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## Settlement, Development and Conservation of Aldabra

D. R. Stoddart

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## Settlement, development and conservation of Aldabra

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[Plates 32 and 33]

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## 1. HISTORY OF HUMAN SETTLEMENT

The early history of human settlement at Aldabra is obscure. Voeltzkow (1897) summarizes early knowledge, mainly from the charts in A. Grandidier's *Histoire physique, naturelle et politique de Madagascar* (1885) from the sixteenth century onwards. It is possible that the atoll was visited by Arab or even Chinese seafarers before this time, for there was a flourishing trade on the East African coast, and the Arabs knew the Comoros, Madagascar and probably the Mascarenes (Hourani 1951; Freeman-Grenville 1962; Toussaint 1961). Apart from a single, probably Islamic, sherd on Ile Picard, however, no archaeological remains of such visits have been found, and the only fragment of Chinese pottery, found in Passe du Bois, is nineteenth century (Chittick 1968). Low drystone walled enclosures (figure 10, plate 33) are found in several places round Aldabra (Voeltzkow 1897, p. 52), together with water-holes protected by rock slabs and blocks of imported rock far from the coast. All of these may be of some antiquity, but the enclosures have certainly been used and repaired in recent years, both to keep captured tortoises in before export, as at Anse Cèdres, and to keep tortoises away from growing vegetables, as at Dune Jean-Louis. Because of the lack of water and distance from trade routes it is likely that pre-European visitors were castaways and not settlers: even the far more attractive Seychelles were apparently not settled in pre-European times (Sauer 1967).

Aldabra was probably discovered by Europeans soon after the Portuguese expansion into the Indian Ocean at the end of the fifteenth century. Many islands, now difficult to identify, are recorded on early sixteenth century maps north of the Mozambique Channel and Madagascar. Ilha Dara appears in Pedro Reinel's chart of 1517, and persists until 1558; other names which appear consistently are Ilha do Natal and Ilha do Arco. Cosmoledo first appears on Diego Homen's chart of 1558. Accurate knowledge of the coral islands of the western Indian Ocean dates, however, from a series of exploring expeditions sent to the Seychelles from the Ile de France (Mauritius) in the middle of the eighteenth century. Lazare Picault and Jean Grossin are said to have called at Aldabra in the *Charles* and the *Elisabeth* in 1742 (Findlay 1882; Keller 1901), during the voyage which discovered the Seychelles. According to Horsburgh (1852, pp. 174–176), Aldabra was visited in August 1756 by Nicolas de Morphey, in *Le Cerf*, on the voyage in which the French took possession of Mahé.

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For the next century little is known of activities at Aldabra. The atoll was visited in November 1766 by the ship *Asia*, in December 1815 by the *Lord Castlereagh*, and in 1841 by Captain Jehenne in *La Prévoyante* (Horsburgh 1852; Voeltzkow 1897). A schooner from Réunion was wrecked at Dune Jean-Louis in 1855, and another at Ile Picard in 1865 (Bergne 1900). The ship *Euphrates*, out of London for Karachi, anchored in the lagoon in 1862, and gave its name to the island properly known as Ile Esprit. It is also frequently stated (Ommanney 1952, p. 274) that at a much later date the German cruiser *Königsberg* hid in Grande Passe for two months in 1915, before being destroyed by British warships on the African coast. The *Königsberg* certainly called at Aldabra to meet a supply ship, and anchored at Settlement, but there is no evidence that the ship entered Grande Passe (Looft 1929, 1936).

The atoll was undoubtedly visited from time to time by local fishermen, particularly after the French established their settlement in the Seychelles in 1770. In common with neighbouring islands, it certainly formed a source for the export of Giant Land Tortoises, though the lack of a water supply probably prohibited permanent settlement. Because of the rocky nature of the ground it was impossible to dig wells, and as a result it was recorded that 'les pecheurs qu'on y envoie quelquefois des Seychelles, sont réduits, quand leur provision d'eau diminue, à boire l'urine des tortues' (Unienville 1838, p. 217). There is no record of sovereignty being claimed by either the French or the British at this time. The French settlement at Mahé was defeated by the British in 1794, and the Ile de France was taken by them in 1810. The Seychelles were finally transferred to Britain by the Treaty of Vienna in 1815. During the rest of the nineteenth century, when the Seychelles were administered from Mauritius, Aldabra presumably formed part of the latter colony, though formal claim seems not have been laid until the visit of H.M.S. *Redbreast* in 1892. The Administrator of Seychelles, T. R. Griffith, erected a flagstaff at Ile Picard on this occasion, and raised the Union Jack.

Aldabra was apparently uninhabited in 1878, when H.M.S. *Fawn*, Commander Wharton, carried out the first hydrographic survey. In 1879, however, an attempt was made to settle by a party of 27 adults and 13 children, all Norwegians from Bergen, who arrived via Nossi-Bé to found a fishing station on communistic principles (Anonymous 1879; Reclus 1889, p. 155). The fate of this scheme is unknown. Shortly afterwards it was decided by the Government of Mauritius to exploit the atoll by leasing it commercially for a small annual rent. The first lease was allotted to Jules Cauvin of Mahé in 1888. Cauvin established a settlement at Ile Magnan in West Channels, where he planted coconuts while exploiting timber. In 1890 the lease passed to James Spurs, at a rent of Rs. 500 per annum, and he held it for ten years, moving the settlement to its present site on Ile Picard. Spurs had worked for many years as manager at Diego Garcia in the Chagos Archipelago (Scott 1961, pp. 165–169). The Administrator of the Seychelles considered that 'the Government are fortunate in having secured Mr Spurs for a tenant; for it will be gathered from his report. . . that he is an observant man and a lover of Nature, nor do I think he is likely, to use an old and homely phrase, to kill the goose that lays the golden eggs by exhibiting that rapaciousness which had characterized the actions of others who have been there before him' (Griffiths, in Spurs 1892, p. 45). Nevertheless, Spurs proposed to take up to 12000 Green Turtles a year from Aldabra, for what was then a 'trifling' rent. He did, however, attempt to repopulate Ile Picard with tortoises, warned of the disappearance of the Hawksbill and of the consequences of taking many more female than male Green Turtles, and even brought Chinese to Aldabra from Mahé to make trepang.

By the time of Voeltzkow's and Baty's visits in 1895, there was a settlement at Ile Picard of



FIGURES 1 AND 2. The settlement at Aldabra (West Island) in 1908 (photographs by the late Sir John Fryer.)

FIGURE 3. The settlement at Aldabra (West Island) in 1968.

FIGURE 4. The guest house (Royal Society Expedition Headquarters) and main rainwater tank in the West Island settlement.

FIGURE 5. The manager's house, Settlement, with fish-drying racks and charcoal stocks.

FIGURE 6. West Island cemetery.

(Facing p. 612)

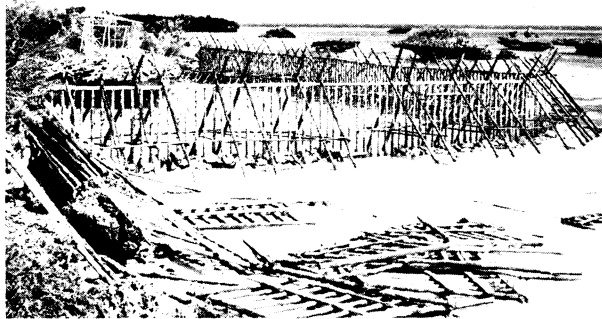


FIGURE 7. Temporary fishing shack on Middle Island at Passe Houareau (1966).

FIGURE 8. Temporary turtling hut at Dune Jean-Louis, South Island (1968).

FIGURE 9. Green Turtle pound, in use until August 1968, south side of Passe Femme, West Channels.

FIGURE 10. Drystone enclosure, possibly for tortoises, at Dune Jean-Louis, South Island.

FIGURE 11. Introduced sisal *Agave sisalana* and cedar *Casuarina equisetifolia* at Anse Cèdre Polymnie, Ile Polymnie.

FIGURE 12. Large *Casuarina* grove at Anse Cèdres, South Island. Note the lack of ground vegetation.

20 Seychellois labourers in ten houses, growing maize and vegetables, and taking turtles and tortoises (Voeltzkow 1897; Keller 1901). Occupation was largely seasonal: during the dry season, from June to December, only two men were left there, to act as watchmen, collect water, and 'hoist the jack on the approach of any ship' (Baty, in Bergne 1900). Water supply was a matter of grave concern for the labourers. In 1895 Baty found tanks and barrels, fed from three iron roofs, with a capacity of 900 velts (6100 l; 1350 gal), and coral basins with a capacity of 3000 velts (13 600 l). The earlier settlement site at Ile Magnan, and that at Ile Michel, recommended after the survey by H.M.S. *Fawn* as 'the only suitable place for building a house' (Findlay 1882, p. 550), had both by this time been abandoned, though Ile Michel was used by both Voeltzkow and Fryer as a natural camping site for work at the east end of the atoll.

The lease passed in 1900 to Messrs Baty, Bergne and Co., at a rent of Rs. 3000 per annum. Bergne visited the atoll in October 1901, and found the settlement derelict. There was one house with an iron roof, and a diverse array of sugar pans, iron and zinc cisterns, and teak tubs, with a water storage capacity of 8400 l. Nevertheless, Bergne formed a favourable impression of the possibilities: 'the whole place looked extremely habitable, in fact I was reminded of the wilder portions of Kew Gardens' (Bergne 1901). The company concentrated on fishing rather than on timber, and also planted many coconuts. In 1904 M. D'Emmerez de Charmoy became the lessee, with James Spurs as his manager; and his administration became notorious for its wasteful and inefficient exploitation of the turtle industry (Hornell 1927). D'Emmerez was still lessee at the time of Fryer's visit in 1908–9 (figures 1 and 2, plate 32); and the atoll was leased in this way until 1945, when commercial exploitation lapsed temporarily. The lease was renewed ten years later, when in 1955 M. Harry Savy of Mahé obtained a 30-year lease, with an option on a further 20 years. His company employs labourers to work the atoll, under contract from the Seychelles for periods of up to three years. Under Article 17 of the Lease the total population of Aldabra may not exceed 200 at any time without the permission of the Government; during the last three years the number has fluctuated from less than 10 to nearly 100. The settlement on Ile Picard now consists of well-built wood and cement houses, with three large rainwater tanks (figures 3–6, plate 32). There are small temporary fishing huts at Passe Houareau (figure 7, plate 33) and at Dune Jean-Louis (figure 8, plate 33), and shelters are erected from time to time at other sites such as Anse Cèdres and Dune d'Messe. There are clear traces of former settlements at Anse Mais on Grande Terre and at Anse Polymnie on Polymnie, but no buildings now remain there.

The other islands of the Aldabra group were settled at approximately the same time as Aldabra itself. There was a temporary settlement on Astove in 1895, and the present settlement has been fairly continuous, with a recent intermission, since 1905. Settlement took place on Cosmoledo before 1895, and began on Assumption in June 1908. On all three islands, in contrast to Aldabra, mining of guano has been an important operation. Cosmoledo and Assumption are now leased jointly with Aldabra by M. Savy; Astove is leased separately from the Government of Seychelles by Mr M. Veevers-Carter.

## 2. POLITICAL STATUS

After the Seychelles were transferred to Britain in 1815, Aldabra was governed from Mauritius. After 1903, when the Seychelles administration became independent of that of Mauritius, Aldabra was administered as part of the Crown Colony of Seychelles, and had in

fact been so administered informally since the 1880s. With the development of defence interests in the 1960s, however, the political status of the atoll changed once more. By the British Indian Ocean Territory Order in Council, 1965, Aldabra was detached from the Colony of Seychelles to form, with Farquhar, Desroches, and the islands of the Chagos Archipelago, a new Territory, the British Indian Ocean Territory. Under the B.I.O.T. Order 1965 and the B.I.O.T. Royal Instructions 1965 (*Seychelles Gazette*, Supplement, 13 December 1965, pp. 184–193), the Territory is to be governed by a Commissioner, with powers of legislation, and laws in force in the individual islands at the time of the formation of the Territory are to continue to be valid. The first Commissioner of B.I.O.T. is the Governor of the Seychelles; and the laws of the Seychelles will continue to apply and to be enforced in the Territory, including Aldabra (Ordinance to provide for the exercise of powers and duties in Seychelles in respect of B.I.O.T., for the enforcement of process and the execution of judgement in Seychelles issued or given by Courts in the exercise of their jurisdiction in respect of B.I.O.T., Ordinance 27 of 1965: *Seychelles Gazette*, Supplement, 20 December 1965, pp. 131–132). In addition to the conservation legislation remaining in force in B.I.O.T. (discussed in §4), a further specific measure concerning Aldabra is the designation of Ile Picard as a port for purposes of Customs laws, under Proclamation 11 of 1956 (*Seychelles Gazette*, Supplement, 8 October 1956).

Of the other islands of the Aldabra group, two (Cosmoledo and Assumption) are leased jointly with Aldabra, and the third (Astove) is leased independently. All three islands remain under the jurisdiction of the Colony of Seychelles.

Following the formation of B.I.O.T. in 1965, the British Government signed an agreement with the United States on 30 December 1966 (published in April 1967: Treaty Series no. 15 of 1967), providing that the islands constituting the Territory ‘shall be available to meet the needs of both Governments for defense...for an indefinitely long period’. This period was defined as being an initial period of fifty years, with renewal for a further twenty years unless notice of termination is given by either signatory. Both Governments can make use of the islands, and if necessary the United States can do so during an emergency without reference to Britain. In spite of the British Government’s decision not to proceed with its defence proposals in 1967, the 1966 agreement remains in force.

### 3. ECONOMIC DEVELOPMENT

Because of the lack of soil and water, opportunities for agriculture at Aldabra have been extremely limited. Though Sauer (1967) considers the coconut endemic to the western Indian Ocean, it was probably introduced to Aldabra by man. Coconuts are now found at Settlement on Ile Picard, between Anse Mais and West Channels on Grande Terre, at Anse Polymnie on Polymnie, and on Iles Esprit and Michel. The first definite record of coconuts on the atoll was in 1878, when 50 were planted, together with *Casuarina*, by H.M.S. *Fawn* at Ile Michel (Findlay 1882, p. 550); though some are said to have been planted there as early as 1830–40. Active planting by lessees began about 1880, and for some time was made a condition of the lease. Baty (1896) found 200 coconuts on Ile Picard in 1895. These included three old trees, a few planted in 1890, and the majority only 1–2 years old. At the time of Bergne’s visit in 1901 about 100 of these were well grown, and another 100 were not thriving. Dupont in 1906 found the total at Ile Picard had increased to about 1000, with some trees up to 25 years old. The small pocket beaches at the western end of Grande Terre had also been planted by this time (Dupont

1907, p. 21). Few coconuts were planted other than at Picard. Cauvin planted eight coconuts and six cedars at Ile Magnan in 1888; three or four coconuts were planted at Anse Mais in 1892–3; and of 400 coconuts planted at Ile Michel, about 100 were growing in 1895 (Baty, in Bergne 1900). Spurs as manager was active in planting, and went so far as to dynamite holes in the champignon in which to plant the nuts.

It is uncertain whether the groves of *Casuarina* (figure 12, plate 33) at pocket beaches on the north and west sides of the atoll, and at Iles Esprit and Michel, are natural or were planted for timber. 'Quelques filaos' were noted as early as 1838 (Unienville 1838), and the main groves now existing were charted at the time of the *Fawn* survey in 1878. More were planted on Ile Michel at this time, and in the 1880s and 1890s at Ile Picard. A tall grove at Ile Magnan was planted by Cauvin in 1888.

Small-scale cultivation of food and other crops has been carried out since settlement began. Maize has been cultivated at Ile Picard, Ile Michel, and Anse Mais on Grande Terre, as well as on a much smaller scale at Dune Jean-Louis. There are stands of sisal at Picard and at Anse Polymnie on Polymnie (figure 11, plate 33). Cotton, *Ricinus communis*, decorative plants, and such trees as *Terminalia catappa*, *Carica papaya* and *Moringa oleifera* are also found at the main settlement. Tobacco and tomatoes are also grown. The only plant under cultivation away from the Ile Picard settlement in 1966–9 was 'brède', *Solanum nigrum* L., in stone enclosures at Cinq Cases. Introduced plants are dealt with in greater detail in this volume in the papers by Renvoize (p. 227) and Fosberg (p. 215).

The mangrove woodland has been exploited since the 1880s both for timber and bark (Dupont 1907, pp. 23–24). Because of the distance from Mahé and the cost of schooner voyages, production now is mainly for local construction purposes, and the resource is no longer economically important. Hardly any timber has been cut on Aldabra since 1966. It was at one time hoped to export orchella weed as an organic dyestuff (Dupont 1907, pp. 28–29), but this collapsed with the development of synthetic dyes.

The animal resources of Aldabra have been of much greater economic importance than agriculture. The effects of harvesting the tortoise and turtle populations are considered in detail in §5. The quantities of bones accumulating were so great in the 1930s that a small windmill was built at Passe Femme to crush them for fertilizer. Marine molluscs have also been collected for their shells. Two species have been particularly important, *Turbo marmoratus* and *Pinctada margaritifera*. In recent years the export of these species is said to have reached 6–9 and 4–5 tonnes per year, respectively, each fetching about £350 per tonne.

The prospects for economic development of Aldabra seem unpromising. The areas of sandy soil suitable for coconuts are very limited, and the rainfall small and erratic. The present lessee operates Aldabra, with Cosmoledo, as a source of dried fish and (until 1968) turtle meat for the guano-mining settlement on Assumption. The Green Turtle is now, however, protected, and the Mauritius–Seychelles Fisheries Survey gave a disappointing estimate of Aldabra's fisheries potential (Wheeler 1953*a*). It was estimated that 8 men could produce an initial yield of 70 tonnes of fresh fish a year from the lagoon, falling to a steady figure of 12–16 tonnes per annum; and that eighty men could produce 460 tonnes per annum outside the atoll. At present the only economic products which it is profitable to export to Mahé are Giant Tortoises, which sell at £25 each but which must be exported under licence and which are in practice limited to 50 per annum, and marine molluscs for their shells.



## 4. INTRODUCED ANIMALS

Several species of mammal have been introduced to Aldabra during the last century. Since the Royal Society Expedition began in August 1967, records have been kept of sightings of such animals, with notes of location, numbers and other data, such as colour. This section presents the results of this survey in the form of maps of the sightings of cats, dogs and goats, the most important of the introduced mammals. Because these observations were made during the course of other work, sightings are concentrated near the expedition camp sites where most work was carried out. Since members covered the greater part of the atoll, however, the general patterns shown by these data are probably significant.

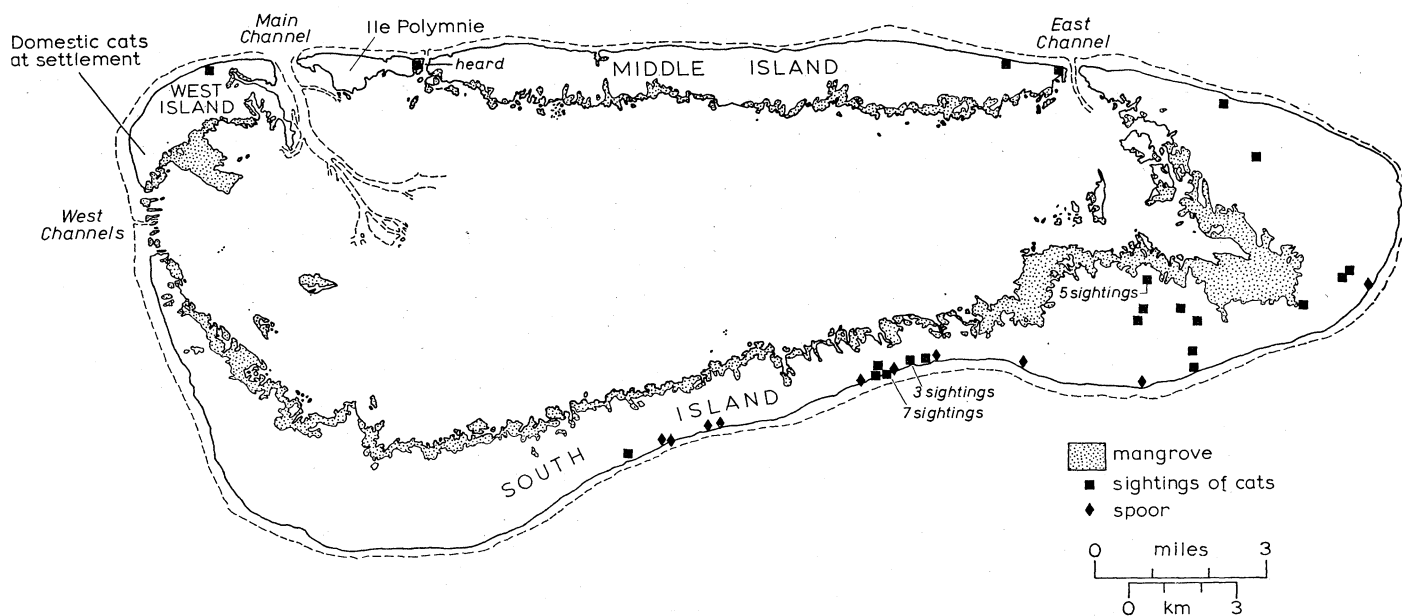


FIGURE 13. Records of feral cats, August 1967 to November 1968.

## (a) Cats

Voeltzkow in 1895 recorded the presence of a feral cat, though his narrative does not make it clear where it was seen (Voeltzkow 1897, p. 66). Abbott (1893, p. 762) and Fryer (1911, p. 417) considered that feral cats were confined to South Island, and though an unidentified observer in 1906 considered they were 'everywhere' he only saw them on Grande Terre (Anon. 1920, ch. 9, pp. 5-7). The cats are said to have been introduced to control rats by James Spurs, who rejected the suggestion that only one sex should be introduced. Both Abbott and Fryer stated that the feral cats had exterminated the flightless White-throated Rail *Dryolimnas cuvieri*, at least in the Takamaka area.

Sightings of feral cats since 1966 have been mostly few and fleeting (figure 13). Apart from domestic cats at the settlement on Ile Picard and one sighting of a feral cat at Anse Var on the same island, and of a sighting at Middle Camp, Ile Malabar, all the records are on Grande Terre. Most are near Takamaka, Dune Jean-Louis or Dune d'Messe. In three cases where colour was noted in the Takamaka area, the cats were black, black and white, and ginger. All the cats seen at Dune Jean-Louis were black and white, or tawny. There is no colour record for that at Dune d'Messe. There are scattered records also from Anse Cèdres, from the platin near

Croix Blanc, and inland from Cinq Cases. These records suggest that there are two cats in the Takamaka area, perhaps two at Dune Jean-Louis, and one at Dune d'Messe. One tawny cat was killed during phase III at Dune Jean-Louis.

The single record from Ile Malabar gives greatest concern, for it had hitherto been believed that there were no cats in the areas occupied by the White-throated Rail. Because of the threat to ground-nesting birds and other species, cats are being killed whenever possible, except for the domestic cats on Ile Picard.

(b) *Dogs*

Feral dogs are less numerous than cats, and appear to be restricted to the plain area, especially north of Cinq Cases and to a lesser extent in the Takamaka area (figure 14). Most records are sound records only: the only two colour records are black and the 'colour of a foxhound'. Labourers state that there are only two feral dogs, which are said to be of the same sex. Two dogs have been seen together on one occasion, and two have been heard together on several occasions. The dogs are not thought to be a significant danger to the native fauna of the atoll.

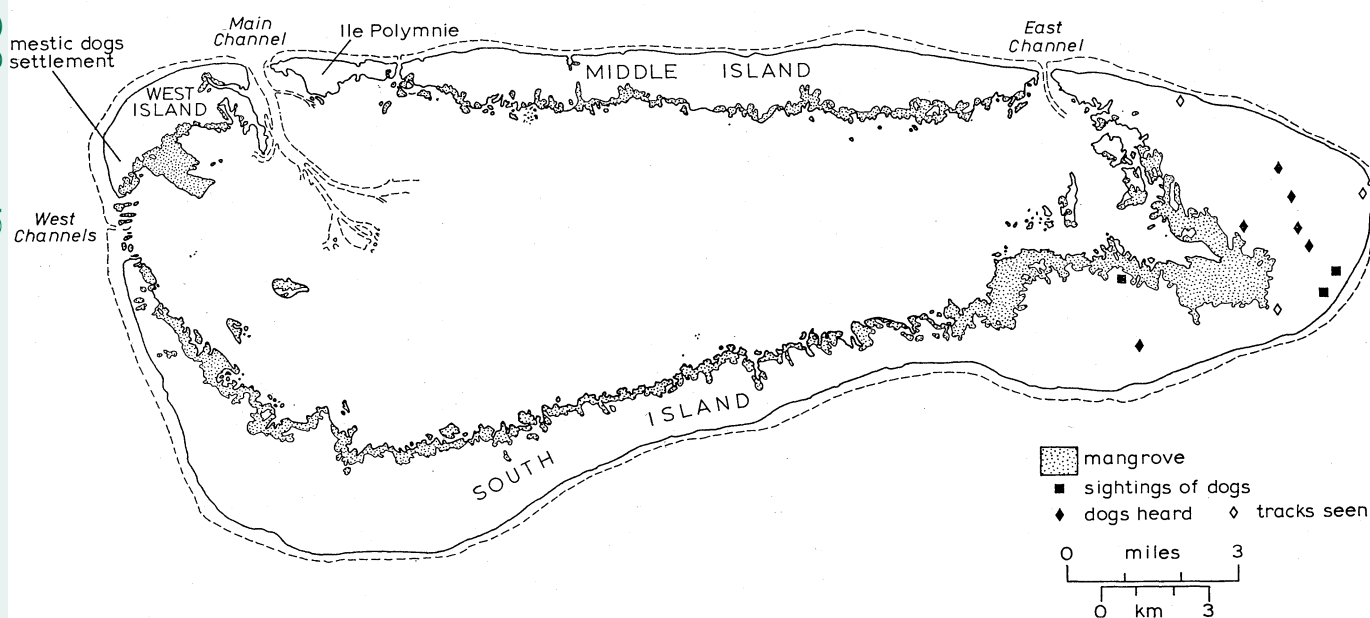


FIGURE 14. Records of feral dogs, August 1967 to November 1968.

(c) *Goats*

Goats were introduced to Aldabra by James Spurs when lessee in 1890. Griffiths (in Fairfield, Griffith & Abbott 1893, p. 154) states that they were brought from Cosmoledo but we have found no other reference to goats on that atoll (Bayne *et al.* 1970*a, b*). According to Dupont (1907, pp. 13, 22) they were brought from Assumption, where they had been introduced by a whaler in about 1887, possibly from Europa Island in the Mozambique Channel (Abbott 1893, p. 763). Baty (in Bergne 1900) states that the original introduction was of one female goat and one kid to Ile Picard, and that by 1895, when they numbered 40–50, eight more were brought from Assumption. Baty recommended that goats should be placed 'on the plain near the Takamakas', and they were certainly introduced at some stage to Grande Terre. Dupont (1907, p. 22) states that they were exterminated on Ile Picard soon after being introduced, but Bergne (1901) saw 20–30 there in 1901, when there were said to be several hundred. They

were again reported there in 1905 (Anon. 1920, ch. 9, p. 2). There are no further records until recent times. Travis (1959, pp. 178–181) describes considerable herds on the southern dunes, and Proserpi (1957, p. 198) records goats at the east end of Ile Malabar.

Feral goats have been recorded during the Royal Society Expedition from all the islands of the atoll rim (Ile Picard, Ile Polymnie, Ile Malabar, Grande Terre) and from Ile Esprit. They have not been recorded from Ile Michel or the smaller lagoon islands. Though sightings have been widespread (figure 15), however, numbers are apparently small. Most of the records on Grande Terre are of groups of one, two or three animals. There are two exceptions to this

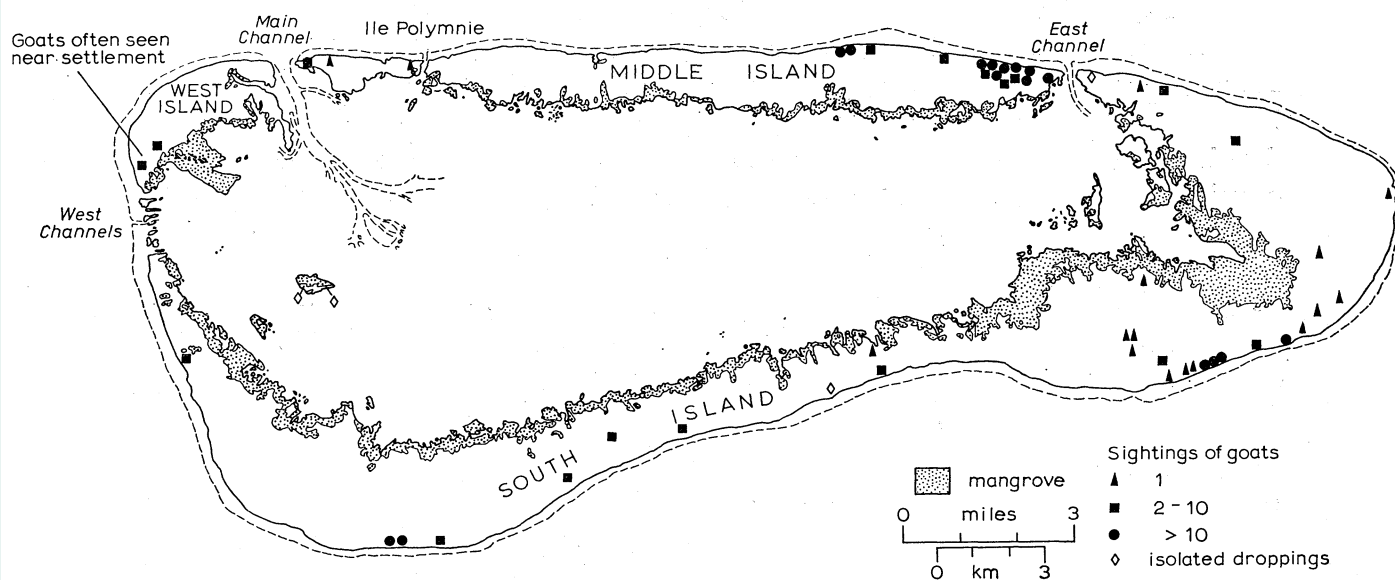


FIGURE 15. Records of feral goats, August 1967 to November 1968.

generalization. First, there is a group of sightings between Anse Takamaka and Cinq Cases of a herd of 20, 18, 22 and 20 animals in January, February and March 1968. Secondly, there are several sightings between Dune Blanc and Dune d'Messe, including one of a herd of 25 animals in June 1968 at Dune Blanc. It is possible that there is only one herd, perhaps two, of about 20 goats on Grande Terre, with a considerable number of very small groups scattered over the island. In some areas goats seem to be very rare: J. G. Frazier kept an intensive watch between Dune Jean-Louis and Anse du Bois for six months (February to July 1968) without seeing any sign of goats, and he considered it unlikely that any goats were present during this period. The density of feral goats on Grande Terre is in fact extraordinarily low, as shown by actual sightings, droppings, and absence of effects on vegetation. They are clearly not now present in the numbers suggested by, for example, Travis, and at present represent no threat to the native biota.

The population density is higher at the eastern end of Ile Malabar, between Anse Malabar and Passe Houareau, where herds of 15 to 20 animals are frequently seen. These are regularly cropped for food by the settlement labourers. Small groups of up to ten goats have also been seen on platin near the settlement on Ile Picard, where they are also cropped, and a group of five has been seen on Ile Polymnie.

The Aldabra goats are very variable in colour: mottled white and black, mottled white and brown, chocolate brown, and black are the main colours. Why numbers have remained so small

on Aldabra in view of the catastrophic increases of goats on other oceanic islands is unknown. A study of the interactions between the introduced and native herbivores on Aldabra would be of considerable interest.

(d) *Rats*

Rats (*Rattus rattus* L.) are common throughout the atoll, and have been recorded from Ile Picard, from Middle Camp on Ile Malabar, and from Takamaka, Cinq Cases, Dune Jean-Louis and Dune d'Messe on Grande Terre. They have also been seen on the small islands in West Channels. Honegger (1967) refers to *Rattus norvegicus* on Aldabra, but this species has not been collected during the present expedition. Abbott (1895, p. 762) also refers to *R. norvegicus* (as *Mus decumanus*) as common on the atoll, but there is no specimen in his collections in the U.S. National Museum, and the reports of this species must be considered unconfirmed (S. D. Ripley, J. E. Hill, personal communications).

### 5. EXPLOITATION AND CONSERVATION

The scientific importance of Aldabra was not realized until the latter part of the nineteenth century, after the disappearance of tortoises and rare land birds from the Mascarene Islands and the Seychelles. When the Government of Mauritius first proposed to lease the atoll for woodcutting, there was a considerable outcry, and an appeal for the protection of the tortoise on Aldabra was addressed to the Government by Charles Darwin and others (§5(a)). During the period of Seychelles administration, protective legislation was passed covering several species. 'Legislation is one thing', however, an early Administrator observed, 'and the enforcement of laws against fishermen on the open sea or in uninhabited places is another' (Griffiths, in Spurs 1892, p. 44). This section reviews the measures which have been taken to conserve the populations of the tortoise, turtles and land and sea birds, and summarizes the progress of conservation legislation affecting Aldabra.

(a) *Tortoises*

Figure 16, based on data in Rothschild (1915), maps the distribution of the Indian Ocean Giant Tortoises in the early eighteenth century, when, according to Rothschild, they extended from Madagascar to the Seychelles, the Mascarenes, and even to the Chagos Archipelago. In the early eighteenth century, tortoises were abundant on Mauritius, Réunion and Rodriguez; but during the period 1750 to 1800 they became extremely rare, and had disappeared before 1840. Large populations existed on some of these islands: thus on Rodriguez in 1691 Leguat described 'two or three thousand of them in a Flock; so that one may go above a hundred Paces on their Backs. . . without setting Foot to the Ground. They meet together in the Evening in shady Places, and lie so close, that one wou'd think those Places were pav'd with them' (Leguat 1708, pp. 64-66). Picault and Grossin, during the first voyage to the Seychelles, found the Giant Tortoises on Mahé to be even larger than those on Rodriguez, but they had disappeared from the main islands and from most of the smaller coral islands of the western Indian Ocean by 1840, surviving only as semi-domestic animals in a few places. Confirmation of Rothschild's distribution data has been obtained in records of the former existence of Giant Tortoises on Assumption, Astove and Cosmoledo, as well as Aldabra; but not for Gloriosa, Farquhar, St Pierre and Providence, which Rothschild also cites. (Coppinger in 1882, however, found seven Giant Tortoises imported from Aldabra roaming in woodland on Providence (Coppinger 1883, p. 234), and there were small numbers, again derived from Aldabra, existing in 1968 on Astove and on Farquhar (Bayne *et al.* 1970*b*, Stoddart & Poore 1970).) There does not appear to be

any confirmation of Rothschild's record of wild populations in the Chagos Archipelago. These records are therefore marked as doubtful in figure 16. The recent records of tortoises on Providence, Farquhar and Astove provide examples of the manner in which, as described by Rothschild, domestic herds were recruited from many different islands, and how transfer of wild tortoise took place from one island to another, thus making any study of geographical variation impossible. Some of the domestic tortoises on the Seychelles, of unknown provenance,

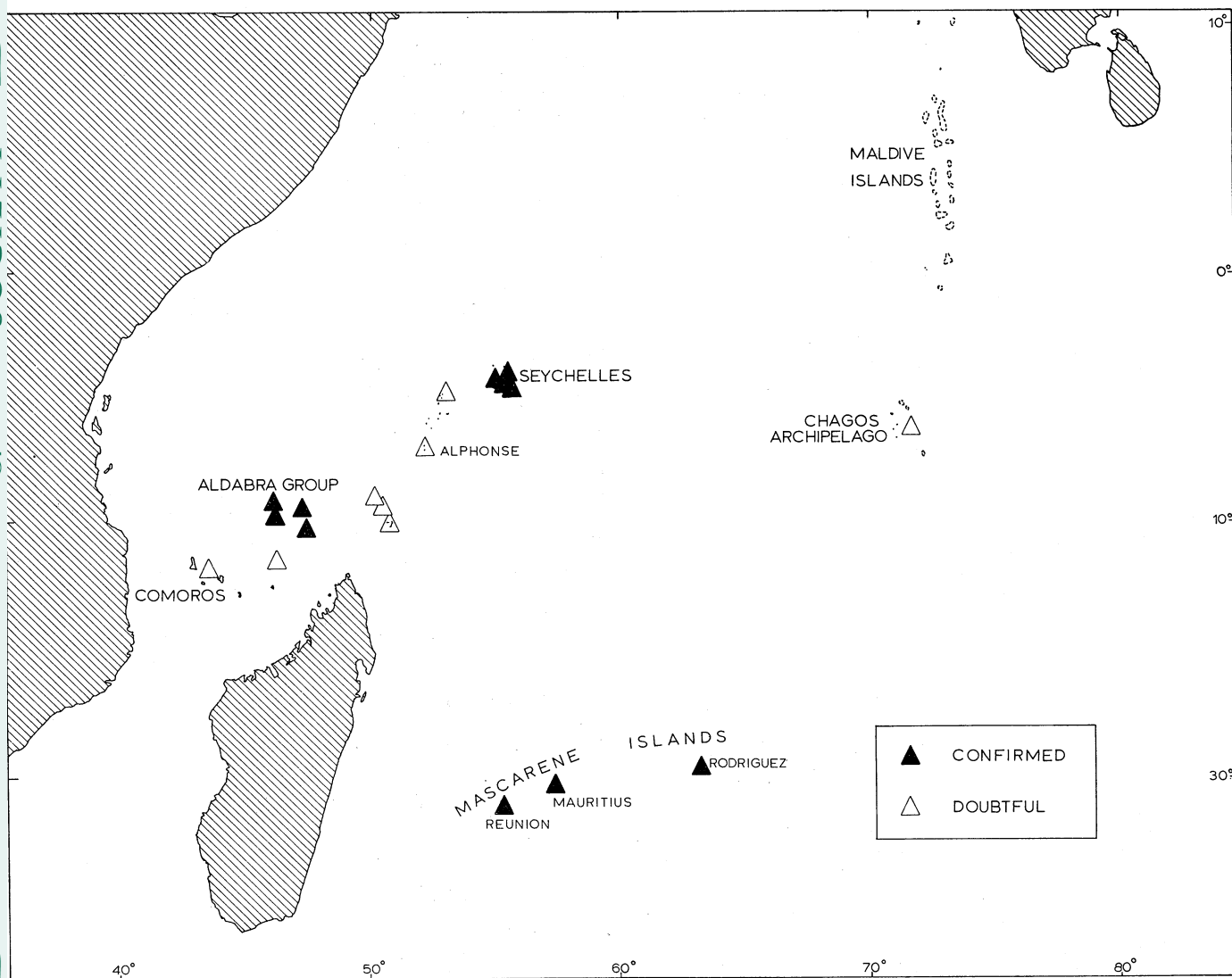


FIGURE 16. Distribution of the Giant Land Tortoise *Geochelone gigantea* on Indian Ocean islands at the end of the eighteenth century, after Rothschild (1915).

were released, for example, on the north and west islands of Aldabra in the nineteenth century (Rothschild 1915, p. 433).

The massive decline in tortoise numbers in the Malagasy region seems to have resulted from many factors. Direct predation by man for food seems to have been considerable, both as a ready source of food for sailors reaching these remote islands, and for export. Du Quesne in 1650 found 'their Flesh very delicate; the Fat better than Butter or the best Oil', and Leguat

found the liver 'extraordinarily delicate' (Leguat 1708, pp. 40, 64). As early as 1822, Aldabra was being visited each monsoon by ships collecting tortoise to sell in Mahé or Mauritius at 1 to 3 Spanish dollars each (Moresby 1842, p. 741). Sauzier (1893) records exports from the Seychelles and Mauritius of more than 3000 tortoises in 1826 alone, and in 1847 two ships took 1200 Tortoises from Aldabra (Rothschild 1915, p. 424; Voeltzkow 1897, p. 59). This trade was probably episodic, but on such small islands and with such a long-lived animal it could only have drastic long-term population consequences, as indeed was realized in the Seychelles as early as the eighteenth century (Malavois 1787). Secondly, the disturbance of the environment, particularly through the clearing of vegetation and spread of cultivation, as in the Galápagos, forced the tortoises into more marginal environments, especially in the high islands. By the time that massive guano digging and habitat modification began in the smaller reef islands of the southwest Indian Ocean, however, the tortoises had already become extinct, except at Aldabra, where commercial guano was in any case absent. Thirdly, tortoise numbers were directly affected by the introduction of competitors and predators. In the Galápagos, for example, feral pigs attack and kill young tortoises, and rats and dogs also harm the young and may destroy eggs. The introduction of goats, cattle and donkeys in the 1920s led to direct competition for food (Snow 1964), and recent studies have suggested that the Galápagos tortoises will become extinct in this century (Hendrickson 1966, p. 256). By the time that such introduced species spread to the smaller Indian Ocean islands, however (§5), the tortoise populations had disappeared, except at Aldabra, where the rats and feral goats do not seem to be a threat to tortoise survival.

From the scattered information available, it appears that the Aldabra tortoise came close to extinction at the end of the nineteenth century, and certainly numbers were much lower than the present estimated total of at least 80 000 individuals made by Grubb (this volume, p. 327). Wharton's sailors spent three days finding one tortoise in 1878 (Wharton 1879). James Spurs estimated the total population at only 1000 in the 1890s (Griffiths, in Fairfield *et al.* 1893, p. 153). In 1895 Voeltzkow found only three tortoises during four days of searching in the Cinq Cases area, which now supports the highest population density on the atoll (Voeltzkow 1897, pp. 53–54), though he did find six on the south coast near Dune d'Messe. The diary of Bergne's visit in 1901 makes no mention of tortoises, and Fryer's 1908 diary contains hardly any references to tortoises in places where they now abound. Fryer (1910, p. 258) commented that 'it would be possible to live for years on Aldabra and never see a specimen'. It is certainly known that the tortoise became extinct on Ile Picard, and was reintroduced there by James Spurs (Abbot 1893, p. 761; Dupont 1907, p. 20). The contrast between the evidence for the later nineteenth century and that for the present day is remarkable: either earlier reports were wrong, or the population fluctuates cyclically, perhaps in response to climatic fluctuations in marginal conditions, or it has recently increased following the halt in the tortoise-meat trade and the introduction of conservation measures.

Active conservation of the tortoises was begun by the letter sent to the Governor of Mauritius in 1874 by a group of naturalists which included Charles Darwin, Joseph Hooker and Richard Owen (Günther 1877, pp. 20–21; Hooker and others 1875), when it was first proposed to establish a wood-cutting colony on the atoll. Particular concern was expressed over the 'imminent extermination of the Gigantic Land-Tortoises of the Mascarenes'. Even at that time it could be stated that 'Aldabra is now the only locality where the last remains of this animal form are known to exist in a state of nature', and it was argued that:

'The rescue and protection of these animals is, however, recommended... less on account of their utility... than on account of the great scientific interest attached to them. With the exception of a similar tortoise in the Galápagos Islands (now also fast disappearing), that of the Mascarenes is the only surviving link reminding us of those still more gigantic forms which once inhabited the continent of India in a past geological age... It flourished with the Dodo and Solitaire; and whilst it is a matter of lasting regret that not even a few individuals of these curious birds should have had a chance of surviving the lawless and disturbed conditions of past centuries, it is confidently hoped that the present Government and people... will find a means of saving the last examples of a contemporary of the Dodo and Solitaire' (Günther 1877, pp. 20–21).

The leasing of exploitation rights on the atoll proceeded, however, without legislation to protect the tortoises. For a number of years they were conserved by the private philanthropy of the Hon. Walter (later Lord) Rothschild, who entered into an agreement by which he paid half of the lessee's annual rent (Rs. 1500 per annum of a total rent of Rs. 3000) on condition that the tortoises were rigidly protected. This agreement was first made with Messrs Baty, Bergne and Co., the lessees in 1900–1904, and was later transferred to their successors (Dupont 1907, pp. 15–16).

No protective legislation covering the tortoises was enacted until recently (Lane 1953 *a, b*), though powers were available under the Wild Birds and Animals (Protection) Ordinance of 1906, and later under the Ordinance to provide for the Protection of Wild Animals and Birds, no. 37 of 1961 (*Seychelles Gazette* (suppl.), 26 December 1961, pp. 163–165). Action was taken during administration by the Seychelles only under the Customs Management Ordinance, by Proclamation 4 of 1961, to prohibit the export of the Giant Tortoise from the Seychelles without written authorization from the Colonial Secretary (*Seychelles Gazette* (suppl.), 13 February 1961, p. 40). This instrument did not cover the export of tortoises from Aldabra to other parts of the Seychelles, or the conservation of the tortoise on Aldabra itself. Following the transfer of the atoll to the British Indian Ocean Territory in 1965, the Commissioner took new powers under an Ordinance for the Protection and Preservation of Wild Life, no. 2 of 1968, and issued Regulations to control the export of Giant Land Tortoises (Statutory Instrument no. 12 of 1968). These prohibit the export from the Territory of Giant Land Tortoises, except under an export permit specifying the numbers to be exported and any other conditions, and lay down penalties for contravention of a fine of Rs. 1000 and up to one year imprisonment. Protection of tortoises on Aldabra is at present given under the terms of the 1955 commercial lease, wherein the lessee is required to protect the tortoises and not to interfere with them. At present up to 50 Giant Tortoises are exported by the lessee each year, being sold for about £25 each in Mahé and re-exported to zoos. Labourers on Aldabra kill the animals occasionally for food, though such losses are small by comparison with the very high population numbers which now exist.

(*b*) *Turtles*

The marine biota of the Aldabra group of islands is best known for its turtles: Aldabra, Cosmoledo and Assumption support 'the greatest concentration of breeding turtles in the Indian Ocean in modern times, and perhaps in antiquity' (Parsons 1962, p. 47). The Green Turtle *Chelonia mydas* L. is the most abundant in these waters, and still breeds in small numbers on Astove, Assumption, Cosmoledo and Aldabra. The Hawksbill *Eretmochelys imbricata* L. is also found at Aldabra, though in smaller numbers than the Green Turtle, and the Loggerhead

*Caretta caretta* L. has also been recorded (Frazier, this volume, p. 373). Large numbers, particularly of the Green Turtle, have been recorded on these islands in the past. At Astove in 1895, Baty was told of 150 being taken in a single 24 h period (Bergne 1900), and though it was no longer possible at the time of Fryer's visit in 1908, it had once been possible to take 200 in one night at Assumption (Fryer 1910, p. 263; Hornell 1927, p. 27). At Aldabra, on 12 November 1895, Baty saw 300 Green Turtles in the sea off the pocket beaches south of West Channels (Bergne 1900), and Voeltzkow (1897) recorded seeing 50 in a few hours.

Commercial exploitation of the turtles, mostly the Green Turtle, began about 1906, though there must have been less systematic exploitation for several years before this. The scale of this exploitation may be judged from the fact that James Spurs aimed to take 12 000 Green Turtles a year when he obtained the lease of Aldabra. Fryer in 1908–9 regretted their 'wasteful slaughter', which even then had resulted in a considerable decline in numbers (Fryer 1910, p. 260; 1911, pp. 421–423). Hornell, commissioned to inquire into the state of the Seychelles turtle industry, reported that at Aldabra 'the policy of the lessee cannot but lead to an early extinction of the trade' (Hornell 1927, p. 37). At this time the total number of Green Turtles taken from the islands of Aldabra, Assumption and Cosmoledo was of the order of 3000 to 4000 per annum. Hornell made specific recommendations for conservation and for the revision of the original conservation legislation which dated from the beginning of the century (Ordinances 16 of 1901 and 2 of 1904). The new legislation (Ordinances 5 of 1925 and 5 of 1929) specified minimum sizes for both Green and Hawksbill Turtles taken, prohibited the taking of buried eggs, barred the use of torches at night and the taking of turtle within 1000 m of the high water line, and laid down control procedures (Lane 1953 *a*, pp. 114–120; 1953 *b*, pp. 195–200). The major recommendation made by Hornell which was not adopted in the legislation was that for a close season from December 1 to the last day of February, during which no turtle might be taken. Hornell also proposed the control, at Aldabra, of frigate birds, herons, and the ibis, all of which (but especially the frigate) were said to kill large numbers of newly hatched turtle. Dupont (1907, p. 29) had previously proposed the extermination of frigates and herons by shooting and poisoning, for the same purpose, but neither proposal was fortunately accepted.

In spite of the legislation of 1925 and 1929, the numbers of Green Turtle continued to decline, and by the time of the Mauritius–Seychelles Fisheries Survey the number taken annually was less than 1500. Following this survey, Wheeler (1953 *b*) again put forward Hornell's close-season recommendations, and these were adopted in Government Notice 452 of 1948. Under this, the close season, during which no Green Turtles might be taken at Aldabra or Cosmoledo, was defined from 1 December to the last day of February; and it was further made illegal to turn turtles on the beaches between 1 March and 31 May (Lane 1953 *a*, pp. 200–201). This last provision was designed to protect females during the earlier of their repeated egg-laying visits. Minor changes in this legislation were made by Ordinance 22 of 1957 (*Seychelles Gazette* (suppl.), 23 December 1957, pp. 64–66). A further revision of the Turtles Ordinance was made by the Female Turtles Protection Regulations 1962 (*Seychelles Gazette* (suppl.), 23 July 1962, p. 44), in which the close season, during which it is illegal to catch, kill, harpoon, or otherwise take female turtles, is extended from 1 December to 31 March. This originally applied to both the Green Turtle and the Hawksbill on Aldabra, Cosmoledo, Farquhar, Providence and other islands; but the Hawksbill was deleted in revised regulations later the same year (Female Turtles Protection (no. 2) Regulations 1962: *Seychelles Gazette* (suppl.), 1 October 1962, p. 68). Subsequently, the use of underwater guns or other underwater equipment for taking the



Hawksbill was prohibited (Hawksbill Turtle Protection Regulations 1963: *Seychelles Gazette* (suppl.), 3 June 1963, p. 48); and this provision specific to the Hawksbill was later revoked and added as an amendment to the Turtles Ordinance, prohibiting the use of underwater equipment in taking either the Green Turtle or the Hawksbill (Ordinance 1 of 1964: *Seychelles Gazette* (suppl.), 9 March 1964, pp. 9–11).

Under the terms of the 1955 commercial lease, not more than 500 Green Turtles may be taken each year on or within 3 miles (5 km) of Aldabra, and none at all on Cosmoledo and Assumption without written permission from the Seychelles Government, and no turtle eggs may be taken on any of these islands. Until 1968 an adult Green Turtle was worth Rs. 150 at market in Mahé. Some 300 Green Turtles a year have entered Mahé from the outlying islands, mainly from Aldabra, in recent years (F.A.O. 1968).

In spite of these legislative constraints, the Green Turtle populations continued to decline. Following a survey for the United Nations Food and Agriculture Organization in 1967, Dr H. F. Hirth concluded that the nesting population of Green Turtle on Aldabra and Assumption was 'almost insignificant', though larger on Astove and Cosmoledo. Hirth recommended that Aldabra be made a nature reserve, with complete turtle protection, and that exploitation should cease at Astove, Cosmoledo and Assumption for a period of 10 years (F.A.O. 1968). Following the creation of the British Indian Ocean Territory in 1965, the Protection and Preservation of Wild Life Ordinance 1968 revoked the earlier turtle protection regulations and suspended the Seychelles Turtle Ordinance. New regulations have been made (Green Turtle Protection Regulations 1968) which prohibit the taking of any Green Turtle throughout the Territory, and the purchase, sale or possession of turtle meat, calipee or any other products, and provide for penalties for infringement of a fine of Rs. 1000 or 1 year imprisonment. No Green Turtles have been taken on Aldabra since these regulations came into force on 13 August 1968, and all turtle then in the pound at West Channels (figure 9, plate 33) were released.

#### (c) *Birds*

The bird fauna of Aldabra is comprehensively reviewed by Benson (1967), Benson & Penny (this volume, p. 417) and Diamond (this volume, p. 561). Birds have long been protected in the Seychelles under the Wild Birds and Animals (Protection) Ordinance of 8 December 1906 and the Plumage Birds (Exportation) Ordinance of 21 February 1914. The former gave the Governor of the Seychelles powers to prohibit the killing or taking of any scheduled bird, or the taking of its eggs, with exceptions permitted for scientific or natural history purposes (Lane 1953 *a*, pp. 124–125). The schedule of birds thus protected (Wild Birds and Animals Protection Ordinance of 21 June 1941) included several species present on Aldabra. These are listed in table 1 (the nomenclature has been revised; the original nomenclature is given in brackets). The schedule of birds protected under the Plumage Birds (Exportation) Ordinance includes (by Proclamation 5 of 1914 and 1 of 1947), for Aldabra, all the species named in table 1 except *Phaethon lepturus lepturus*, together with the eight additional species named in table 2 (Lane 1953 *b*, p. 193). All these protected birds are land birds except for the Tropic birds, the Sacred Ibis, and the Flamingo. The Bird's Egg Ordinance of 1933, designed to protect the Sooty Tern in the Seychelles, and subsequently extended and many times revised (chiefly by the Collection of Birds' Eggs Regulations 1957 and the Collection of Birds' Eggs Regulations 1962: *Seychelles Gazette* (suppl.), 17 May 1957, pp. 25–26, and 4 June 1962, pp. 32–34), has never extended to Aldabra.

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In 1961 the Wild Birds and Animals (Protection) Ordinance and the Plumage Birds (Exportation) Ordinance, under which all the above birds were protected, were both revoked, and replaced by a single Ordinance to provide for the Protection of Wild Animals and Birds (Ordinance 37 of 1961: *Seychelles Gazette* (suppl.), 26 December 1961, pp. 163–165). Regulations under this new Ordinance did not come into force in the Seychelles until 1966, after the formation of B.I.O.T. The Commissioner of B.I.O.T. took powers to suspend earlier Seychelles legislation affecting the Territory, including Aldabra, in the Protection and Preservation of Wild Life Ordinance 1968. Under the terms of the 1955 commercial lease, no birds' eggs may be commercially exploited at Aldabra, and the only birds which can be taken are crows and poultry.

TABLE 1. SCHEDULE OF BIRDS ON ALDABRA PROTECTED UNDER THE WILD BIRDS AND ANIMALS PROTECTION ORDINANCE 1941

<i>Phoenicopterus ruber roseus</i>	( <i>Phoeniconaias minor</i> )
<i>Threskiornis aethiopica abbotti</i>	( <i>Ibis abbotti</i> )
<i>Phaethon lepturus lepturus</i>	( <i>Phaethon lepturus</i> )
<i>Alectroenas sganzini minor</i>	( <i>Alectroenas minor</i> )
<i>Dryolimnas cuvieri aldabranus</i>	( <i>Dryolimnas aldabranus</i> )

Source: Lane (1953*b*, pp. 204–205).

TABLE 2. SCHEDULE OF BIRDS ON ALDABRA PROTECTED UNDER THE PLUMAGE BIRDS (EXPORTATION) ORDINANCE 1914 AND 1947

<i>Phoenicopterus ruber roseus</i>	( <i>Phoeniconaias minor</i> )
<i>Threskiornis aethiopica abbotti</i>	( <i>Ibis abbotti</i> )
<i>Phaethon rubricauda rubricauda</i>	( <i>Phaethon rubricauda</i> )
<i>Alectroenas sganzini minor</i>	( <i>Alectroenas minor</i> )
<i>Dryolimnas cuvieri aldabranus</i>	( <i>Dryolimnas aldabranus</i> )
<i>Streptopelia picturata aldabrana</i>	( <i>Turtur aldabrana</i> )
<i>Dicrurus aldabranus</i>	( <i>Buchanga aldabrana</i> )
<i>Zosterops maderaspatana aldabrensis</i>	( <i>Zosterops aldabrensis</i> )
<i>Caprimulgus madagascariensis aldabrensis</i>	( <i>Caprimulgus aldabrensis</i> )
<i>Centropus toulou insularis</i>	( <i>Centropus insularis</i> )
<i>Foudia eminentissima aldabrana</i>	( <i>Foudia aldabrana</i> )
<i>Nectarinia sovimanga aldabrensis</i>	( <i>Cinnyris aldabrensis</i> )

Source: Lane (1953*b*, p. 193).

(*d*) *General considerations*

Following the Darwin–Hooker appeal over the tortoises and the gradual development of protective legislation for tortoises, turtles and birds, commercial exploitation of Aldabra on a small scale became accepted. The next major issue was in the early 1950s, when it was proposed to settle 1200 Seychellois, discharged from the Army Pioneer Corps in the Middle East, on the atoll, the last commercial lease having lapsed in 1948 and not having been renewed. Fosberg (1954) prepared a memorandum on the scientific importance of Aldabra and the inadvisability of such a scheme, and the proposal was dropped.

Following the visit of the *Calypso* to Aldabra in 1954, Commander J.-Y. Cousteau became interested in the conservation of the atoll, at a time when the commercial lease was about to be renewed. Cousteau's proposal to lease the atoll 'as a wildlife sanctuary and... tropical research centre on an island almost uncontaminated by man' (Cousteau 1963, p. 149) was not accepted, but his publicity in London (Cousteau 1959, 1963) led to important conservation

clauses in the commercial lease concluded between the Seychelles Government and Mr H. Savy, of Mahé, on 2 and 5 February 1955. Proposals for turning Aldabra into a commercial breeding ground for Chinese ducks were also rejected. The lease is for 30 years, with an option of a further period of 20 years. Article 5 of the lease states:

‘That the lessee shall respect South Island in the atoll of Aldabra as a nature reserve. Without prejudice to the generality of the implications of this condition, the lessee hereby covenants:

- (a) That there shall be no settlement on South Island.
- (b) That he shall protect all animal life on South Island.
- (c) That he shall not introduce any new animal or plant on South Island.
- (d) That he shall not exploit any of the resources of the said South Island except mangrove which he shall have the right to cut and remove’.

Article 6 allows ‘unrestricted exploitation’ of coconuts, mangroves, seaweed, shellfish, sea slugs, fish, goats, crows and poultry. Quarrying of stone (Article 9(b)) and clearing of woodland (Article 10) are restricted; clearing by fire is prohibited without permission (Article 11). The total resident population is not to exceed 200 persons without permission (Article 17).

Articles 12, 13 and 14 add further conservation measures:

‘12. That the lessee shall be the guardian and protector of all wild life and all the resources of the Islands and of the surrounding seas. The lessee shall ensure to the best of his ability that, save as provided in this lease, no wild birds, tortoises or other animals are molested, deprived of their proper sustenance, disturbed, taken or killed by any person not holding the express permission in writing of the lessor.

13. That apart from the restricted and unrestricted exploitation detailed above the lessee shall in no way exploit or permit the exploitation of the animal and mineral resources of the Islands or surrounding seas without the express permission in writing of the lessor.

14. That the lessee shall not exploit for export or otherwise birds’ eggs without the express permission in writing of the lessor.’

An important clause, Article 16, gave the Government of the Seychelles powers to establish a research station on the atoll:

‘16. That the lessor reserves the right for the Government of Seychelles or for any person, body of persons corporate or incorporate, sponsored by the Government of Seychelles, to establish on any of the Islands, scientific research stations for the purposes of zoological, oceanographic and other scientific researches. The lessee shall be bound to grant, free of any charge, all the reasonable facilities on the Islands for the establishment of the said research stations and shall do everything in his power to promote and facilitate any researches that may be carried out.’

Finally, Article 21 gave the Government of Seychelles power to resume possession of the islands at any time for a ‘public purpose’, defined to include ‘the building of lighthouses, Police Stations, or other public buildings and all Admiralty and War Department requirements’.

With the transfer of Aldabra to the British Indian Ocean Territory in 1965, and with the events leading up to the eventual suspension of the British Government’s plans to build a military base on the atoll (Stoddart 1968), new conservation measures applicable to Aldabra have already been enacted, and have been discussed in previous sections, and it is hoped that the whole atoll can be scheduled as a nature reserve and managed accordingly.

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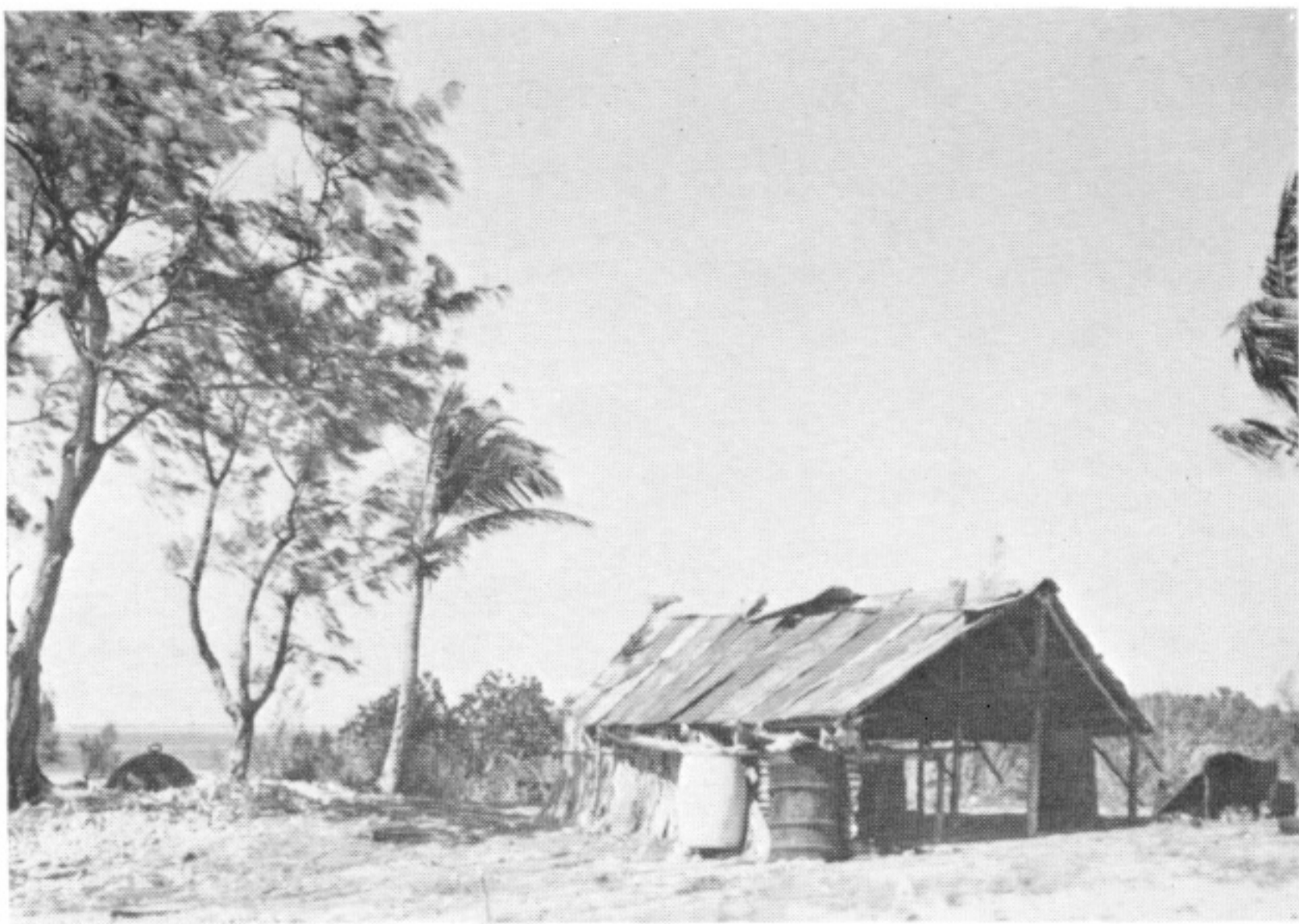
FIGURES 1 AND 2. The settlement at Aldabra (West Island) in 1908 (photographs by the late Sir John Fryer.)

FIGURE 3. The settlement at Aldabra (West Island) in 1968.

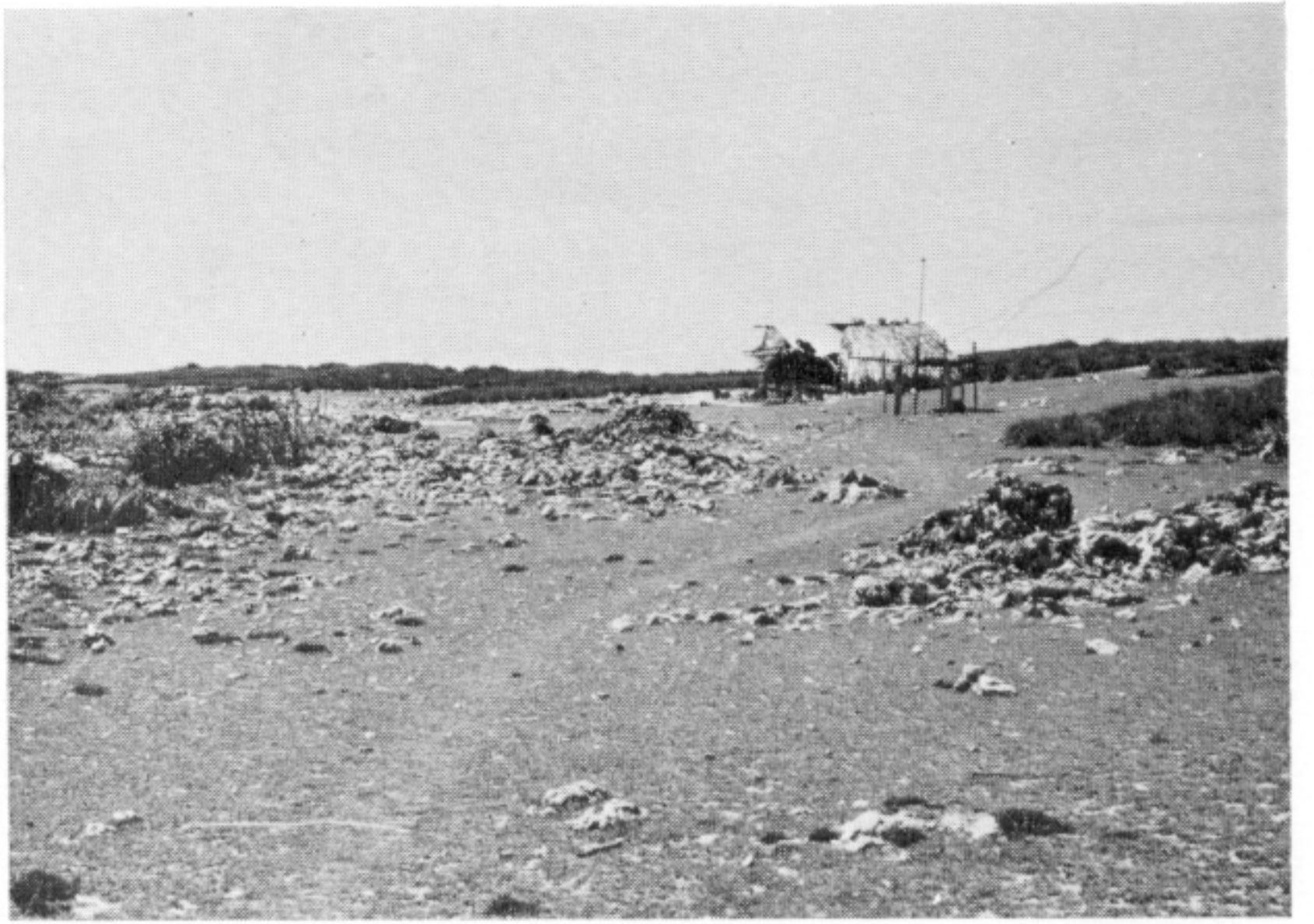
FIGURE 4. The guest house (Royal Society Expedition Headquarters) and main rainwater tank in the West Island settlement.

FIGURE 5. The manager's house, Settlement, with fish-drying racks and charcoal stocks.

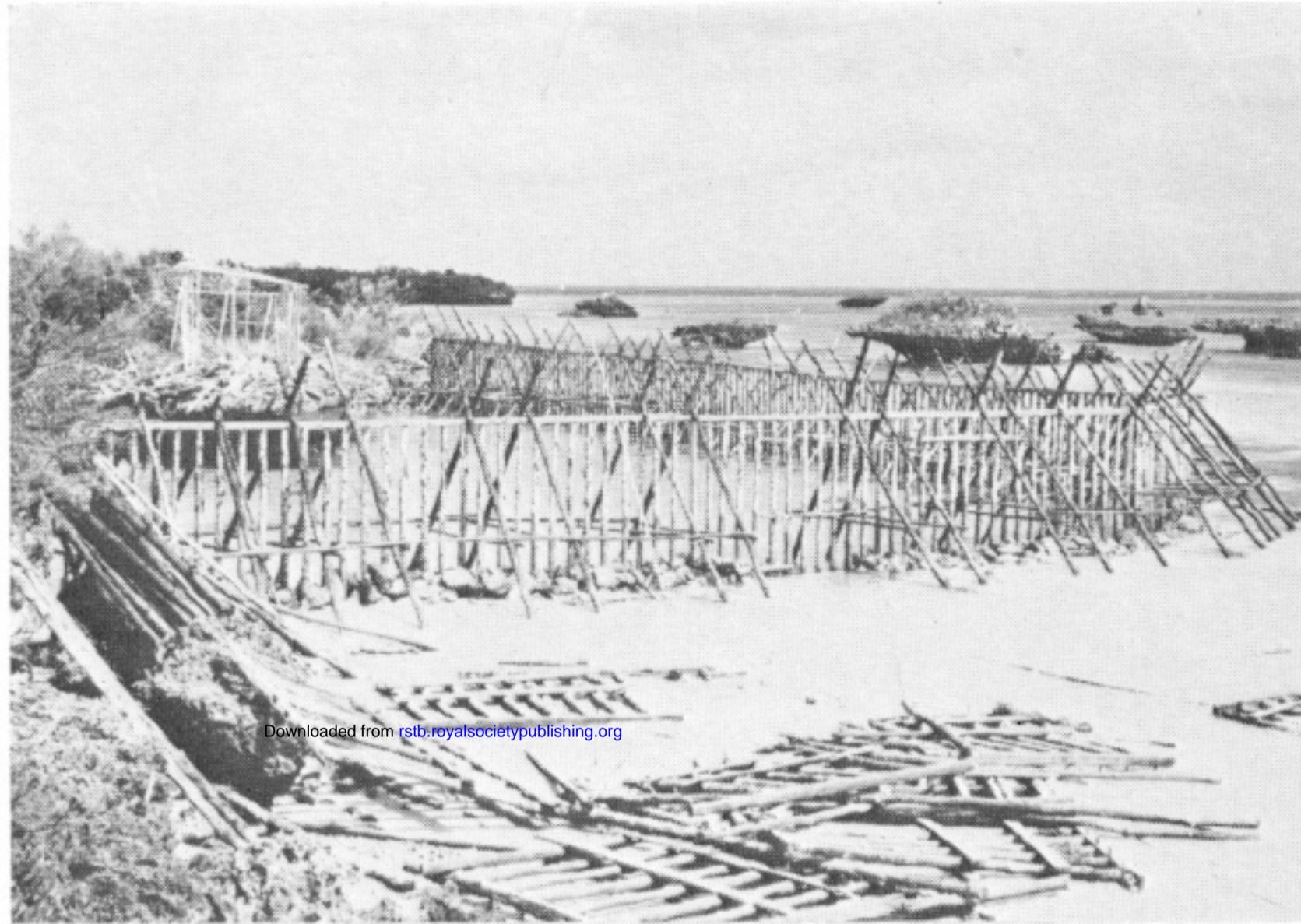
FIGURE 6. West Island cemetery.



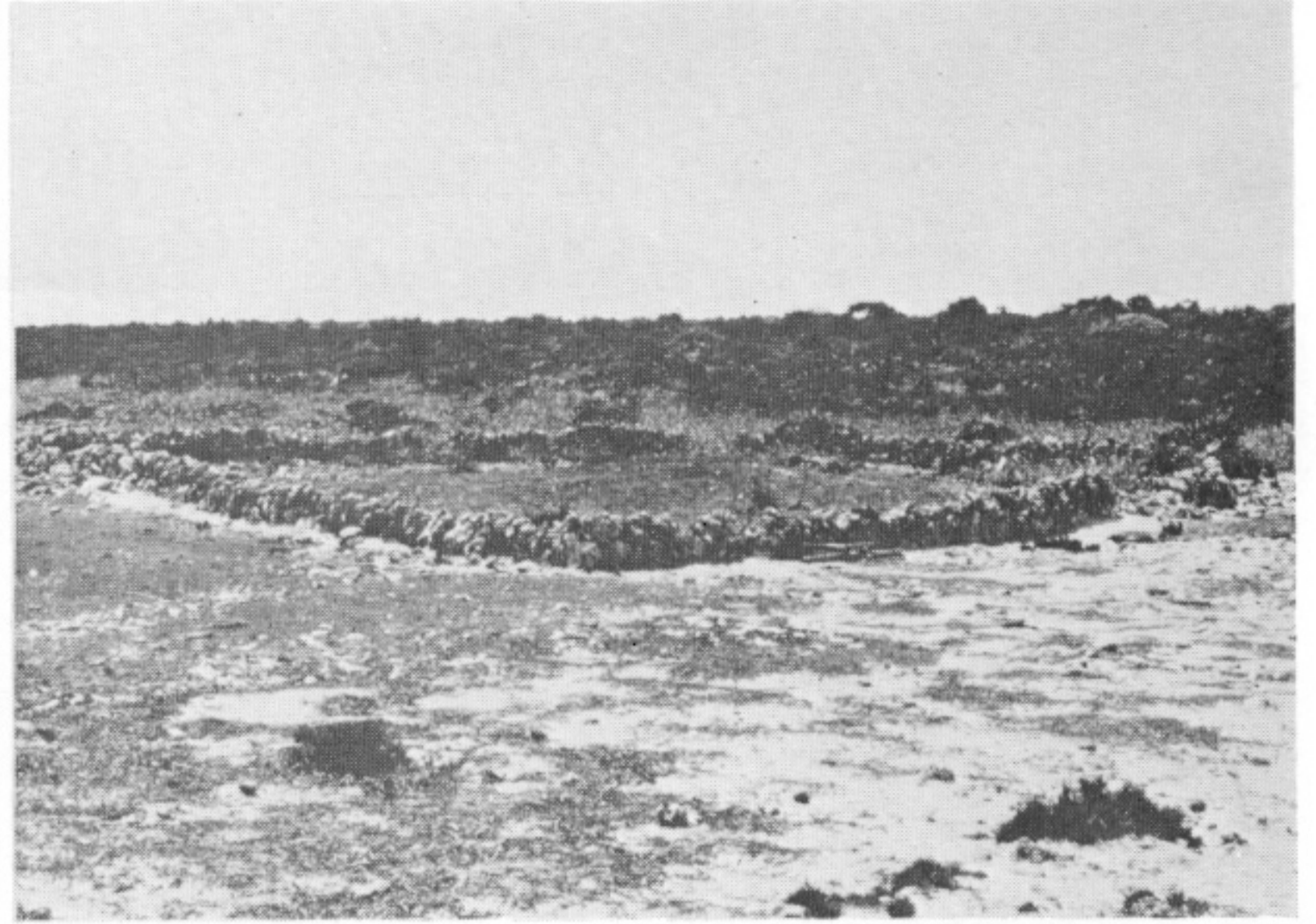
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FIGURE 7. Temporary fishing shack on Middle Island at Passe Houareau (1966).

FIGURE 8. Temporary turtling hut at Dune Jean-Louis, South Island (1968).

FIGURE 9. Green Turtle pound, in use until August 1968, south side of Passe Femme, West Channels.

FIGURE 10. Drystone enclosure, possibly for tortoises, at Dune Jean-Louis, South Island.

FIGURE 11. Introduced sisal *Agave sisalana* and cedar *Casuarina equisetifolia* at Anse Cèdre Polymnie, Ile Polymnie.

FIGURE 12. Large *Casuarina* grove at Anse Cèdres, South Island. Note the lack of ground vegetation.