed by a monthly sampling interval, thus confirming the earlier inferences from the Enewetak and Canton data. The spatial dimension of rainfall events is thus smaller than the atoll dimension, and the occurrence of rainfall across the atoll is in general non-synchronised. These generalisations will not, however, necessarily hold when the atoll is affected by large-scale regional disturbances such as cyclones.

It is of particular interest to ascertain whether over longer time-scales the average conditions vary systematically with location. Inspection of the data suggest that they do. If we group together the stations on the northwest side of the atoll (Anse Mais, Bassin Lebine, Anse Var, Polymnie and Gionnet, with 31 individual annual totals altogether) the mean of all annual totals is 1340 mm. That for the south coast stations (Cinq Cases, Anse Takamaka, Dune Jean-Louis, Dune d'Messe, with 24 annual totals) is 1203 mm. That for the northeastern area (Anse Malabar, Middle Camp: 13 annual totals) is 1137 mm. The mean of all annual totals for all stations (92) is 1228 mm.

Conclusion

Whether these regional differences would be sustained by longer-term records is an open question, but as they stand at present they point to interesting geomorphological and ecological consequences. In his study of a long series of hourly observations, June 1949 to February 1959, at Enewetak Atoll, Lavoie (1963, iv) concluded that 'the atoll influence upon cloud or precipitation over the atoll itself is hardly detectable and probably insignificant'. However he did not have available rainfall data (other than occurrence or non-occurrence) for quantitative analysis. If Lavoie's conclusion can be taken to imply spatial heterogeneity of rainfall over the ocean irrespective of the presence of an atoll, then it is compatible with the Aldabra data. If, however, it is interpreted to mean that the atoll itself has a homogeneous rainfall environment at least up to time-scales of a decade and spatial scales of 30-40 km, then as a generalization it needs re-examination. It would be of great interest to examine rainfall characteristics on other atolls with large compact land masses (e.g. Christmas Island, Pacific Ocean) as well as those with small and scattered islets. Without the benefit of an active research programme, however, as on Aldabra, such a study could only feasibly be carried out using automatic recording equipment.

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Table 1. Monthly and annual rainfall at Aldabra 1968-1982

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1968	11.9	28.0	133.0	72.4	21.0	38.0	69.5	14.8	9.7	7.3	56.5	85.0	547.1
1969	153.4	147.2	151.5	393.5	176.3	36.8	38.7	14.3	18.5	11.8	54.9	56.8	1253.7
1970	47.5	85.2	139.6	210.5	31.7	29.5	33.7	25.7	7.3	20.9	12.7	56.0	700.3
1971	244.5	57.4	285.9	192.5	34.7	65.9	14.3	19.1	8.6	6.0	89.6	201.8	1220.3
1972	224.5	15.0	112.2	162.2	28.2	100.3	54.6	75.1	4.2	12.7	25.6	240.2	1054.8
1973	261.0	286.8	262.8	56.7	57.1	47.7	81.3	25.2	21.8	33.7	9.2	77.6	1220.9
1974	290.6	114.5	380.8	346.4	50.4	29.4	52.2	31.8	1.9	1.1	19.4	148.9	1467.4
1975	131.4	162.8	111.1	166.7	76.7	41.4	16.1	14.9	14.5	2.9	91.7	136.2	965.8
1976	358.4	177.4	260.9	87.2	66.6	64.4	65.5	35.1	4.7	0	16.7	104.4	1241.3
1977	262.4	116.3	255.7	240.8	132.3	89.5	82.2	26.9	5.0	37.0	63.5	120.8	1432.4
1978	254.0	139.2	339.0	18.0	54.8	48.1	135.4	23.2	8.7	16.9	191.6	234.4	1463.3
1979	233.6	108.6	105.2	67.8	116.8	51.4	61.4	32.6	19.4	0.1	52.3	278.5	1127.7
1980	82.1	151.9	120.8	184.9	19.1	66.1	16.6	40.0	10.0	1.6	9.5	123.1	825.7
1981	143.5	52.9	238.1	17.8	94.5	26.2	22.1	24.3	12.1	8.6	10.8	339.6	990.5
1982	83.0	43.0	125.0	130.0	73.0	103.0	12.9	17.2	40.9	47.5	110.4	34.6	820.5
Mean	185.5	112.4	201.4	156.5	68.9	55.8	50.4	28.0	12.5	13.9	54.3	149.2	1088.8

Table 2. Local rainfall stations at Aldabra Atoll

Locality	Grid reference	Gauge installed[1]	Final record
Station	050 090	13 February 1975 (10 March 1977)	3 December 1981
Bassin Lebine	067 100	9 November 1976 (15 April 1977)	26 December 1981
Anse Var	070 100	18 August 1976 (11 May 1977)	28 December 1981
Polymnie	106 126	9 November 1973 (1 June 1977)	29 December 1981
Gionnet	139 125	15 April 1974 (9 February 1977)	29 December 1981
Anse Malabar	253 128	21 April 1974 (23 September 1977)	14 January 1982
Middle Camp	314 119	5 April 1973 (5 April 1973)	13 January 1982
Airstrip Trace	374 083	16 November 1977 (16 November 1977)	12 January 1982
Cinq Cases	398 058	1 June 1973 (3 August 1977)	11 January 1982
Anse Takamaka	346 035	28 February 1974	17 December 1977
Dune Jean-Louis	260 035	30 June 1973 (23 March 1977)	27 January 1982
Dune d'Messe	189 013	29 April 1973 (16 September 1977)	27 January 1982
Anse Mais	069 043	3 July 1973 (17 September 1976)	11 December 1981
Ile Esprit	105 061	27 June 1976 (31 August 1977)	29 December 1981

[1]Date in parentheses is that of the installation of a standard Bradford gauge.

Table 3. Annual rainfall at different localities at Aldabra Atoll 1974-1982

Locality	1974	1975	1976	1977	1978	1979	1980	1981	No. of years	Mean
Meteorological Station	1467	966	1241	1432	1463	1128	826	991	8[1]	1189
Station	-	-	-	-	-	1125	777	-	2	951
Bassin Lebine	-	-	-	1877	1682	1367	1047	978	5	1390
Anse Var	-	-	-	1538	2070	1411	1250	-	4	1567
Polymnie	1908	1443	1635	906	1439	1355	1000	919	8	1326
Gionnet	-	1338	2208	1656	1371	1418	1036	1107	8	1448
Anse Malabar	-	-	1217	-	1552	1129	1179	917	5	1199
Middle Camp	1235	1150	1201	921	1541	989	1070	679	8	1098
Airstrip Trace	-	-	-	-	1593	1092	1180	913	4	1195
Cinq Cases	1332	1690	1217	1355	1308	1085	1065	792	8	1231
Anse Takamaka	-	1442	1241	-	-	-	-	-	2	1342
Dune Jean-Louis	990	1029	-	1469	1443	997	1084	863	7	1125
Dune d'Messe	-	852	1129	2391	1398	947	900	855	7	1210
Anse Mais	-	1106	1416	2073	1401	1064	1033	-	6	1349
Ile Esprit	-	-	-	1196	1564	1029	955	960	6	1141
Number of stations[2]	4	8	8	10	12	12	11	10		
Mean[2]	1366	1256	1408	1538	1530	1145	1070	898		1284

[1] Total length of record 15 years and overall mean 1089 mm.

[2] Excluding Meteorological Station.

Table 4. Percentage difference between annual rainfall at each station and the mean annual rainfall at that station

Locality	1974	1975	1976	1977	1978	1979	1980	1981
Station	-	-	-	-	-	+18.3	-18.3	-
Anse Var	-	-	-	-1.9	+32.1	-10.0	-20.2	-
Polymnie	+43.9	+8.8	+23.3	-31.7	+8.5	+2.2	-24.6	-30.7
Gionnet	-	-7.6	+52.5	+14.4	-5.3	-2.1	-28.4	-23.5
Anse Malabar	-	-	+1.5	-	+29.4	+5.8	-1.7	-23.5
Middle Camp	+12.5	+4.7	+9.4	-16.1	+40.3	-9.9	-2.6	-38.2
Airstrip Trace	-	-	-	-	+33.3	-8.6	-1.3	-23.6
Cinq Cases	+8.2	+37.3	-1.1	+10.1	+6.3	-11.9	-13.5	-35.7
Anse Takamaka	-	+7.5	-7.5	-	-	-	-	-
Dune Jean-Louis	-12.0	-8.5	-	+30.6	+28.3	-11.4	-3.6	-23.3
Dune d'Messe	-	-29.6	-6.7	+97.6	+15.5	-21.7	-25.6	-29.3
Anse Mais	-	-18.0	+5.0	+53.7	+3.9	-21.1	-23.4	-23.4
Ile Esprit	-	-	-	+4.8	+37.1	-9.8	-16.3	-15.9

Table 5. Percentage difference between individual local and Meteorological Station rainfalls for each year

Locality	1974	1975	1976	1977	1978	1979	1980	1981
Station	-	-	-	-	-	-0.3	-5.9	-
Anse Var	-	-	-	+7.4	+41.5	+25.1	+51.3	-
Polymnie	+30.1	+49.4	+31.7	-36.7	-1.6	+20.1	+21.1	-7.3
Gionnet	-	+38.5	+77.9	+15.6	-6.3	+25.7	+25.4	+11.7
Anse Malabar	-	-	-1.9	-	+6.1	+0.1	+42.7	-7.5
Middle Camp	-15.8	+19.0	-3.2	-35.7	+5.3	-12.3	+29.5	-31.5
Airstrip Trace	-	-	-	-	+8.9	-3.2	+42.9	-7.9
Cinq Cases	-9.2	+74.9	-1.9	-5.4	-10.6	-3.8	+28.9	-20.1
Anse Takamaka	-	+49.3	0	-	-	-	-	-
Dune Jean-Louis	-32.5	+6.5	-	+2.6	-1.4	-11.6	+31.2	-12.9
Dune d'Messe	-	-11.8	-9.0	+67.0	-4.4	-16.0	+9.0	-13.7
Anse Mais	-	+14.5	+14.1	+44.8	-4.2	-5.7	+25.1	-
Ile Esprit	-	-	-	-16.5	+6.9	-8.8	+15.6	-3.1

Table 6. Percentage difference between the annual rainfall at each locality and the 15-year mean annual rainfall at the Meteorological Station

Locality	1974	1975	1976	1977	1978	1979	1980	1981
Meteorological Station	+34.7	-11.3	+14.0	+31.5	+34.3	+3.6	-24.2	-9.0
Station	-	-	-	-	-	+3.3	-28.7	-
Bassin Lebine	-	-	-	+73.4	+54.5	+25.5	-3.8	-10.2
Anse Var	-	-	-	+41.2	+90.1	+29.6	+14.8	-
Polymnie	+75.2	+32.5	+50.1	-16.8	+32.1	+24.4	-8.2	-15.6
Gionnet	-	+22.9	+102.8	+52.1	+25.9	+30.2	-4.9	+1.7
Anse Malabar	-	-	+11.8	-	+42.5	+3.7	+8.3	-15.8
Middle Camp	+13.4	+5.6	+10.3	-15.4	+41.5	-9.2	-1.7	-37.6
Airstrip Trace	-	-	-	-	+46.3	+0.3	+8.4	-16.2
Cinq Cases	+22.3	+55.2	+11.8	+24.4	+20.1	-0.4	-2.2	-27.3
Anse Takamaka	-	+32.4	+14.0	-	-	-	-	-
Dune Jean-Louis	-9.1	-5.5	-	+34.9	+32.5	-8.4	-0.5	-20.8
Dune d'Messe	-	-21.8	+3.7	+119.6	+28.4	-13.0	-17.4	-21.5
Anse Mais	-	+1.6	+30.0	+90.4	+28.7	-2.3	-5.1	-
Ile Esprit	-	-	-	+9.8	+43.6	-5.5	-12.3	-11.8

Table 7. Monthly rainfall at Station, Ile Picard

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1975	-	-	123	140	77	38	14	3	2	76	72	74	-
1976	-	-	-	-	-	-	-	-	-	-	-	-	-
1977	-	-	-	168	105	102	63	31	25	21	-	-	-
1978	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	260	100	108	105	77	50	62	27	17	0	50	269	1125
1980	87	143	112	144	63	64	21	27	27	28	27	34	777
1981	130	56	185	158	91	57	26	13	13	1	9	-	-

Table 8. Monthly rainfall at Bassin Lebine, Ile Picard

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1976	-	-	-	-	-	-	-	-	-	-	-	182	-
1977	260	338	470	310	90	91	28	20	16	35	35	184	1877
1978	245	216	235	202	60	44	200	30	13	8	177	252	1682
1979	306	150	165	114	98	94	69	33	28	11	124	175	1367
1980	104	140	173	186	86	57	37	37	35	37	35	120	1047
1981	172	60	108	71	59	45	32	30	7	19	240	135	978
Mean[1]	217	181	230	177	79	66	73	30	20	22	122	173	1390

[1]Complete years only

Table 9. Monthly rainfall at Anse Var, Ile Picard

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1976	-	-	-	-	-	-	-	-	1	7	23	110	-
1977	154	384	198	155	134	111	57	24	7	9	98	207	1538
1978	766	114	449	30	45	74	180	28	6	3	211	164	2070
1979	350	122	311	103	85	54	49	30	21	1	93	192	1411
1980	66	314	314	129	94	73	56	56	33	43	41	31	1250
1981	21	19	21	21	21	25	15	0	0	34	23	282	482
Mean[1]	423	207	319	96	88	80	95	27	11	4	134	188	1673

[1]1977-1979; frequency of readings after May 1980 too low for records to be reliable

Table 10. Monthly rainfall at Polymnie, Ile Polymnie

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1973	-	-	-	-	-	-	-	-	-	-	-	110	-
1974	320	368	405	551	44	52	60	12	0	0	0	96	1908
1975	331	355	196	192	63	42	7	6	4	6	114	127	1443
1976	288	234	513	87	31	162	117	10	2	7	91	93	1635
1977	104	94	104	74	82	85	48	35	14	33	79	154	906
1978	183	120	442	39	43	69	195	15	2	8	93	230	1439
1979	388	183	164	123	101	82	53	34	18	19	142	48	1355
1980	102	88	138	217	111	38	39	39	24	3	70	131	1000
1981	155	140	73	114	82	74	41	25	28	33	15	289	919
Mean[1]	234	198	254	175	70	76	70	21	12	14	76	146	1326

[1]Complete years only

Table 11. Monthly rainfall at Gionnet, Ile Malabar

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1974	-	-	-	-	-	-	-	-	-	-	11	249	-
1975	445	319	144	150	66	48	17	4	2	5	33	105	1338
1976	286	263	841	193	32	167	188	14	12	13	21	178	2208
1977	333	119	124	111	110	143	246	123	8	50	121	168	1656
1978	131	145	417	25	63	59	141	43	15	9	93	230	1371
1979	325	226	152	137	94	75	77	49	16	15	98	154	1418
1980	86	77	145	206	87	55	51	32	18	19	122	138	1036
1981	174	162	74	115	104	87	27	32	19	20	41	252	1107
Mean[1]	254	187	271	134	79	91	107	42	13	19	76	175	1448

[1]Complete years only

Table 12. Monthly rainfall at Anse Malabar, Ile Malabar

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1975	-	-	124	94	78	36	8	8	5	3	49	88	-
1976	218	200	279	97	45	111	95	30	5	4	3	130	1217
1977	116	127	69	-	-	-	-	10	12	23	61	166	-
1978	154	131	439	62	165	151	94	35	13	11	182	115	1552
1979	219	180	171	43	143	55	56	51	34	14	40	123	1129
1980	126	110	122	258	156	37	38	38	37	38	49	170	1179
1981	170	72	69	66	69	66	26	46	16	128	93	96	917
Mean[1]	177	139	216	105	116	84	62	40	21	39	73	127	1199

[1]Complete years only

Table 13. Monthly rainfall at Middle Camp, Ile Malabar

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1973	-	-	-	-	13	15	40	44	16	4	25	121	-
1974	384	97	226	300	29	24	17	29	0	0	0	129	1235
1975	257	244	167	93	81	34	18	11	9	12	56	168	1150
1976	288	135	318	59	47	67	72	29	1	4	21	160	1201
1977	192	86	110	124	109	83	55	18	6	4	37	97	921
1978	265	294	335	109	54	25	118	14	2	0	151	174	1541
1979	207	139	165	52	93	30	36	30	47	4	57	129	989
1980	136	125	151	173	107	69	40	31	10	77	74	77	1070
1981	77	58	63	61	63	61	9	8	16	7	128	128	679
Mean[1]	226	147	192	121	73	49	46	21	11	14	66	133	1098

[1]Complete years only

Table 14. Monthly rainfall at Airstrip Trace, Grande Terre

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1977	-	-	-	-	-	-	-	-	-	-	-	169	-
1978	353	171	341	51	132	65	125	29	11	22	165	128	1593
1979	302	135	143	47	114	50	52	45	15	5	33	151	1092
1980	177	156	168	162	101	80	42	37	36	37	54	130	1180
1981	130	74	72	70	72	70	58	24	14	148	89	92	913
Mean[1]	241	134	181	83	105	53	69	34	19	53	85	125	1195

[1]Complete years only

Table 15. Monthly rainfall at Cinq Cases, Grande Terre

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1973	-	-	-	-	-	-	119	79	28	7	30	167	-
1974	280	125	439	133	43	60	110	46	22	6	1	67	1332
1975	501	453	147	338	55	36	13	6	11	14	29	87	1690
1976	138	125	484	74	77	105	92	7	0	1	26	88	1217
1977	183	86	195	120	131	180	186	45	19	20	39	151	1355
1978	190	226	295	33	50	115	34	31	7	10	160	157	1308
1979	307	121	128	47	125	45	66	26	20	12	23	165	1085
1980	182	156	170	162	100	30	27	20	15	16	41	146	1065
1981	146	60	53	52	53	52	45	31	11	128	79	82	792
Mean[1]	241	169	239	120	79	78	72	27	13	26	50	118	1231

[1]Complete years only

Table 16. Monthly rainfall at Anse Takamaka, Grande Terre

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1974	-	-	189	460	84	0	0	0	0	0	0	300	-
1975	284	248	274	266	180	31	4	7	5	9	41	93	1442
1976	288	154	171	165	171	165	107	11	9	0	0	0	1241
1977	67	78	98	115	189	140	60	140	101	117	113	-	-
Mean[1]	286	201	223	216	176	98	56	9	7	5	21	47	1342

[1]Complete years only

Table 17. Monthly rainfall at Dune Jean-Louis, Grande Terre

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1973	-	-	-	-	-	-	-	56	38	39	112	193	-
1974	188	63	215	186	17	53	30	44	1	0	6	187	990
1975	193	187	188	151	105	29	6	16	10	15	41	88	1029
1976	-	-	-	-	-	-	-	-	4	0	58	120	-
1977	360	207	242	143	101	89	54	19	23	26	59	146	1469
1978	287	136	354	33	68	34	100	18	2	7	158	246	1443
1979	222	128	94	56	103	68	70	48	20	5	15	168	997
1980	147	184	109	106	66	54	72	37	20	81	102	106	1084
1981	104	87	124	76	63	61	45	36	24	95	73	75	863
Mean[1]	214	142	189	107	75	55	54	31	14	33	65	145	1125

[1]Complete years only

Table 18. Monthly rainfall at Dune d'Messe, Grande Terre

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1975	139	130	144	139	123	25	2	6	9	12	42	81	852
1976	358	231	177	78	49	19	70	60	2	16	25	44	1129
1977	437	252	130	346	330	230	236	123	48	47	104	108	2391
1978	146	245	385	33	44	94	71	39	7	3	163	168	1398
1979	251	150	96	60	79	47	48	36	10	8	34	128	947
1980	178	91	101	98	101	67	53	29	16	27	68	71	900
1981	109	123	137	73	57	55	26	25	99	51	49	51	855
Mean	231	175	167	118	112	77	72	45	27	23	69	93	1210

Table 19. Monthly rainfall at Anse Mais, Grande Terre

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1975	230	167	180	123	76	2	11	6	10	7	102	192	1106
1976	404	124	299	109	23	8	8	274	9	4	28	126	1416
1977	588	200	498	241	136	80	66	36	13	68	74	73	2073
1978	278	116	311	51	35	50	129	68	37	77	106	143	1401
1979	200	122	98	96	92	54	74	31	9	2	89	197	1064
1980	88	130	164	149	119	114	43	34	18	4	26	144	1033
1981	104	68	168	40	77	31	26	50	19	18	43	-	-
Mean[1]	298	143	258	128	80	51	55	75	16	27	71	146	1349

[1]Complete years only

Table 20. Monthly rainfall at Ile Esprit

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1976	-	-	-	-	-	-	111	34	2	10	103	107	-
1977	145	204	191	132	143	124	52	33	8	32	35	97	1196
1978	182	210	270	200	55	221	18	17	4	83	92	212	1564
1979	209	144	139	80	61	64	66	34	10	14	50	158	1029
1980	287	213	108	26	27	26	27	27	30	62	60	62	955
1981	98	112	125	121	54	50	33	18	16	17	21	295	960
Mean[1]	184	177	167	112	68	97	39	26	14	42	52	165	1141

[1]Complete years only

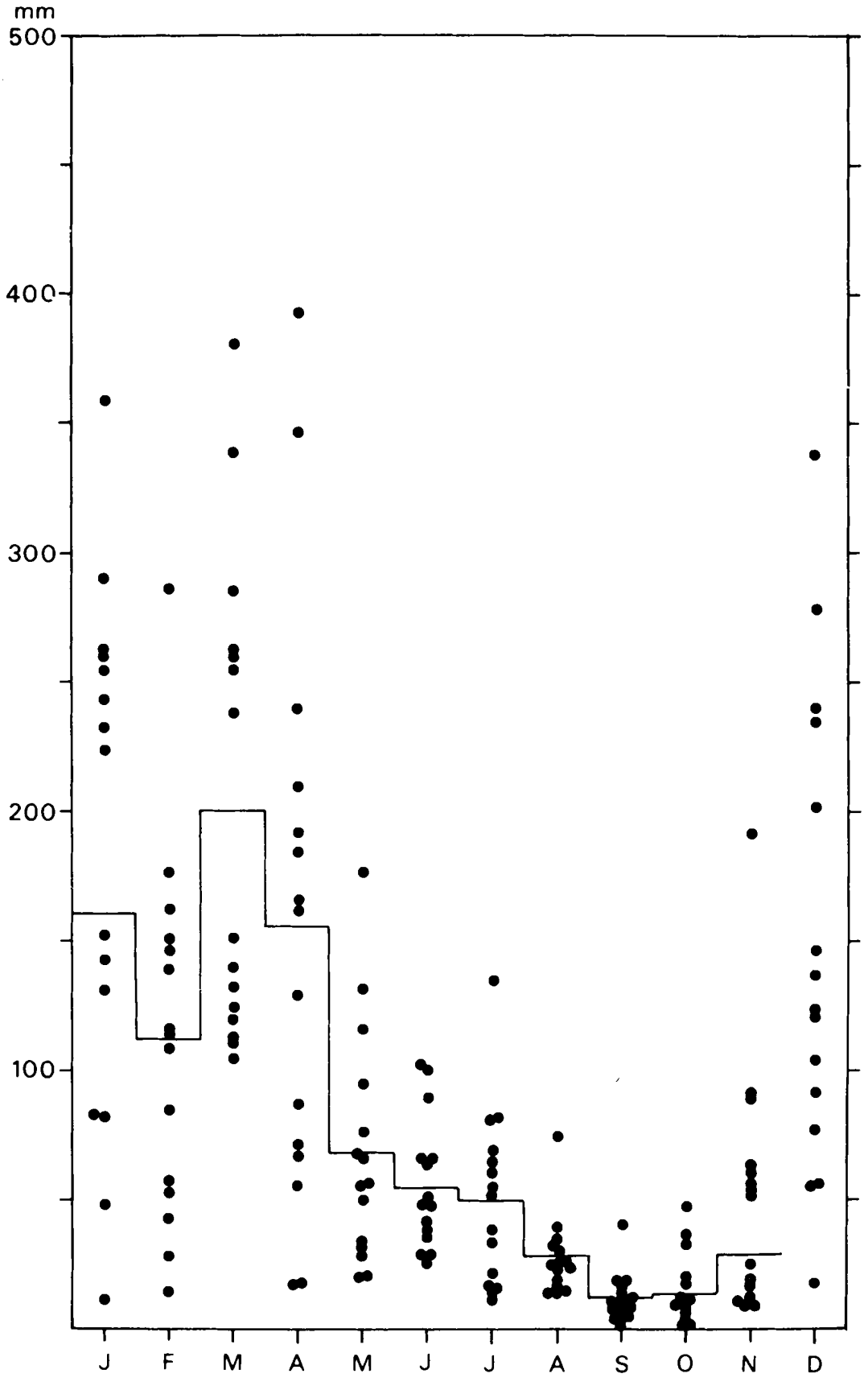

Figure 13. Monthly rainfall on Aldabra 1968-1982 (Meteorological Station data)

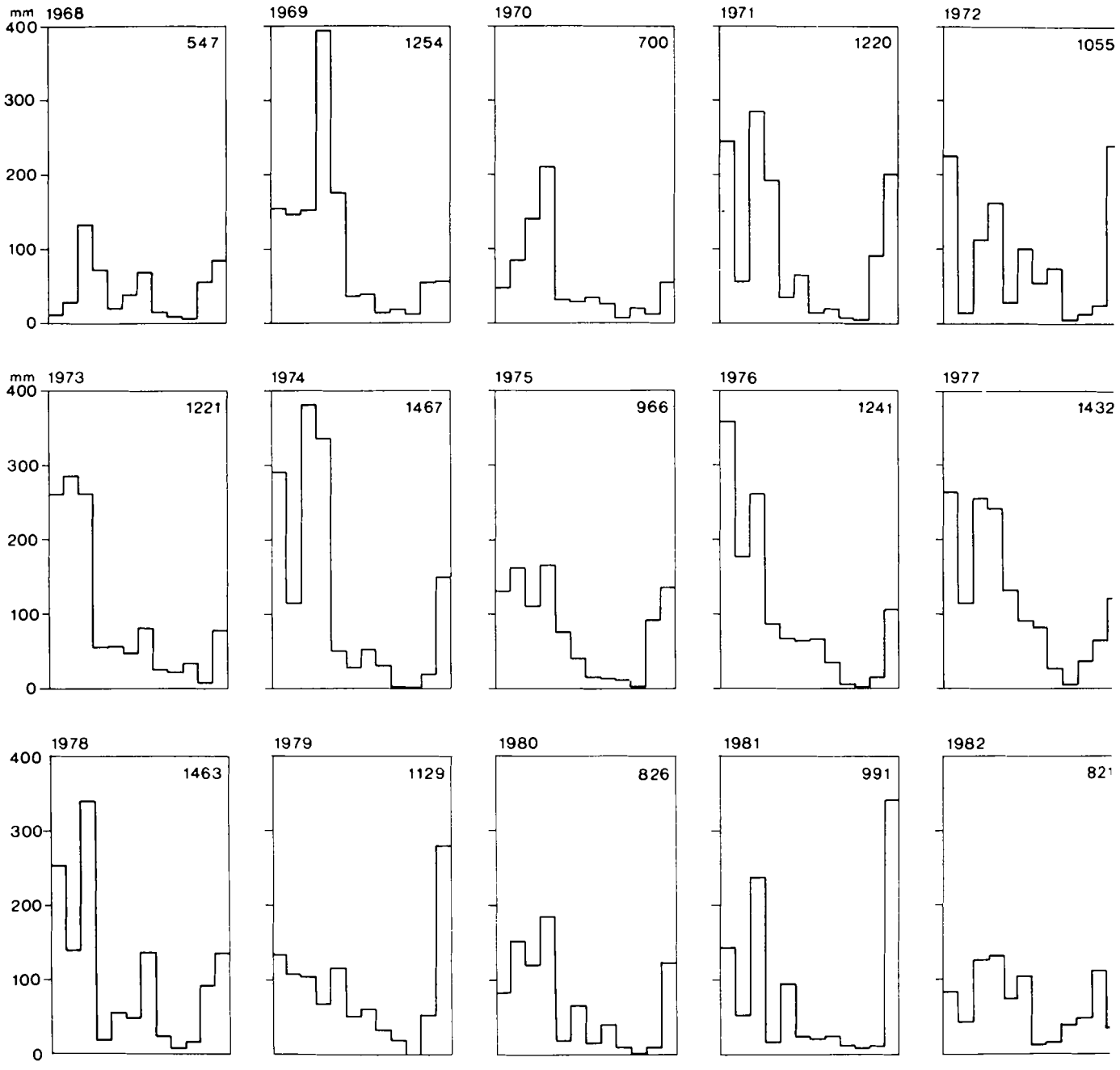

Figure 14. Histograms of monthly distribution of rainfall for each year of record at Aldabra, 1968-1982 (Meteorological Station data)

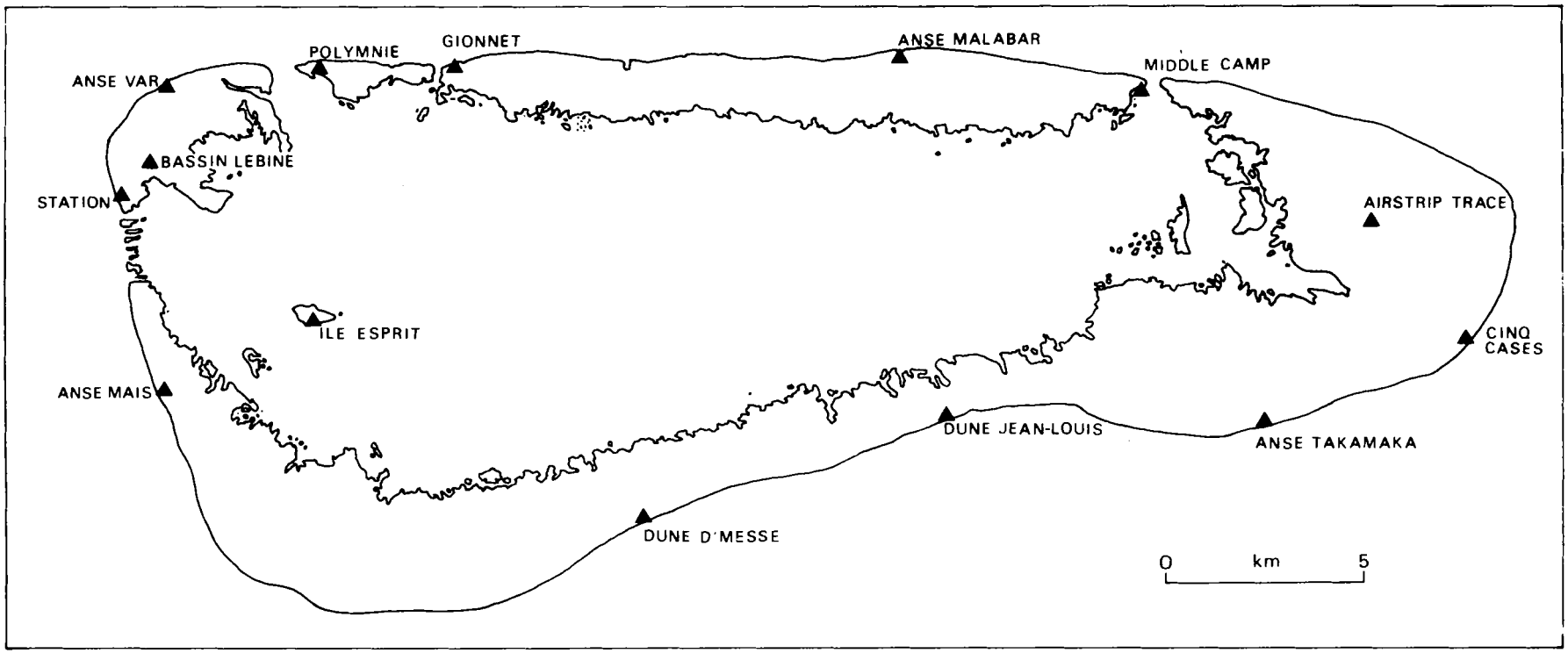

Figure 15. Location of local rainfall stations at Aldabra

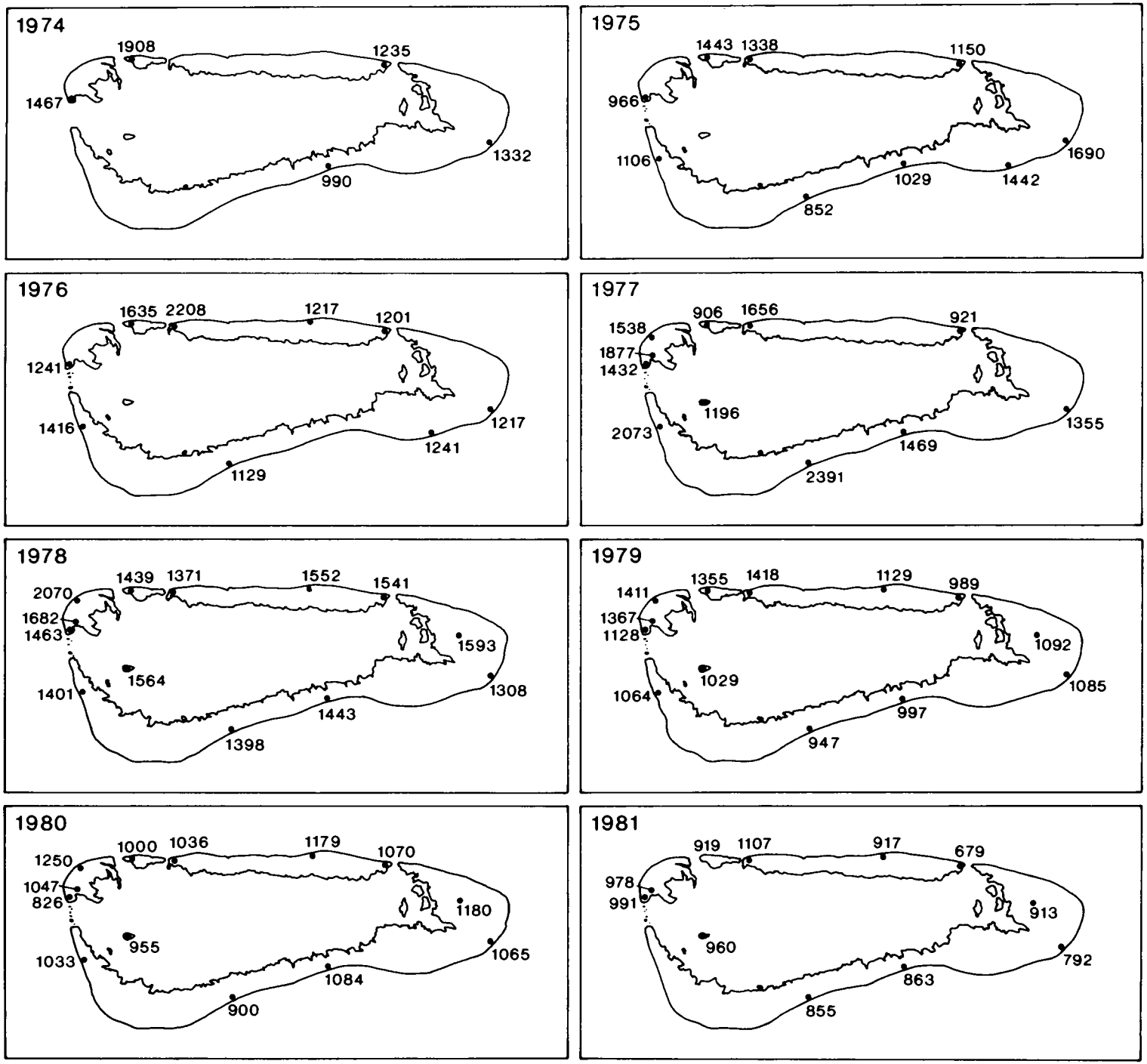

Figure 16. Annual rainfall totals at recording stations on Aldabra, 1974-1981

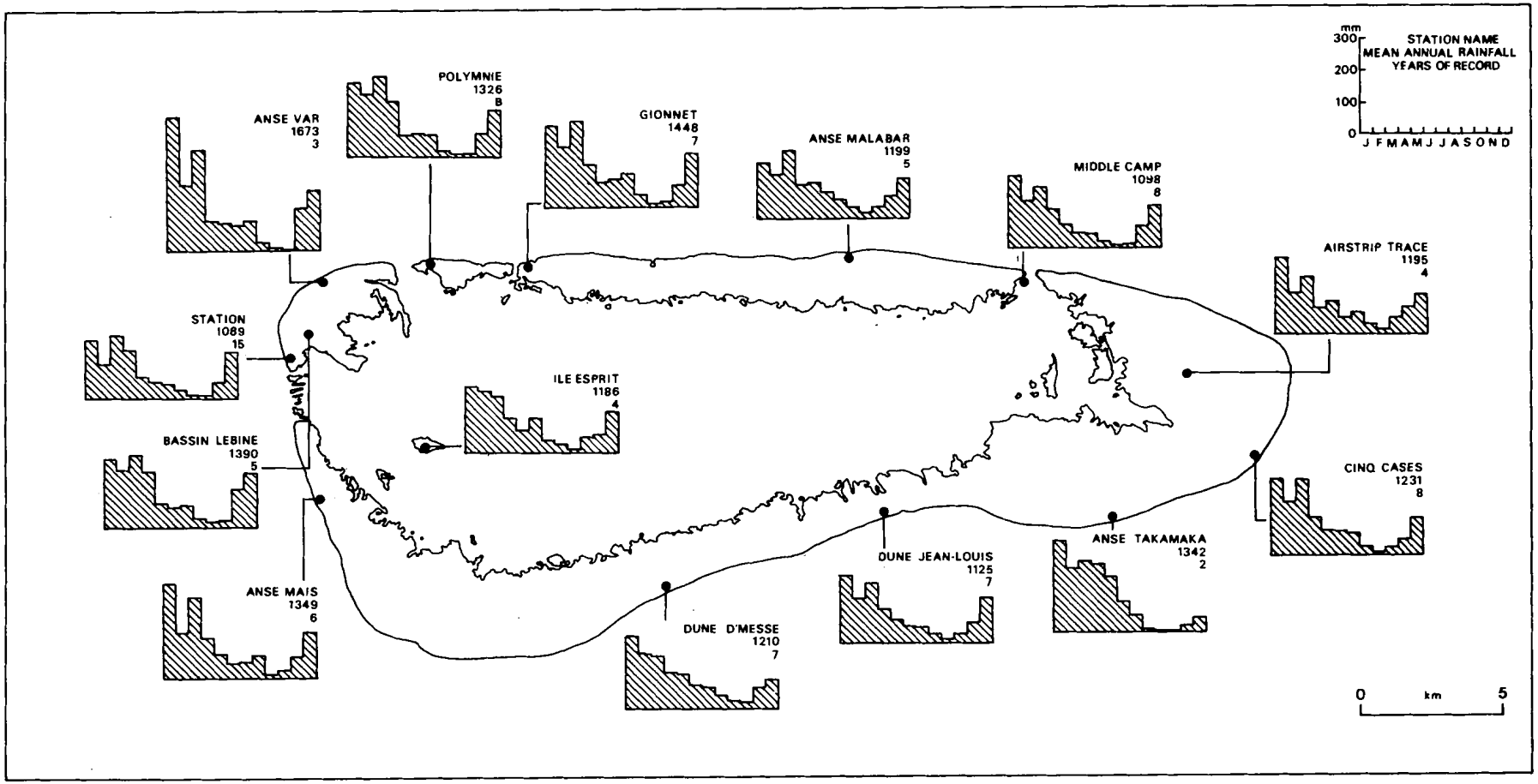

Figure 17. Monthly distribution of rainfall at local recording stations on Aldabra

13. THE GOAT AND THE COCCID: INTERACTIONS BETWEEN TWO INTRODUCED HERBIVORES AND THE VEGETATION OF ALDABRA ATOLL

by Margaret S. Gould, M. Garry Hill and David McC. Newbery

Abstract

Feeding preferences of two introduced, taxonomically remote herbivores were examined on Aldabra Atoll, in the western Indian Ocean. Both the feral goats (Capra hircus) and the coccids (Icerya seychellarum) exhibited clear preferences as to which plant species were fed upon, and these preferences overlapped to some extent. Although the individual actions of goats and coccids did not contribute directly to plant mortality, the combined effect of these two herbivores may be enough to jeopardize the survival of preferred, susceptible plant species, and thus may alter community structure on the atoll. When given a choice, a captive goat preferred coccid-infested vegetation to uninfested vegetation.

Introduction

Interactions between herbivores of very different taxonomic orders have been seldom investigated, though their importance is often suspected in many ecosystems. Situations rarely arise in which their effects can be separated from many other environmental interactions. We present here an unusual example of such an interaction which may generally be more common than previously realized. This paper summarizes our knowledge of the feeding preferences of two taxonomically remote but extremely important herbivores on the atoll of Aldabra and discusses their combined impact on the island ecosystem.

Aldabra is a large, raised coral atoll in the western Indian Ocean (46°20'E, 9°24'S). Its geology and ecology have been extensively reported elsewhere (e.g., Westoll & Stoddart, 1971; Braithwaite et al., 1973; Gould & Swingland, 1980; Hill & Newberry, 1980).

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The only introduced vertebrate herbivore on the atoll has been and still is the feral goat (Capra hircus L.). Although the precise history of the population is uncertain, it probably originated from introductions in the late 19th century (Stoddart, 1981; Gould & Swingland, 1980). Gould (1979) and Gould & Swingland (1980) have described the population dynamics and behavioral ecology of the goats and their interactions with the atoll's major native herbivore, the giant tortoise (Geochelone gigantea Schweiger).

The most abundant invertebrate herbivore on Aldabra is a phloem-feeding insect, the coccid Icerya seychellarum Westwood (Homoptera; Margarodidae). From the time of its first report in 1968, the population rose to epidemic proportions on the atoll in the mid-1970's and has now (1979-82) fallen to a stable, low level (Hill & Newbery, 1980; Newbery, unpublished). The origins of the infestation are uncertain, although accidental introduction on fruit or plant stock is the most likely explanation (Hill & Newbery, 1982). Newbery (1980a, b) found that this coccid could reduce substantially the growth of highly susceptible tree species, but it seems that infestation caused little direct tree mortality (Hill & Newbery, 1980).

Methods

Experiment 1: General vegetation preferences of goats

Experiments on the feeding preferences of goats were conducted from January to May 1977, in a 4m x 4 m mangrove-pole enclosure at the eastern end of Malabar Island, Aldabra. A goat was captured at night, placed in the enclosure and allowed the following day to become accustomed to its confinement, the presence of an observer, and the experimental routine. Data collected from the second day on were used in the analysis. At dawn each day, five forage bundles were hung inside the enclosure at head height for the goat and spaced so that the animal had to take at least several steps to move from one bundle to another. The positions of the bundles were randomized daily. Each bundle was composed of one of five plant species known from direct field observations (Gould, 1979) to be preferred browse species for the goats: Capparis cartilaginea Decne, Pemphis acidula Forst., Phyllanthus casticum Willemet f., Polysphaeria multiflora Hiern, and Sideroxylon inerme L.. An effort was made to have all five bundles approximately the same size each day. Beginning weights of the bundles ranged from 275 to 2280 g over the course of the experiments. The experimental animal was observed continuously throughout the day until dark when the remnants of the bundles were removed from the enclosure. During the day, the cumulative time spent feeding at each species bundle was recorded. Each experiment lasted 2-4 days and three replicate goats were used: a mature male, a mature female, and an immature (sub-adult) male.

Experiment 2: Goat preference for Icerya-infested versus Icerya-free vegetation

To determine if feeding preferences were influenced by the presence of coccids on some of the vegetation, a captive goat was allowed to choose

between infested and uninfested food bundles. Using the same experimental set-up as in the first experiment, two small (25-80 g) bundles, one with Icerya-infested Sideroxylon and the other with Icerya-free Sideroxylon, were hung in the enclosure for two minutes, then removed. Only Sideroxylon inerme was used for this experiment since Experiment 1 had shown that it was the goat's most preferred browse species. The time spent feeding at and the amount eaten from each of the two bundles were recorded during the two minutes. The experiment was repeated 32 times with the same goat, the immature male. The position of the bundles was reversed on successive trials to remove any positional bias.

Field studies on Icerya feeding preferences

Feeding preferences of Icerya were recorded in surveys of the Aldabra vegetation 1976-1978. The abundance of Icerya on 52 common plant species at 79 sites was assessed using a subjective five-point scale (0 = no Icerya present, to 4 = Icerya infestation devastating). The median score for each plant species over the whole atoll may be considered a comparative measure of Icerya preference (Hill & Newbery, 1980).

Results

Experiment 1 and Icerya feeding preferences

Sideroxylon inerme was by far the most preferred food source for both the feral goats and the coccids (Table 1). Agreement between the goat and coccid rankings of the other four species is less clear, especially since the goats showed individual variation. Capparis cartilaginea, however, was least preferred by the goats overall and was not utilized at all by coccids. Polysphaeria multiflora on the other hand had a fairly high preference rank with Icerya (11th out of 52 species in 1978), but was a low choice for two of the goats.

Experiment 2

The Icerya-infested bundles of Sideroxylon were preferred significantly to the uninfested bundles both in terms of the time spent feeding at each and the percentage (by weight) of available forage eaten (Table 2).

Discussion

The ranking of plant species obtained in Experiment 1 does not match the frequency of consumption of those same species observed in the field. For example, captive goats preferentially consumed much Sideroxylon and relatively little Capparis. Yet in field observations made at the eastern end of Malabar Island during the same time of year, Capparis was the most frequently observed browse species and Sideroxylon ranked third (Gould, 1979; Gould & Swingland, 1980). This discrepancy is most likely explained by differences in availability of browse species in the field versus in the enclosure. In the enclosure, all five species

were readily and equally available, and the consumption pattern of the goats was an accurate reflection of their preferences. Yet in the field under natural conditions, much more of the low, shrubby Capparis was available to the goats than was the tree-form Sideroxylon with its established browse lines (Gould, 1979). There was also a high procurement cost (in terms of time, energy and risk of injury from browsing on hindlegs) associated with trying to feed on Sideroxylon in the field (Gould & Swingland, 1980).

In detailed studies of Icerya on Aldabra, Newbery (1980a, b) has shown that heavy infestations of this species can reduce the growth rate of two host plant species (Scaevola sericea Vahl, and Euphorbia pyrifolia Lam.) by approximately 50%. The long term effect of this level of infestation upon the survival of these plant species and upon the structure of the plant community is not yet known. Those species which are preferred by both invertebrate and vertebrate herbivores will be subject to even greater levels of stress.

Sideroxylon inerme is an important component of most scrub communities on Aldabra (Hnatiuk & Merton 1979; Newbery & Hill, 1981). Many of the mature trees of this species have clearly defined goat browse lines and are often badly infested with Icerya. In addition, on those parts of the atoll where goat densities are greatest (e.g., the eastern end of Malabar Island) seedling Sideroxylon are rare and restricted to areas of deeply dissected coral limestone inaccessible to goats (Gould & Swingland 1980). The combined impact of goats and Icerya may well have a serious effect upon the competitive ability and survival of Sideroxylon, at least on some parts of the atoll.

Experiment 2 showed that Icerya-infested Sideroxylon was consumed preferentially to uninfested Sideroxylon. This is encouraging, as one pest (the goat) will thereby eat the other (the coccid). However, since the foliage is also consumed in the process, the net result is of dubious benefit to the vegetation. The reason for the preference is unclear, though a likely explanation is that the goat is attracted by honeydew, the sweet excrement characteristic of phloem-feeding insects such as Icerya.

The results suggest that two herbivores of widely differing taxa demonstrate strong feeding preferences which overlap to some degree. The cumulative effect of such taxa being introduced into island ecosystems such as Aldabra may be far reaching, and is likely to affect plant community structure significantly in years to come. Furthermore, successive accidental introductions of herbivores are likely to have an accelerating influence upon plant community changes if certain plant species are typically more susceptible to a wide range of herbivores.

Future research aimed at quantifying the susceptibility of plants to a wide range of herbivores would be of interest, particularly with regard to islands such as Aldabra which have a high degree of endemism (Renvoize, 1971). It has been postulated that plants evolving on islands in the absence of strong herbivore pressure are more likely to lack

Table 1. Daily mean feeding time (minutes) of goats, median abundance of Icerya (Hill and Newbery, 1980), and relative preference ranks for five plant species. Numbers in parentheses for Icerya = preference ranks among the 52 plant species examined for Icerya infestation.

	Goat #1 feeding time	rank	Goat #2 feeding time	rank	Goat #3 feeding time	rank	Goat Totals feeding time	rank	Icerya infestation median score 1976/1977	1978	rank
Sideroxylon inerme	52.5 (49%)	1	30.5 (57%)	1	62.8 (61%)	1	145.8 (55%)	1	0.60 (12)	1.35 (5)	1
Pemphis acidula	27.2 (25%)	2	11.6 (22%)	2	16.2 (16%)	3	55.0 (21%)	2	0.01 (31)	0.05 (24)	3
Phyllanthus casticum	15.6 (14%)	3	0.2	4	16.8 (16%)	2	32.6 (12%)	3	0	0	=4
Polysphaeria multiflora	4.7 (4%)	5	11.0 (21%)	3	7.2 (7%)	4	22.9 (9%)	4	0.59 (14)	0.43 (11)	2
Capparis cartilaginea	7.7 (7%)	4	0	5	0.7 (1%)	5	8.4 (3%)	5	0	0	=4

chemical defenses against herbivore attack (Levin, 1976). If this is true, it is endemic plant taxa such as Sideroxylon inerme (endemic ssp. cryptophlebia (Baker) Hemsley) which are most at risk from introduced herbivores.

Table 2. Chi-square test of time (seconds) spent feeding on infested and uninfested Sideroxylon bundles, plus test for equality of two percentages (Sokal & Rohlf, 1969) based on the grams (g) eaten of each.

Bundles	time	χ^2	g eaten	g not eaten	p(of being eaten)	t_s
Coccid infested	1683		711	679	0.5115	
		14.66*				9.55**
Uninfested	1468		451	903	0.3331	

* = $p < 0.005$

** = $p < 0.001$

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