Notes on the Sea Birds breeding in Malayan Waters

By C. A. GIBSON-HILL, M.A., M.B.O.U.

Contents

(Completed, August 1950)

The object of this paper is to collect in one place the information now available on the local nesting habits of the sea birds breeding on the coasts of the Federation of Malaya and its off-lying islands. It aims at showing the extent of our present knowledge, and such implications as can be drawn from it. We have, following the investigations undertaken at different times by Robinson, Madoc, Coope and the present writer, a fairly clear idea of the nature and potentialities of all the Malayan islands except for Pulau Bĕrhala, off the coast of Pahang. We are accordingly in a position to say with reasonable certainty which birds are breeding members of the Malayan avifauna. Nevertheless the greater part of the information collected here is of relatively recent origin, and it is obviously still incomplete in a number of particulars.

There is an interesting negative aspect to the existing information in that four species which might well be nesting somewhere off the Malayan coast are apparently not doing so. Accordingly, in this paper, in addition to the notes on the five which we know are breeding in Malayan waters, there is an appendix which summarises the data available on these four birds. It is not suggested that Malayan colonies have been overlooked (unless the birds are on Pulau Bĕrhala, or possibly visiting Pulau Perak), but one or two of these species are probably nesting very close to our area, while at least three of

them certainly do so within 300–400 miles of it. Their inclusion here thus extends the field covered by the present paper, though lack of precise information about the avifauna of many localities in neighbouring territories (including the Aroa Islands, the Natuna and Anamba Islands, the Tambelan Islands and even the west coast of Borneo) prohibits the preparation of a detailed paper on the Malaysian Sea Birds as a whole.

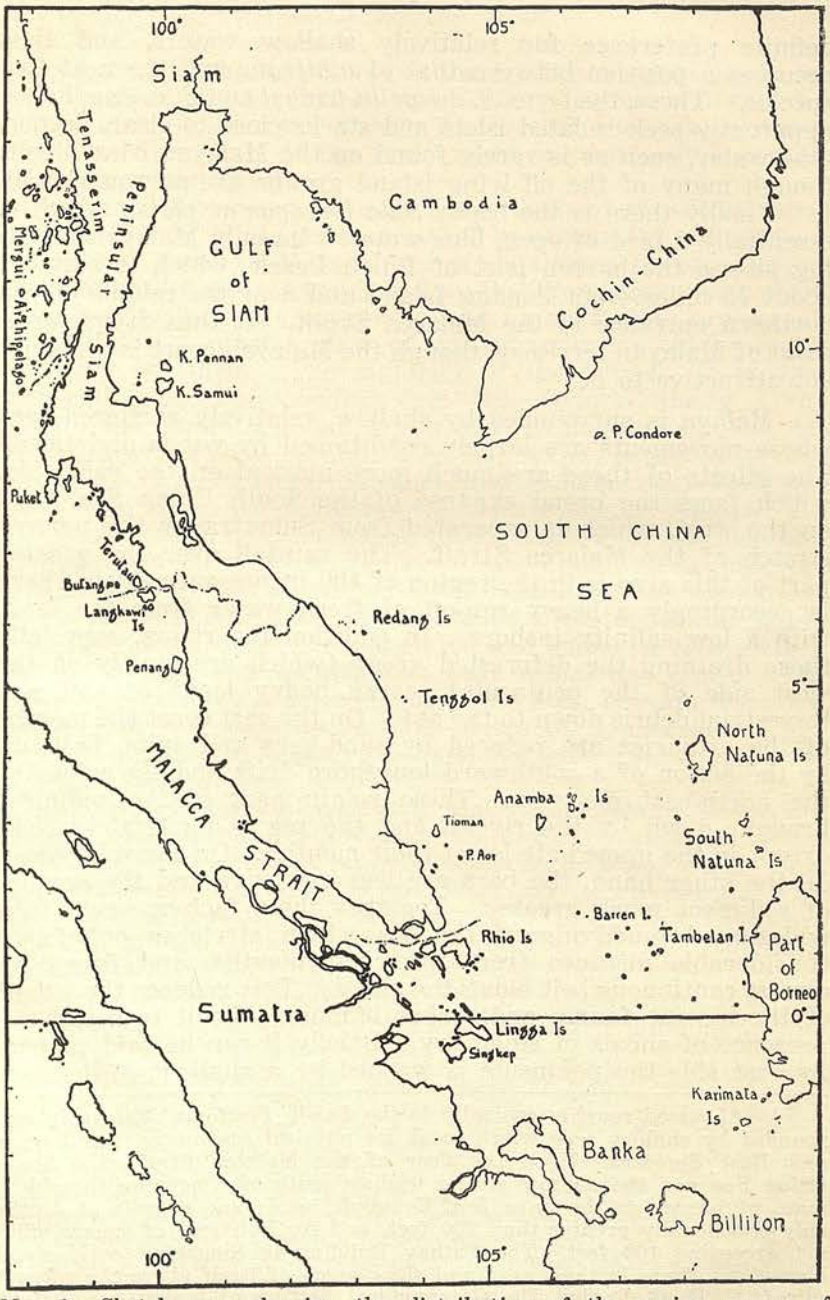
The five sea birds known to be nesting in Malayan territory, with the approximate numbers of the local breeding populations, are as follows,

Sula leucogaster plotus (Forster)	4,500–5,000 prs: Pulau Perak only.
Sterna s. sumatrana Raffles	(3,000–4,000 prs): widely scattered on both coasts.
Sterna a. anæthetus Scopoli	3,000 prs: largely off the East Coast.
Sterna albifrons sinensis Gmelin	(250–400 prs): East Coast only.
Sterna dougallii bangsi Mathews	45–55 prs: East Coast islets only.

The figures for *sumatrana* and *albifrons* are shown in brackets as they are not strictly comparable with those given for the other three birds. In the case of the latter, as the text below shows, it seems probable that at least the great majority of the Malayan nesting sites have been discovered and examined. The figures published here are based on counts made during visits to them in recent years, and they give a fairly accurate picture of the numbers at the present time. Those quoted for *sumatrana* and *albifrons* are only rough estimates.

Two general points merit consideration here. One is the local distribution of these birds on the Malayan coasts. The second is the apparent timing of their breeding seasons. It is probable that we know more about the former than the latter. The majority of the birds nest on off-lying stacks and islets, and in most cases these have been examined critically on only one or two occasions.

The natural site preferences of these birds in Malaya, so far as we have been able to determine them, are much as might be expected from the known behaviour of kindred races elsewhere. As a nesting bird, *Sterna albifrons sinensis* is apparently restricted to sandy shores and gravel banks where it can find shallow but moderately clear water: if, as seems likely, it does not breed on the west side of our area its absence is probably due to the greater amount of silt in the Malacca Strait. *Sterna s. sumatrana*, though more maritime in its habits, shows a



Map 1. Sketch map showing the distribution of the major groups of islands surrounding the area of the Malay Peninsula.

definite preference for relatively shallow waters, and thus occupies a position between that of *albifrons* and the next two species. These, the terns *S. dougallii bangsi* and *S. a. anæthetus*, apparently seek isolated islets and stacks close to clear, deeper, blue water, such as is rarely found on the Malayan coast itself, though many of the off-lying island groups are surrounded by it. Finally there is the booby *Sula leucogaster plotus* which is essentially a bird of open, blue water. Its only Malayan breeding site is the barren islet of Pulau Perak, which is situated about 75 miles from Penang Island and near the middle of the northern entrance to the Malacca Strait. It thus frequents a point of Malayan territory, though the Malayan coast is certainly not attractive to it.

Malaya is surrounded by shallow, relatively sheltered seas whose movements are largely conditioned by winds and tides.[1] The effects of these are much more marked on the east side, which faces the broad expanse of the South China Sea, than on the west, which is separated from Sumatra by the narrow stretch of the Malacca Strait. The rainfall over the greater part of this area is in the region of 100 inches annually. There is accordingly a heavy run-off of fresh water from the land, with a low salinity inshore. In addition the rivers, especially those draining the deforested areas (which are mostly on the west side of the peninsula), carry heavy loads of soil and terrestrial debris down to the sea. On the east coast the mouths of the estuaries are reduced by sand-bars and spits, built up by the action of a southward longshore drift and the winds of the north-east monsoon. These retain part of the sediment brought down by the rivers, and the sea is moderately clear except in the immediate lee of their mouths. On the west coast, on the other hand, the bars are less extensive and the amount of sediment much greater. Together these factors result in a widespread muddying of the sea which stretches out for a considerable distance from the river mouths, and forms an almost continuous belt along the shore. This reduces the extent of the marine fauna, and makes it more difficult to detect the presence of shoals of small fry. Briefly it can be said that on its east side the peninsula is washed by a shallow, moderately

1. "Located roughly centrally to the Sunda Platform, Malaya is surrounded by shallow seas which mask its physical continuity with Borneo and East Sumatra. Upon the floor of the Malacca Strait, the South China Sea and the narrow straits leading south of Singapore through a maze of islands to the Java Sea, lie sands, muds and gravels at depths only occasionally greater than 200 feet, and for hundreds of square miles not exceeding 100 feet. The Cathay Building in Singapore could stand almost anywhere in these seas and show much of itself above the water." (Prof. E. H. G. Dobby, The Geographical Setting of Malayan Fisheries, in "Malayan Fisheries", Singapore, 1949: 25–32).

clear sea with a bottom of coarse sand. On the west conditions close inshore are estuarine, with stiller, muddy water and a bottom of fine sand and silt: only further out, towards the centre in the northern part of the Strait, does one normally encounter reasonably clear water.

For the most part the east coast north of the Sĕdili River consists of long, sandy beaches backed by casuarinas and coco-nut palms. At intervals these stretches are broken by broad estuaries, flanked by spits of sand, and, on the Trengganu coast, short, steep headlands. The mangrove and nipah forests are largely confined to the inner waters of the estuaries, or tidal swamps leading from them. The majority of the islands lie in four scattered groups of varying sizes (the Johore-Pahang Archipelago, the Pulau Tenggol group, the Redang group and the Perhentians). These are situated in clearer, moderately deep water, 10–25 miles from the shore, and include rocky islets and steep-sided stacks as well as typical, thickly-wooded islands. The sandy shores on the mainland provide, at intervals, suitable nesting sites for *Sterna albifrons*, while the rocky outcrops associated with the occasional cliffy headlands are used by *S. sumatrana*. The majority of the islands, including all the larger ones, have steep, rocky shores, cliffed and embayed (*see* plate 1, lower picture), and they attract only *sumatrana* again. The smaller islets and stacks, lying in blue water, provide the great majority of the Malayan nesting places of *S. anæthetus*, and the only recorded colonies of *S. dougallii* (*see* plate 2 and plate 4, lower picture).

The south and west coasts of Malaya are less exposed than the east side north of the Johore-Pahang Archipelago. There are extensive stretches of mangrove forest, and only a few long, sandy beaches.[1] The water is less clear, and the greater majority of the scattered islands lie fairly close to the coast. There are only two groups of importance. One of these, the Langkawi group, consists of fairly large, well-wooded islands with relatively narrow channels between them: so far as sea birds are concerned it has no more to offer than the cliffed portions of the

1. "Mangrove forest (of *Rhizophora* spp. and *Bruguiera* spp.) is extensively developed along the western shores of Malaya, where there is no surf to disturb the seedlings, and where the calm seas allow the mud and silt brought down by the rivers to form banks where the pioneer species may establish themselves. The west coast mangroves extend from Kedah to Singapore in an almost unbroken belt, in some places as much as twelve miles broad. On the east coast, on the other hand, mangrove develops only in sheltered bays and in river mouths, and it is replaced by a narrow belt of Casuarina just behind the sandy beaches". (M. R. Henderson, A Note on the Vegetation, in "Malayan Fisheries", Singapore, 1949: 32–34). There are actually some sandy beaches at intervals all along the west coast, but they are almost invariably away from the river mouths and do not apparently tempt *Sterna albifrons* into setting up house there.

Trengganu coast. The other group, the Sembilan Islands, south of Pangkor, is more open and consists of much smaller islands, all thickly wooded (see plate 1, upper picture), and two small, low-lying rocky islets. Unfortunately they are apparently too near to the shore to attract *S. dougallii*. Small granite outcrops (of the kind shown in plate 3, lower picture) occurring at intervals along the west side of the peninsula, both on the mainland and among the islands, provide nesting sites for *S. sumatrana*, more particularly from Kuala Selangor northwards. Apart from these, the only sea bird breeding in coastal waters is *S. anæthetus*, which has established two very small colonies on the rocky islets in the Sembilan group. Seemingly, however, it is not particularly happy even there, and in 1946 less than twenty pairs were said to be present in this area.

Three isolated localities, nearer to the centre of the Malacca Strait, require comment here. Two are small islands which form part of the territory of the Malay States: the third, the Aroas, is a group of low-lying islets and stacks, situated in the middle of the Strait and forming part of the territory of Sumatra. The more northerly of the isolated islands is Pulau Perak (Lat. 5° 42′ N., Long. 98° 56′ E.), a steep-sided, barren rock, about 500 yards long and 400 yards wide, lying about 75 miles west-north-west of Penang Island (*see* plate 3 middle picture, and plate 4 upper). An account of it, based on a visit made in April 1949, is given in an earlier paper by the present writer (1950*a*: 1–4). Only *Sula leucogaster* was found to be nesting, though we had hoped that we might also encounter breeding populations of the Common Noddy and possibly a tropic-bird. Pulau Perak is apparently very similar in form to Mait Island, in the Gulf of Aden, which has a much richer avifauna. An excellent paper on the latter by North, who visited it in November 1942, appears in the *Ibis* for July 1946. North (1946: 479) says of Mait Island,

> "It is a mountain-chain in miniature, long, narrow and deep-sided, rising abruptly out of the sea. The western half is whale-backed; the eastern, razor-edged. Along the south face, rocky buttresses alternate with scree-gullies; the north face is unbroken precipice. There is no vegetation whatsoever, and no fresh water except after rain".

There, at a slightly higher latitude but not in a cooler climate, nest two kinds of boobies (*Sula leucogaster* and *S. dactylatra*),[1] the tropic-bird *P. æthereus indicus* Hume, the Common Noddy and two terns.

1. We saw two examples of the Masked Booby, *Sula dactylatra* Lesson, standing together among the scattered *S. leucogaster* on the upper portion of Pulau Perak on 9 April, 1949, but there were no indications that they were nesting there (Gibson-Hill, 1950*a*: 3).

The second off-shore island is Pulau Jarak, situated just over 38 miles from the nearest point of the Perak coast and in approximately the same latitude as the Sembilan Islands. Jarak is a steep-sided, thickly wooded island, similar in form to a number of those closer in on the west side of the peninsula including, particularly, Pulau Pisang. Several expeditions have been made to Jarak, beginning with Robinson in 1904 and at present finishing with Audy and Harrison who stayed there for three weeks in 1950. A full account of our knowledge of its vertebrate fauna is given in a series of papers edited by Harrison and published in this journal. Apparently no sea birds are nesting there. The only one which might be attracted by its shore line is the Blacknaped Tern, *S. sumatrana*, but presumably Jarak is situated too far from the mainland to suit it.

The last of the localities of interest near the middle of the Malacca Strait is the Aroa group, in about the same latitude as the One Fathom Bank Lighthouse and almost halfway between it and the Sumatran coast. Robinson visited the islands in August and November 1906 (Robinson, 1906: 8–9), but they do not appear to have been examined critically since then. The group would, I think, well repay a careful investigation, conducted if possible in June and December. It includes a wide range of habitats, possessing, as it does, both wooded and open islands, low-lying rocky islets and stacks. There can be no doubt that *Sula leucogaster*, *Sterna dougallii* and *S. anæthetus* are breeding there: probably *Fregata ariel* is also present as a nesting species (on the stack known as Tokong Simbang), and possibly *Anoüs stolidus*. It is extremely unfortunate that this locality is difficult of access and politically Sumatran territory.

We have, then, two terns, *Sterna sumatrana* and *S. albifrons*, breeding at suitable points on the coast on the east side of the peninsula, and three species, *S. sumatrana* again, *S. anæthetus* and *S. dougallii*, nesting in varying numbers, mostly on stacks and low-lying rocky islets, among the off-lying islands. On the west side we have *S. sumatrana* at scattered points along the coast and its islands, and two very small colonies of *S. anæthetus* on rocky islets in the Sembilan group. Finally there is a large colony of *S. leucogaster* breeding on the isolated island known as Pulau Perak. The east coast of the Malay States lies along the south-west side of the South China Sea. From November to March it is swept by the strong winds of the north east monsoon, carrying with them rain and heavy seas. During this period fishing and most maritime coastal traffic is at a standstill from the Sĕdili river northwards. On the other hand this is normally

the season of good weather on the east side of the Malacca Strait, which lies well sheltered in the lee of the peninsula. From about the middle of May to the middle of September the conditions are reversed. Malaya is dominated by southern or south-westerly winds which bring squalls, swells and rain to its west coast and a period of relative calm on the east. It is not, of course, a complete reversal in that the south-west monsoon, travelling across the Malacca Strait, gains less hold on its waters than the north-east monsoon on those of the South China Sea, sweeping as it does almost unhindered down its long axis. In addition even during this period sudden off-sea winds may spring up on the east coast for a few hours between noon and sundown. Nevertheless, on the whole this is the period of good weather on the east side of the peninsula, much as November to March is the period of settled calms on the west side. In the two intervening periods, April and early May and late September and October, calm spells broken by occasional sudden storms occur on both coasts.

The accompanying table shows the periods, as far as we can assess them, during which the majority of the members of the five species are incubating in Malayan waters. In each case it is equivalent to the normal laying season with the incubation period added on at the end of it. The data on which it is based are outlined in the appropriate sections later in this paper. Two interesting points emerge from this table. One is that the terns nesting on the east side of the peninsula are clearly breeding during the good weather in this area: but at the same time those on the west coast are doing so between approximately the same dates, although they lie in the season of bad weather in the Malacca Strait. Apparently only *Sula leucogaster* times its nesting period to fit in with the weather on the west side of the peninsula. Subsequent investigations may modify our estimate of the laying times of the Malacca Strait terns by a few weeks. I am not fully satisfied that the main season for *S. sumatrana* is really as long as it appears to be at present. Nevertheless there can be no doubt that the birds are normally all away from their breeding grounds from about October to April. Even in the Aroas Robinson (1906: 10) found terns plentiful in August, while "not a single tern of any kind was seen in November".

The second point is the relation between the breeding seasons in Malayan waters and those in comparable areas. Unquestionably additional and more precise data are needed on this subject. In particular it would be of value to have comprehensive records from the west coast of Borneo, lying

Summary of Egg Dates recorded from Malaya and other Comparable Areas

——	Malaya (West Coast)	Malaya (East Coast)	Inner Gulf of Siam	Java Sea area	Ceylon
Sula leucogaster plotus ..	October to February	..	..	..	..
Sterna dougallii bangsi ..	(? June: Aroas) (*korustes*)	July	mid June to early August	April and May (West Java)	April to June (*korustes*)
Sterna s. sumatrana ..	June to mid August	June and July	May and June	May (West Java)	..
Sterna a. anaethetus ..	June	June and July	May and June	June and August (Mid Java)	..
				February and March (East Java)	
Sterna albifrons sinensis	..	June (Pahang River) July to mid August (on the coast)	?	May to July (West Java)	May to August
Sterna bergii cristatus ..	..	..	May and June	May and June (Karimon Java)	May (*velox*)
Anoüs stolidus pileatus ..	..	(June: Barren I.)	May to July	August (Karimon-Java)	..
Anoüs minutus worcesteri	..	..	..	August (Karimon-Java) October (nr Billiton)	..

The table above gives the egg dates, so far as they are at present recorded, for the five sea birds breeding in Malayan waters and the three breeding in adjacent territory but not in Malaya. The section "Malaya (West Coast)" with the inclusion of *S. dougallii bangsi* from the Aroas, given in brackets, actually covers all that we know from the whole length of the Malacca Strait. The data for Malaya, the Inner Gulf of Siam (from Williamson and Madoc), and the Java Sea area (mostly from Hoogerwerf 1949; partly from van Bemmel *in litt.*) are discussed in the text under the appropriate headings. The data for Ceylon are from information obtained by Phillips (1923 and in Whistler 1944). Such information as is available for the Sulu Sea area can be found in Worcester (1911*a*) and for Gunong Api in the Banda Sea in van Bemmel and Hoogerwerf (1940). A thorough and most useful summary of the data from the African coasts is given in a paper by Moreau in the *Ibis* for July 1950. A fuller paper summarising the information covering the tropical Indian Ocean and adjacent seas as a whole is in preparation by the present author.

as it does along the south-east side of the South China Sea,[1] and from the Sulu Sea between Borneo and the Philippines. Also, in spite of the excellent work done by Hoogerwerf and other Dutch field-naturalists, we still require more information from the Java Sea and its immediate environs. At present only one point seems certain: that is that both *Sterna sumatrana* and *S. anæthetus* are breeding three to four weeks earlier on the islets in the Inner Gulf of Siam than they are doing on those off the east coast of the Malay States. On the other hand the few records that we have for *Sterna dougallii* suggest that the breeding season is at least as late in Siamese waters as it is in Malayan, and that it may possibly be later there. The information that we have from West Java supports a tentative conclusion that the birds there are nesting at about the same time as those in the Inner Gulf of Siam, and rather earlier than those in Malayan waters. Unfortunately the picture is a little confused by the wide range of dates collected by Hoogerwerf for *S. anæthetus* further east, in the middle and eastern sections of the Java Sea (*see* page 37).

Notes on a further four birds which are of interest in connection with a study of the sea birds breeding in Malayan waters are given in an appendix on pages 43–59. Three of these species, the Larger Crested Tern, *Thalasseus bergii cristatus* (Stephens), the Common Noddy, *Anoüs stolidus pileatus* (Scopoli), and the Whitecapped Noddy, *Anoüs minutus worcesteri* (McGregor), are known to nest in neighbouring territories, less than 300–400 miles away. Details of their egg dates, as far as they are available, are given at the bottom of the table on page 13. In all three cases sites apparently suitable for colonies exist in our area. *Thalasseus bergii* and *Anoüs stolidus* are breeding in the Inner Gulf of Siam in company with three smaller terns which nest off the east coast of Malaya. *Anoüs minutus* is known to lay in trees on small, wooded islets and stacks, of which there are a number of suitable examples off the east side of the peninsula, and, one would have thought, several off the west side. Further all three birds are found nesting to the south as well as to the north of our area.

1. In July 1949 I saw small parties of *S. sumatrana* at numerous suitable points all round the coast of North Borneo from Labuan to the islands south of Lahad Datu. There were also several large flocks of *S. bergii*, similar to those seen off the Malayan coast in July 1948, in and around Darvel Bay. In neither case was I able to obtain any direct evidence of nesting, though *sumatrana* at least must be breeding in that area. Similarly both it and *S. albifrons* must, I think, be nesting on the coast of Sarawak, but Banks tells me that so far as he knows there are no records of their doing so. We have, in fact, no data from this area beyond those supplied by the eggs of *S. anæthetus* and *Anoüs stolidus* taken by Sir John Anderson on Barren Island on 25 June, 1921.

A fourth species, the Least Frigate-bird, *Fregata a. ariel* (G. R. Gray), is also discussed in the appendix. Nesting has not been confirmed nearer to Malayan waters than the Cocos-Keeling Islands, roughly 600 miles south-west of Sumatra, but there must certainly be additional breeding grounds much closer to the peninsula.

Thalasseus bergii is known in Malayan waters as a winter visitor, seen from the middle of July to almost the end of April: *Fregata ariel* has been recorded as a non-breeding visitor in most months of the year, but chiefly from May to July: *Anoüs stolidus* has been taken five times in the northern part of the Malacca Strait, mostly in November: *Anoüs minutus* is said to have been taken once off Malacca, in August 1865 (Dr. Maingay coll.), but it is certainly breeding just south of Billiton, in the Banka Strait area. There is also *Phaëthon æthereus indicus* Hume, of which Dr. Cantor is said to have shot an immature example in the Malacca Strait: the record is usually quoted as "off Penang". The skin is now in the British Museum (N.H.) collection, ex. India Museum, B.M. Reg. 80.1.1.3423. There is no doubt of its identity, but it is surprising that there have been no subsequent records during the last hundred years. Pulau Perak is the kind of place on which *Ph. æthereus* might breed, but we found no indication of any tropic-bird doing so when we visited the islet on 9 April 1949. Its normal home would seem to be the Arabian Sea and adjacent waters. Hume and Davison (1878: 493) give two visual records, based on observations by Davison, for the northern part of the Bay of Bengal. Otherwise it does not appear to have been reported away from the north-western corner of the Indian Ocean except by Delacour and Jabouille (1931: 30–31), who say that Tirant (1879: 347) lists an example from Pulau Condore and that it nests in large numbers on the Paracel Islands. M. Delacour tells me that the record of the colony on the Paracels is based on information supplied to him by collectors sent there in June 1926, and the identity of the bird on a chick in spirit which they brought back with them. Neither he nor Jabouille were ever able to go to the islands themselves. Seemingly, as given in the Malayan Checklist (1949: 17), on the information at present available, the nearest certain breeding grounds of *æthereus indicus* are in the Persian Gulf, and its appearance in or near our area must be regarded as an extremely rare occurrence. If there is a tropic-bird nesting somewhere near the Bay of Bengal it would seem to the present writer to be more likely that it is a race of *Phaëthon rubricauda* Boddaert, of which F. G. H. Allen took an immature example in the strait between the north end of Sumatra and the Nicobar Islands (Gibson-Hill, 1950*b*: 77).

A further eight sea birds appear on the Malayan Checklist. Five of these are gulls and terns,

Larus ridibundus Linnaeus (No. 148)

Chlidonias leucoptera (Temminck) (No. 149).

Gelochelidon nilotica affinis (Horsfield) (No. 150)

Sterna hirundo longipennis Nordmann (No. 151)

Thalasseus b. bengalensis (Lesson) (No. 156)

which occur here only as passage migrants and winter visitors from breeding grounds to the north of our area. The other three are two pelicans and a cormorant,

Pelecanus onocrotalus Linnaeus (No. 5)

Pelecanus roseus Gmelin (No. 6)

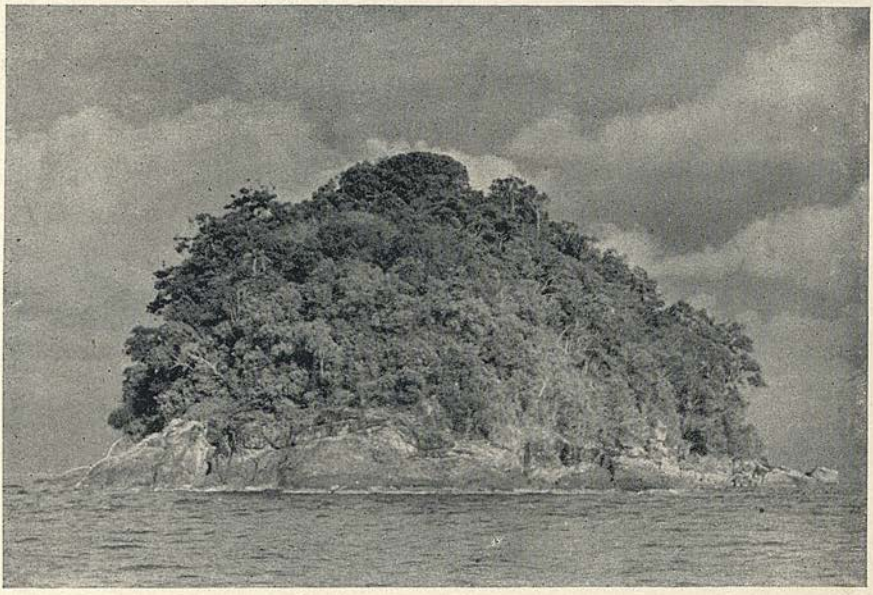
Phalacrocorax carbo sinensis (Blumenbach) (No. 8)

which are no more than occasional visitors from territories further north. The last pelican to be recorded here was a solitary example of *P. onocrotalus* which was taken on a Singapore reservoir in January 1903, although according to Hume (1880: 119) "in some years Pelicans appear in prodigous numbers on the coasts of the Malay Peninsula, but since we have been regularly collecting there, they have been extremely rare": in all there appear to be only about half-a-dozen formal records for each species. The last cormorant to be taken in Malaya was shot at Johore Bahru in 1905 by Boden Kloss (Robinson, 1910: 5): there are about seven formal records for our area, including a bird taken on Pulau Lalang, in the Sembilan Islands.

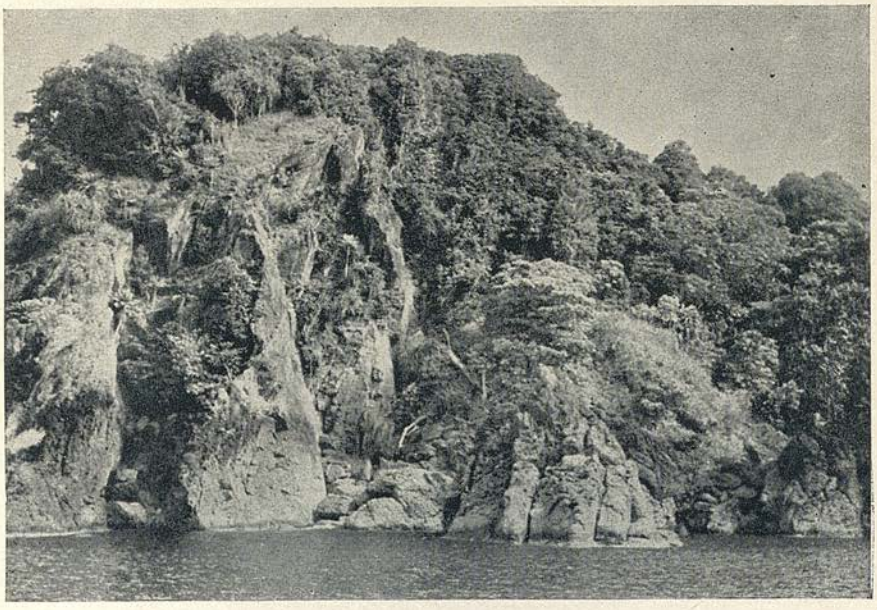
Birds known to be breeding in Malayan Waters

7. **Sula leucogaster plotus** (Forster). Brown Booby.

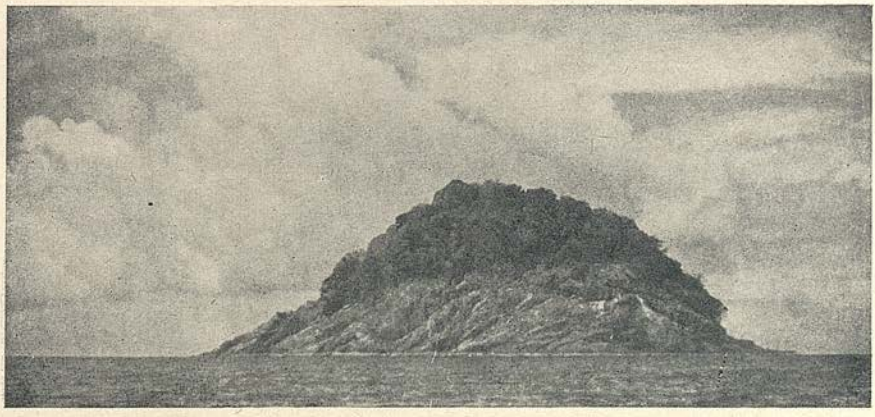
The Brown Booby normally frequents blue water stacks and islands, and seldom approaches shallow-shored mainlands. It is fairly common in the central portion of the Malacca Strait throughout its whole length. It does not often come close to the Malayan coast, but the Raffles Museum collection includes specimens taken in the Langkawi group, off the coast of Perak and on Pulau Pisang (Johore), in addition to Pulau Jarak, the One Fathom Bank Lighthouse and Pulau Jemor, in the Aroa group. There is also a recent visual record from one of the aerodromes on Singapore Island, but it is not otherwise known



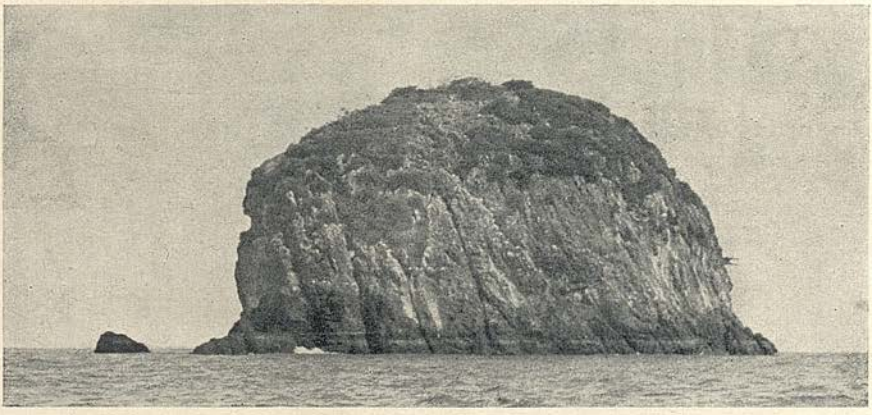
Pulau Lalang in the Sembilan group, off the coast of Perak, seen from the north-west; lat. 4° 1′ N., long. 100° 32′ E.



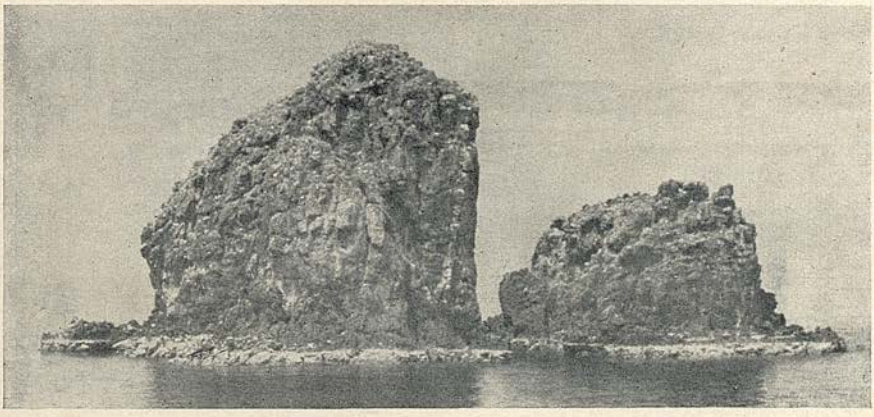
Part of the north-east side of Pulau Lima, lying south of Pulau Tinggi, in the Johore-Pahang Archipelago; lat. 2° 13′ N., long. 104° 9′ E.



Pulau Chibeh.

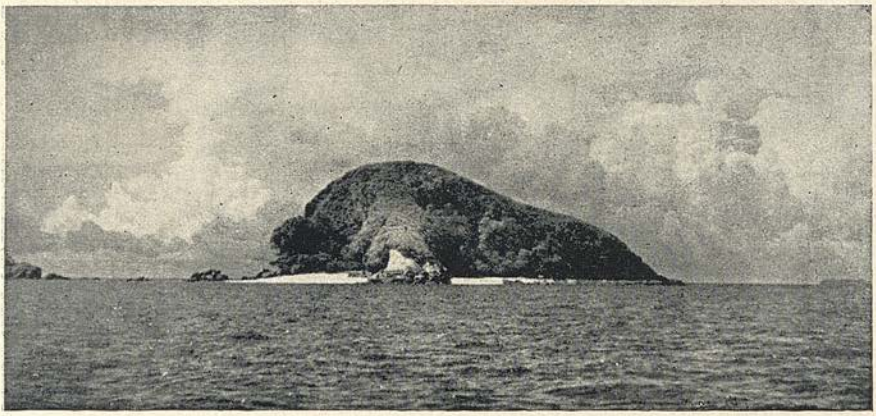


Tokong Chondong.

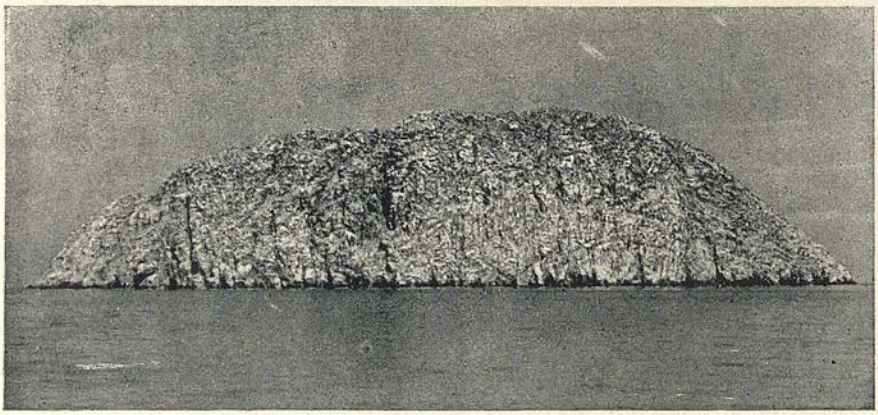


Two of the four stacks of Tokong Burong.

Islets and stacks in the Johore-Pahang Archipelago.



Pulau Mensirip, off Mersing: lat. 2° 33′ N., long. 103° 57′ E.



Pulau Perak, in the Malacca Strait, from the east north-east, distant approximately 2½ miles: lat. 5° 42′ N., long. 98° 56′ E.

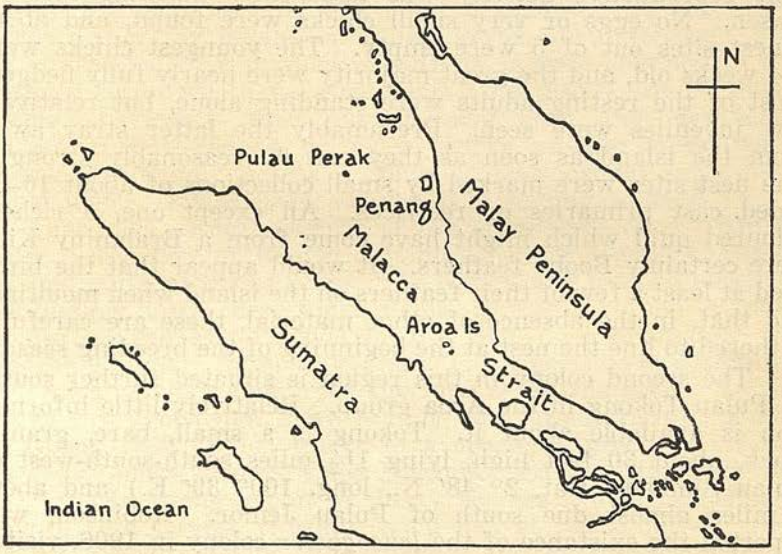
Granite outcrops off the north coast of Penang Island.

The south-east corner of Pulau Perak, in the Malacca Strait: lat. 5° 42′ N., long. 98° 56′ E.

Pulau Jagat, south of Tioman in the Johore-Pahang Archipelago: this islet is marked as "Gut Island" on the Admiralty Charts: lat. 2° 39′ N., long. 104° 10′ E.

from the area to the south of the Peninsula, or from its east side south of Nakon Sri Thamarat.[1]

Two breeding grounds have been discovered in the Malacca Strait. The larger colony is situated on Pulau Perak (Lat. 5° 42′ N., Long. 98° 56′ E.), the barren, dome-shaped rocky islet lying about 75 miles west-north-west of Penang Island. On 9 April, 1949, the present writer visited Pulau Perak in company with Mr. T. W. Burdon, of the Fisheries Department, and was



Map 2. The position of Pulau Perak and the Aroa group, the two known breeding sites of *Sula leucogaster* in the Malacca Strait.

1. There is a most confusing statement in Hume and Davison (1878: 493) with regard to this species. It reads "Very numerous between Penang and Singapore, where Davison procured a specimen, but seen by him continually, the whole way up the coast of the Malay Peninsula. . . ." Several authors, including the present writer in an earlier paper, have assumed from this that Davison actually obtained a bird on or near Singapore Island. Sharpe and Ogilvie-Grant (1898: 437) transcribe the record as "Penang; Singapore", thereby attributing it to both places. A full examination of Hume's writings shows that he had only one specimen from our area, and that it came from open water in the Malacca Strait, approximately 18 miles west of Cape Rachado. The most detailed reference to it is given in his revision of the genus *Sula* (1877: 320), where he describes it as "a young female probably about a year old that we caught on boardship, between Malacca and Penang, Lat. 2° 25′ N., Long. 101° 40′ E., on the 8th of August. . . ." In the British Museum catalogue (26, 1898: 439) it appears as taken "Between Malacca and Penang, August 12 (*W. Davison*)". The only other Malayan specimens listed in the catalogue are from; Penang (*Dr. Cantor*), pres. Indian Museum; Malacca, July (*Dr. Maingay*), Tweeddale Coll.; Straits of Malacca, August, pres. F. W. Styan, Esq.

able to spend about four hours ashore (Gibson-Hill, 1950*a:* 3). There were approximately 5,000–6,000 adults of *Sula leucogaster* on the island itself, in addition to several hundred feeding or resting on the water in the immediate neighbourhood. As far as we could see all the available portions of its surface were dotted with nests, spaced at intervals of about 10–20 feet from each other. If this is so Pulau Perak must be providing accommodation for 4,500–5,000 breeding pairs. At the time of our visit reproductive activity was apparently finishing for the season. No eggs or very small chicks were found, and about 4 nest sites out of 5 were empty. The youngest chicks were 3–4 weeks old, and the great majority were nearly fully fledged. Most of the resting adults were standing alone, but relatively few juveniles were seen. Presumably the latter stray away from the island as soon as they can fly reasonably strongly. The nest sites were marked by small collections of about 10–30 faded cast primaries or rectrices. All except one, a richer-coloured quill which might have come from a Brahminy Kite, were certainly Booby feathers. It would appear that the birds shed at least a few of their feathers on the island when moulting, and that, in the absence of other material, these are carefully gathered to line the nest at the beginning of the breeding season.

The second colony in this region is situated further south, on Pulau Tokong in the Aroa group. Relatively little information is available about it. Tokong is a small, bare, granite stack, about 30 feet high, lying 1½ miles south-south-west of Pulau Simbang (lat. 2° 48′ N., long. 100° 39′ E.) and about 7 miles almost due south of Pulau Jemor. Robinson, who reported the existance of the *leucogaster* colony in 1906, visited the Aroas twice, once in August and once in November. On each occasion he camped on Pulau Jemor, which has two sandy beaches and is the only island with a permanent supply of fresh water. He was unable to effect a landing on Pulau Tokong, owing to the heavy surf; to the best of my knowledge no subsequent visitor has been more successful. In his notes (**1906: 11**), Robinson says that all the birds on Pulau Tokong, amounting to some hundreds, appeared to be adults. It is not clear whether this statement applies to August or November, but it may well refer to both months.

From observations made on Christmas Island the incubation period in this species apparently lasts about 40–43 days, and the chick finally abandons the nest site when it is 15–17 weeks old (Gibson-Hill, 1949*c:* 225). In many colonies pairs can be found breeding in all months of the year, with or without a peak period. On the other hand on Pulau Perak, and probably also on Pulau Tokong, the season would seem to be short and well-defined. The youngest chicks on Perak were 3–4 weeks old,

while the great majority were about 10–15 weeks old. Presumably, therefore, egg-laying had dropped off steeply during the previous December, and ceased about the middle of January. May to September, the months of the south-west monsoon, form a period of bad weather in the Malacca Strait, which includes rain as well as wind. It seems very unlikely that the little collections of cast feathers found on Pulau Perak would retain their order and position, at least in the more exposed sites, through the monsoon. If this point is accepted we must take it that egg-laying begins on Pulau Perak about October, and that the period of reproductive activity is here confined to the season of fairer weather. Presumably this also occurs on Pulau Tokong. Certainly there cannot have been any significant number of half-fledged or older chicks on the stack when Robinson saw only adults. Some at least would have been visible when he was lying off the islet hoping to land.

There are several records of the occurrence of the Brown Booby in the Bay of Bengal, but no breeding ground has been reported north of Pulau Perak. If, however, it is at all plentiful still further north there must almost certainly be one or more colonies on the eastern side of the Bay. Unfortunately the evidence is in part conflicting, and it is not possible to determine with certainty how numerous the bird is in this area. To the best of my knowledge there is only one formal record; Hume (in Oates, 1882: 247)[1] refers to a specimen procured off the Irrawaddy delta, east of Cape Negrais. Earlier Hume (1874: 324) reports seeing a pair of dusky boobies, which he believed to be of this species, chasing flying fish at sea about 40 miles west of Preparis Island, and roughly 105 miles south-west of Cape Negrais; the following day he saw a second pair near the Coco Islands, about 50 miles further south. There do not appear to be any records for the Andaman Islands proper, and this species is not listed by Kloss (1903). Possibly there is a colony somewhere in the neighbourhood of the Preparis channels.

The Brown Booby is also said to occur along the eastern shore of the Bay of Bengal. According to Hume (Davison and Hume, 1878: 493) Davison saw examples "continually the whole way up the (west) coast of the Malay Peninsula, and well up in amongst the islands of the Mergui Archipelago". Robinson and Kloss (1921: 85) describe it as common on the western coast of Siam. Both these accounts may be exaggerated. Dr. Abbott (Riley, 1938: 21) took an immature female off the Aroas and

1. Hume refers to this bird as *Sula fiber* Linn. in Vols. 2 and 4 of *Stray Feathers*, where he publishes his records from the Laccadive and the Andaman groups. In subsequent volumes he gives it as *Sula australis* Stephens. Robinson and Kloss (1921) and Williamson (1916 and 1918) term it *Sula sula* (Linn.), following the British Museum Catalogue (1898: 436–40).

another in the neighbourhood of Pulau Perak, but he does not appear to have encountered *leucogaster* further north. Legge (1880: 1177) refers to a not quite mature example in the British Museum collection labelled "Tenasserim", but as his description shows the specimen is really a young Masked Booby, *Sula dactylatra*.

Sula leucogaster undoubtedly occurs in the Gulf of Siam, but there are few records from this area. Robinson and Kloss (1921: 85) say that they "have been assured that it is found breeding in a small island off the coast of Nakon Sritamarat"; unfortunately I cannot determine the name of the island or trace the source of their information. More certainly Williamson reports this species from two islands on the east side of the Inner Gulf of Siam. On 18 July, 1916, a member of his party found a sun-dried cadaver in good condition on the shingly beach of an islet near Kok Rin, presumably White Rock (1916: 63–64). Subsequently, on 9 May, 1918, he discovered four or five living birds on an islet "a few miles south of Koh Chuan" (presumably Kok Hin Chalarm); he was able to collect one specimen, an adult male in full plumage (1918: 38–39). Madoc tells me that he did not encounter this bird when he was examining the islands in this neighbourhood in 1949, and there do not appear to be any additional records. Nevertheless there is probably a small colony somewhere in or near the Gulf of Siam. It is scarcely likely that birds from the Malacca Strait are making their way there undetected, and the nearest known breeding grounds to the east are on islands in the Sulu Sea (Worcester, 1911*a: passim*), and the Paracel group (Delacour and Jabouille, 1930: 18).

It is of interest to note that breeding does not appear to take place all the year round in either of these localities. Worcester says that he found "numerous nesting brown boobies" on three low islands on the Tub-bataha Reef at the end of June; with his paper he publishes two general views taken on one island, Usong, which show a very large number of birds standing or sitting by their nests, but only a few eggs and no *leucogaster* chicks. On the other hand when he had visited Bankoran and the Maeander Reef at the end of September the previous year he had found large numbers of Brown Boobies with eggs and chicks up to about 6–8 weeks old. This suggests that the laying period in this region is from the end of June to September at least, possibly running on but presumably not extending far beyond the end of the year; I cannot detect any immature *leucogaster* in the photographs of Usong Island. Delacour and Jabouille say that the Brown Booby had already left Triton and the neighbouring islets in the Paracel group when their collectors visited it at the end of June, and they were able to get only a solitary adult female.

152. **Sterna dougallii bangsi** Mathews. Roseate Tern.

This bird is by no means common in Malayan waters. It occurs in small numbers off the east side of the peninsula, and has been recorded from as far south as the Horsburgh Lighthouse (where de Fontaine took three examples on 13 October, 1921), but it is not otherwise known from the neighbourhood of the Singapore Strait. Two nesting grounds have been discovered off the Malayan coast. In both cases the colonies are small and situated in much larger colonies of the Bridled, *Sterna anæthetus* Scopoli, and Blacknaped Terns, *S. sumatrana* Raffles. One is on Pulau Yu, at the south end of the Johore-Pahang Archipelago, and the other on a low-lying rock (Tokong Burong) in the Pulau Tenggol group, off Dungun on the Trengganu coast.

The Pulau Yu colony was found by the present writer on 12 July, 1948. Yu is an oval, humped islet, rising to a height of about 135 feet and crowned with a sparse vegetation in which a species of *Pandanus* predominates. At its east end is a spur of bare rock sloping fairly steeply to the sea. This was occupied by a mixed colony containing about 200 pairs of *anæthetus* and 100 pairs of *sumatrana*. Among them were about a dozen Roseate Terns. Three nests of the latter, each containing two eggs, were found close together and in the shelter of a small outcrop of rock. The sites were sparsely and untidily lined with a few strands of dried *pandanus* leaves. The colony in the Pulau Tenggol group was discovered by A. E. Coope, who took a clutch of two eggs from it on 29 July, 1938. Tokong Burong is a low, turtle-backed granite outcrop about 100 yards long and almost entirely devoid of vegetation; the central portion is 25–30 feet above sea level. I visited the locality on 27 July, 1948, but it was not possible to effect a landing owing to the strong north-westerly swell that was running at the time. There appeared to be about 50 pairs of Blacknaped Terns and 100 pairs of Bridled Terns on the islet. With them were 70–80 Roseate Terns, about a third of which rose reluctantly from a confined area near the highest point. The remainder were resting on a low spur of boulders at the east end in company with 50–60 Crested Terns.

Both the above colonies are situated in Malayan waters. No nesting grounds have yet been found off the east coast of Peninsular Siam, though this species is known to breed on the east side of the Inner Gulf of Siam, and Robinson and Kloss (1921: 51) took two males freshly moulted into full adult plumage on Kok Pennan, in the Bandon Bight, on 26 May, 1913. The presence of the Roseate Tern in the Inner Gulf was first reported by Williamson (1916: 63), who took one bird from a pair seen flying over an islet near Kok Rin (possibly White Rock) on 17 or 18 July, 1916. On 11 July, 1949, Madoc (MS notes)

was able to visit Kok Hin Chalarm, a bare, rocky islet, about 30 feet high and 150 yards long, at the south-east corner of the gulf. Its surface is much seamed with crevices and littered with broken boulders; the only vegetation is a few patches of a *Portulaca* sp. which grows in the hollows where guano has accumulated. Madoc found a large mixed population of Bridled and Blacknaped Terns; with them were a few Noddies (*q.v. infra*) and Roseate Terns. He made out 4 pairs of the latter. They had established a compact little colony in a small area of bedrock and boulders at one end of the island. There he found two eggs "in the last stages of incubation" in a crevice on the top of a boulder, and a single chick lying in another crevice about 2 feet away. On 22 July his collector revisited the islet, and reported that the Roseate Terns had moved to the summit, where they were occupying a small patch of *Portulaca*. There were 5 clutches of eggs (2 c/2, and 3 c/1) laid on the soft humus; some were under the shade of the creeping vegetation. All the eggs were fresh except for one of the single ones, which was on the point of hatching.

Hoogerwerf (1949: 64) reports breeding off western Java with eggs in April and May. The records at present available for the colonies along the western border of the China Sea suggest that there the birds normally lay in late June and July. This must almost certainly be true of the Siamese islands, at least; both Williamson and Madoc had collectors on them at different dates in May and June, and neither received notice of *dougallii* eggs in these months. So far as is known none of the breeding sites have been visited in August; a few birds may not begin nesting until the latter month, but it should be remembered that the weather begins to break in this region towards the end of September[1].

1. An interesting note on breeding dates of *bangsi* in Ceylon was received from W. W. A. Phillips (*in litt.*, 15.9.50) after the above passage was completed. On 6 April 1924, Phillips found the birds in a fairly large colony on a rocky islet off Ambalangoda (Galle district) beginning to lay: the great majority of the clutches were incomplete. On 5 May 1932 the islet was visited by Felsinger who found a colony of over 2,000 pairs breeding there: the eggs, nearly always c/2, occasionally c/1 and 1 c/3, were mostly fresh, but a few were hard set. Ten days later, on 15 May 1932, he landed on the islet again: most of the eggs that he took on the second occasion were partly incubated, and there were a few chicks about. On 15 June 1926, Phillips visited a small islet near the mouth of the Yan Oya River (Kokkalai district, eastern Ceylon), where he found a colony of about 50–100 pairs of *S. dougallii korustes:* most of the birds had eggs, the majority of which were fairly well incubated; a few eggs had hatched, while some c/1 were still fresh. Seemingly in Ceylon laying is spread over a period of about ten weeks, with the greater part of it taking place in the second half of April and May. This agrees well with Hoogerwerf's records from western Java, but not with the data at present available from the Gulf of Siam and the east coast of Malaya.

According to Robinson and Kloss (*loc. cit.*) the two males which they took on Kok Pennan at the end of May had the tarsi and toes orange-red, the claws blackish and the bills entirely black, with no suggestion of red on them. On the other hand, three males which they shot on Pulau Jemor, in the Aroa group, on 2 August, 1906, had the feet and bills entirely orange-red, with no trace of black. All the examples that were observed sufficiently closely on the east coast of Malaya in July 1948, appeared to have the latter colouring, and Madoc tells me that the birds he saw on Kok Hin Chalarm had the legs and bill a "brilliant sealing-wax red throughout their length". This would, in fact, seem to be the normal condition of breeding birds in our area. It is of interest to draw attention to Hume's comments (1876: 294) on the Andaman race, *S. d. korustes* (Hume), in which he says that the bills vary in colour with the season; "in birds killed in April they are blackish, in May they begin to change to orange red at the bases. In June only the terminal portions are blackish dusky, and in July the whole of the bill has become red or orange red". It seems probable that the same rhythm, associated with egg-laying in July, is exhibited by the birds occurring at the western end of the China Sea.

The 8 eggs that I have examined were egg-shaped, with the surface fine matt. The ground colour was vinaceous buff, or biscuit brown, boldly spotted and blotched with dark gull grey and sepia (above). From the accounts given it would seem that the eggs collected by Madoc and Hoogerwerf do not differ appreciably from these in shape or colour. The 8 Malayan eggs average 38·9 × 28·1 mm.; Madoc's 9 eggs from Kok Hin Chalarm average 39·1 × 28·2 mm.; maxima 40·9 × 28·4 and 39·6 × 29·2, minima 37·5 × 28·5 and 40·6 × 26·2 mm. If Hoogerwerf's 4 eggs are included we have a series of 21 examples averaging 38·7 × 28·1 mm. Madoc, working on his small series of *bangsi*, has compared the eggs of this form with those of *Sterna s. sumatrana*. His conclusions are supported by the additional material that I have handled. The eggs of *bangsi* have a brown or brownish tinge in their ground colour, whilst those of *sumatrana* are generally whitish or pale stone-grey; most eggs of *bangsi* are fairly boldly marked with irregular blotches of black or golden-brown and purplish grey, whilst the eggs of *sumatrana* are more lightly dappled with smaller, paler markings.

If the race *bangsi* is valid the eastern seaboard of the Malay Peninsula probably represents the western limit of its normal range. Eastward it spreads north to the Riu Kiu Islands, and south-east to the Solomons and New Caledonia. Not many breeding grounds have been reported. A number are given by Peters (1934: 335); further recent records occur in van Bemmel (1948: 381), in addition to those noted in the present paper.

There are no authentic records of the occurrence of a Roseate Tern on the west coast of the Malay Peninsula, though a form of this species is known from the neighbourhood of the Aroa Islands, in the centre of the Malacca Strait. Nesting has not been confirmed, but the birds must undoubtedly be breeding somewhere in the group. According to Robinson (1906: 10) examples were very abundant there in August, 1906, when Seimund shot three adults in full breeding plumage on Pulau Jemor; they were apparently absent in November, when not a single tern of any kind was seen. Two of Seimund's skins are still in the Raffles Museum collection. Chasen (1935: 46) records them as *bangsi*, but they must, I think, be assigned to *S. d. korustes* (Hume); their bills are a shade longer than those of two fine examples of *bangsi* from the Horsburgh Lighthouse, but they are clearly much weaker and more slender. The presumed breeding range of *korustes* as given by Peters (*loc. cit.*) is Ceylon, the Andamans and the islands of the Mergui Archipelago; "the Aroa Islands" should be added to this list, and deleted from the range of *S. d. bangsi*.

153. **Sterna sumatrana sumatrana** Raffles. Blacknaped Tern.

This bird occurs fairly widely in Malayan waters, and is undoubtedly the most numerous of the terns frequenting our area. On the mainland it is very largely restricted to the stretches of coast where granite boulders or other rocky outcrops lie off the shore. In this habitat it is found at suitable points along both sides of the peninsula, in the Straits of Singapore and Johore, and round all the larger islands. In addition it occurs in much greater numbers, generally in company with the Bridled Tern, on many of the more isolated stacks and low rocky islets. It is, however, less attracted by deep, blue water than either *Sterna anæthetus* or *S. dougallii*, and it does not appear to have been recorded from Pulau Jarak, the Aroas, the One Fathom Bank Lighthouse or the Horsburgh Light (Pedra Branca). On the other hand it is widespread in the Langkawi group, among the Sembilan Islands and in the Johore-Pahang Archipelago. Seemingly the birds abandon some of the more exposed nesting sites outside the breeding season, but they can generally be found near rocky coasts on the mainland throughout the year.

Breeding has been reported from a number of localities from the Langkawi group (Madoc) south to Squance Rock, in the Johore Strait (F. G. H. Allen). A full list is no longer likely to be of value, but it is still of interest to outline the kinds of sites that are utilised in Malayan waters. Many of the birds nest fairly close inshore. Here they normally make use of small outcrops of granite boulders standing in 1–3 fathoms

of water at a distance of 2–3 furlongs from the land. Squance Rock is a typical example of such a site. The colonies in these situations consist of only a few pairs, and rarely contain more than 5 or 6 active couples. Nevertheless the number of such sites occupied in our area more than compensates for their size; there can be no doubt that here the majority of the Blacknaped Terns are breeding in these small, isolated units. In this respect their behaviour differs markedly from that of the Bridled Tern.

The other Malayan colonies of the Blacknaped Tern reported so far are in association with those of the Bridled Tern. They fall into two groups. The first kind occurs typically on the stacks or stack-like islets off the east coast of Malaya, of which examples are shown on Plate 2. Here *anæthetus* is clearly the predominant species, and *sumatrana* is present in very small numbers, much as it might be on a suitable series of inshore granite outcrops. An extreme instance of this is given by Tokong Burong, west of Tioman Island off the coast of Pahang; in 1948 there were roughly 1,000 pairs of the Bridled Tern nesting on the three stacks, and only about 25 pairs of the Blacknaped Tern. Other instances are given in the accompanying table.

Locality	Approximate numbers in pairs	
	Sterna s. sumatrana	*Sterna a. anæthetus*
Sibu-Tinggi group—		
Pulau Lima and rocks	60	270
Tokong Lali	10	150
Tokong Gatang	10	250
Tokong Chondong	10	250
Pulau Yu	100	200
Tioman group—		
Pulau Jagat	100	200
Tokong Barat	20	100
Pulau Chibeh	15	75
Pulau Sepoi	20	250
Pulau Labas	20	50
Tokong Burong	25	1,000
Sribuat group	100	10
Tokong Burong (Tenggol group) ..	50	100
Pulau Barat (Redang group) ..	20	60

Table showing the approximate number of pairs of the Blacknaped Tern (*sumatrana*) breeding on stacks and rocky islets which house colonies of the Bridled Tern (*anæthetus*) off the east coast of Malaya. Data collected July–August 1948. All the possible breeding grounds of *anæthetus* were visited except Pulau Bĕrhala, off the coast of Pahang. The large number of localities where we found only small colonies of *sumatrana* are not listed above.

The second group consists of a few low-lying islets composed mostly of weathered outcrops of granite, but usually in part possessing a little seant vegetation. Pulau Jagat (*see* plate 4, lower) is a good example of one of these sites on the east side of the peninsula. Tokong Burong, in the Pulau Tenggol group off Dungun (Trengganu), is another. Pulau Yu, at the south end of the Pulau Tinggi group (Johore), is not a typical example in that it is in part stack-like, but it apparently has some of the features sought by *sumatrana*. In these three cases there are large colonies of this bird. In no instance is it as numerous as the Bridled Tern, but as the table shows it is present in much greater numbers than in any other single place on the coasts of the eastern Malay States.

E. F. Allen & Berwick (1950: 33) report colonies on White Rock and Fairway Rock, in the Sembilan group, off the west side of the peninsula, which may fall in this latter group. They describe the Blacknaped Tern as "more of a colonial nester" than *anæthetus*, suggesting that it is present in some numbers, but their evidence is not conclusive. They found a total of only about 19 nests of *sumatrana* on the two islets on 8–9 June, possibly because the sites were being robbed. They did not, unfortunately, visit the colonies again, but they were told by a boatman that on 14 August, White Rock was "covered with eggs and young"; 60 fresh eggs were collected by the Malays, who estimated that there were 400 birds there, including the breeding Bridled Terns. Further information is wanted. There may easily be large numbers of the Blacknaped Tern on these two islets, but if one allows for the inevitable exaggeration of local sailors it must be admitted that the point is still not proven. The Bridled Tern is apparently scarce on the west side of the Malay States, and the numbers so far recorded from the Sembilan Islands are less than those reported from any site on the east coast except for the little group of about 10 birds on a stack off Pulau Sribuat. This may have given the authors the impression that *sumatrana* breeds in larger colonies than *anæthetus*, but this is certainly not true of the Malayan coast as a whole.

I have stressed this point because it appears from the evidence given by Herbert (1918: 84) and Madoc (1950: this journal) that in the Inner Gulf of Siam the Blacknaped Tern is breeding on low-lying islets, not isolated stony outcrops, and doing so, as on Pulau Yu and Pulau Jagat, in some numbers. This again is seemingly the kind of site selected in the Andaman group; Hume (1874: 319) says ".... they make no nest, but lay in a tiny depression on the bare ground. The place where Captain Wimberley (to whom I am indebted for several specimens) found the eggs was a small rocky islet near the main island, and, but for a little low scrub, entirely bare". The text

suggests that *sumatrana* was present in moderate but not large numbers. It seems, in fact, that typically this bird breeds in fairly small colonies, up to say 80–120 pairs, on low-lying rocky islets. When these are scarce and widely spaced, as on the Malayan coast, it does so in smaller numbers on bare, isolated rocks near to the shore, rather than mass in larger communities on the few suitable sites. There is no doubt that a number of the small islets, such as Tokong Burong (in the Pulau Tenggol group), Pulau Jagat and Pulau Yu, could support larger populations than they do, so far as nesting space is concerned. Either feeding difficulties, or a growing reluctance to associate with its fellows as the numbers increase, forces *sumatrana* to spread by way of less typical sites rather than congregate in numbers comparable to those of the larger colonies of the Bridled Tern.

The Blacknaped Tern makes no nest, but lays its eggs direct on the bare rock or on the ground. A normal clutch consists of one or two eggs.[1] Baker (1929: 140) says that the eggs "are nearly always two in number, sometimes only one". In Malaya single eggs are probably commoner than pairs; in a total of 100 nests examined on different islets off the east coast of the peninsula 59 contained solitary eggs or chicks and only 41 pairs of eggs. Williamson (1918: 84) gives 37 single eggs to 26 pairs in a collection made on some of the islets in the Inner Gulf of Siam; later he says "In Siam .... about half the clutches contain two eggs, and the remainder only one". It would be interesting to know if there is any correlation between clutch-size and the size of the colony, but at present there are no data available. Nearly all my observations on the east coast of Malaya were obtained from the larger colonies, which are no doubt very similar to those occurring in the Inner Gulf of Siam.

The eggs are usually egg-shaped, sometimes slightly pyriform, with a fine matt surface. The ground colour ranges from white to a light buff or greenish stone; it is variously and coarsely blotched with lilac grey, gull grey, dark chestnut brown and occasionally black, the darker shades being above the paler. In a few cases the markings are thickest round the broadest portion of the egg, but in many instances they are fairly evenly distributed over the whole surface. Twenty eggs measured on Pulau Yu averaged 38.2 x 28.2 mm.; maxima 40 x 27.5 and 38.9 x 28.8; minima 36 x 27.1 and 37.5 x 26 mm. Details of other collections made in or near our area are given below. The eggs from localities 2 and 3 are now in the Raffles Museum collection

1. Hoogerwerf (1949: 63) says "2 eieren, ook wel 3 stuks, soms 1", but so far as I know no author has recorded three eggs from any locality in or near our area except for F. G. H. Allen who found 1 c/3 together with 2 c/2 on Squance Rock on 12 June, 1949.

and were measured by the present writer. Two of the Malacca Strait clutches are slightly peculiar in that both eggs are abnormally long (Pulau Jemor, Selangor, 14 June 1937, Madoc, 42.5 x 29 and 41 x 28: Pulau Bĕsar, off Malacca, 18 July 1930, Coope, 41 x 28.5 and 44 x 28).

Locality	No.	Average	Maxima	Minima
1. Pulau Yu (Gibson-Hill)	20	38·2 x 28·2	**40** x 27·5 38·9 x **28.8**	**36** x 27·1 37·5 x **26**
2. Pulau Tenggol (Coope)	8	39·3 x 27·8	**40.5** x 28 40 x **28.5**	**38.5** x 27·5 39·5 x **27**
3. Malacca Strait (Madoc and Coope) ..	6	40·8 x 28	**44** x 28 42·5 x **29**	**38** x 27 38 x **27**
4. Gulf of Siam (Madoc).	13	38·1 x 27·9	**40.1** x 28·4 36·1 x **28.4**	**37.1** x 29·2 38·4 x **26.9**
5. Java (Hoogerwerf) ..	6	37·6 x 27·2	**40** x 26·4 36·1 x **28.3**	**35.7** x ? ? x **26.4**

Egg-laying begins in May in both Malayan and Siamese waters, but on the evidence at present available it appears to run earlier in the latter area. The majority of the Siamese records show eggs in May or early June. Williamson (1918: 84) took a few eggs (3 c/1 and 5 c/2) on an island in the Inner Gulf on 9 May, 1918. Madoc's collectors found birds breeding on three rocky islets between Hua Hin and Pranburi on 18 May, and took 13 eggs. On 22 May, Madoc himself visited many of the islets on the eastern side of the Inner Gulf of Siam, and found nesting colonies on all except the largest (Kok Phai). Williamson (*loc. cit.*) took a number of fresh eggs on some of these islands on 2 June, 1917, and about a week latter received 10 eggs from a further island in the same neighbourhood, all of which were more or less incubated. In 1916 his collector obtained a number of eggs on a rocky islet near Kok Phai as late as 27 June, but when he himself visited this islet, and others nearby, on 17 and 18 July he found only a few eggs, most of which were addled.

I can trace only two other records of eggs taken in May in or near our area; Hoogerwerf (1949: 63) reports two clutches from western Java and Madoc found a single clutch on the Langkawi Islands. June would seem to be the month in which

laying normally begins in the Malay Peninsula, with replacements or late breeding running on until the middle or end of July. The earliest reported June dates for Malayan waters are those given by E. F. Allen & Berwick (1950: 33) for Fairway Rock (7 clutches, 8 June), White Rock (about 12 clutches, 9 June) and Turtle Rock (1 clutch, 8 June) off the Perak coast. F. G. H. Allen found three clutches on Squance Rock, in the Johore Strait, on 12 June. The Raffles Museum collection contains eggs taken by Madoc on 14 June on Tokong Burong, west of Tioman (1934) and Pulau Jemor, off the coast of Selangor (1937). The majority of the clutches examined by the present writer on Pulau Yu on 12 July were moderately fresh, but a few were well incubated; no chicks were seen there, nor on any of the other colonies examined in the Johore-Pahang Archipelago during the succeeding week. Coope took fresh eggs on Tokong Burong, in the Pulau Tenggol group, as late as 29 July. Further north, in the Redang group, I found that the great majority of the eggs had hatched by 9 August, and some of the chicks were as much as 140 mm. long. E. F. Allen & Berwick (*loc. cit.*) refer to eggs taken in the Sembilan group as late as 14 August.

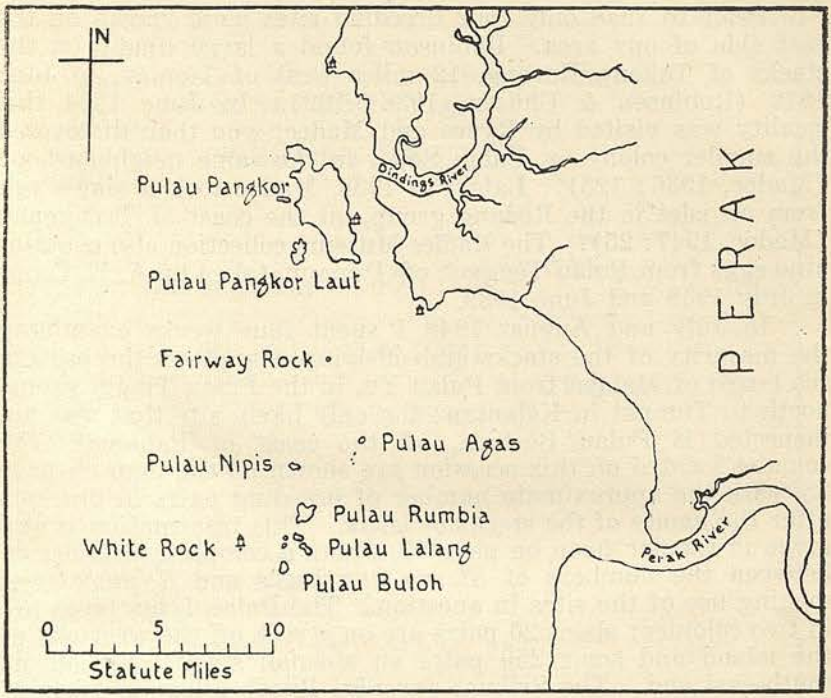
These birds lay again after their eggs have been taken. According to the boatmen in the Johore-Pahang Archipelago, they may replace their clutches two or three times before they abandon the attempt for the season. As nearly all the larger accessible colonies in Malayan waters are robbed fairly regularly it is almost impossible to determine the close of the laying season under fully natural conditions. In the Gulf of Siam, as we have seen, laying apparently starts early in May, and normally ceases in the latter part of June. The Malayan birds seem to begin about three to four weeks later. Where they are not disturbed the peak period is probably the second half of June and the first two weeks of July. Certainly on the east side they cannot normally go on much beyond the end of July as the weather begins to break in the second half of September, and at least the more exposed breeding sites are apparently abandoned by the end of the month. Presumably eggs found after the first week in August are final replacements, with a relatively poor change of survival.

In young nestlings (exposed culmen about 9–12 mm.) the down is white, sometimes slightly tinged with buffish on the forehead, crown, hind-neck and scapular region. In older birds it has a marked greyish or buffish tinge above, but remains a uniform white below. Later it becomes fairly thickly spotted with black on the upper parts (exposed culmen about 15 mm. or more).

154. **Sterna anæthetus anæthetus** Scopoli. Bridled Tern.

This is the second most numerous tern in Malayan waters, but it is less widely distributed than *Sterna sumatrana* as a breeding species. It prefers bluer water for its fishing, and normally nests in medium-sized or large colonies on isolated stacks and rocky islets near or beyond the ten-fathom line. It is accordingly absent from the greater part of the coast, but for the most part more plentiful in the limited areas which it frequents. The nesting sites are abandoned outside the breeding season, and the majority of the birds then scatter southwards. It is fairly plentiful during the winter months off the Horsburgh Lighthouse (Pedra Branca) at the eastern end of the Singapore Strait, and it occurs again in small numbers near Pulau Pisang at its western end. It does not, however, appear to enter the Strait itself to any extent, and there are still no authentic records of its presence in these waters. This is in marked contrast to the two Crested Terns, *Thalasseus bergii* and *T. bengalensis,* which are numerous on and near the fishing stakes all along the Strait during the winter months.

The Bridled Tern breeds on suitable sites on both sides of the southern part of the Malay Peninsula, but naturally it is much more numerous off the east coast. As far as the Malacca Strait is concerned we have definite information of only two small colonies, both on low-lying rocky outcrops in the neighbourhood of the Sembilan Islands, off the coast of Perak. One is on Fairway Rock, between Pangkor and Pulau Agas, and the second on White Rock, three miles west of Pulau Lalang (*see* map on page 31). The colony on Fairway Rock was first reported by Edgar, who found five pairs nesting there in June 1935 (Robinson & Chasen, 1936: 102). Subsequently this locality was visited by E. F. Allen and Berwick on 8 June 1946: they again found only five nests, and saw less than ten birds. On the following day they visited White Rock and discovered four nests there, all in rock crevices, but on this occasion they saw at least twenty-four adults in the immediate vicinity of the colony (E. F. Allen & Berwick, 1950: 33). The authors were told that the Bridled Tern also nested on one or two of the rocky islets off Pangkor itself before the war, but they were unable to find any signs of its presence there in 1946. Even allowing for the possibility of further unlocated nests on White Rock, which though small is difficult to search thoroughly, there were apparently less than twenty pairs breeding in this area in June 1946. I examined the islets at the beginning of April, 1949, but it was too early in the year, and no Bridled Terns were present. The most northerly birds that we saw on that occasion were east of the One Fathom Bank, about 120 miles further south.



Map 3. The islands of the Sembilan group, off the coast of Perak.

The Bridled Tern has not been observed nesting at any other localities in the Malacca Strait, but there is almost certainly a colony, possibly a fairly large one, on Sumatran territory in the Aroa group (*see* Robinson, 1906: 10; and Robinson & Chasen, 1936: 102).[1] It has been suggested that *anæthetus* also breeds on Pulau Perak, about 75 miles west-north-west of Penang Island, but we found no trace of its presence there when we visited the islet in April 1949, and it did not seem to be a promising locality (*see* plate 3, middle picture, and plate 4, upper). At the same time there must be many more than twenty pairs nesting in or near the Malacca Strait area. We encountered a total of 150–200 birds at different points on the two-day run between the western entrance to the Singapore Strait and the mouth of the Sungei Langat. These cannot all have been making their way back to the two small colonies off the Perak coast.

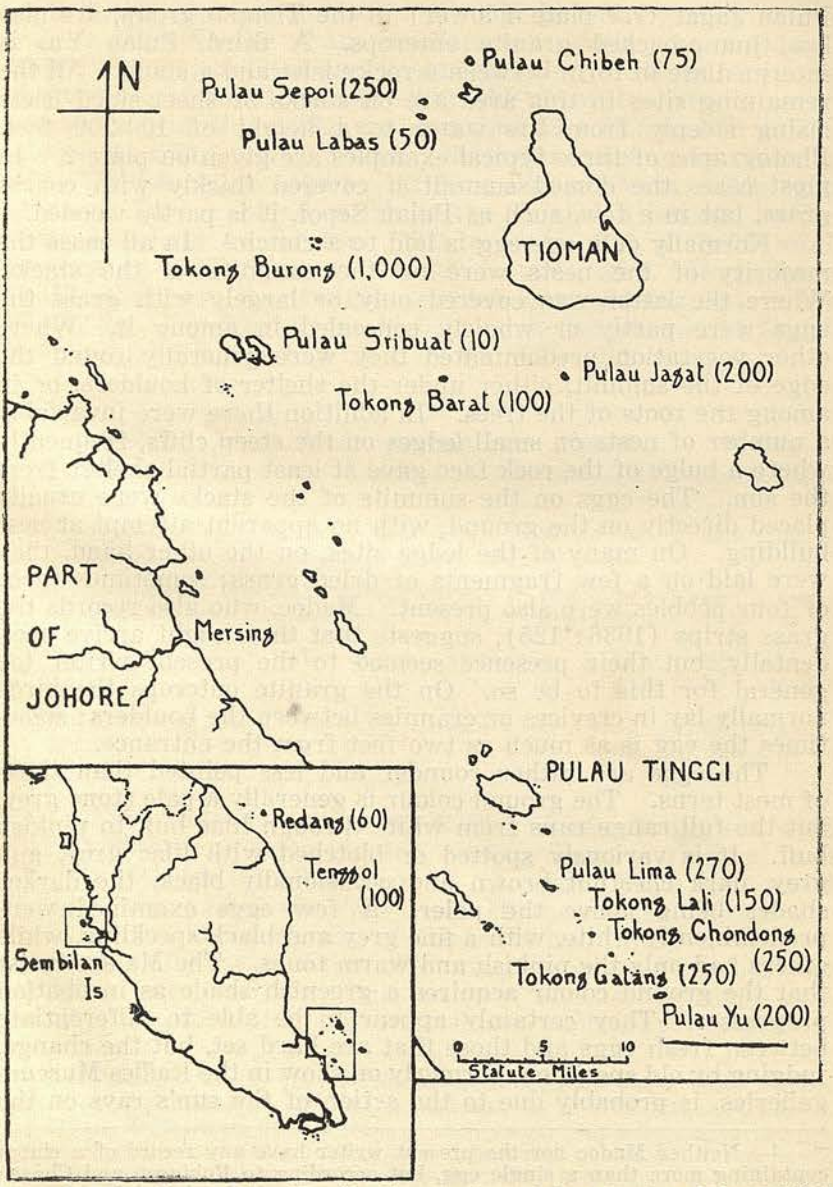
1. It of interest to note that according to Robinson (1906: 10) *Sterna anæthetus* was "fairly abundant in August (1906), but not so common as the Roseate Tern" in the Aroa group. None were seen when he paid his second visit in November the same year.

Prior to 1948 only four breeding sites were known on the east side of our area. Robinson found a large colony on the stacks of Tokong Burong, 12 miles west of Tioman, in June 1912 (Robinson & Chasen, 1936: 102). In June 1934 this locality was visited by Ryves and Madoc, who then discovered the smaller colony on Pulau Sepoi in the same neighbourhood (Madoc, 1936: 125). Later, in 1938, Madoc took a single egg from an islet in the Redang group, off the coast of Trengganu (Madoc, 1947: 25). The Raffles Museum collection also contains nine eggs from Pulau Tenggol, off Dungun, taken by A. E. Coope in July 1938 and June 1939.

In July and August 1948 I spent four weeks examining the majority of the stacks and off-lying islands on the eastern sea board of Malaya from Pulau Yu, in the Pulau Tinggi group, north to Tumpat in Kelantan: the only likely site that was not inspected is Pulau Bĕrhala, off the coast of Pahang.[1] The colonies located on this occasion are shown on the map on page 33, with the approximate number of breeding pairs in brackets after the names of the stacks or islets. This information is also given in tabular form on page 25, where a comparison is drawn between the numbers of *Sterna anæthetus* and *S. sumatrana* making use of the sites in question. The Pulau Lima birds are in two colonies: about 20 pairs are on a rock off the west end of the island and some 250 pairs on a small stack lying off its south-east end. The Sribuat (or Sĕri Buat) colony consists of about 10 pairs on a rocky stack off the south-east end of the eastern island. The Pulau Tenggol birds are on a low-lying, turtle-backed granite outcrop known as Tokong Burong, situated on the north side of the group. The Redang ones are on a stack-like islet known as Pulau Barat lying to the south-west of Great Redang. The largest colony, containing about 1,000 breeding pairs in 1948, is on Tokong Burong (Tioman), a group of four typical stacks lying in open water some 12 miles west of Tioman. The total for the east coast colonies amounted in 1948 to about 3,000 pairs. Unless there is a large colony on Pulau Bĕrhala (Pahang) this was presumably the approximate number for the country as a whole.

Fairway and White Rocks (off the Perak coast) are small, low, broken rocky islets of the kind usually associated with the Blacknaped Tern, *S. sumatrana,* in Malayan waters. Two of the east coast sites, Tokong Burong in the Tenggol group and

1. The data obtained on this occasion has already been published in an earlier paper by the present writer (1949*a*: 19–23), some sections of which are reproduced here. In the map illustrating the 1949 paper Fairway Rock is incorrectly placed north of Pulau Pangkor. It lies to the south of the island, between it and the Sembilan group proper (E. F. Allen and Berwick, 1950: 33, footnote).



Map 4. Sketch map showing the distribution of the colonies of the Bridled Tern, *S. a. anæthetus* Scopoli, at present recorded in the waters off the Malay Peninsula. The figures in brackets after the names of the east coast colonies give the approximate number of breeding pairs present in July and August 1948.

Pulau Jagat (*see* plate 4 lower) in the Tioman group, are also low, hump-backed granite outcrops. A third, Pulau Yu, is intermediate in form between a rocky islet and a stack. All the remaining sites in this area are on stacks or sheer-sided islets rising steeply from the water to a height of 100-200 feet. Photographs of three typical examples are given on plate 2. In most cases the domed summit it covered thickly with coarse grass, but in a few, such as Pulau Sepoi, it is partly wooded.

Normally only one egg is laid to a clutch.[1] In all cases the majority of the nests were on the summits of the stacks. Where the latter was covered only or largely with grass the eggs were partly or wholely concealed in among it. Where other vegetation predominated they were generally round the edge of the summit, either under the shelter of boulders, or in among the roots of the trees. In addition there were invariably a number of nests on small ledges on the steep cliffs, frequently where a bulge of the rock face gave at least partial shelter from the sun. The eggs on the summits of the stacks were usually placed directly on the ground, with no apparent attempt at nest building. On many of the ledge sites, on the other hand, they were laid on a few fragments of dried grass; sometimes three or four pebbles were also present. Madoc, who also records the grass strips (1936:125), suggests that they might arrive accidentally, but their presence seemed to the present writer too general for this to be so. On the granite outcrops the birds normally lay in crevices or crannies between the boulders: sometimes the egg is as much as two feet from the entrance.

The eggs are rather rounder and less pointed than those of most terns. The ground colour is generally a pale stone grey, but the full range runs from white through lilac buff to pinkish buff. It is variously spotted or blotched with lilac grey, gull grey, dark chestnut brown and occasionally black, the darker shades being above the paler. A few eggs examined were predominently white, with a fine grey and black speckling, while others had only the pinkish and warm tones. The Malays insist that the ground colour acquires a greenish shade as incubation progresses. They certainly appear to be able to differentiate between fresh eggs and those that are hard set, but the change, judging by old specimens formerly on show in the Raffles Museum galleries, is probably due to the action of the sun's rays on the

1. Neither Madoc nor the present writer have any record of a clutch containing more than a single egg, but according to Robinson and Chasen (1936: 102) two out of a very large number of clutches taken by Sir Walter Williamson on rocky islets in the Inner Gulf of Siam consisted of two eggs. Williamson (1918: 83) writing of his collecting in 1917 in the Inner Gulf says that he found 89 single eggs and one pair. Hoogerwerf (1940: 466) says one egg to a clutch.

shell during the periods when the egg is left exposed, rather than to the influence of any development taking place inside it. Thirty-eight eggs from east coast localities (obtained as in the accompanying table) measured by the present writer give an average size of 45.9 x 32.8 mm., maxima 49 x 32.5 and 46 x 35.5, minima 43 x 31.5 and 45.5 x 31. No measurements are available from the two small colonies off the coast of Perak. Ten eggs taken on Barren Island, north of the Tambelan Islands, by Sir John Anderson on 25 June 1921 average 45.1 x 32.75 mm., maxima 48 x 35, minima 42 x 32 and 45 x 30.5. Hoogerwerf (1940: 465) says that twenty eggs taken on Gunong Api, in the Banda Sea, measured from 42–51 mm. in length and 31.5–35.5 mm. in breadth, maxima 51 x 35 and 45 x 35.5 mm.

Locality	No.	Average	Maxima	Minima
1. Tokong Burong, Tioman (Madoc) ..	9	46·5 x 33·1	**49** x 33 46 x **35**	**43.5** x **32**
2. Tokong Burong, Tioman (Gibson-Hill) ..	10	45·75 x 33	**48.5** x 33·5 47·5 x **34.5**	**43** x 31·5 45·5 x **31**
3. Pulau Yu (Gibson-Hill)	10	45·5 x 32·4	**49** x 32·5 45·5 x **35.5**	**43.5** x 33 46 x **31.5**
4. Tokong Burong, Tenggol (Coope) ..	9	46 x 32·9	**47** x 33 46 x **34**	**43** x 33 45.5 x **31**

All the Malayan eggs in the Raffles Museum collection were taken between 14 June (Madoc, Tokong Burong Tioman) and 29 July (Coope, Tokong Burong Tenggol). The east coast Malays, who gather the eggs from all the accessible sites for food, say that the majority of the birds lay during the middle two weeks of June, and that if the egg is removed the hen will lay again once, and sometimes twice.[1] This is consistent with the data obtained from all the colonies visited by the present

1. Formerly, in the Johore-Pahang Archipelago at least, some attempt was made, by means of the local penghulus, to restrict the collecting of the eggs. Each stack, or a portion of each stack, was left undisturbed one season in three or four. In 1948 the system had obviously broken down, and the men were taking all the eggs that they could get. Nevertheless, though a fall in numbers is inevitable if this goes on for long, the existance of the species in Malayan waters is not likely to be menaced seriously. Some of the stacks are virtually unclimbable, while on others at least a few of the cliff face nests cannot be reached without the aid of a rope.

writer. It would seem that their assessment of the middle two weeks of June as the laying period for the majority of the birds in a normal year is quite sound. Madoc's observations from the visit paid to Tokong Burong and Pulau Sepoi, both in the Tioman group, on 14 and 19 June show that laying in some cases certainly begins as early as the beginning of June, but not before the last week in May. Presumably we should take it that on the islands off the east coast of Malaya laying begins at the end of May and runs on to about the middle of July, with the peak period in the second and third weeks of June. The limited data available from the two Perak colonies, in the Malacca Strait, and from Barren Island also fit in this period. On the other hand according to Robinson (in Robinson & Chasen, 1936: 101) on the Aroas the birds lay about the end of July, but as this colony has never been examined critically (or even located precisely) the dates can only be conjectural, or derived from the accounts of the turtle-egg collectors.

Sterna anæthetus nests at several points off the east coast of Peninsular Siam, and widely on the islands in the Inner Gulf. It is possible that there has been some variations in numbers in the latter area in the last thirty years. Williamson (1918: 83) describes it as the most numerous of the terns on the islets in the Gulf. Madoc (1950, this journal) says that he has records of breeding colonies on all the islands where he found the Blacknaped Tern, *S. sumatrana,* present, but usually in rather smaller numbers.[1] According to Williamson (quoted in Robinson & Chasen, 1936: 102) the Bridled Tern breeds in this area in May and June. This is a few weeks earlier than on the east coast of Malaya, as in the case of *S. sumatrana,* which also lays rather earlier on the islets in the Inner Gulf than it does further south. Whatever the factors may be that are determining the timing of the breeding season it would seem that they are effecting both birds. Williamson (1919: 83–84) also found the Crested Tern, *Thalasseus bergii,* with eggs in this area in May and June, but it cannot be that the weather breaks and the islets become uninhabitable by the beginning of August, (which would be six to eight weeks earlier than those off the east coast of Malaya). Both the Common Noddy, *Anoüs stolidus,* and the Roseate Tern, *Sterna dougallii,* have been found laying on the Siamese islets as late as the second half of July, when laying is ceasing on the stacks off the Malayan coast.

1. Similarly, as is shown in a later section of this paper (p. 50, *infra*), Williamson found colonies of the Crested Tern, *Thalasseus bergii,* on two islets on the east side of the Inner Gulf of Siam in 1917–18, but in 1949 Madoc failed to find any indication of its presence there as a breeding bird.

Hoogerwerf (1949: 65) gives several egg dates for this species for the Java and Banda Sea areas. Unfortunately it is not clear whether the months represent the full extent of the laying periods in the localities concerned, or are merely based on one or two visits. They are, however, not without interest here as they serve to show the possible range of dates in the latter area, and the difficulty at present attending any attempts to correlate apparent breeding seasons there with those obtaining in waters off the Malay Peninsula. Hoogerwerf's dates, together with those outlined above, are as follows,

Locality	Months recorded with Eggs
Inner Gulf of Siam (Williamson) ..	May, June.
East coast of Malay States (Gibson-Hill)	June, July.
Barren Island (Anderson) ..	June.
Mid-Java (Hoogerwerf, 1949: 65) ..	June and August.
East Java (Hoogerwerf, *loc. cit.*) ..	February, March.
Bawean Island (Hoogerwerf, *loc. cit.*)	May.
Gunong Api (van Bemmel and Hoogerwerf, 1940: 465)	July, August.

One other point deserves a comparative note here. Attention has been drawn to the Bridled Tern's habit of laying in sheltered positions, or actually in rock crevices, at its breeding grounds off the Malayan coast. Madoc says that on the islets of the Inner gulf of Siam the eggs are again very well concealed—"even more carefully hidden than those in the Tioman Archipelago off the east coast of Malaya. Some we found laid on rock debris at the bottom of big pits amongst the rocks; some were in neat little cavities in the rock face where a rectangular block of the strata had fallen out of its place; and one I found inside a shallow cave, laid in an old and disintegrating nest of the Reef Heron, *Demigretta sacra*." According to Hoogerwerf (in van Bemmel & Hoogerwerf, 1940: 466) the birds on Gunong Api were nesting in an old lava bed, bare of all vegetation, in clefts and cavities "often so deep that on no account the clutch, consisting of a single egg, could be detected. Only a few times we found the eggs lying uncovered between the rocks ..... One nest was found in a cavity in a steep slope, that in about horizontal direction had a depth of more than a meter". Yet the Bridled Tern is not, apparently, completely restricted to such situations. It has been found breeding on a coral reef near Bawean, in the Java Sea, with the eggs laid in exposed positions on the bare ground. Similarly, on some at least of the islands in the Sulu Sea area it nests on exposed flats of coral sand, without any form of shelter or concealment.

The colouring of the young chick, as observed on the colonies on the east coast of Malaya, is fairly variable. The down ranges from a very light, almost silvery, grey through buffish grey to a moderately dark, drab grey above, often mottled with dark brown. The under parts are usually greyish white, except for the throat and foreneck, which are generally much darker. The irides are dark brown, the bill deep grey, becoming black later, and the feet and legs a deep, leaden grey.

155c. **Sterna albifrons sinensis** Gmelin. Chinese Little Tern.

The Little Tern, *Sterna albifrons* Pallas, occurs on both sides of the Malay Peninsula, but it has not yet been taken in the Strait of Singapore.[1] On the west coast it is apparently only a passage migrant and winter visitor. On the east it nests in small numbers at scattered points as far south as the mouth of the Sungei Bebar (approx. lat. 3° 5′ N.) on the coast of Pahang. Typically it frequents shallow, fairly sheltered, but not still or muddy waters: it is not found on pools or lakes, or along the mangrove and nipah flanked sections of estuaries. On the coast it is largely confined to the neighbourhood of sandy shores and beaches with, on the east side, a preference for low barren islets and sandy spits near the river mouths. On the Pahang River at least it also occurs on gravel-banks some distance inland. It is not markedly gregarious during the summer months, and large numbers have never been recorded at any one place.

Robinson (1926: 24) says that he thought that the Little Tern was nesting on the larger rivers on the east side of the peninsula, but he was never able to confirm that it does so. Breeding was not proved until June 1934, when Ryves and Madoc made a most successful journey down the lower reaches of the Sungei Pahang (Madoc, 1936: 124). On 9 June they found five nests on a sand-bank near Kuala Bĕra (2 c/3, 3 c/1). The following day they found a single egg on a bank near Kuala Chini, and from their boat saw a bird apparently incubating near Lubok Paku. On 11 June a number of birds were seen near Kuala Lepar, but they did not appear to have started laying. Examples were also encountered at Tanjong Agas, at the mouth of the river, but again no eggs were found in this locality. Probably, as Madoc (1947: 24) suggests, the birds lay a month or so later on the coast.

1. The subspecific name of the birds found in Malaya is discussed at the end of this section. For the present it is sufficient to state that the birds breeding on the east side of the peninsula, and the great majority of those reaching both sides as passage migrants and winter visitors, are undoubtedly examples of the Chinese race, *S. albifrons sinensis* Gmelin, as given in the heading above.

It is not unlikely that the Little Tern also nests inland on the Kelantan River, and possibly the Trengganu, but it has not yet been reported from these areas. It is, however, now known to frequent several points on the coast in this region. In 1948 we found small parties on a sandy spit at the mouth of the Sungei Bebar (19 July), on a bar at the mouth of the Pahang River near Pulau Sayid Hassan, on spits at the mouths of the Pahang Tua, the Sungei Ular, the Sungei Kerteh, the Sungei Marang, the Sungei Sĕtiu and the Sungei Kĕmassin, and on two small bars in the delta of the Kelantan River (12 August). Details of these are given in the accompanying table. In all cases the birds were breeding, or apparently breeding, on open exposed sites without any shelter from sun or wind. None of the parties was large and it is doubtful if we saw as many as 90 nesting pairs in all. We must, however, have missed a number of other groups tucked in on the stretches of coast which we did not approach closely. Accordingly a much higher conjectural total has been given in the table at the beginning of this paper.

Locality	*Date*	*Approximate Number of Adults Seen*	*Eggs or Chicks Found*
S. Bebar ..	19 July (dusk) ..	c. 12	1 c/3, 1 c/2.
Pahang Delta	20 July (early afternoon)	c. 25	Landing not possible.
S. Pahang Tua	21 July (noon) ..	c. 15	2 c/3.
S. Ular ..	22 July (early afternoon)	c. 20	Landing not possible.
S. Kerteh ..	24 July (afternoon)	13	2 c/3, 1 c/2.*
S. Marang ..	27 July (dusk) ..	c. 12	Landing not possible.
S. Sĕtiu ..	8 August (afternoon) ..	7	2 c/3.*
S. Kĕmassin	11 August (afternoon) ..	5	2 chicks.*
Kelantan Delta	12 August (early afternoon)	c. 14+12	1+1 chicks.

In the three cases marked with an asterisk a fairly prolonged search was possible: in the other three instances it was hurried and perfunctory, because of the necessity of getting under way again. Strong winds and a rising sea prevented our landing on the sand-banks off the delta of the Pahang River and on the spit at Kuala Sungei Ular: a septic leg kept me in the boat at Kuala Marang. The two parties encountered on the seaward side of the Kelantan delta were on separate sand-banks.

The eggs are laid in a shallow depression in the ground. Madoc (1936: 124) says that in two instances he found them in old foot-prints. Seemingly there is no noticeable lining to the nests on the gravel banks up-river. On the coast the depressions generally contain a few shells and shell fragments which would appear to have been placed there deliberately.

The eggs are normally egg-shaped, with a fine matt surface. The ground colour varies from a light buff through stone-colour to pinkish buff. It is generally marked with a few coarse blotches and smaller spots of lilac grey, gull grey, dark chestnut brown and black, the darker shades being above the paler. In most cases the markings are more plentiful round the broader part of the egg. In one clutch of three taken by Madoc (Kuala Bĕra, 9.6.'34) they are much reduced and the pinkish buff ground colour is merely sparsely and finely speckled with lilac grey and dark chestnut brown.[1] Four eggs in the Raffles Museum collection from Kuala Bĕra average 32.4 x 24.1 mm. Twenty measured by the present writer on the east coast of Malaya averaged 32.6 x 23.9 mm.: maxima 34 x 24 and 32.5 x 24.5, minima 31 x 23 and 32.5 x 22.5 mm. Hoogerwerf (1949: 62) gives 31.55 x 23.58 mm. for six eggs (2 c/3) taken on the coast near Batavia, in western Java.[2] The average dimensions for the whole series of thirty are approximately 32.4 x 23.9 mm. A full clutch apparently contains three eggs, or occasionally two (*see* Hoogerwerf, *loc. cit.*, and the data from the east coast of Malaya given above). Madoc's four single eggs, which in all cases were fresh, must have been incomplete clutches.

Incubation had not progressed far in the clutches found at Sungei Bebar and Kuala Pahang Tua, on the Pahang coast, on 19 and 21 July. On the other hand it was fairly well advanced in the eggs examined at Kerteh on 24 July, and in those seen at Kuala Sĕtiu on 8 August. Briefly it can be said that the data collected from the coastal sites suggests laying during the last three weeks of July in this area. Madoc's material from the Pahang River gives us laying in June, with the dates becoming progressively later as one moves towards the mouth of the river. Hoogerwerf (1936: 124) says that he found birds breeding in May, June and July near Batavia. The only precise data available from Siam are contained in a note by Madoc, "On 12 June 1949 I observed several birds on the disused salt-pans at Na Kok, near Tachin. During the day we saw probably twenty

1. Madoc (1936: 125; and 1947: 24) describes the ground colour of the c/3 that he took at Kuala Bĕra as olive brown, but I consider it to be a pinkish buff. In general the eggs of this bird are very similar to those of the typical race, *Sterna a. albifrons*, taken in Great Britain.

2. Earlier (1936: 124) Hoogerwerf writes of 12 eggs taken near Batavia averaging 32 by 24 mm., but as he did not quote these figures in 1949 I have not made use of them here.

pairs, most of which were behaving as if they had eggs or young. We found one nest containing a single fresh egg which was being brooded by a very persistent parent. It was laid on the flat debris of a dead *Suaeda* bush. It measured 1.27 x 0.95 ins." (= approximately 32.3 x 24.1 mm.). This suggests laying at about the same period as on the Pahang River.

Robinson (in Robinson & Chasen, 1936: 103) is said to have been of the opinion that this tern breeds on the extensive sand beaches at Tanjong Patani, "after the conclusion of the north-east monsoon" (that is from May onwards), but he never obtained eggs. In May 1948 Madoc saw several birds on the sea beach at Hua Hin, about 200 miles further north, but again he was not able to confirm breeding there. Nevertheless it seems likely that it nests at intervals on secluded and little frequented sand bars and beaches all along the east coast of Peninsular Siam, though it probably does not lay there until June. It may be pointed out that it will only be following the pattern of the Bridled and Blacknaped Terns if it breeds earlier in the Gulf of Siam than it does on the coast of Malaya.

So far as we know at present the Little Tern does not nest on the west coast of the Malay States, though it has been taken twice in this region (on the Perak coast) in July. Apart from these two examples it has been recorded only between early October and the middle of March. During this period it is not uncommon between Penang and Selangor (as far south as Batu Laut and Morib) at least, and is sometimes present in large, if widely spread, flocks. It has also been seen on the shore near Port Dickson, in Negri Sembilan, and taken once among the islands south of the Singapore Strait. It is not at present known from any of the off-lying islands on either side of the Malay States, nor have we any information about its distribution on the east coast in the autumn and winter months.

The birds breeding on the east coast of Malaya are undoubtedly examples of the Chinese race of *S. albifrons, S. a. sinensis* Gmelin (1789, type locality China). When compiling the Annotated Checklist of the Birds of Malaya I followed Peters (1934: 340), Chasen (1935: 48) and Robinson & Chasen (1936: 102) and accepted a second eastern form, *pusilla* Temminck (1840, type locality the Sunda Islands and the Moluccas), which I took to be the common bird on the west side of the peninsula.[1]

1. "Petite Hirondelle de Mer—*S. minuta. Remarque.* Il paraît que la petite Hirondelle de mer des îles de la Sonde et des Moluques, diffère un peu de celle d'Europe par la taille, moins forte, et par la forme plus grêle du bec. Quoique M. Horsfield la considère comme la même que notre *Minuta*, nous sommes d'avis qu'elle forme une espèce distincte, à la véritié très-peu disparate de la nôtre. Elle a été désignée par nos voyag/eurs sous le nom de *Pusilla*. On la trouve jusqu'à la Nouvelle-Guinée." Temminck, Manuel d'Ornithologie, ed. 2, 4, 1840 (1839): 464–5.

Peters (*loc. cit.*) gives the range of this race as the rivers of northern India and Burma, Java and Sumatra.[1] On the other hand Whistler (1944: 272) lists the bird breeding on Ceylon as *sinensis*. Earlier Hoogerwerf (1936: 124) had ascribed his birds from western Java to this race "on grounds of probability". I have not had an opportunity of examining Hoogerwerf's skins, but I have recently been able to go over the fairly extensive series in the British Museum (N.H.) collection. I have also re-examined the skins in the Raffles Museum collection. In consequence I am now strongly of the opinion that the form *pusilla* of Temminck, who apparently was not aware of Gmelin's *sinensis*, is not valid and that the name should be sunk as a synonym of the latter race.

This makes *sinensis* the form normally found over all the coasts of eastern and south-eastern Asia, and through the Philippines and Moluccas to New Guinea and the Bismarch Archipelago. On the west it brings it in contact with the Indian race, *S. a. saundersi* Hume (1877, type locality Karachi, Sind), which is said to occur on the southern coasts of the Red Sea, the Somali coast of Africa and the southern coasts of the Persian Gulf east to Sind (Peters, 1934: 340). There is no doubt that these two birds can be distinguished in the hand without difficulty. *Saundersi* has the outer three or four primaries black, with the median border of the inner webs white and the shafts black, at all stages. In *sinensis* the outer two primaries are a dark hoary grey (sometimes black in more western birds), with the median borders of the inner webs white and the shafts white. This pattern again, including the white shafts, is constant in all birds taken in the *sinensis* breeding region, including a barely fully fledged youngster from Yokohama (B.M. Reg. 94.1.6.50) and a slightly older bird from Amoy (B.M. Reg. 92.5.4.20). In addition in adult summer plumage *saundersi* has the rump light grey, while in *sinensis* it is white again, as in typical *albifrons*.

Birds from north-western and western India are undoubtedly referable to *saundersi*. Seven examples in the British Museum (N.H.) collection from the Laccadives (coll. Hume & Armstrong, 13 February 1875) also belong to this form. On the other hand, as Whistler says, the Ceylon birds (represented in the B.M. collection by six adults in breeding plumage) are clearly *sinensis*, though the outer primaries lack the full frosting of the Chinese specimens. All the examples that I have been able to examine

1. Peters avoids the difficulty of determining which races of the Little Tern occur in Malayan waters by making no reference to this area under any of them.

from Burma and areas further east, including the Andamans, are also *sinensis*, with the following exceptions: Sittang (coll. Oates, 2 June, 1875), Pegu (coll. Oates, 13 November, 1878), Lower Pegu (coll. Oates, 7 October, 1879) and a juvenile said to have been taken in Java (India Museum collection), all of which are in the British Museum (N.H.) collection, and four birds in the Raffles Museum collection from Penang and the Selangor coast, dated January, July and November (all taken by native collectors). The British Museum collection also contains an example of *saundersi* taken at Madras in June 1866.

As far as our area is concerned, therefore, it seems that the resident birds and the great majority of the passage migrants and winter visitors are members of the Chinese race, *S. a. sinensis*. A few examples of the Indian race, *S. a. saundersi*, at present known here by four specimens, also make their way down the Malacca Strait, possibly from western Burma or, more probably, from the rivers of eastern India. These birds are Nos. 155c and 155a respectively in the Malayan checklist: No. 155b, *S. a pusilla*, should be deleted from the list and the notes given under it transferred to *S. a. sinensis* (No. 155c). Similarly, if this revision is accepted, the summaries of distribution given in the Checklist of the Birds of the World (Peters, 1934: 340) should be amended to read,

Sterna albifrons saundersi Hume, Southern coasts of the Red Sea, the Somali coast of Africa, southern coasts of the Persian Gulf to Sind and south to the Laccadives, the rivers of northern India and possibly Burma, occasionally south to the Malacca Strait.

Sterna albifrons sinensis Gmelin, Korea and Japan south along the coast of eastern China and Indo-China to the Malay Peninsula, Ceylon, the Andaman Islands, Sumatra and Java, and eastward through the Philippines, Celebes and Lesser Sunda Islands to the Bismarch Archipelago and New Guinea.

Appendix

11. **Fregata ariel ariel** (G. R. Gray). Least Frigate-bird.

The behaviour of this bird in and around Malayan waters is a little puzzling. From a number of observations it would seem that both adults and juveniles visit the Johore-Pahang Archipelago fairly regularly, sometimes in considerable numbers, at least during the period from May to July. They may well do so at other times of the year, but conditions are difficult from October to March and it is not easy to reach the islands in the season of the north-east monsoon. The Least Frigate-bird is

also common at times at the eastern entrance to the Singapore Strait, and it has been recorded as far up the east coast of Malaya as the Pahang River. There are several recent visual records for the immediate neighbourhood of Singapore Island, including a bird seen over the Yacht Club anchorage in June 1948 (A. J. Rycroft, *in litt.*). In the Malacca Strait it apparently keeps further from the shore line. There are only a few formal records from the Aroas northwards, and seemingly only two visual records for Penang, both off Pulau Kendi to the south of the island, 1st January, 1933, and the 2nd June, 1938, (J. Cairns, *in litt.*). On the other hand Madoc (MS notes) says that he saw quite a number of birds in the middle of the Strait during an unsuccessful attempt to reach the Aroas in September 1936, and considerable numbers round the Tokong Simbang stacks at the south end of the group when he flew over them in September 1946. It is also not uncommon at times in the Langkawi group, where again it may take up temporary residence. According to Hume (1880: 119) Davison repeatedly saw a frigate-bird, which must have been this species, about the coasts of the Malay Peninsula at Tonka (= Puket, off the west coast of Peninsular Siam) and Copah (= ?), and on one occasion he encountered nearly 20 together in the Langkawi group. There do not, however, appear to be any further records for the Bay of Bengal or the coasts of Sumatra proper.

Turning south and east, outside our area, we find that small parties of these birds are not uncommon in the waters round the islands of the Rhio-Lingga Archipelago and off Banka and Billiton. I saw at least one group on each of four voyages between Singapore and the Sunda Strait. It certainly occurs in the Anamba Islands, in common with *Fregata andrewsi* Mathews which is said to be the more plentiful of the two, but there does not appear to be any record of its presence in the Natuna group. According to Chasen (1935: 67) it has been taken on the coast of Sarawak, as it well might be, but the only reference that Moulton (1914: 60) makes to it is to note that Treacher recorded it from Labuan. It is certainly present at intervals along the greater part of the coast of North Borneo, and I encountered small parties frequently during a voyage in that region in July 1949. The greatest concentration was in the neighbourhood of Darvel Bay, but birds were seen at intervals from Marudu Bay round to Bum-Bum island, off Semporna.

This bird is said to nest on one or more of the islands off Darvel Bay, but I visited four possible ones, and on each they told me that it inhabited another more distant island. Personally I am of the opinion that no one has yet found a breeding ground

in this immediate area. The most promising of the islands which I did not reach is Sipadan, on the north side of St. Lucia Bay, which probably has a few examples of the Robber Crab, *Birgus latro* Linnaeus, on it; I commend it to any future travellers as a place worth visiting if they can get hold of a reasonably reliable launch. Worcester (1911*a*, *passim*) says that a frigate-bird nests on Cavilli Island, near the centre of the Sulu Sea, and that he also saw examples on Bankoran and Arena Islands and the Meander Reef, but he stresses that in all cases they were the larger species, to which he gives the name *Fregata aquila* (Linnaeus). They cannot, of course, have been the real *aquila*, but at that time only two species were recognised. Worcester's birds must have been *Fregata minor* or *F. andrewsi*. One would be tempted to suggest that there had been an error in diagnosis, and that the birds were actually *ariel*, but Worcester took a good series of specimens which were examined by McGregor, who landed on Cavilli with him. McGregor (1909: 207) gives a number of records of *ariel* for the Philippines proper but does not refer to nesting.[1]

The problem is just where *Fregata ariel* is breeding in the neighbourhood of the South China Sea. The frigate-birds nesting on isolated oceanic islands do not, as a general rule, stray far from their bases. In certain weathers they are almost wholly dependent on other sea birds for their food, and it is essential that they should not risk being away from such a source of supply for too long. In more sheltered waters, on the other hand, non-breeding members of the smaller species might easily drift for a considerable distance, and take up temporary residences at points where they could obtain food for themselves. Lacking webbed feet, and with their short, weak legs and very long wings, they cannot dive, and they have little chance of getting into the air again if they once come down on the water. They are, however, adept at hovering over it in calm weather and picking up small fry from shoals that have been driven to the surface by larger fish. In Malayan

1. Unfortunately the Philippines collection, which was housed in the Bureau of Sciences at Manila, was destroyed during the war. Since writing the above passages I have heard from Dr. C. G. Manuel, who is now ornithologist at the Philippines National Museum. He tells me (*in litt.*, 12 August, 1950) that the old collection certainly contained examples of *F. ariel*, but he does not mention any other species of *Fregata*. Possibly there was an error in diagnosis, and the birds breeding on the Sulu Sea islands are really *F. ariel*. One hopes very much that it will be possible for further collections to be made in this area at some not too distant date. There are still several problems which remain to be solved in connection with the birds of the Sulu Sea, apart from the precise identity of the frigate-bird nesting there.

waters they take the smaller Clupeids in this way, when they are being chivvied by tunny, *Thynnus* sp. They will also chase and catch flying fish while they are in the air. *Fregata ariel* frequently nests in bushes of the tea-shrub, *Pemphis acidula* Forster. It will presumably also make use of any tall, fairly bare trees, as the other members of its genus do, though it would not be likely to resort to palm.

Bearing these points in mind it is apparent that the examples of *Fregata ariel* seen off and near the Malayan coasts may be coming from anywhere within quite a wide area. At the same time it can scarcely be from as far afield as Peters's summary of the bird's range suggests. He says that it breeds on islands off northern Australia and New Caledonia and in the South Pacific, with races peculiar to Aldabra, in the western Indian Ocean, and South Trinidad, in the Atlantic (Peters, 1931: 97). This does not take cognizance of the undoubted colony on the Cocos-Keeling Islands, nor does it allow for the nesting site which must exist somewhere in the South China, Sulu or Celebes Sea areas.

It has been suggested that these birds might be nesting in the Johore-Pahang Archipelago. They certainly seem to be very much settled there in the period from May to July at least, but fairly thorough searches undertaken at different times by Madoc and the present writer have failed to locate any signs of breeding activity. As in the case of the islands round Darvel Bay, the birds always appear to be making use of the island that one is not on. On his visit in 1934, however, Madoc did succeed in finding a wooded area on Pulau Sepoi that was clearly serving as a roost for them. I think that they were still using this island, and possibly Pulau Labas near to it, when we were there in 1948. We landed at Tekek Bay on the north-west coast of Tioman late in the afternoon. Away towards the north we saw a great concourse of frigate-birds, well over a hundred strong, drifting leisurely on rigid wings high over the sheltered sea. As the light faded they shifted idly westwards, until finally we saw them against a rich orange sunset, circling over Pulau Sepoi, some six miles away. They were still there when the night came, and a last lone Reef Heron flapped slowly across the deserted bay. The procedure was repeated the following evening. In the interval we had examined Sepoi and the islands round it and found nothing beyond evidence of roosting by large numbers of birds lavish in their ejection of guano.

Chasen, who visited the Anamba Islands in September and October 1925, had in part the same experience. He collected examples of both *Fregata andrewsi* and *F. ariel* there, but he

found no evidence of nesting. Under the heading of *F. andrewsi* he says (in Robinson and Chasen, 1936: 232).

> "In the Anamba Islands this frigate bird is common, but its hunting-grounds seem yet farther afield, for it is only at dusk that it becomes really conspicuous, although during the day small parties may be seen fishing in the sheltered water between the islands where the flying-fish forms part of their food. Sometimes in the late afternoon huge flocks of this species mixed with smaller numbers of *Fregata ariel* may be seen wheeling about, high in the air above the island of Siantan. This is a preliminary to the nightly flight to a neighbouring islet, where on bare trees many thousands of frigate birds congregate nightly. . . ."

In the Johore-Pahang Archipelago we frequently saw single frigate-birds, or groups of two or three, flying over the waters between the islands by day, but it was only in the evening and west of Tioman that we witnessed the large gatherings. On the other hand on both Christmas and the Cocos-Keeling Islands there were always a number of birds circling over the breeding colonies, except in the calmest weather when the still air made flight tedious for them. In addition I have examined at least the majority of the skins which Chasen brought back from the Anamba Islands. It is of interest to note that none of the adults exhibit the rather longer breeding plumes on the crown and mantle.

Personally I doubt if the Least Frigate-bird is breeding on any of these islands, or the ones off the north coast of Borneo, though it could easily do so. If there is a colony near the Malay Peninsula I think that it is more likely to be in the Aroa group, in the middle of the Malacca Strait, in spite of the fact that the birds appear to be less numerous on the west side of the peninsula. Tokong Simbang, at the south end of the group, seems a promising place. It is apparently small, with the sides almost precipitous and the top well wooded; according to the Malacca Strait Pilot (3rd edn., 1946: 165), it rises to a height of 121 feet. It has two points to recommend it, apart from its name which means Frigate-bird Islet. One is that Madoc tells me that when he tried to reach the Aroas in 1936 he noticed clearly a prominent red gular pouch on some of the birds which he encountered near the islands. This should mean that they were breeding (or very disappointed) males, as the pouch shrivels with the seasonal cessation of gonadial activity, and ultimately becomes barely detectable except at close quarters. Again when he passed over the group in 1946 he saw the birds flying off Tokong Simbang as the plane swooped towards it. According to his account a larger number of them were actually on the islet, not in the air; this again suggests that they were nesting there, and not merely congregating for food and company. Nothing ties a frigate-bird down as effectively as its

egg or chick, for if either is left unattended for long it provides one of the neighbouring birds with an easy meal. The second point is that the Aroa group as a whole has a breeding population of boobies and terns. This is an important consideration. Even if frigate-birds can exist without the presence of other sea birds outside the nesting season, they can scarcely do so when they have young to feed. The northern skuas winter largely over the open sea, and during this time they must of necessity fish for themselves, but in the breeding season they almost invariably augment their own catches by taking food from other birds.

If the Least Frigate-bird is not breeding in the Aroa group I would suggest that the most likely source of the birds seen off the Malayan coasts lies in the Paracel Islands, in the middle of the South China Sea. Here again we have relatively isolated islands situated in rather bluer water and with nesting populations of boobies and terns. The only objections to postulating that these birds are coming from the Paracels is the question of distance, and the fact that *Fregata* ariel is not at present recorded as breeding there. The first is something of a drawback; it means that they would be coming over 1,000 miles, partly across open water, to reach our area. If they are flying that far it is surprising that they do not appear to spread more than halfway up the Malay Peninsula; it is even surprising that they come on beyond the islands of the Sulu Sea and the coast of northern Borneo. It is more likely that the birds seen in the latter region do, in fact, come from the Paracel group by way of the coast of Palawan, while those in the south are spreading out from the Aroa Islands.

Although *Fregata ariel* has not been reported officially from any of the Paracel Islands it may still be breeding there. Certainly a species of frigate-bird is known to nest in the group, but Jabouille and Delacour (1930: 19) record it as *F. m. minor* (Gmelin). They say that it frequents the coast of Annam, presumably as a non-breeding visitor, particularly such bays as that of Tourane, where it takes refuge from bad weather at sea. But they also say that two frigate-birds have been recorded from the waters round Indochina, *Fregata aquila* and *F. minor,* though they have taken examples of only the second. *F. aquila,* which is confined to Ascension Island, in the South Atlantic, certainly cannot have reached the coasts of Indochina, but this would not have been apparent before 1914, when Mathews revised the nomenclature of the *Fregata.* The Indochinese record for *aquila,* like those from the Sulu Sea, must refer to the present *F. minor* or *F. andrewsi.* This might mean that only one frigate-bird, really occurs in this area, but in the past there was sometimes confusion between the two birds now

known as *minor* and *ariel*.[1] This would scarcely be a profitable speculation were it not for one important point. Apparently Jabouille and Delacour received only one specimen of *Fregata* from the Paracels when their collectors visited the group in June and July 1926. This was an immature male taken on Lincoln Island. The authors ascribe it to *F. m. minor*, but they give its wing measurement as 510 mm. In a long series of measurements of my own and other authors I have not encountered a fully feathered male of *F. minor* (immature or adult) with the wing measured flat coming to less than 540 mm. (range 540–612), or in a female less than 562 (range 552–648). On the other hand the males of *F. ariel* which I took on the Cocos-Keeling Islands ranged from 518–555 mm., and the females from 524–581 mm.; Chasen and Kloss (1924: 64) give 508–554 for a series of Malaysian males of *ariel* and 526–578 mm. for the females. Unless the Paracel bird was recovering from a moult it must have been an immature *Fregata ariel*, not a *F. minor*. Unfortunately the specimen is not in the collection of the National Museum in Paris, but Prof. Berlioz, Keeper of Birds and Mammals, tells me that in his opinion the Paracel bird is obviously *F. ariel* (*in litt.*, 22 April, 1950).

156. **Thalasseus bergii cristatus** (Stephens).

Larger Crested Tern.

The local race of the Crested Tern breeds, or at least formerly bred, both north and south of our area in roughly similar climatic conditions to those pertaining here. Moreover, if we survey the range of the species as a whole we find that it normally nests in small, tightly packed colonies on flattish, low-lying islands, or rocky outcrops; in some instances it lays among the sparse vegetation, and in others on the strips of bare shingle above the high tide level. In either case there are a number of localities suitable for it on the east coast of Malaya, and presumably also among the Tambelan Islands, Anambas and Natunas, but it is not yet known to breed anywhere in this neighbourhood. The area's proximity to the equator can scarcely be the operative factor. Raffles Lighthouse is about 1° 9′ north of the equator, and the parallel of 6° north latitude passes a few miles north of the Bunting Islands, off the coast of Kedah, and the Perhentians, off Besut. In the Banda and Java Seas it has been recorded nesting in the corresponding belt of south

1. The bird which Latham describes in his General Synopsis under the name of *Fregata minor* Gmelin is seemingly composite, and for that reason I have no hesitation, above, in referring Davison's records, actually attributed to "*minor*", to the present *Fregata ariel*. Latham's account was reproduced by Hume in Stray Feathers, 7: 447–8 (1878).

latitude. According to van Bemmel (1948: 381) it breeds on Obi Major, Obi Laut and Batu Kapal off Buru. Hoogerwerf (1949: 67) cites eggs taken by Houwing on the Karimon-Java Islands, north of Semarang.

Again, though no breeding grounds have been located off the southern half of the Malay Peninsula, nesting has been reported on Koh Samui, off Bandon, on the east coast of Peninsular Siam (lat. 9° 23–33′ N.). Herbert (1926: 348) says that two fresh eggs from this island were given to him by an old collector on 14 May, 1913; "the single egg, as only one is laid, was in most cases on the bare rock without any debris or other material near it". Nesting has also been reported from further north, in the Inner Gulf of Siam, though the bird's status there at the present time is not clear. Robinson and Kloss (1921: 50) say that they examined nine fully adult birds in fresh breeding plumage from various islands in this area, but they do not give any further details. Sir Walter Williamson (1919: 83–84) records nesting on two islets on the eastern side of the Gulf. He says that on 2 June, 1917, he found 9 eggs of the Crested Tern "laid singly on the bare shingle of a beach at one end of a small islet, near Kok Rin". Again on 9 May, 1918, he found swarms of terns, including this species, nesting "on a perfectly bare, low-lying rock near Kok Chuan, some little distance further south than Kok Rin"; he collected 23 single eggs and 2 pairs.

In 1949 Madoc (1950, this journal) attempted to visit these colonies, but was unable to find them. Apparently the only island in the Kok Rin group which has a shingle beach is White Rock, lying very close to Kok Rin. He visited the islet on 21 May and found Blacknaped Terns nesting there on the raised portion of the beach, but no signs of *cristatus*. Subsequently, on 11 July he landed on Kok Hin Chalarm, the outermost of the islands south of Laem Samae Sarn, assuming it to be the bare, low-lying rock to which Williamson had referred. Again he found no evidence of the presence of the Crested Tern.

This species, in common with the great majority of the terns, normally leaves its nesting grounds outside the breeding season. Early July might be too late to find it still there, but it should be remembered that Williamson (1916: 63) says he took birds in this neighbourhood on 17 and 18 July, 1916; he adds "the few eggs we found were mostly addled, but two chicks were observed, trying to escape notice by snuggling away in crevices of the rocks, with their bills and heads wedged in as far as possible". It is not clear to which species this last remark applies, but it certainly shows that normal nesting of all the terns using the islet had finished for the year. In a

premature season the young Crested Terns might have begun to fly by 11 July, but Madoc should have encountered birds in the neighbourhood if they had been breeding there in 1949. Similarly adults should certainly have been present on White Rock on 21 May, if they were making use of the islet that season. From reports from other areas it seems that they normally congregate on the breeding grounds early, and begin pairing at least a month before the first eggs are laid (*cf.* Archer and Godman, 1937: 530). Possibly this bird, like its near relative the Sandwich Tern, *Thalasseus sandvicensis* (Latham), occasionally establishes a colony on an island, builds it up over a period of years, and then abandons the site for no apparent reason. If this is so it has not, seemingly, been recorded before. The summaries given by Archer and Godman (*loc. cit.*) and Stuart Baker (1929: 122) suggest that *T. b. velox* (Cretzschmar), the race inhabiting the northern part of the Indian Ocean, is more strongly attached to its breeding grounds. Similarly Serventy and Whittell (1948: 126–27) make no reference to colonies forsaking their nesting sites after a period of years in their account of the West Australian race, *T. b. gwendolenae* (Mathews).

The breeding range of *cristatus* extends north to the Bonin Islands (Nisi-no-shima), the Riu Kiu Islands (Tonbaru Rocks, off Toku-no-shima) and South Borodino Island, that is roughly to 28° north latitude.[1] Worcester (1911*a*: 171) says that he found eggs and young chicks on the Meander Reef, in the Sulu Sea, on 23 September. Apart from this all the dated records throughout this area show the birds normally laying in May or June. Presumably they do so a week or two earlier in the south than in the north, but unfortunately the available data are not sufficiently precise to demonstrate this. Hoogerwerf (*loc. cit.*) merely reports that eggs were found on Karimon-Java in these months, while at the other end of its range Kobayashi (1940: 225) gives the laying season on the islands south of Japan as May to June, without further details.

This would seem also to be the normal nesting season for *velox*. According to Hume (2nd edn., 1890: 298), Capt. Shopland found a considerable colony of these terns with eggs on Oyster Island, near Akyab, in May, Parker found it nesting at Adam's Bridge, Ceylon, in June and in the same month Nevill took eggs from a rocky islet about 20 miles north of Galle. Slightly earlier dates are also recorded from Ceylon; Wait is said to have obtained eggs there on 30 April, and Phillips on 5 May (data

1. To the south it extends down the east coast of Australia to Tasmania (approx. 42° S. lat.) and Lord Howe Island, while to the east it spreads out across the Pacific to the Hawaian Islands, the Marquesas and the Paumotu Islands.

from Baker, *tom. cit.:* 123)[1]. Butler (1877: 298–300) took fresh eggs on Astolah, an island on the Mekran coast, on 29 May, and had others sent to him that were collected on 17 June; some at least of the latter, which were nearly all slightly incubated, would appear to have been the second layings of the birds robbed at the end of May. The only locality where *velox* definitely breeds at a slightly different season seems to be on the islands off the Somali coast, where according to Archer and Godman (1937: 530) it mostly lays in August; the delayed breeding is apparently associated with the late establishment of the dry season in that area.

The fact that the Crested Tern normally lays in May and June near the north of the equator raises another point. According to the data summarised in the British Handbook the Sandwich Tern incubates for between 20 and 24 days, and the young fly when they are about 5 weeks old; this gives a total period of about 8 weeks. During the winter months the Crested Tern is fairly plentiful along the east coast of Malaya, and in the Straits of Singapore where it collects in parties of 50–200 individuals on the fishing stakes.[2] The great majority of the birds disappear in April, and usually only an occasional example is seen during the succeeding few months. We have no reliable records for the east coast of Malaya during May or June, but it is undoubtedly there in some numbers from the middle of July onwards.

1. Phillips's eggs came from a small rocky islet off Ambalangoda (Galle district). Recently (*in litt.*, 15.9.50) he has kindly supplied me with further information about this colony of considerable interest. On 5 May 1923, Phillips found 19 c/1 on the islet, laid on the bare sand and shingle of a raised beach; all the eggs were fresh. On 5 May 1932, the site was visited by Felsinger who saw only one egg. Ten days later, on 15 May 1932, Felsinger again landed on the islet and then found over 250 eggs, all c/1 except for a single c/2. On 17 May 1949, Phillips was in the neighbourhood of the islet but did not go out to it; Crested Terns were present in some numbers in the area, but they did not appear to have begun laying. The exact date on which breeding begins obviously varies from year to year, but the data considered together suggest strongly that the normal laying period in this region is in May, probably somewhere about the middle two weeks of the month. The Galle district of Ceylon is in roughly the same latitude as the northern half of Kedah.

2. The Crested Tern is very much less numerous in the Malacca Strait, and there would seem to be little chance that it is breeding in or near this region. So far as I know the most easterly nesting ground on the west side of the Malay Peninsula recorded with certainty is the colony on Oyster Island, *vide supra.* Oates (1882: 247) also reports it as common near the mouth of the Bassein River; Hume and Davison (1878: 493) say that it is rare on the Tenasserim coast, and seen only from Mergui southwards. Peters includes this area, that is the northern part of the Bay of Bengal, in the range of *T. b. velox*, but skins from the Malacca Strait in the Raffles Museum cannot be separated from *cristatus* from the South China Sea.

When I travelled up the coast by motor launch in 1948 we encountered *cristatus* first on 16 July, on a sandbar situated in the open channel between the two islands of the Sribuat group. There were over 200 birds present, packed in a fairly tight flock. Additional parties of 52 and 98 were settled on two of the dozen or so fishing stakes at the south entrance to the channel. From then on we encountered groups of about 50 to 200 individuals at a number of points up the coast until we reached Tumpat, north of the Kelantan River, on 12 August. The great majority in all cases were in what appeared to be winter plumage, and may well have been youngsters in their first summer plumage. About 10–12 per cent were obviously adults, in most instances moulting from summer to winter plumage; they could easily have been birds that had failed to breed that season, or pairs that had lost their egg too late for the hen to lay again. Either way there are reasonable grounds for assuming that they were not birds that had reared chicks that year. Clearly this point is not important in regard to the terns seen during the latter part of the trip, but it is of some significance in relation to those encountered during its early stages. It is difficult to see how birds that do not start to lay until after the beginning of May, and then seemingly some distance further north or north-east, can be free in time to reach Malayan waters in appreciable numbers by the middle of July. On the other hand there is nothing unusual in first summer birds, too immature to breed, remaining in or near their winter quarters all through the year, or in thwarted adults coming south early to join them. Birds in either of these categories could easily be in the Johore-Pahang archipelago at this time.

Rather more difficulty is presented by the fact that among them we saw occasional examples of individuals obviously in their first juvenile plumage, and presumably only one to three months old. The greatest proportion of these was in the first flock that we encountered, the one on the bank in the Sribuat group, where there were 13 juveniles out of a total of a little over 200 terns. There can be no doubt of the identity of these birds; by approaching submerged through the water we were able to get within 15 yards of the flock. There are three possible explanations of their presence, none of which are as yet supported by the necessary supplementary evidence. They might be very early birds from a flourishing colony in Malayan waters, or nearer to them that any so far recorded; some birds nesting to the north of our area may be laying about the middle of April, and not as late as May; finally there may possibly be some colonies north of the equator which breed in the last month or two of the year.

The last suggestion is the least acceptible on the evidence at present available on the habits of the Crested Tern north of the equator. Further, in view of the timing of the north-east monsoon such a colony can hardly be situated on the east coast of the Malay Peninsula, or in similar localities further north. On the other hand, of course, the period of the north-east monsoon is a suitable season for breeding on parts of the coasts of Cambodia and Borneo, as well as some sections of the Sulu Sea and the Philippine archipelago. We must also bear in mind the fact that autumn breeding has been recorded from points south of the equator. Three races of *Thalasseus bergii* occur in this latter area; *gwendolenae* (Mathews) which is confined to the coasts of western and north-western Australia; *thalassinus* (Stresemann) which inhabits parts of the Seychelles group, Aldabra and Rodrigues Islands; and the typical race, *bergii* (Lichtenstein), which occurs on the coast of South Africa from Walvis Bay in the west round to Portuguese East Africa and parts of Madagascar in the east. As far as is known at present *thalassinus* lays in November, during the southern spring. On the other hand, according to Roberts (1940: 121), *bergii* breeds on rocky islets off the southern coasts of South Africa in June or November. Similarly Serventy and Whittell (*loc. cit.*) in an excellent summary, record *gwendolenae* laying in November (Seal Island, off Cape Leeuwin, and the Abrolhos group), and April (Fraser Island, off Point Cloates) and May (Bedout Island); they also report autumn nesting on the south coast of Australia at Rocky Island, east of Hopetoun. This raises the possibility that *cristatus* may be behaving in a similar manner in the region of the South China Sea, but, of course, it by no means proves that it is doing so. It may merely be the way they do things in the south. It is interesting to note in this context that the phenomenon occurs in other Australian sea birds, including the Silver Gull, *Larus n.-h. novae-hollandiae* Stephens, the Noddy, *Anoüs stolidus pileatus* (Scopoli) and the Pied Cormorant, *Phalacrocorax varius perthi* (Mathews); in the Silver Gull both spring and autumn breeding populations may use the same island (Serventy and Whittell, *tom. cit.;* 7).

It will be seen that though the text of this note runs to over five pages it does not reach any definite conclusion. Nevertheless it seems of value to gather together the facts assembled here, in case at any point additional information should come to light. For the present we can only say that though the Larger Crested Tern is in Malayan waters for at least 10½ months of the year, with occasional juveniles reaching as far south as the Johore-Pahang Archipelago by the middle of June, there is as yet no direct evidence that it is breeding here.

158. **Anoüs stolidus pileatus** (Scopoli). Common Noddy.

The Noddy is more oceanic in its habits than the other terns discussed in this paper. It generally nests on the more isolated stacks, reefs and islands, and outside the breeding season disperses over the open sea instead of frequenting coastal waters. It is definitely scarce in our area, and is known with certainty only by five formal records from the northern half of the Malacca Strait. It is not at present known to be breeding here, but the evidence (outlined below) suggests strongly that there is an unrecorded nesting ground somewhere in or near the eastern side of the Bay of Bengal. This might possibly be situated on Pulau Perak, though we found no trace of the birds there at the beginning of April, 1949. The barren nature of the island is not incompatible with its utilisation by the Noddy, which is known to nest on sites ranging from the barest stacks to well wooded islands. The difficulty is that an analysis of the breeding seasons of the recorded colonies in Malaysia and the South China Sea area suggests that the birds should be arriving at their nesting ground between April and June, and laying between May and July or August. This means that they would be occupying the stack during the period of the north-west monsoon, the season of bad weather in the Malacca Strait. On the other hand certain of the other terns breed at this time, using less exposed sites. The Noddy, with a preference for isolation, might not be deterred by the storms, and its presence on Pulau Perak must remain a possibility, which was not definitely disproved by our visit: we could easily have been a month or so too early for the first arrivals.

The majority of the formal records for our area are of birds taken in November; these are, of course, compatible with a breeding season May-September on Pulau Perak. Dr. Abbott shot an immature female off the Perak coast on 18 November, 1899, and a second similar bird off the Dindings the following day; on 8 April 1903 he took an adult male at sea 100 miles west of Penang (Riley, 1938: 102). Cantor also took a young bird near Penang (no date), and Seimund a nearly adult male on Pulau Jarak on 16 November, 1919, when large numbers were seen (Robinson & Kloss, 1921: 53). The Common Noddy certainly occurs further north, in the Bay of Bengal. Hume (1874: 321) says that it has been taken in the Andamans several times, Oates (1882: 247) reports it from the south coast of Pegu, between Cape Negrais and Rangoon, and Davison saw it on a number of occasions when he was passing through the Mergui Archipelago (Hume & Davidson, 1878: 493). As is shown below, colonies are known to exist in the Java Sea and on the fringes of the South China Sea, but nevertheless this bird

has not yet been reported from the Rhio-Lingga Archipelago or the southern half of the Malacca Strait. On the other hand it is known from Nias Island, in the Mentawi group, and the west coast of Sumatra. On the whole it seems unlikely that these birds are coming from any of the colonies in the seas east of the Malay Peninsula.

There are three colonies to the south and west of Sumatra, but they are all some distance away. The largest is on Christmas Island, 180 miles south of Java Head, where there were 4,000–5,500 breeding pairs in 1940. There is also a smaller colony (500–750 pairs in 1941) on the Cocos-Keeling Islands, about 530 miles almost due west of Christmas Island. The nearest site in the northern part of the Indian Ocean is in the Laccadives, west of India; it is situated on the Cherbaniani reef, approximately 11° 55′ north latitude. Hume (1876: 478–81) visited it during the second week in February, and found the birds just beginning to lay. This means that the great majority should be in residence, or at least in the vicinity of the island, from about January to early July. The Cocos-Keeling birds lay slightly earlier, and are mostly in residence from December to June. Noddies from either colony could, therefore, be in the Bay of Bengal and adjacent areas in November, though the distance would be rather far for them. The Laccadives are about 1,750 miles from the northern entrance to the Malacca Strait, and the Cocos-Keeling Islands about 1,250 miles. On the whole it seems more likely, as we have suggested, that there is another colony nearer at hand.

To the east of the Malay Peninsula the Common Noddy breeds on Barren Island, to the east of the Tambelan group, and on Kok Hin Chalarm, on the east side of the Inner Gulf of Siam. It is known as a stray from the Tambelan, Anamba and Natuna Islands, and from the coast of Borneo. Further afield it nests on the islet of Kebatoe south of Billiton (van Bemmel, *in litt.*, 5.7.50),[1] the Karimon-Java Islands (Hoogerwerf, 1949: 68) in the Java Sea, Gunong Api (van Bemmel & Hoogerwerf, 1940: 457–63) in the Banda Sea, a number of islands in the Sulu Sea (Worcester, 1911*a*, *passim*) and the Paracel Islands (Delacour & Jabouille, 1930: 14–15). According to van Bemmel (1948: 380) there are at present no breeding records from the Moluccas.

Relatively little is known about the colony on Barren Island (lat. 1° 32′ N., long. 106° 26′ E.). According to the China Sea Directory (5th edn., 2, 1906: 63) the island is a whitish rock, 80 feet high, about one cable in length, and without the slightest

1. Lat. 3° 48′ S., long. 108° 04′ E. The islet is also known as Tjina Pebatoen (China Pebatun); a short note on it is given in the account of *Anoüs minutus* below.

trace of vegetation; it appears to be very like a miniature edition of Pulau Perak. As has been noted earlier in this paper, both the present species and the Bridled Tern apparently nest there in some numbers. The stack was visited on 25 June, 1921, by Sir John Anderson, who collected several adults and a number of eggs of both species. The Raffles Museum collection still contains 9 of the Noddy eggs; the dimensions of the series are, average 50.9 x 36.0 mm., max. 57.5 x 37, 48 x 38, min. 47 x 35, 48.5 x 33. The ground colour is white or off-white with a few spots and blotches of gull grey, chestnut or umber brown, and black, mostly round the broader end; the majority resemble fig. 55, plate 6 in Hoogerwerf 1949, fairly closely.

The colony on Kok Hin Chalarm was first visited by Sir Walter Williamson (1918: 38) on 9 May, 1918. He says that the rock "was absolutely swarming with terns (*Sterna bergii, S. melanauchen* and *S. anæsthetus*), all breeding, and among these the dark smoky or chocolate-brown Noddies were very conspicuous. They were also most extraordinarily tame, and I could have shot any number, but was content with four". He obtained 2 eggs, "each laid singly on a slight depression on the bare rock". In 1949 Madoc landed on Kok Hin Chalarm on 11 July. He found about four pairs of the Common Noddy among the Blacknaped and Bridled Terns on the southern tip of the islet, but he was only able to locate one egg. It was laid on a small, bare ledge 3 feet below the lip of a sheer cliff, a position very similar to the favourite site on Christmas Island. The egg, which measured 54·4 x 38·1 mm., was quite fresh, but the bird was apparently very anxious to brood it. Madoc's collector returned to the islet on 22 July, and found another fresh egg, 57·7 x 38·6 mm., in a small patch of guano in a hollow of the rock. While he was there a pair of Whitebellied Sea-Eagles, *Haliæëtus leucogaster* (Gmelin), flew over from a neighbouring island and attacked the tern colony. The terns scattered, but some of the Noddies rose into the air and eventually drove the hawks away. This rather suggests that one or more pairs had an egg near to hatching, or a very young chick. At such times the Noddy is extremely aggressive, and I have seen birds sally from their cliff-ledge nests on Christmas Island to attack frigate-birds that were merely gliding past them.

As a general rule the Noddies in a particular colony usually adhere fairly closely to a common breeding season, though its timing may vary from island to island. The above data are meagre, but they suggest laying in the two colonies between May and July, with a preference for May and June. Delacour & Jabouille (*loc. cit.*) say that when their collectors visited the Paracels at the beginning of July they found Woody Island covered with Noddy's nests (built in trees and large shrubs),

the majority of which contained young birds; this also gives May and June as the peak period for laying. Hoogerwerf took eggs on Karimon-Java in August, and eggs and nestlings in down between 21 July and 11 August on Gunong Api. This indicates slightly later laying in this area. In general the China Sea Noddies should be in residence at their nesting grounds from about April to September, and those in the Java and Banda Seas from May to November. In the remaining months at least the majority of the birds are presumably scattered over the open waters of the corresponding seas, but there do not appear to be any records of their presence there. Certainly the Common Noddy has not yet been taken on the east side of the Malay Peninsula.

159. **Anoüs minutus worcesteri** (McGregor).

Whitecapped Noddy.

There is only one record of the occurrence of this bird in Malayan waters, a solitary female said to have been taken off Malacca in August, 1865 (*Micranous leucocapillus*, B.M. cat., Maingay coll.). This, a "Malacca" record of the middle of the nineteenth century, is itself open to suspicion. Further, until recently there were few additional reports of its occurrence in the Malaysian sub-region. Chasen (1935: 49) lists only Sumatra (Straits of Malacca), Billiton and Borneo, in addition to the Malacca specimen. The Borneo record is apparently a bird taken by Ussher on the Lawas River (Moulton, 1914: 27). The type locality is Cavilli Island, in the Sulu Sea, where Worcester (1911*a*: 173) found it nesting in September, 1910; Peters (1934: 347) still gives Cavilli as the only known breeding place.

More recently, however, the Whitecapped Noddy has been shown to be nesting on the rocky islet of Kebatoe, situated 31 miles south of Billiton and about 410 miles south-east of Singapore[1]. Kebatoe, which rises to a height of some 340 feet, is steep-to except at its north-western point, where there is a sandy beach. It is partly covered with stunted trees, and thus provides both cliff and tree sites for breeding sea birds. The Billiton fishermen refer to Kebatoe as Tjina Pebatoen (China Pebatun) on the grounds that its humped-up shape, seen from a distance, bears some resemblance to a seated Chinaman. The two names have caused a little confusion; different authors have used one or the other, and by varying the supposed distance of

1. Kebatoe, lat. 3° 48′ S., long. 108° 04′ E. Data from the Eastern Archipelago Pilot, 4, 2nd ed., 1939: 122. Notes on the island are also given in Kuiper 1937. *Anoüs stolidus pileatus* is said to be breeding there in addition to *A. minutus*.

the locality from Billiton have given the impression that there is more than one major islet in this neighbourhood. The presence of *Anoüs minutus* on Kebatoe was first reported by Kuiper (1937: 67–68), who gives a good photograph of a nesting bird. According to van Bemmel (*in litt.*, 5.7.50) Kuiper's specimens are now in the Bogor (Buitenzorg) collection, together with additional eggs taken there by Dr. Reuter in October 1940. Hoogerwerf (1949: 68) gives measurements of 25 clutches based on this material[1]. He also refers to breeding on the Karimon-Java Islands (approx. lat. 5° 51′ S., long. 110° 36′ E.) in the Java Sea in August.

The dates published by Hoogerwerf agree well with Worcester's notes from Cavilli Island where he found some eggs, but mostly fairly advanced nestlings, on 24 September. There is, of course, nothing to suggest that *worcesteri* is breeding in our area, and we still have no record other than Maingay's. Nevertheless it is of interest to note that this bird is actually nesting much closer to Malaya than several of our better-known casual visitors. Attention should also be paid to the apparent egg-dates, August on Cavilli Island and the Karimon-Java Islands and October on Billiton. Between them they frame a laying period different from the local dates for all the other terns known to be breeding in or near Malayan waters.

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1. Hoogerwerf gives one egg to a clutch: average dimensions (25 eggs) 44·30 × 30·94 mm., maxima 48·50 × 30 and 44·50 × 32·10. The birds from Karimon-Java were at first erroneously listed as examples of *Anoüs stolidus pileatus* (Chasen and Kloss, *Treubia*, 14, 1933: 167). Shortly before the recent war Dr. van Bemmel questioned the identification and sent the skins back to Chasen, who agreed that they were really *minutus worcesteri*. He intended publishing a correction, but was not able to do so. Attention is drawn to the presence of examples of *Anoüs minutus worcesteri* from Karimon-Java in the Bogor collection by Hoogerwerf (*Limosa*, 20, 1947: 197; and *Ardea*, 21, 1948: 103).

A Note on the Plates

The photographs on plate 2 have appeared previously in "Notes on the nesting of the Bridled Tern on the Malayan coast", *Malayan Nature Journal*, Vol. 4, pt. 1, (March, 1949), and are reproduced here from blocks kindly lent by the editor of that journal. All photographs are by the author.

Plate 1.

Upper, Pulau Lalang in the Sembilan group, off the coast of Perak (lat. 4° 1′ N., long. 100° 32′ E.), a densely wooded island rising from a rocky base which is exposed round its edge. This is typical of a number of the small islands lying off the Malayan coast. They offer few attractions to sea birds, though small groups of Blacknaped Terns may breed on the off-lying granite boulders.

Lower, part of the north-east side of Pulau Lima (Lat. 2° 13′ N., long. 104° 9′ E.) in the Johore-Pahang Archipelago. This is a good example of a group of islands differing from the one above principally in having part or all of the sides cliff-like, instead of running down to the water in rocky slopes. Like the former it apparently offers few attractions to the local sea birds, apart from the usual small colonies of Blacknaped Terns. An interesting feature lies in the broken cliff-faces which usually contain several small, deep, fissure caves which may house colonies of one of the Birds' Nests Swiftlets (*Collocalia* spp.). The cliff in this picture has one such cave with its entrance just above the water-level close to the middle of the photograph; it contained a colony of about 400 pairs of Robinson's Swiflet, *Collocalia lowi robinsoni* Stresemann, in July 1948 (Gibson-Hill, *Malayan Nat. Journ.*, 3, (4), 1948: 197).

Plate 2.

Typical nesting sites of the Bridled Tern, *Sterna a. anæthetus* Scopoli, off the east coast of Malaya.

Upper, Pulau Chibeh, lat. 2° 56′ N., long. 104° 6′ E., in the Tioman group; a steep-sided, wooded islet where the terns nest along the edge of the vegetation.

Middle, Tokong Chondong, lat. 2° 10′ N., long. 104° 11′ E.; a stack sparsely covered with coarse grass.

Lower, two of the smaller stacks of the Tokong Burong assembly, lat. 2° 47′ N., long. 103° 58′ E., about 11 miles west of Tioman; bare stacks virtually devoid of vegetation where the birds nest mostly on slightly sheltered ledges on the cliff faces.

Plate 3.

Upper, Pulau Mensirip, lat. 2° 33′ N., long 103° 57′ E.; a small, heavily wooded island in the chain between Pulau Sribuat and the Pulau Babi group.

Middle, Pulau Perak, lat. 5° 42′ N., long. 98° 56′ E., in the middle of the northern portion of the Malacca Strait.

Lower, granite outcrops off the north coast of Penang Island. Small, rocky islets of this formation are a favourite nesting place of the Blacknaped Tern, *Sterna s. sumatrana* Raffles, when situated slightly further from the shore.

Plate 4.

Upper, the south-east corner of Pulau Perak (lat. 5° 42′ N., long. 98° 56′ E.) in the Malacca Strait. This, a steep-sided, barren, waterless island, is unique among the Malayan islands. It is entirely devoid of vegetation and (as far as could be determined during the four-hour examination at the beginning of April, 1949) is occupied only by a large colony of *Sula leucogaster*. See also the middle picture on plate 3 above, and Gibson-Hill 1950*a*.

Lower, part of Pulau Jagat (lat. 2°39′ N., long. 104° 10′ E.), south of Tioman in the Johore-Pahang Archipelago. This island consists of an untidy stretch of large granite boulders, in the centre section of which a few trees and palms have established themselves and gathered round them a scant, well-drained soil. Tokong Burong in the Tenggol group is somewhat similar; so, though smaller, is Pulau Labas, north-west of Tioman, and Paku Kechil and Chipor in the Redang group. The first two of these islands have fairly large colonies of the Blacknaped Tern, together with about twice as many pairs of the Bridled Tern. The last two have only colonies of *sumatrana*. White Rock and Fairway Rock in the Sembilan group, off the west side of Malaya, are fairly similar, except that they lack the centre core of vegetation.

Maps

Map 1, p. 7.

Sketch map showing the distribution of the major groups of islands surrounding the area of the Malay Peninsula.

Map 2, p. 17.

The position of Pulau Perak and the Aroa group in the Malacca Strait.

Map 3, p. 31.

The Sembilan group, off the coast of Perak.

Map 4, p. 33.

A sketch map showing the distribution of the colonies of the Bridled Tern, *S. a. anæthetus* Scopoli, at present recorded in the waters of the Malay Peninsula. The figures in brackets after the names of the east coast colonies give the approximate number of breeding pairs present in July-August 1948.

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