

21. GEOGRAPHY AND ECOLOGY OF TROMELIN ISLAND

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Introduction

Location

Tromelin Island, a dependency of Réunion Island, is located at 15°52' South and 54°25' East, 390 km east of Antongil Bay, Madagascar, and 480 km north-northwest of Mauritius. Cargados Carajos shoals are about 480 km due east.

Topography

The pear-shaped island measures 1750 meters in length and about three quarters of this distance at its greatest width (Paulian 1955). It consists of coral sand piled up on a coral reef substratum rising to an approximate height of six metres above the high water mark in the northwestern region. The whole structure crowns an abruptly rising submarine cone towering from abyssal depths of about 2500 fathoms. The island profile slopes gently from the highest point in the north-west to the south-east. To the west, a band of raised reef of the "platin" type, met with in some of the Cargados Carajos islets, fringes the beach, passing to the south-east into a belt of coral blocks piled up by the action of heavy swell and breakers driven by the trade winds. On the lee side, sandy beaches occur with formation of small sand dunes. Reefs girdle the island at about 150 metres from the coast and are interrupted by a pass opposite the north-western coast. Access however to the islet is rather difficult and the landing of material for the construction of the meteorological station proved a hazardous operation. The airstrip runs along the long axis of the island.

History

Tromelin Island was first sighted by Captain Briand de la Feuillée on board the Diane in 1722 and was called Sandy Island (Bourde 1934). On the 21st of November, 1776, the Chevalier de Tromelin sailing in La Dauphine and returning from a voyage of exploration to Madagascar rediscovered the island to which he gave his name. He managed to pick up the seven women survivors from the ship L'Utile, wrecked in the vicinity fifteen years before and brought them safely back to Mauritius (Gardiner and Cooper 1907).

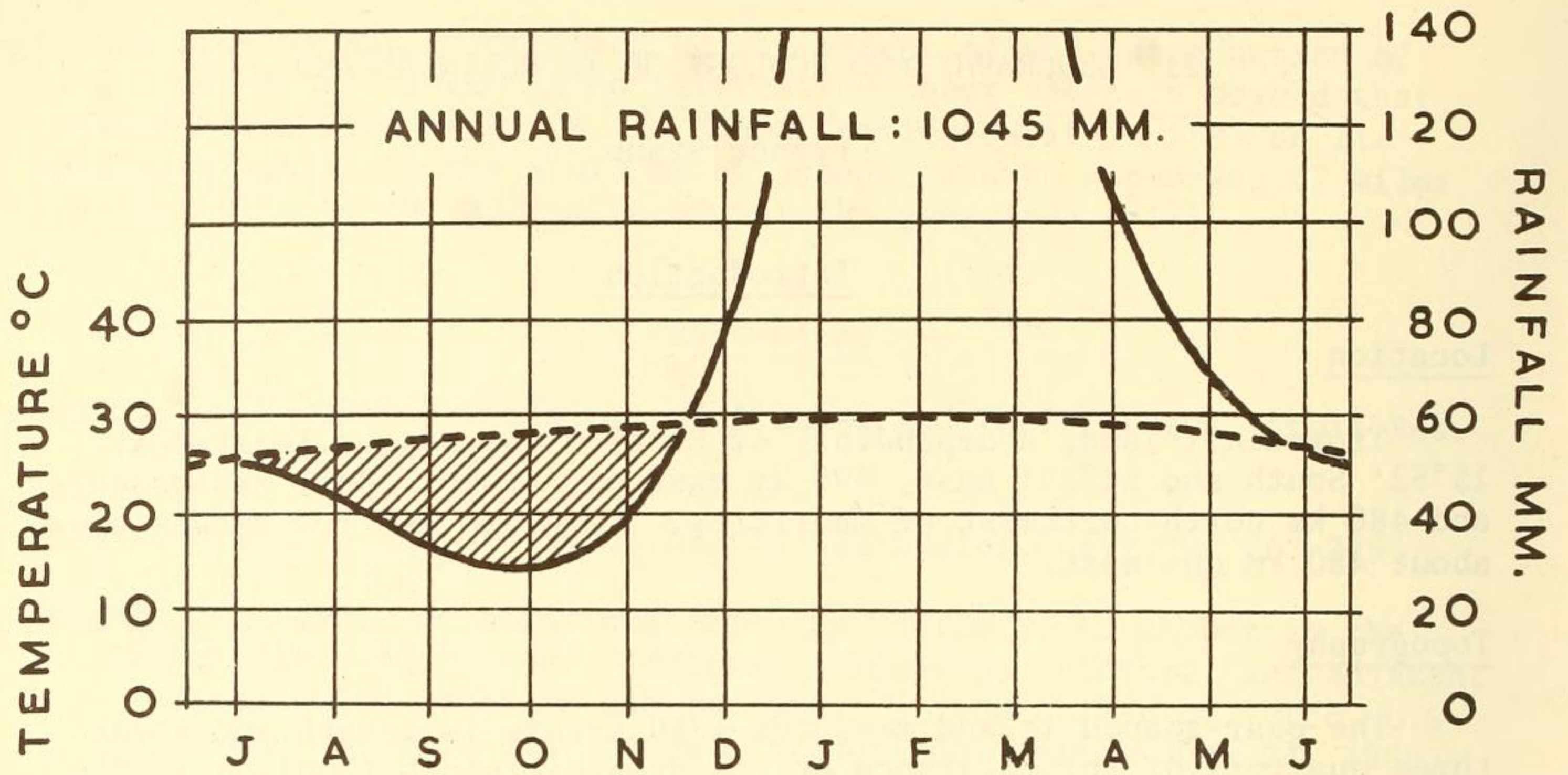


Fig. 9. Ombrothermic diagram for Tromelin

TROMELIN ISLAND

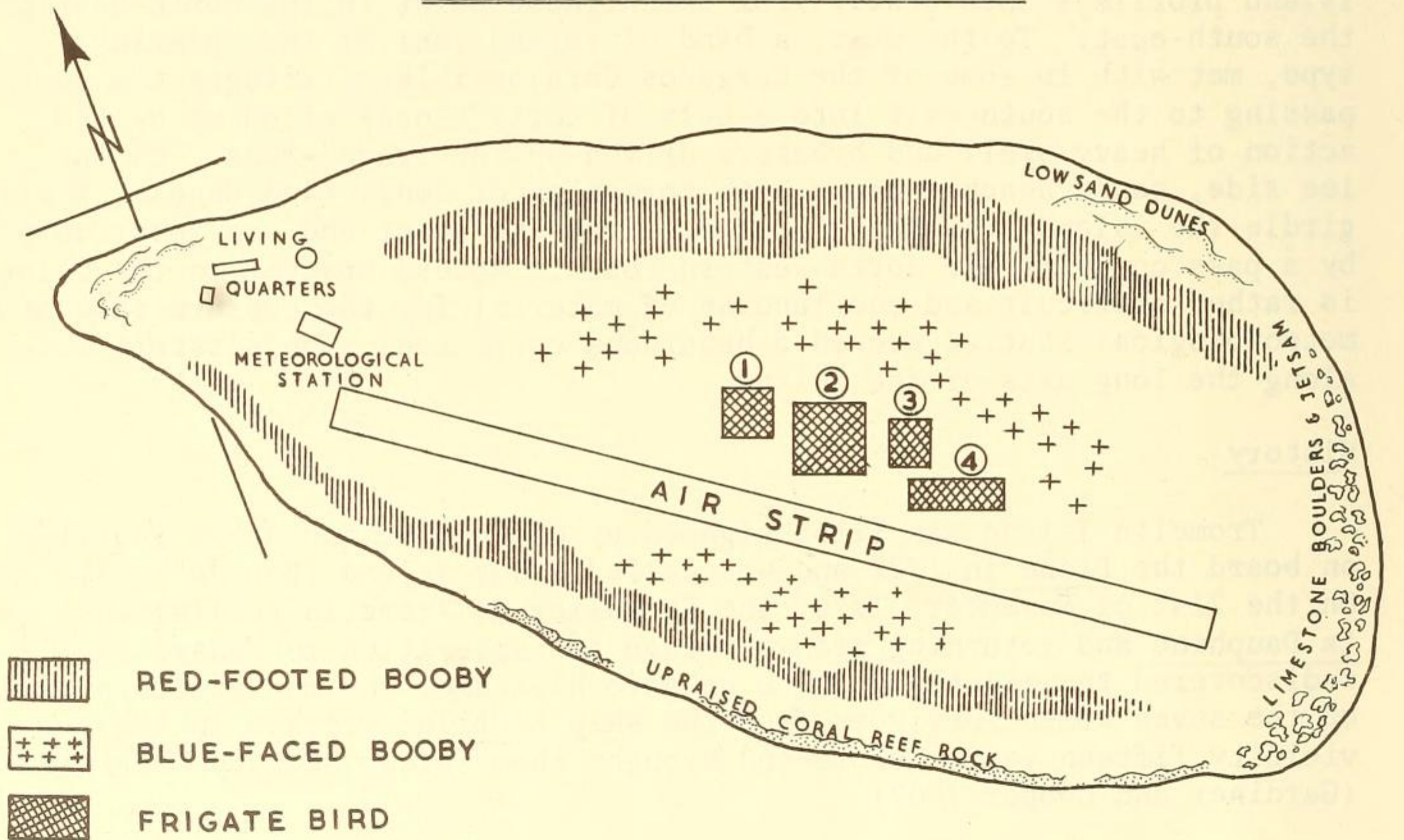
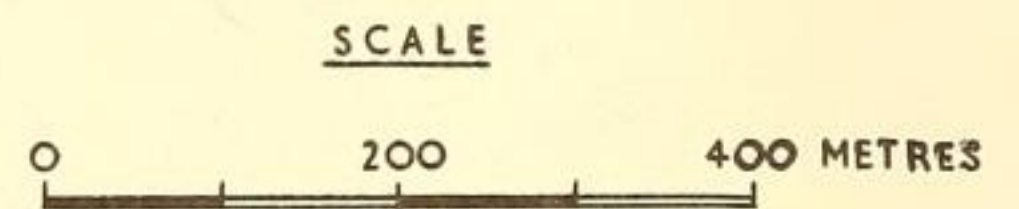


Fig. 10. Tromelin, showing distribution of breeding bird colonies



Climate

In May 1954, a meteorological station was built on Tromelin Island (Platon 1956, Pretceille 1955). It was enlarged later. It is important for the air and sea traffic in this southern part of the Indian Ocean because it is situated in the cyclone zone of the Agalega-Cargados Carajos region where the tracks of cyclones often assume their southern curvature.

The following weather data for the period 1955-1968, obtained from the Meteorological Department, Réunion, through the kindness of Mr. E. Davy, Director of the Meteorological Department, Mauritius, is given in Table 20. An ombrothermic diagram (Fig. 9) is also included interpreting these figures following the method advocated by Bagnouls and Gaussen (1953). A dry cool season extending from July to mid-November prevails, followed by unstable weather with high precipitation during the cyclonic season when the rainfall may exceed 190 mm.

Objectives and description of visit

The aims of the visit were mainly to study, within the limits of the very short time available, the avifauna and vegetation of the islet and to obtain plant material for the Mauritius Herbarium.

We landed from the military plane, which links up Tromelin once every two months with Réunion Island, on the 29th of August 1968 at about 9.30 a.m. and left the next day at 2.15 p.m. having enjoyed the hospitality and comfortable quarters of the meteorological station. In spite of occasional showers passing over with the southeast trade winds, about fifteen hours field work were accomplished. A short 8 mm film on Kodachrome II was made of the nesting bird colonies and a fair amount of photographs both in colour and in black and white were obtained. Ornithological observations and collection of plant specimens were made, with special reference to studies by previous visitors.

Previous studies at Tromelin Island

In November 1953, R. Paulian visited the island, together with a party from Madagascar who came to study the possibilities of building a weather station there. During his two-day visit, he studied the entomological fauna and listed 28 insect species (Paulian 1955). Following the erection of the present station in May 1954, E. Brygoo accompanied the first relieving party in November of the same year. He ringed a hundred Red-footed Boobies and later published his observations on the avifauna (Brygoo 1955). On the 23rd February, 1962, R. O. Morris on board H.M.S. Owen paid a brief visit to the island and subsequently published a report about its avifauna (Morris 1964).

Table 20. Meteorological data, mean monthly figures 1955-1968, Tromelin

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.
Rainfall, mm	175.8	146.0	193.3	109.3	68.0	53.3	61.8	46.8	33.2	29.2	50.3	78.1
Number of rainy days per month	12	14	15	12	10	11	12	12	9	7	6	10
Maximum temperature °C	30.0	30.0	29.9	29.3	28.2	26.9	25.9	25.8	26.4	27.3	28.3	29.7
Minimum temperature °C	25.0	25.3	25.1	24.7	23.5	22.1	21.1	20.8	21.3	22.2	23.6	24.8
Pressure at sea level (millibars)	1010.4	1009.5	1010.7	1012.0	1014.5	1016.8	1017.7	1018.1	1017.6	1016.7	1014.4	1012.3
Humidity %	82	82	83	82	80	82	82	82	82	81	82	81
Insolation (hours) (period 1960-1968)	254.5	235.6	244.2	244.4	247.2	234.4	228.7	233.6	250.1	268.5	272.2	292.0

Vegetation

The vegetation consists mainly of two communities as shown in Plate 45. These are: (1) A Tournefortia argentea L. f. shrubbery, one half to one metre high, extending around the island but becoming more scattered towards the centre, that is, along both sides of the airstrip. Towards the north-western end, some Tournefortia trees may reach two and a half metres, (2) an herb-mat consisting mostly of Boerhavia diffusa L. along with scattered colonies of Sida cf. grewioides Guill. et. Perr., with occasional clumps of Portulaca oleracea L. The first plant to colonise the airstrip after weeding is usually the species of Sida mentioned above.

R. Paulian noted the rare occurrence of Achyranthes aspera L. and Ipomoea pes-caprae L. but we did not find the two plants during our short visit. The presence of rabbits recently introduced and now feral, may account for the absence or rarity of these species which are very common on Cargados Carajos 480 km due East, from where birds, wind, and currents could probably transport to Tromelin a supply of seeds or torn strands. About a dozen coconut trees have been introduced and planted along the track to the meteorological station.

Marine fauna

In the short time available, it was not possible to study in any detail the marine fauna. However, tracks left by turtles coming to lay their eggs were quite frequent on the northern beaches and these were said to be mostly green turtles (Chelonia mydas L.) by the staff members. The Hawksbill or Caret (Eretmochelys imbricata L.) was reported to be scarcer. The capture of a Jackfish (Caranx sp.) on hook and line was witnessed on the east coast of the island. The small extent of the lagoon and the rapid deepening of the waters outside the reef would possibly not sustain a richly varied marine life. Pelagic fish would probably be more often encountered.

Fauna other than birds

A few rats were seen hiding in the shade of the Tournefortia bushes during the day. R. Paulian notes that rats (Rattus norvegicus L.) and mice (Mus musculus L.) were swarming in the southern part of the island in 1953. We found that their number seemed to have been very much reduced, probably due to pest control. There were however quite a number of rabbits all over the island, congregating on the more protected northern side.

Great numbers of hermit-crabs, housed mostly in the shells of Turbo argyrostomus L. were observed at dusk climbing the Tournefortia shrubs. They preyed upon the caterpillars of an insect, Utetheisa pulchelloides Hampson (sensu Jordan 1938), which were themselves actively feeding on leaves of the latter plants.

Insects of Tromelin

The following list records the insects known from the islet and was kindly compiled by Mr. Raymond Mamet, Sugar Industry Research Institute, Mauritius:

Collembola

One undetermined species.

Thysanura

One undetermined species

Orthoptera

Periplaneta americana L. (cosmopolitan)

Blatta orientalis L. (tropicopolitan)

Symploie sp.

Embioptera

Oligotoma saundersi Westw. under bark of Tournefortia (cosmopolitan)

Isoptera

Cryptotermes domesticus Hav. (Ceylon, Eastern Indian Ocean and Pacific Ocean up to Panama)

Psocoptera

One undetermined species.

Hemiptera

Creontiades pallidus Ramb. (Continental Africa, Arabia, Madagascar, Mediterranean region)

Stenarus leucochilus Reuter on Tournefortia (East Africa, Pemba Islands, Madagascar, Mauritius)

Geocoris insularis China (endemic)

Pictinus pauliani China on Tournefortia (endemic)

Homoptera

Igerna bimaculicollis Stål on Tournefortia (South Africa, Kilimandjaro, Madagascar)

Pulvinaria tromelini Mamet on Achyranthes aspera (endemic)

Coleoptera

Cratopus adpersus Wat. on Tournefortia (Amirantes, Chagos, Coetivy, Seychelles, Farquhar, Cargados Carajos, Aldabra, Astove, Cosmoledo, Assumption, Maldives)

Dryotribus mimeticus Horn on dead wood of Tournefortia (Florida, West Indies, Galapagos, Hawaii, Adèle and Nyew Tyew Islands, North Western Australia, Chekiang)

Stephanoderes vulgaris Schauf. on dead wood of Tournefortia (Madagascar)

HymenopteraPheidole megacephala F. (wide distribution)Apanteles sp. near sphingivorus Granger. A parasite of Utetheisa (Lepid.) (Madagascar)LepidopteraUtetheisa pulchelloides Hampson (sensu Jordan 1938) on Tournefortia (Africa, throughout Indian Ocean up to Gilbert Isls.)Loxostege coelatalis Walk. (Ceylon)DipteraSichopogon reginaldi Séguy (endemic)Ornithoctona plicalilis van Olfers. Host: probably frigate birds (Mauritius, Philippines, New Hebrides, Samoa, Comoros, Madagascar)Sarcophaga spinosa Villn. (Mediterranean region)Sarcophaga sp.Acanthonotiphila scotti Séguy on inflorescences of Tournefortia (endemic)Hippelates longiseta Lamb. on inflorescences of Tournefortia (Seychelles, Amirantes, Cargados Carajos)Siphunculina signata Woll. (Madeira, Cargados Carajos).Birds

At our time of visit, the bird population of Tromelin Island comprised the following nesting species: the Red-footed Booby, the Masked or Blue-faced Booby and the Great Frigate Bird.

Sula sula rubripes

Red-footed Booby

In 1954, E. Brygoo noted about 200 nesting pairs scattered on the Tournefortia bushes, some nesting alongside the Frigates. Of 100 nests inspected, two thirds were occupied by the "white" form, the rest by the "brown and white" form. R. O. Morris in February counted from 150 to 300 individuals. In August 1968, our estimates for the northern half of the island as assessed by the census of occupied nests along 100 x 5 metres of the Tournefortia belt were about 300 pairs, compared with 200 pairs for the southern half (Fig. 10). About one third of the observed birds were of the "brown and white" form. It is interesting to note that R. Newton (1958) found about 4 per cent nesting "brown" forms on Ile Albatros at Cargados Carajos in January 1956, in an overall population of three hundred. It is a pity he did not describe this form, as Red-footed Boobies have now disappeared there probably through the depredations of feral cats. Our discovery of a pair of the "white" form roosting on South Island of the Cargados Carajos, in April 1968 might suggest the possibility of recolonisation from Tromelin Island.

As to their nesting habits, the Red-footed Boobies of Tromelin build on top the Tournefortia bushes. Nests are two thirds to one metre apart and made up of Boerhavia strands with a lining of Tournefortia leaves on which the egg is deposited. Brygoo in 1954 found the lining

to have been of Ipomoea pes-caprae leaves. A few egg measurements were taken. In spite of the meagre data obtained, the eggs from the "brown and white" form do appear more slender as shown by the figures given below:

<u>Eggs under "brown and white" form</u>			<u>Eggs under "white" form</u>		
cm			cm		
5.4	x	3.7	6.3	x	4.2
5.2	x	3.7	5.9	x	3.8
5.2	x	3.7	6.2	x	3.7
5.9	x	3.8	6.0	x	4.0
5.9	x	3.8	6.3	x	3.9
5.4	x	3.7			

Colour variation

All the forms of the versatile Red-footed Booby were observed, from naked or fluffy chick that looked as big as its parent, to the two adult forms. It might prove useful to describe its morphology in the light of previous studies made on this same species by Nelson (1968) as occurring in the Galapagos on Tower Island. There they nest, about two metres distant from one another, on the Cryptocarpus shrubs.

At Tromelin the following variations in plumage occur as follows:

Chick: naked, later covered with fluffy white down.

Juvenile: has fledged to chocolate brown form. Bill black, feet dark khaki, eyes clear yellow.

First adult form: Golden brown above, light brown beneath, back streaked with white to all degrees. Rump, tail and underpart of tail pure white. Bill now turned blue. The fleshy part of the head deep pink. Eyes dark brown. The head is tinted a golden hue. The feet now bright red. The gular spot is black.

Second adult form: All white plumage with black primaries. Head suffused with yellow. Fleshy part of the head, bill and feet as of first adult form. The gular spot is velvety black.

The species at Tromelin as described above seems very much like its Galapagos counterpart. It is only in the first adult form that differences occur as to plumage colouration, the Tower Island first adult form being basically brown sometimes with white scapular markings (Nelson 1968). The question whether the first "brown" adult form completes its change to the second "white" adult form is still uncertain. This would require continuous observation of ringed birds in the field for a number of years (Plate 44).

Skins from a "juvenile brown" and a "brown and white" form were prepared and later presented to the Mauritius Institute, Port Louis. Their measurements are given below:

	♀ "juvenile brown" cm	♀ "brown and white" cm
Culmen	8.6	8.7
Tail	20.0	20.0
Wing	37.0	38.6
Tarsus	4.6	4.7
Weight (g)	900	900

Feeding

We noted that the chicks and juveniles regurgitated mainly flying fish when disturbed just as they did at the Galapagos as noted by Nelson. Rich fishing grounds in the vicinity of Tromelin Island exist for these birds and R. O. Morris noticed that they were very active only twenty miles away.

Sula dactylatra melanops

"Blue-faced Booby"

This species occupied about fifty nest sites scattered along both the north and south of the airstrip near the central part of the island as shown in Fig. 10. Few eggs were seen, two in a nest being more common than one. About fifteen chicks, just hatched or with down, were being attended by a parent. They were obviously half way through the off period season when breeding is at its lowest. No juveniles were observed and the majority of the colony was apparently keeping to the high seas feeding. As at the Cargados Carajos the peak period of reproduction is probably from November to March as reported by previous visitors.

The "meeting ceremony" of the male relieving a female with chick was filmed while they jabbed at each other before assuming the "parallel standing" illustrated and described by Nelson at the Galapagos. Like the Red-footed Boobies, they were attacked and robbed of their food bolus by the Frigate Birds.

Fregata minor

"Great Frigate Bird"

Although both species of the often associated Frigate birds, F. minor and F. ariel iredalei, have been noted flying over Tromelin Island by R. O. Morris in February 1962, only one species, F. minor was noticed just starting its nesting season. On this late August visit in 1968, the males had an extended gular pouch, a few eggs had already been laid.

In the Cargados Carajos F. ariel iredalei was observed starting its nesting in late April (Staub and Guého 1968) at the onset of the dry cool season. F. minor starts probably later there. The juveniles of both species were nearly all gone from the breeding grounds by April-May the following year. It is surprising that living in identical climates, the F. ariel iredalei of Tromelin Island had not set to breeding by late

August, whilst at Cargados Carajos, chicks of this species would already have been well on the way to being fully fledged. During our stay, other groups of Frigates were seen keeping far out at sea but the conspicuous male F. ariel iredalei with its two white side breast patches was not observed with certainty.

The Frigate birds were settled in low Tournefortia bushes in four colonies just north of the central part of the airstrip as shown in Fig. 10. We counted about fifty individuals segregated and associated with Red-footed Boobies into 4 main Colonies, detailed census of which is given in Table 21. A few were gliding low just by the shore, waiting for the homing Boobies which they compelled to regurgitate their food. Red-footed Boobies were the usual victims. Sitting F. minor females had a red ring round their eyes, just as the type of female F. ariel iredalei described by R. Pocklington (1965) from Cargados Carajos. Their bill was also pinkish when compared with the horn-blue colour in the males. The nesting materials were Boerhavia strands and Tournefortia sticks.

Migrant visitors

A small flock of three Whimbrels (Numenius phaeopus ssp.) were seen feeding along the shore on our two-day visit. E. Brygoo (1954) recorded the following three unidentified species: (i) a black and white small wader, often in pairs, (ii) a curlew-like bird running between bushes. This could be a curlew sandpiper, as often seen in the Cargados Carajos, running after insects sometimes far inland. (iii) A noisy bird flying briskly round at dusk, (iv) Brygoo also mentioned that according to staff members a Flamingo was reported to have rested for a night. R. O. Morris (1962) noted the presence of a "few Terns with light grey mantles and black crowns and napes", most probably Roseate terns (Sterna dougalli). These could well have come from the Cargados Carajos where they are known to breed (Table 22).

Settlement

In November 1953, a party from the Meteorological Department of Madagascar visited Tromelin Island to investigate the possibility of building a weather station there. In November 1954 the first station was built and later, additions were made. Nowadays the one-storey high building is one of the best equipped in the Indian Ocean and is doing good service (Plate 2). The first meteorological officer to be in charge, Mr. Jouanney, has imposed rules as to bird preservation which so far have been scrupulously observed, much to the credit of the staff at the station.

Table 21. Fregata minor colonies on Tromelin Island

Colony as shown by map of islet	Associated occupied nests. <u>S. sula rubripes</u>	Number of nests <u>F. minor</u>	Number of nests with egg <u>F. minor</u>	Size of egg of <u>F. minor</u> cm
1	3	11	-	-
2	3	11	4	(8.1 x 4.8 (6.8 x 5.0 (6.9 x 4.82 (7.0 x 4.7
3	1	2	2	(6.7 x 4.5 (6.7 x 4.7
4	9	1	-	-

Table 22. Breeding birds and occasional visitors, Tromelin

	E. Brygoo Nov. 1954	R.O. Morris Feb. 1962	F. Staub Aug. 1968
<u>Breeding Birds</u>			
Fregatidae			
<u>Fregata ariel iredalei</u> Lesser Frigate bird	X ?	X	
<u>Fregata minor</u> Great Frigate bird	X ?	X	X
Sulidae			
<u>Sula dactylatra melanops</u> Blue-faced Booby	X	X	X
<u>Sula sula rubripes</u> Red-footed Booby	X	X	X
<u>Migrants and occasional visitors</u>			
Laridae			
<u>Sterna dougalli</u> Roseate Tern	X ?		
<u>Erolia testacea</u> Curlew Sand-Piper	X ?		
<u>Numenius phaeopus</u> Whimbrel			X
Phoenicopteridae			
<u>Phoeniceros</u> sp. Flamingo	X		

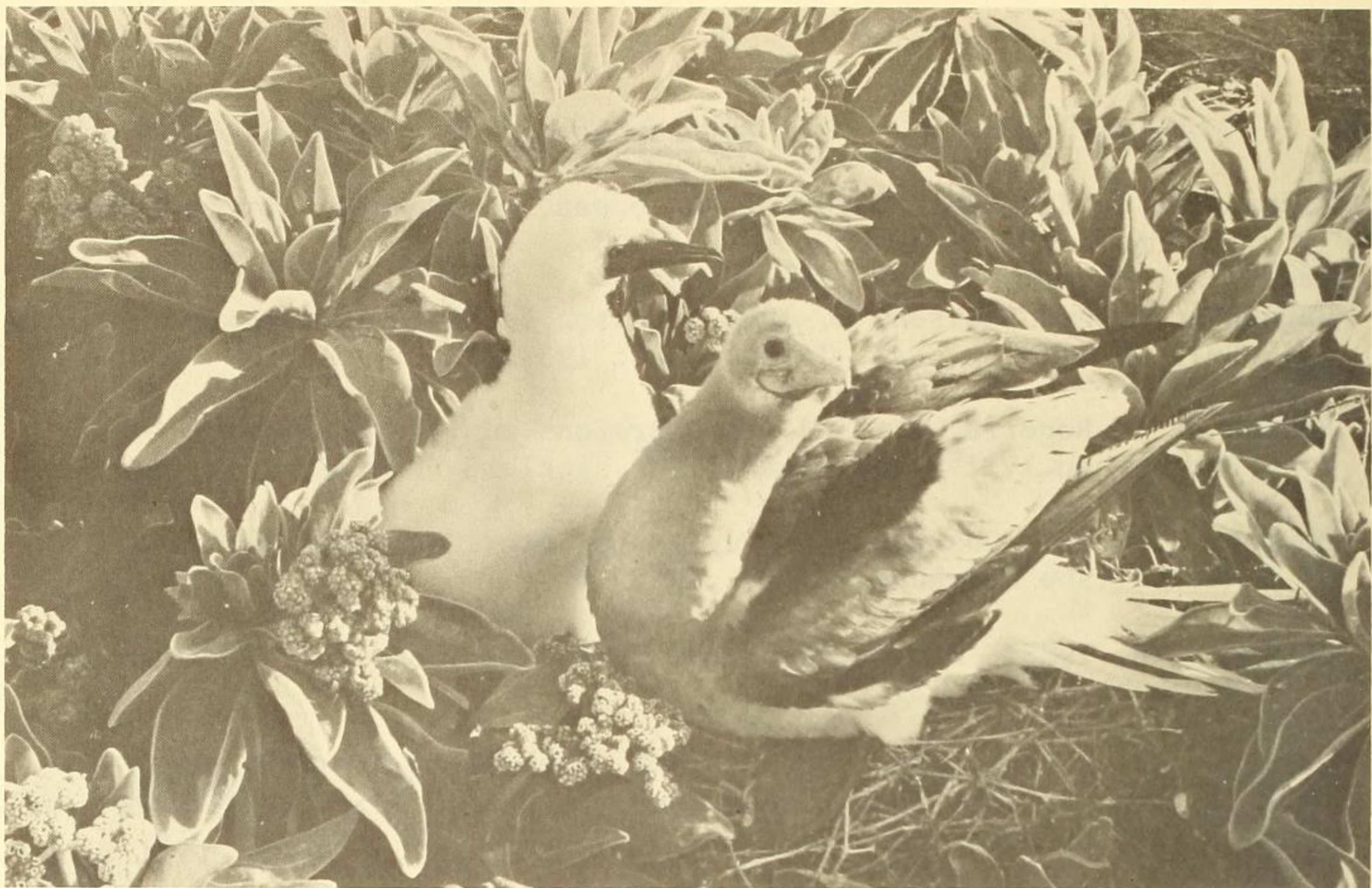
N.B. X identified species
X ? unidentified species

Acknowledgments

We are grateful to Mr. Edwin Davy, director of the Meteorological Services, Mauritius, whose help made the visit possible, to Mr. Trendel, Director of the Réunion Meteorological Services and to Mr. Malik, assistant-director, who made arrangements for the journey. Our thanks are due to Dr. R. E. Vaughan, Curator of the Mauritius Herbarium for helpful suggestions, to Mr. R. Mamet from the Mauritius Sugar Research Institute who compiled the list of insects and to Mr. J. Guého who has kindly plotted the ombrothermic curve from the meteorological data and drawn the sketch map.

References

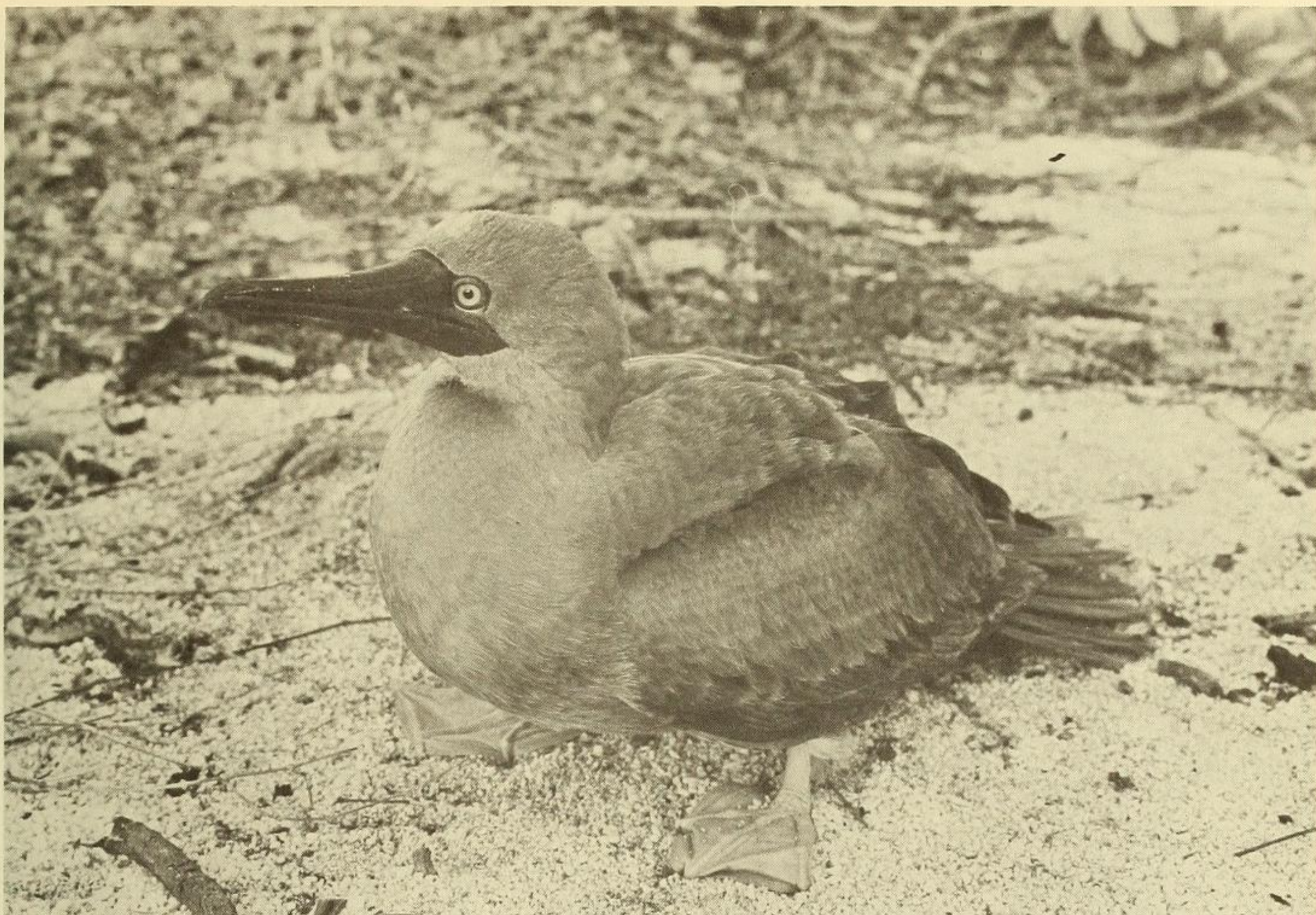
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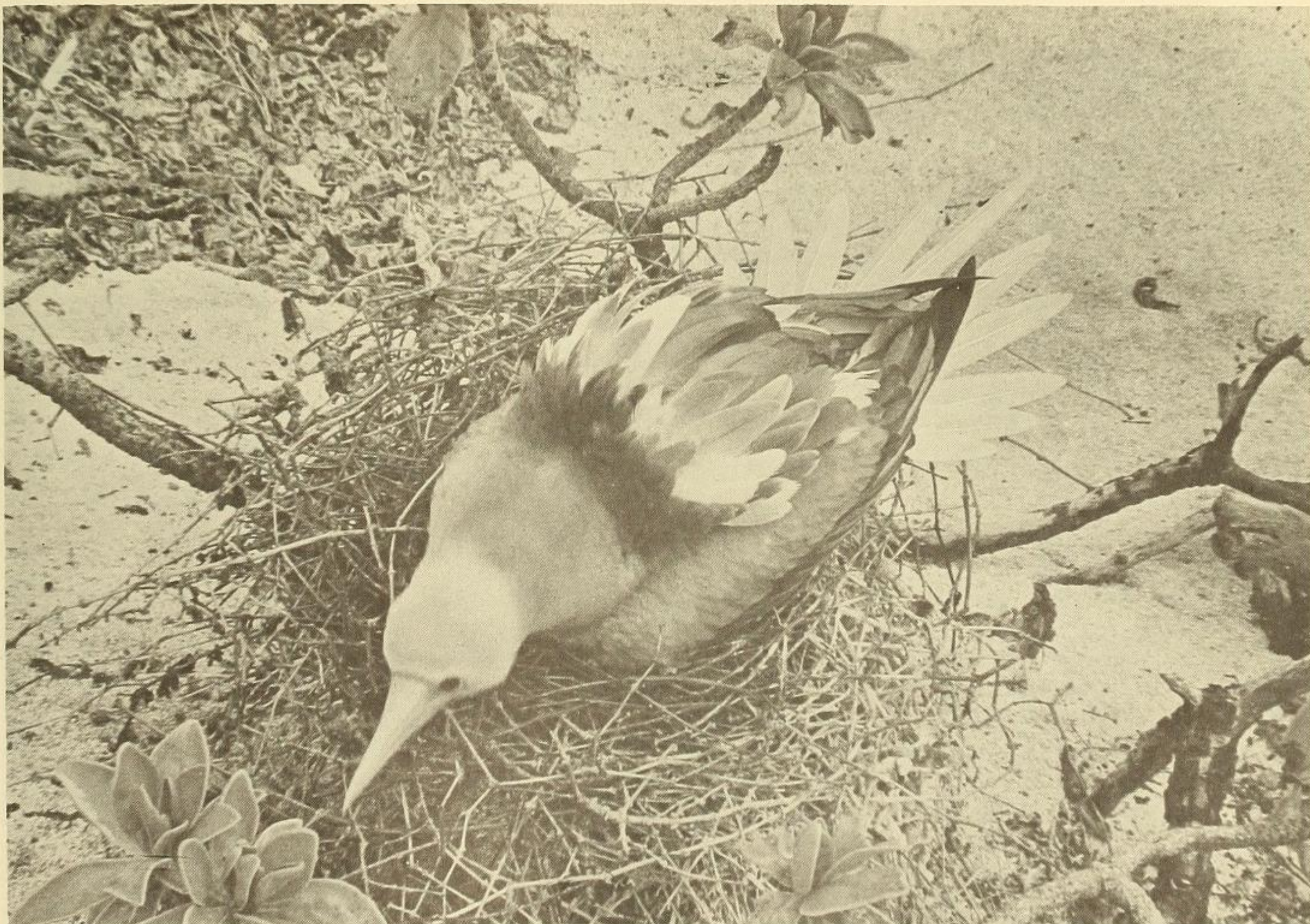
44. Sula sula rubripes: chick with "brown and white" parents



45. Sula sula rubripes: chick nearly fledged to "brown" juvenile form



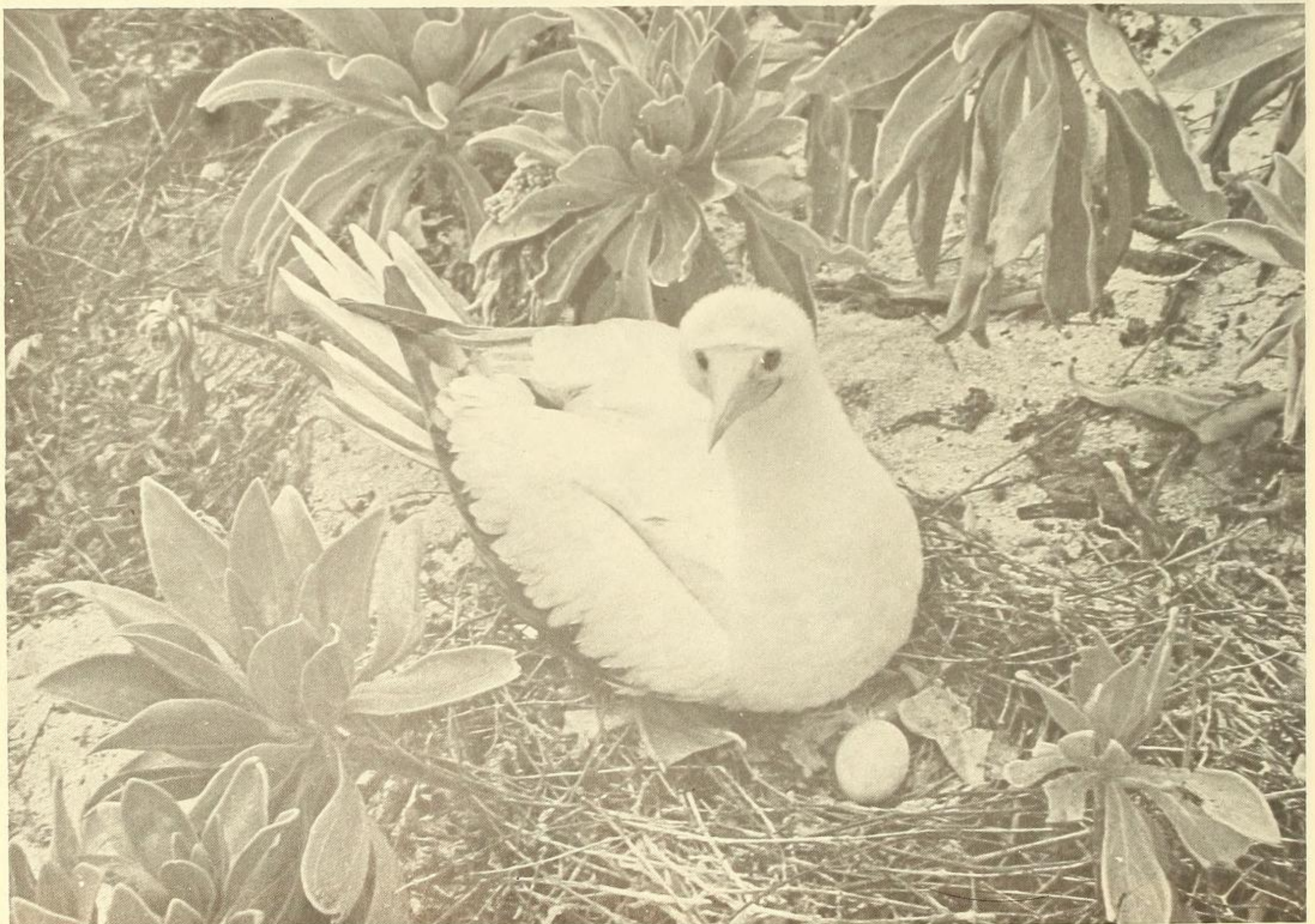
46. Sula sula rubripes: "brown" juvenile



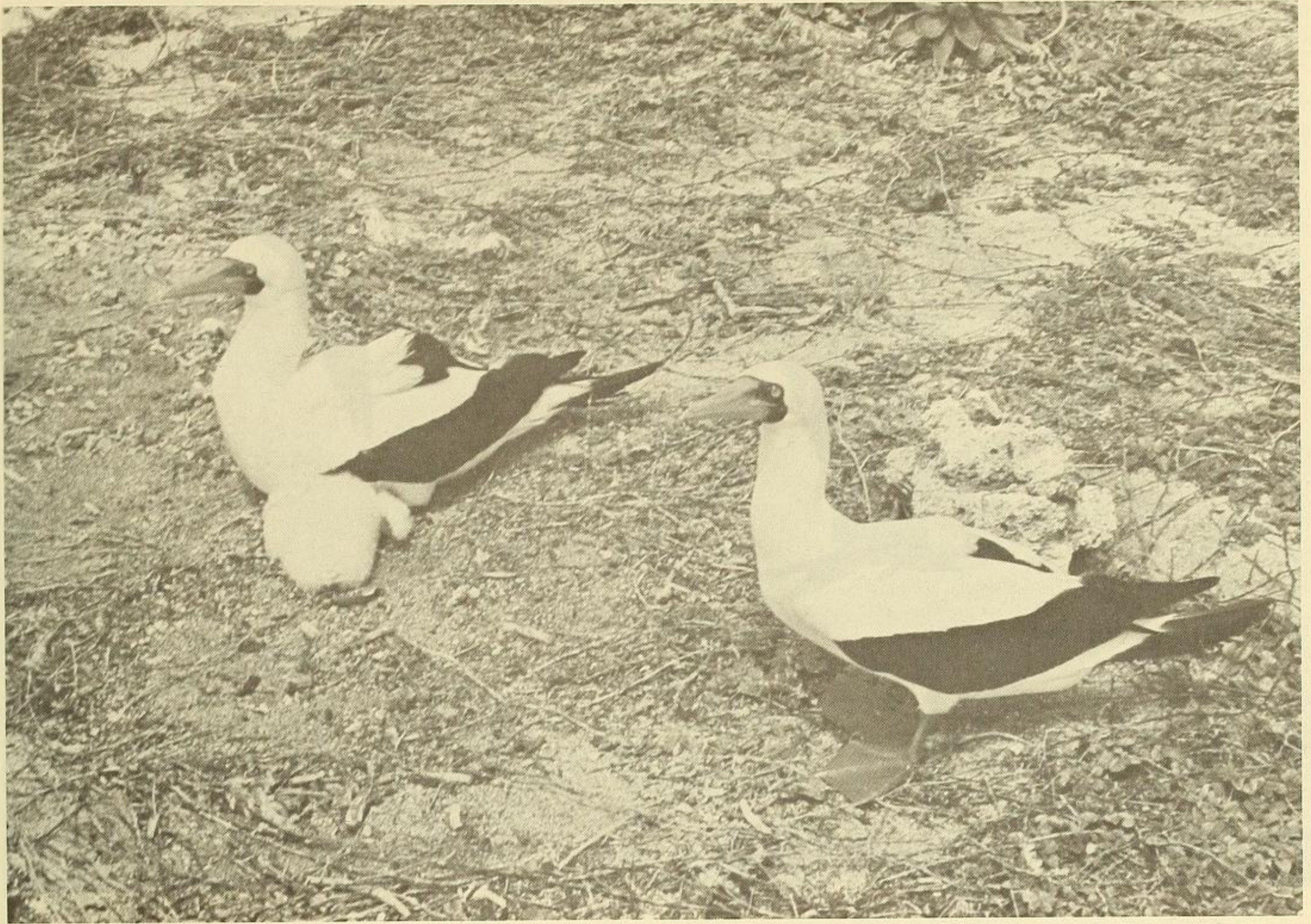
47. Sula sula rubripes: adult "brown and white" form with few white scapular markings.



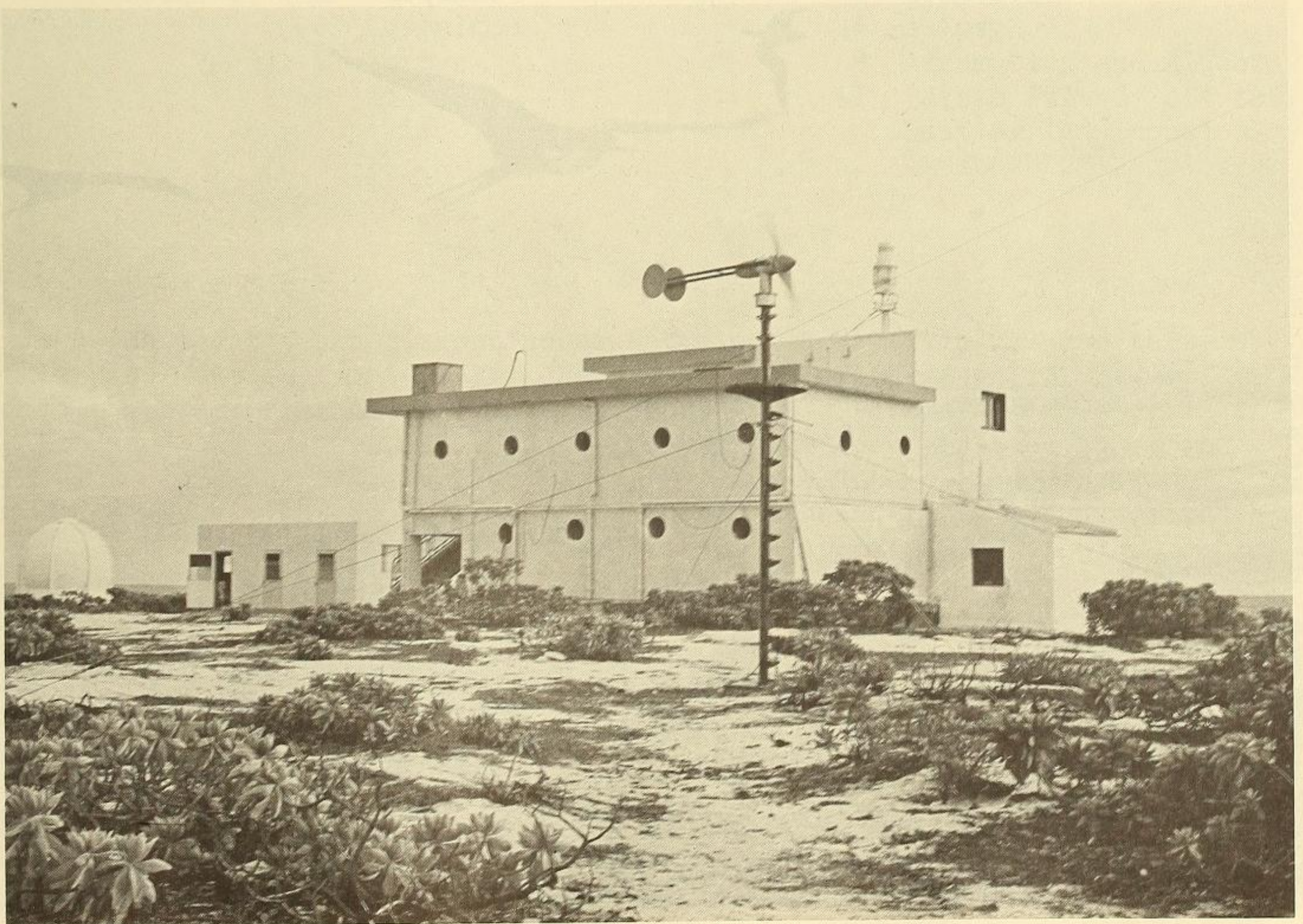
48. Sula sula rubripes: adult "brown and white" form with back nearly white



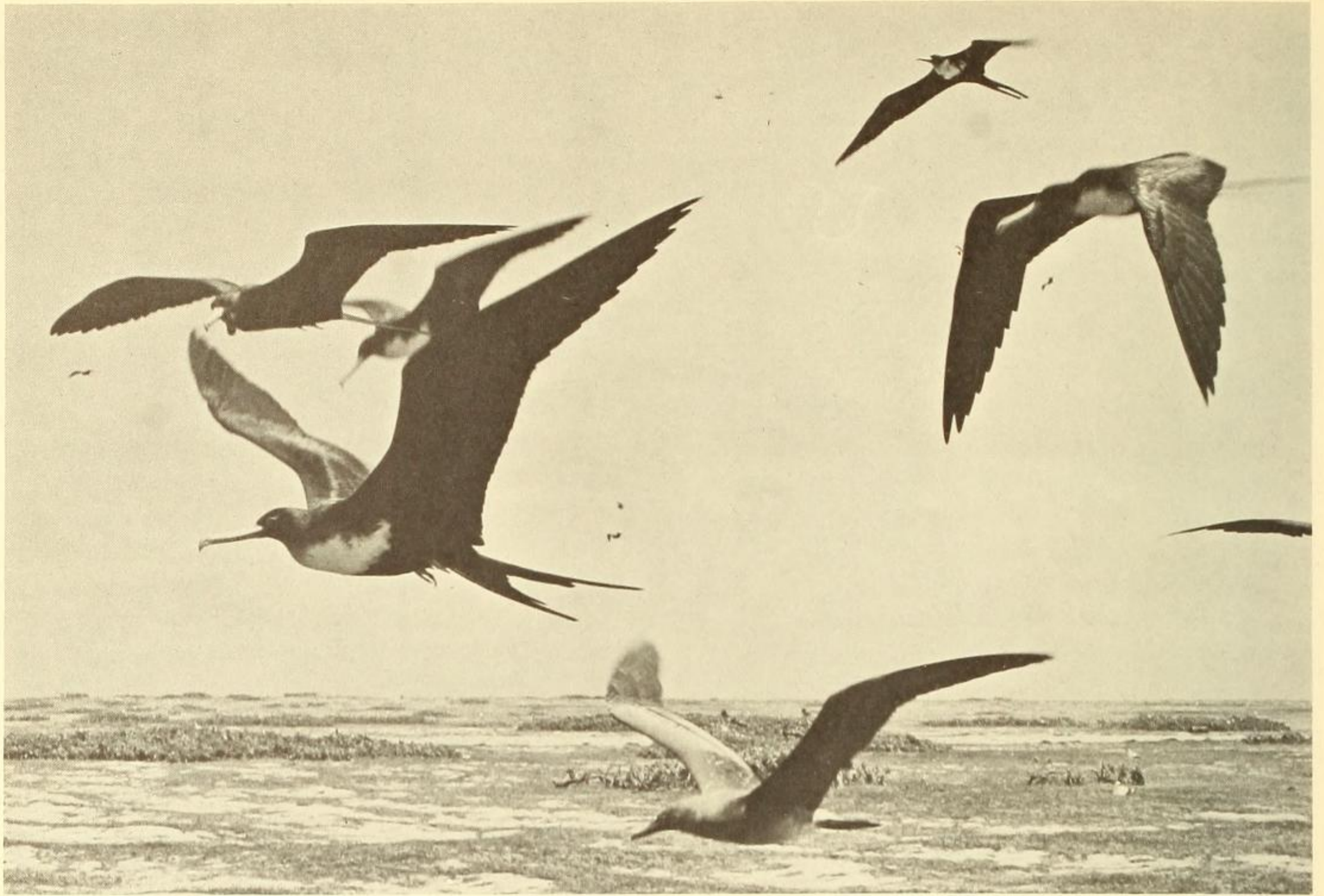
49. Sula sula rubripes: adult "white" form



50. Sula dactylatra melanops: parents with chick



51. Tromelin Meteorological Station



52. Male and four females of Fregata minor with Red-footed Booby in flight



53. Nesting colony of Fregata minor and Sula sula rubripes near airstrip, with Tournefortia thickets and herb-mat vegetation