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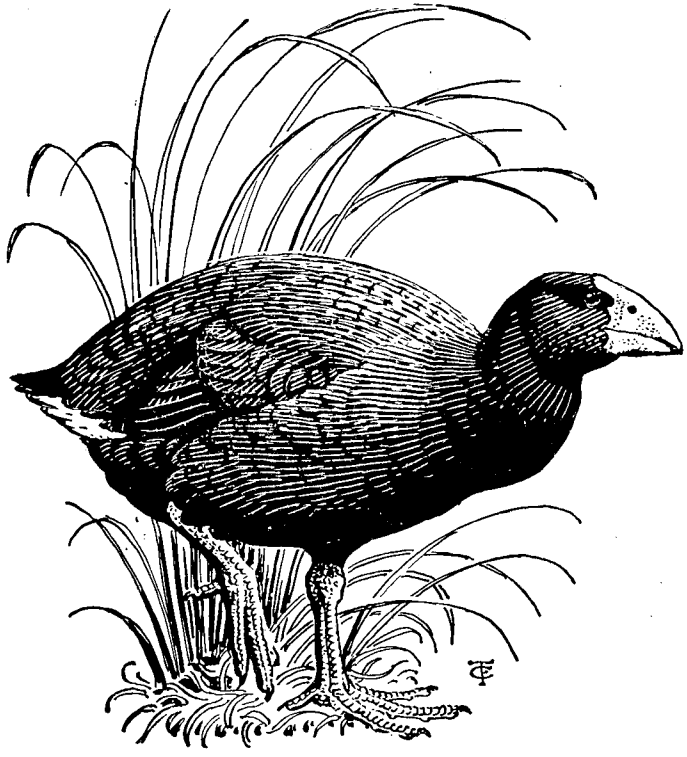
NOTORNIS



Bulletin of the Ornithological Society of New Zealand.
Published Quarterly.

NOTORNIS

In continuation of New Zealand Bird Notes.

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CONTENTS.

DONATIONS INVITED.—Donations are invited from members to the General and Illustrations funds. Although the Department of Scientific and Industrial Research generously paid for the cost of the blocks and art paper used in this issue, the total cost has considerably exceeded the quota and has entailed the holding over of several articles due for publication. The cost of various other services for members, e.g., the library, ringing, nest records and beach patrol schemes, is additional to the publication of Notornis. If sufficient donations are forthcoming it may be possible to issue an extra number of Notornis to reduce the accumulation of papers. Donations received during the year ended March 31, 1952, for which thanks are expressed to the donors, are: Anon., 1/6; A. R. Annabell, 10/-; W. R. Bull, 5/-; D. E. Crockett, 5/-; E. Dear, 5/-, 5/-; J. Edmond, 10/-; Miss S. E. Kearns, 5/-; W. F. I. Hunt, 5/-; A. A. Kirk, 10/-; E. H. Matwig, 5/-; J. L. Moore, 4/-; Miss B. McDougall, 10/-, 10/-; H. L. Secker, 10/-; R. B. Sibson, 45/-; E. St. Paul, 10/-; A. H. Watson, 5/-; D. G. Williams, 3/9; E. G. Turbott, 15/-; A. S. Wilkinson, 30/-; total, £10/9/3.

FAIRY TERN INQUIRY.—Members are reminded that an inquiry into the status of fairy tern (**Sterna nereis**) is being conducted for the society by Miss Noelle Macdonald, "Keppoch Lodge," Sale Street, Howick, and anyone who has any information about this bird is asked to send it as soon as possible to Miss Macdonald. Some questionnaires have already been returned, but others are very slow in coming in. More information is particularly wanted about the following areas: From Pakiri north on the East Coast; the Kaipara area; Stewart Island and the extreme south of the South Island. An interim report on this inquiry will be published in the next number of Notornis and members are requested to send in their information immediately. Questionnaires may be obtained from the above address.

OCCURRENCE OF WHITE-NECKED HERON IN N.Z.

By R. H. D. Stidolph, Masterton.

A strange bird appeared on a farm property near Methven, Canterbury, in mid-April, 1952, and Mr. John T. Oram, to whom full credit is due for bringing this bird to notice, sent a description, accompanied by a sketch, asking if the bird could be named. His description and sketch were ample enough to identify the bird as the white-necked heron (**Notophoyx pacifica**) an Australian bird not hitherto recorded in New Zealand.

As the occurrence of this species in this country is of especial interest, Mr. Oram's description is given: "At first sight I thought the bird to be a white-fronted heron, then a reef heron, but since I have seen it take off in flight twice now and show conspicuous white patches on the wings, I cannot identify it. . . The following is as good a description as I am able to give: Colour: The head, throat and neck are white. The back and wings seem to be a blue-grey colour and sparkle in bright sunlight but appear dull on a cloudy day. When the bird is standing with its neck tucked back it appears to have a white breast but this is due to the white throat-feathers. I am unable to ascertain the true colour of the underparts but they seem to be blue-grey. The legs seem to be yellowish-green or grey. The bill seems to be grey-green. There are two distinct white patches on the leading edge of each wing that only show when the bird spreads its wings for a take-off or in flight."

Mr. Oram added that the bird was still there on July 27, 1952, the date of writing the above particulars, and that it was sharing a small pond with five geese which did not seem to notice it. It had lost most of its wariness and it was possible to approach within 100 yards at times before it would take off and settle in one of the paddocks. The property is near Methven, at the foot of the hills, about 32 miles from the coast, and three or four miles from the foot of Mount Hutt.

I identified the bird as the white-necked heron and sent a copy of the above description with a copy of the sketch to Mr. K. A. Hindwood, of Sydney, asking for his confirmation or otherwise. Mr. Hindwood replied stating that the description, etc., of the heron agreed with the Pacific heron (white-necked) and that the white patches on the fore part of the wing were more or less diagnostic. "There is no other Australian species that could be confused with it; in size it is actually a good deal larger than the white-faced heron but the difference cannot be appreciated properly until both birds are close together," Mr. Hindwood stated.

After I had written to Mr. Oram informing him of the above confirmation of identification, he sent additional particulars. He states that there is a pure creamy white line extending down the bird's throat feathers, the chin and base of the lower beak having the same colouring. The head and neck are really a dirty white. This streak on the bird's throat shows up well in bright sunshine, when it can be very distinctive. Also, in bright sunlight, though the main colouring appears nearly royal blue, there seems to be a rich wine red sheen or sparkle overlying the blue. The underparts are pale blue or grey. The bird flies short distances with the neck outstretched but when in full flight the head is drawn back and the legs trailed out behind. The wings are large and beat slowly, though strongly."

An influx of large numbers of the white-necked heron into southern Victoria in the spring and summer of 1951 is recorded in the Emu, Vol. 52, page 218, by Ina Watson. This evidence of a considerable dispersal movement supports the appearance of the bird in New Zealand and as it is possible that others of its kind may have reached this country, all herons seen should be critically examined. I wish to thank Mr. Hindwood for his assistance.

CLASSIFIED NOTES.—Members are reminded that classified notes for the January issue require to be in the hands of the editor not later than October 14.

A CENSUS OF THE GANNET (**Sula serrator**) IN NEW ZEALAND.

By C. A. Fleming and K. A. Wodzicki, Wellington.

CONTENTS.

INTRODUCTION.

In 1943 and 1944 the results of an investigation of the breeding, distribution, history and population of the North Atlantic gannet (**Sula bassana** Lin.) were published by Fisher and Vevers (1943). These authors summarised reports of observers who had visited most of the North Atlantic gannetries in the 1939 breeding season. They assessed the breeding population as 165,600 (plus or minus 9,500) individuals, and discussed changes in the gannet population during the last century.

In December, 1945, one of us, with Dr. C. P. McMeekan, visited the well-known New Zealand gannetry of Cape Kidnappers (Wodzicki and McMeekan, 1947). Apparent changes in the population there aroused the desire to undertake a census of the gannet in New Zealand in an endeavour to ascertain past population trends and to provide a basis for discussion of future changes. The Ornithological Society of New Zealand, in 1946, adopted the gannet census as a project for co-operative study during the 1946-47 breeding season, and the writers were appointed organizers of the survey (Wodzicki and Fleming, 1946). In the summer of 1946-47, members of that Society visited 20 of the 32 known or suspected gannetries in New Zealand waters and another gannetry (Aldermen Is.) was visited by W. Gilliver, of the Marine Department. At the request of the Secretary, Department of Scientific and Industrial Research, the Royal New Zealand Air Force provided aerial photographs of 14 gannetries, taken in November, 1946, and January, 1947, to supplement observations made on land and by boat. The photographs covered four gannetries not otherwise accounted for. In all, 24 gannetries were covered during the 1946-47 season, either by actual visits or by aerial photographs. The Little Solander Island, in Foveaux Strait, the chief omission from the 1946-47 survey, was visited in December, 1947, and in June, 1948, by Dr. R. A. Falla (1948). Accounts of some of the census work have already been published. This paper is a compilation of the results of the census project and a summary of available data on the past history of the gannetries, and it includes discussion of problems for future investigation.

For a number of reasons we have not found it possible to attain the degree of accuracy claimed by Fisher and Vevers. Nevertheless, the data now available allow a more precise assessment of the New Zealand gannet population than has been possible hitherto, and will be a basis for comparison in years to come, when other more accurate counts are undertaken. We have been unable, for lack of historical data, to present a confident account of population changes since ornithological exploration in New Zealand began a hundred years ago. New Zealand ornithologists have left few specific statements on the numerical status of the gannetries they visited. Dated photographs are rare and mostly are difficult to interpret. Although the bird was a source of food to the Maori people before the coming of Europeans, the gannet in New Zealand has had little place in the economy of European inhabitants, so that any changes in its numbers have, in general, passed unnoted. We have seldom, therefore, been able to make categorical assertions about changes in the population at any one gannetry, and any general assessment of population trends in New Zealand is tentative.

DISTRIBUTION.

The Australasian gannet breeds in New Zealand and south-east Australia. It ranges to Western Australia (north to Point Cloates), to Brisbane, and, rarely, to Norfolk Island (Hindwood and Cunningham, 1950), and the Chatham Islands (Fleming, 1939). The breeding range is limited by the parallels of 34° and 47° S. latitude and by the meridians of 141° and 178° E. longitude; the flight range extends north to about 22° S. lat. on the west coast and 27° S. lat. on the east coast of Australia, but for no great distance south of the breeding colonies. No regular migration has yet been

demonstrated. S. Fowler (1947) has listed five known or suspected gannetries in Bass Strait and southern Tasmania and, with D. L. Serventy, has prepared an account of a census of the gannet in Australia which they kindly made available to us. The breeding population in Australian seas totals about 4,000 individuals, so that, contrary to an earlier published statement, the bulk of the population of the Australasian gannet breeds in New Zealand seas.

THE ANNUAL CYCLE IN NEW ZEALAND.

(a) Winter Habits and Occupation of Gannetries.

Gannets remain at sea in winter, and few birds visit gannetries at that season. At Oaia (Fleming & Sibson, 1947), Colville, and Horuhoru, however, adults roost on the gannetries in winter months. There is little positive evidence that gannets move to the north. Sladden (1926) notes passage of gannets northwards in the Bay of Plenty in May and June, and, incidentally, points out that the absence of gannets from White Island in June, 1886, was the result of their normal evacuation of the breeding places at that time of year, and not in any way connected with the Tarawera eruption (Buller, 1888). Birds in immature plumage are scarce in coastal waters during the months following their departure from the gannetries. The young Atlantic gannet is strongly migratory (Witherby, et al., 1943, p. 21). Thus some age groups are probably migratory.* Be that as it may, adult gannets are present in most coastal districts of at least the northern half of New Zealand in every month of the year. During the months after the young have left the colony, adults are known to roost on some gannetries perhaps during a protracted moult. This has been observed at Oaia (Fleming and Sibson, 1947, p. 62), at Colville (M. L. Johnson and P. Wood), and at Horuhoru (M. L. Johnson). Occupation of the gannetry is sporadic, and may be limited to nights, or to times of rough weather, in the months of May, June and July. Other gannetries are vacated in the autumn and re-occupied in the late winter.

(b) Laying.

Laying may begin as early as August, and about a third of the nests may contain eggs by August 27 (as in 1940, at Colville), but empty nests remain until October (up to 40 per cent. of total) and the only reports of "nearly all occupied" nests are later, November 25 (1940, Colville) and November 11 (1947, Horuhoru). On the latter date some eggs were fresh, and the oldest chicks were well clothed in short white down. When a colony has suffered high losses in eggs and chicks, as in 1946-47, there is a notable gap between surviving chicks and later-laid eggs. Thus, at Mahuki, on December 27, 1946, there were one surviving chick and 50 new-laid eggs, and at White Island, a few weeks later, about two half-grown chicks and 35 eggs (in various stages up to hatching) in every hundred nests. Such discontinuous distributions of eggs and chicks convinced Fairchild that the gannet had two broods a year, with layings in September and February (Buller, 1888, p. 181). Although it is unlikely that many eggs are laid as late as February when losses are low, fledglings at Bush Island as late as April 27, 1941 (P. Wood) must have hatched from eggs laid late in December in a successful season.

(c) Fledging.

This is not the place to discuss the growth and fledging of chicks, which seem, in general, to follow the pattern of **Sula bassana** Lin. A few points of difference may be noted. Lockley (1947, p. 193) and Perry (1948) have described how the young gannet leaves for the sea and drifts upon the surface, without flying, for some weeks before it begins to fish

* Four birds ringed at Cape Kidnappers as chicks on January 15 and February 24, 1951, were recovered in March and April of the same year, two on the east coast of Australia, 150 and 190 miles north of Sydney, one at Paekakariki, near Wellington, and one at Kereta, Thames coast, New Zealand. (Cunningham, 1951.)

for itself. This has not been observed among Australasian gannets. On February 26, 1948, R. A. Falla observed fledglings of the year flying and performing shallow dives close to Horuhoru, and on January 14, 1950, one of us (C.A.F.) with P. A. S. Stein saw a young gannet take its first flight from the same islet, head into the wind, and remain airborne until out of sight. August eggs could hatch by early October and the chicks depart by late December, allowing the known incubation and fledging periods for **S. bassana** (Witherby et al. 1943) but there are no records of December fledglings away from the gannetries. Young birds leave some gannetries from January until late April, but Rev. F. H. Robertson (oral comm. 1948) judging by three seasons' observations doubts if any young leave Cape Kidnappers before February.

(d) Progress towards Maturity.

Brown mottled young are freely observed in Hauraki Gulf in late February and March and dead birds on beaches have been reported as late as May 24 (Muriwai) and May 30 (Palliser Bay). Auckland Museum has a mottled juvenile skin from Orewa Beach, dated July 27, 1938. At sea, however, mottled juveniles are rarely seen in winter, giving support to the hypothesis that the Australasian gannet may be migratory in its first year, like its North Atlantic cousin. On November 4, 1948, R. A. Falla saw what he considered an immature gannet in very faded plumage at Wellington. No records of gannets in other than adult plumage are known from gannetries in spring, a condition that contrasts with the presence of immature birds in British gannetries. Buller (1888, pp. 177, 179-180) describes how he took a young bird, brought to him at the end of February, to the Zoological Society of London, where, by the end of October, "head, neck and underparts had assumed the plumage of the adult." The upper surface was "blackish brown, irregularly marked or variegated with white, all the new feathers being pure white, this transitional plumage having a very pretty effect." This first moult, which Buller noted had begun in mid-July, thus corresponds in season with the first moult of the North Atlantic gannet (from March to September) (Witherby et al. 1943, p. 23) and would be complete when the bird was about 15 months old, say late January. Although Buller did not definitely say so, he implied that the captive bird gained "the mature livery" by this moult, and his report of pure white dorsal feathering suggests a notable difference from **S. bassana** in which first-summer birds have dominantly dark upper surfaces. Buller follows his description of the captive bird's moult with the inconsistent observation (middle of p. 178) that "the first moult would seem to take place before the young birds leave the breeding ground, inasmuch as the spotted plumage is never met with at sea."

FIELD WORK IN CONNECTION WITH THE 1946-47 CENSUS.

On September 9, 1946, C. A. Fleming visited the Colville gannetries through the co-operation of Mr. W. Tidey, Fisheries Inspector, Coromandel, and was able to count the occupied nests at a time when the gannetries were crowded with birds, although few eggs had then been laid. (Fleming, 1947 b.) On September 20 he investigated the roost reported by P. C. Bull at "The Sisters", off the south-west coast of Great Mercury Island (Bull and Fleming, 1947) and on October 2 made a count of the gannets at Horuhoru, Waiheke (Fleming, 1947 a). Horuhoru was again visited, by J. M. Cunningham (1947, p. 111) on December 1, and by V. I. Clark and T. M. Roberts (1948, p. 152), on December 29 and February 21, 1947.

On December 27 W. M. Hamilton made an estimate of the population of Mahuki gannetry, Great Barrier, where it appeared that human interference had caused unusual losses among eggs and chicks (1947, p. 128).

During the expedition of the Department of Scientific and Industrial Research to White Island from January 8 to 14, 1947, K. A. Wodzicki and

F. H. Robertson undertook census and other investigations of two of the gannetries there, and W. M. Hamilton and C. A. Fleming were able to make a more hurried examination of the third (Robertson and Wodzicki, 1948).

With Major M. Johnson, Major G. A. Buddle made a short visit to the Three Kings Island from January 3 to 6, 1947. High nesting losses, weather conditions and the intermixture of gannets with gulls (**Larus novae-hollandiae**) hindered estimation of the gannet population, but these investigators were able to land on one of the Princes Islands and climb to the gannetry there; the old-time Maori probably achieved this, but there is no record of a similar landing during the historical period. Major Buddle also made the first detailed examination of the South-West King gannetry since T. F. Cheeseman landed there in 1889 (Cheeseman, 1891). At Cape Karikari, Buddle found gannets nesting on two small rocks where they had not previously been recorded (Buddle, 1947 b, 1948 a).

W. Gilliver, Fisheries Inspector, Marine Department, Tauranga, visited the Alderman Islands gannetry on December 30, 1946 and February 11, 1947. On November 21, 1946, a Royal New Zealand Air Force plane flew over and photographed Cape Kidnappers. The gannetries at Kawhia, Oaia Islet, the Three Kings, Poor Knights Islands, White Island and the Alderman Islands were also photographed by the Royal New Zealand Air Force on January 13 and 14, 1947, to supplement other observations. In February, 1947 P. C. Bull attempted to reach Gannet Island, Kawhia, but was prevented by bad weather.

In the 1947-48 season, a number of visits to gannetries have provided data which are incorporated in this report. F. H. Robertson visited Kidnappers on several occasions. G. A. Buddle and M. Johnson returned to the Three Kings in December 1947 making a further examination of the gannetries there, at Cape Karikari, and at the Poor Knights. M. Johnson independently reported on a new gannetry at Cathedral Rocks, Mokohinau. On December 9, 1947, and July 20, 1948, R. A. Falla was able to examine the small gannetry at the Little Solander, Foveaux Strait. Horuhoru was visited on February 24, 1948, by a party including R. A. Falla, R. C. Murphy and E. G. Turbott; the same party, with P. C. Bull, visited the Colville gannetries on February 26, 1948.

METHODS OF COUNTING AND ESTIMATING GANNET POPULATIONS.

Most of the direct methods of estimating the populations of gannetries discussed by Vevers and Fisher (1936) and Fisher and Vevers (1943) have been attempted in New Zealand. Where the behaviour of the birds permitted, the most satisfactory method was to walk through a gannetry either counting individual nests in small easily defined sections, or calculating the number by counting in the regularly arranged rows of nests. In gannetries where the birds were abnormally shy, several counts were made with binoculars from distant vantage points, and the results averaged. At certain inaccessible gannetries, estimates were based on sample counts of small areas.

From aerial photographs of gannetries, the numbers of birds were counted with the aid of a grid ruled on the prints. Birds on nesting areas were totalled separately from those scattered on adjacent roosting places. In some photographs, nests and even mated pairs can be distinguished; in others, taken in dull weather, it is difficult to distinguish birds from light patches of lichens and guano. The degree of accuracy with which the populations of the gannetries have been estimated differs. Large and inaccessible gannetries presented more difficulties than those in which almost every nest could be counted. This topic is discussed below (page 73).

TABLE I.

New Zealand Gannet Stations.

Station.	Position.	1946-47 Population (Pairs)	Group Totals	Status.
Three Kings Islands.				
1. South West Island	32° 12' S. 172° 06' E.	824		Long-established; breeding 1946-47.
2. Hinemoa Rock, Princes Islands		1,520		
3. Hole-in-the-Wall Rock, Princes Is.		490		
4. Tutanekai Rock, Princes Islands		300		
5. Arbutus Rock		1,000		
Total Three Kings Gannetries		—	4,134	
North Auckland.				
6. Matapia Islet	34° 38' S. 172° 49' E.	0		Of vague history.
7. Cape Karikari Stacks	34° 47' S. 173° 25' E.	30		Breeding, 1946-47 for first time.
8. Bird Rock, Bay of Islands	35° 11' S. 174° 17' E	0		Former gannetry, used as roost, 1946-47.
Total North Auckland Gannetries		—	30	
Poor Knights Islands.				
9. Gannet Stack	35° 36' S. 174° 49' E.	100		Long-established; breeding 1946-47.
10. Sugarloaf	35° 38' S. 174° 43' E.	1,410		Long-established; breeding 1946-47.
Total Poor Knights Gannetries		—	1,510	
Mokohinau Islands.				
11. Groper Rock	35° 54' S. 175° 03' E	0		Breeding 1945-6 for first time; no data, 1946-7.
12. Cathedral Rocks	35° 55' S. 175° 10' E.	0		Of doubtful status, 1946-47.
Great Barrier Island.				
13. Arid Island Stack	36° 09' S. 175° 30' E.	0		Roost of doubtful status.
14. Mahuki	36° 14' S. 175° 18' E.	325		Long-established; breeding 1946-47.
Total Great Barrier Gannetries		—	325	
Mercury Islands.				
15. The Sisters	36° 37' S. 175° 46' E.	0		Roost of doubtful status, 1946-47.

Colville (Coromandel Peninsula).				
16. Double Island	36° 40' S.	175° 24' E.	5	Established c. 1943; breeding 1946-47.
17. Bush Island	36° 41' S.	175° 24' E.	1,513	Long-established; breeding 1946-47.
18. Motutakapu	36° 41' S.	175° 23' E.	288	Long-established; breeding 1946-47.
Total Colville Gannetries			1,806	
Waiheke.				
19. Horuhoru	36° 43 S.	175° 10' E.	1,228	1,228 Long-established; breeding 1946-47.
Muriwai.				
20. Oaia	36° 50' S.	174° 25' E.	338	338 Long-established; breeding 1946-47.
Aldermen Islands.				
21. Sugarloaf	36° 55' S.	176° 05' E.	0	Former gannetry extinct, 1946-47.
White Island.				
22. West Point	37° 3' S.	177° 10' E.	1,254	Long-established; breeding 1946-47.
23. Rocky Point	37° 32' S.	177° 11' E.	1,408	Long-established; breeding 1946-47.
24. Gannet Point	37° 32' S.	177° 12' E.	2,565	Breeding 1946-47.
25. Dam Site	37° 32' S.	177° 12' E.	0	Extinct 1946-47.
26. Club Rocks	37° 33' S.	177° 11' E.	0	Extinct 1946-47.
Total White Island Gannetries			5,227	
Kawhia.				
27. Gannet Island	37° 57' S.	174° 35' E.	3,715	3,715 Long-established; breeding 1946-47.
Hawke's Bay.				
28. Black Reef	39° 38 S.	177° 07' E.	263	Established c. 1938; breeding 1946-47.
29. Cape Kidnappers	39° 38' S.	177° 08' E.	2,337	Long-established; breeding 1946-47.
30. Kidnappers Plateau	39° 38' S.	177° 08' E.	160	Established c. 1940; breeding 1946-47.
Total Hawke's Bay Gannetries			2,760	
Otago.				
31. Nuggets	46° 27' S.	169° 51' E.	40	40 Established before 1923; breeding 1946-47.
Foveaux Strait.				
32. Little Solander	46° 36' S.	166° 57' E.	20	20 Long-established; breeding 1946-47.
Grand Total				21,033 breeding pairs.

HISTORICAL SUMMARY.

Captain James Cook reported gannets near the Three Kings in December 1769, and later during the same voyage named Gannet Island (off Kawhia). Later explorers (D'Urville and his colleagues, Wilkes) made passing reference to gannets in coastal waters but described no nesting places. Dieffenbach (1843) recorded that the islet Matapia, off the Ninety Mile Beach was white with nesting birds. Gray (1845) described New Zealand gannets in his report on the birds of the "Erebus and Terror" expedition. Hutton (1868) first recorded a gannetry at Mahuki, Great Barrier. In the *History of the Birds of New Zealand* (1870) Buller recorded White Island and Gannet Island, Kawhia, as gannetries. In the second edition (1888) "small islands in the Hauraki Gulf, near Coromandel and near to the Great Barrier" were added. Cheeseman described the Three Kings gannetries in 1890 and in his "Supplement to the Birds of New Zealand" (1905) Buller described a visit to the Cape Kidnappers gannetry. A small gannetry at Alderman Islands (now abandoned) was reported by Sladden and Falla in 1928. In addition to those named above, Oliver (1930) listed Oaia, Poor Knights, Bird Rock (Bay of Islands) and Solander Islands, as known or reported gannetries. Since 1930, small gannetries, including some of uncertain status, have been reported at Karaka Point, Groper Rock and Cathedral Rocks, Mokohinau, Mercury Islands, and the Nuggets.

NEW ZEALAND GANNETRIES.

Table I. is a list of New Zealand gannet stations, past and present, in geographic order, from north to south, shown on the map, Fig. 1.

THREE KINGS ISLANDS.

The Three Kings Islands, some 33 miles W.N.W. of Cape Maria van Diemen, were not investigated by a naturalist until T. F. Cheeseman made short visits from the N.Z. Government steamers "Stella" and "Hinemoa" in 1887 and 1889. The reader is referred to Cheeseman's published papers (1888, 1891) and to articles in the Records of the Auckland Institute and Museum (vol. 3, nos. 4 and 5, 1948).

On the accompanying sketch map (Fig. 2) the names of individual Princes Islands are those proposed by Powell and Turbott (Rec. Auckland Inst. Mus., 3 (4, 5) p. 190).

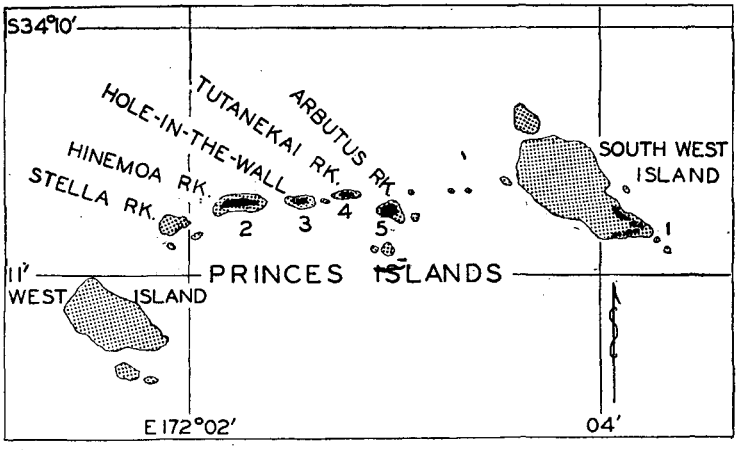


Figure 2.—Sketch-map of part of the Three Kings Islands (based on Rec. Auck. Inst. Mus. 3 (4-5): 190), showing distribution of gannetries. Numbers correspond with those of Table I.

Prior to Buddle's visit in January 1947, no one had described the precise distribution of gannetries at the Three Kings. Cheeseman (1888, p. 145) quotes early voyagers after Cook as stating "that the Maoris were in the habit of crossing from the mainland at long intervals to obtain young muttonbirds or gannets." Later (1891, p. 410) writing of the Princes, he noted that "some of the larger ones are occupied as breeding-places by gannets and other sea-birds, which find on them a home secure at any rate from man's invasion." At the South-West King, on the ridge above the landing place at the south-eastern point, Cheeseman (1891, p. 411) found that "the lower part was open and bare of vegetation, and was occupied by vast numbers of gannets and mackerel gulls as a breeding place; thousands of birds sitting on the rocks as closely as they could be packed. The gulls had their quarters on the portion nearest the beach. . ." "The gannet-rookery was of a much larger extent, and from the multitude of the birds, and their white plumage, presented. . . . a striking and attractive sight."

The "Will Watch" Expedition of the Auckland Museum to the Three Kings, in February 1934, was prevented by weather conditions from landing on South-West Island. From the vessel, adult gannets and fledglings were seen on South-West Island, at the point where Cheeseman described them, and on several of the Princes, notably Hole-in-the-Wall, the north side of which was passed at close range. The other Princes gannetries are now known to be on the southern slopes which were not seen so closely. On this occasion, Dr. R. A. Falla made an estimate of 2000 pairs as the approximate population of gannets at the Three Kings Islands (Wodzicki and McMeekan, 1947, p. 431).

No studies of the gannetries were made by the H.M.S. Arbutus Expedition (1945) and the Department of Internal Affairs Expedition (1946). Buddle examined the several Three Kings gannetries separately, for the first time, in January, 1947.

(1) South West Island.

At the South West Island on January 3, 1947, Buddle (1947 c., p. 129) found that the "lower parts" (of the slope from the southern end) "are covered by a large colony of red-billed gulls; the slope is bounded on the east by a cliff along the edge of which the gannet colony is situated." It comprised "a bare strip of sloping rock, 5 to 20 yards in width," backed by scrub, and "split into four sections by intrusions of the scrub to the cliff edge," the sections containing "a total of 180 nests or eggs." Considering the evidence for destroyed or deserted nests and the number of circling birds, Buddle thought "there should have been a much greater number of occupied nests." "Some distance round the cliffs to the west" were two small colonies of about 20 nests each. "This makes a total of 220 nests" for the South West King, but Buddle would "put the gannet population of the island at a minimum of 750 birds, considering the number wheeling and circling in the area." He also noted that the gannets were encroaching on the scrub, some of the nests being "at least 15 feet in from the edge of the cover." After his visit on January 1, 1948, Buddle considered his previous estimates very conservative, and increased his previous figure of 3750 birds (for the whole group) to 5500. Applying this revised figure, proportionately, to the individual gannetries, we get an approximation of 1100 birds for South West Island. It should be noted that both Buddle (1948 a, p. 41, 42) and Johnson (letter to C.A.F.) concluded that the gannetries had increased in area and population in 1948, but differences in nesting success may account for this apparent increase. It seems clear that at the time of Buddle's visit, large numbers of nests were no longer recognizable once the attendant birds had flown.

Three aerial photographs of the South West King gannetries were taken 10 days after Buddle's landing; they show at least 12 areas of nesting gannets in bays in the scrub edge, or completely surrounded by bush in

such a way that some of them might be easily missed on the ground. On Fig. 3 all the areas are indicated, but those on the far western cliff and on the slope above the landing are better counted on other photographs.

The mean counts of birds are:—

(a) 14; (b) 15; (c) 642; (d) 13; (e) 115; (f) 10; (g) 36; (h) 15; (i) 5; (j) 21; (k) 42; (l) 34; (m) 20; (n) 48.

Total, 1030 birds.

Allowing for the presence of 20 per cent. more birds than nests, the approximate population is put at 824 pairs.

(2) Hinemoa Rock, Princes Islands.

The westernmost of the Princes, visible as a conical rock above Hinemoa Rock in Buddle's photograph of the chain (1947 c, Pl. 2) is not a gannetry. On Hinemoa Rock, the next island in the chain (Figs. 4, 6) Buddle estimated that there were about 1,000 gannets on January 5, 1947, a figure we interpret as meaning approximately 1000 pairs. Buddle considered that his estimates were likely to be too high owing to admixture of gannets with red-billed gulls, but since the estimate was made in January, after a season that had entailed high losses in eggs and chicks, we do not feel that his caution was justified. His revised estimate, a year later, divided proportionately among the separate gannetries, would allow a population of about 1500 birds at Hinemoa.

Oblique aerial photographs of Hinemoa were taken on January 13, 1947. The rock is roughly cigar-shaped in plan and falls steeply on all sides from a broken summit ridge, perhaps 150ft. high. The crest is broken into an east and a west portion by a saddle, and the seaward slope, south of the saddle, is less abrupt than elsewhere. Gannetries are established on the eastern and western crests, and extensively on the central saddle and its south slope. On the photograph showing most detail (Fig. 6) some 25 birds are visible in the air above the rock, and examination with a hand lens shows conclusively that all but one of them are gannets; the other is a red-billed gull, distinguished by its small size, greyness (compared with the glaring white of the gannets) and shape. On the rock, concentrated nests of gannets are easily recognizable as such from the regularity of their arrangement, size, whiteness, and, in some cases, attitude of the attendant birds. Locally (on the lower and steeper parts of the saddle, for instance) small, grey objects are probably gulls, and contrast with scattered gannets, but there are places where the two species may not have been successfully separated. Counts from the photograph range from 1899 to 2019 birds. Because of the possibility of confusion with gulls, we accept the minimum figure. Allowing for the presence of 20 per cent. more birds than nests, we infer a population of about 1520 pairs.

(3) Hole-in-the-Wall, Princes Islands.

Buddle's (1947 c, p. 130) account of the only recorded landing on the Princes may be summarized. "There is a little stunted Karamu [taupata, **Coprosma repens** (Rich)] and grass, flax and tussock but otherwise bare rock. Red-billed gull colonies are on the lower north-west slopes and also all over the south-east slopes, while the gannets occupy the bulk of the top plateau." "By count of the accessible area and an estimate of the small hidden area we made 250 nests, eggs and young (3 p.m., 5/1/47)." Buddle comments on the small number of live young seen, and the absence of recognizable nests, so that this total cannot include birds that had not succeeded with nesting by that date. He assessed the population at 500 birds, which we take to indicate a breeding population of about 500 pairs.

Aerial photographs of Hole-in-the-Wall were taken eight days after Buddle's visit. In contrast with conditions at Hinemoa, less than 8 per cent. of birds flying over the rock, in one photograph, are gannets (Fig. 7): the rest are clearly red-billed gulls. On the rock, nesting gannets are con-

centrated on a narrow summit plateau, which, unlike that of Hinemoa, has a northward slope and a steep fall to the south, but there are other gannets (perhaps chiefly unemployed birds) perching on the two notable ledges developed on west-dipping stratification planes halfway up the rock on its north-east side, above an excreta-covered slope which is apparently the gull colony mentioned by Buddle. Nesting gulls can, in fact, be discerned with a hand lens on this slope and elsewhere, and their grey colour and small size result in a lack of definition which strengthens our confidence in distinguishing the larger, whiter gannets. From grid counts on the photograph (Fig. 7) the total number of gannets on the summit ridge is estimated at 608 individuals. Over much of the area, the photograph is clear enough to distinguish mates also present at the nests. A sample count of part of this area showed that, of 282 occupied nest sites, 56, or 19.8 per cent., are occupied by two birds, and proportionate correction of the total gives a figure of 488 breeding pairs. Five other counts, restricted to occupied nests, gave totals ranging from 486 to 495 nests (mean 490). On the ledges below the summit ridge, about 40 gannets can be counted, taken as roosting birds. The total nesting population of Hole-in-the-Wall is thus assessed at 490 pairs.

(4) Tutanekai Rock, Princes Island.

Tutanekai is much smaller than Hinemoa and Hole-in-the-Wall, and is pyramidal in shape, with steep sides, and a narrow sloping summit ridge, to which, judged by aerial photographs, the nesting gannets are confined. As at Hole-in-the-Wall, the lower slopes are occupied by red-billed gulls. Buddle, from a boat, estimated the gannet population as 500 birds on January 1, 1947. The best aerial photograph of Tutanekai is reproduced as Fig. 8: it is unsatisfactory for counting, owing to the viewpoint and to the lack of definition in the nesting area. The population has been estimated on the inference that every white spot larger than a gull is a gannet. A maximum of about 300 nests may be present, but this figure must be taken as a rough approximation. It certainly seems unlikely, from the size of the nesting area and the nature of the terrain, that Tutanekai supports a population as large as that of Hole-in-the-Wall.

(5) Arbutus Rock, Princes Islands.

Arbutus is the nearer rock indicated in Buddle's (1947 c) photograph as supporting about 1000 gannets. Buddle's 1948 revised estimate, distributed proportionately among the several gannetries, would put the figure for Arbutus at about 1,500 birds.

Arbutus rises steeply from the north, and slopes gently to the south. The lower southern slopes are occupied by red-billed gulls, and the upper two-thirds by nesting gannets, on bare areas among irregular clumps of **Coprosma.** There is doubtless a fair amount of intermingling of the two species, but on the single available aerial photograph (Fig. 9) gannets and gulls can be differentiated, at least in the central part of the colony; higher up the slope definition is poor, and gannets have been estimated by counting the diffuse white spots in the bare patches between the vegetation. Possibly the photograph misses part of the gannetry, but comparison with Buddle's general photograph (1947 c, Pl. 2) shows that most of Arbutus is covered by the air photograph. The totals counted ranged widely, owing to the lack of definition in the photograph. In view of Buddle's estimate, we consider that the maximum counts, of about 1250 birds, are closer to the actual number than lower figures, and allow a figure of 1000 pairs.

Summary.

The Three Kings gannetries were known as sources of food to the Maoris. Gannets were noted near the group in 1769 (Cook); 1887, breeding reported; 1889, breeding ("vast numbers," "thousands of birds"); 1934 (estimated 2,000 pairs); 1947, (estimated about 3,750 birds); 1949, (estimated 5,500 birds).

Counts from aerial photographs: 1947, South West King, 824 pairs; Hinemoa, 1.520 pairs; Hole-in-the-Wall, 490; Tutanekai, 300; Arbutus, about 1,000 pairs; total, 4,134 pairs. This total is far greater than previous estimates made from boats, but these all suffered from the observers' lack of opportunity to examine the islands closely.

NORTH AUCKLAND.

In February, 1932, R. A. Falla and A. H. Watt photographed a gannet asleep ashore on a cliff top, partly bare of vegetation, at Whareano, North Auckland. There is no indication that this locality is a regular roost.

(6) Matapia Islet, Ninety Mile Beach.

Dieffenbach (1843, p. 206) mentioned "a small rocky island, lying about twelve miles from Cape Maria van Diemen, and three miles off shore, and called Matapia. It is covered with countless numbers of seabirds." Matapia is well known to travellers up the Ninety Mile Beach, but no one has ever noted that it was covered with seabirds in recent years: if it were so in 1840 when Dieffenbach saw the islet, it is probable that the birds were gannets, since no other colonial seabirds (terns, gulls) form colonies which are conspicuous from such a distance. A. H. Watt, of Paua, Parengarenga, has been interested in Matapia for many years, and at our request interviewed (1947) a Maori who claims to have been ashore on this relatively inaccessible island many years ago. The Maori stated that there were no gannets nesting there at the time.

Summary.—Doubtfully breeding 1840; no modern evidence of breeding.

(7) Cape Karikari Stacks.

G. A. Buddle reported (1947 b, p. 128): "A new gannetry has been discovered off Karaka Point," (i.e., Cape Karikari) "south of Houhora and north of Doubtless Bay, North Auckland. Gannets were nesting on two small rocks about a mile off Karaka Point in January 1947; according to local fishermen this is the first season they have actually nested there. Landing was not possible owing to a heavy swell but I counted about 30 birds sitting." Later (1948 a, p. 41) he stated that the Karikari colonies were evidently not satisfactory, as they were not in use in December, 1947. A. B. Deeming (letter to C.A.F., April 5, 1948) saw "one solitary bird" on a rock off Cape Karikari in early February, 1948.

Summary.—First breeding 1946-47, c. 30 pairs; not breeding 1947-48.

(8) Bird Rock, Bay of Islands.

Oliver (1930) listed Bird Rock, Bay of Islands, as a breeding place of the gannet. On February 19, 1934, the "Will Watch" Expedition of the Auckland War Memorial Museum, passed close by Bird Rock at dusk and gannets were seen roosting upon it by one of us (C.A.F.). R. A. Falla omitted Bird Rock from the list of New Zealand breeding colonies quoted by Wodzicki and McMeekan (1947, p. 431) since the evidence available suggested that the rock was used solely as a roost.

In response to our enquiry, A. B. Deeming, Opua, Bay of Islands, wrote (November 11, 1946): "Gannets used to nest regularly at Bird Rock, but I have not seen any nests there for many years, though it is possible they may have nests there between my visits, and also, mostly, I have been in that locality during the latter part of the summer. Lately it has been my opinion that they use Bird Rock solely as a roosting ground. It may be that they find rather too much activity there during the deep sea fishing season."

In a further letter (April 5, 1948) Mr. Deeming writes that he could only quote from hearsay that they used to nest at Bird Rock in the past but that Captain Farquar of the steamer "Clansman" (from 1907 to 1914) once stopped close to the Rock, lowered a boat, and collected gannets' eggs.

A relation of Mr. Deeming had two gannet's eggs reputedly from Bird Rock. In about 1933, at Easter time, Mr. Deeming passed the rock at evening and noticed a young gannet, with several adults, ashore there. This is circumstantial evidence of breeding, since young gannets in their first few months of independent life are not known to return to the land to roost after they have left the nest.

Summary.—Breeding, perhaps sporadically, in early twentieth century; last record of probable breeding is about 1933; roosting, but not breeding, thereafter.

POOR KNIGHTS ISLANDS.

(9) Gannet Stack.

A few miles south of the Poor Knights Islands is a group of three rocks to which the name Poor Knights Rocks is customarily applied (Fig. 10). Two of the rocks are small rugged islets of columnar volcanic structure, supporting a little scanty vegetation; the third, nearer to the Poor Knights, is a vertical-walled pinnacle of similar columnar structure, with a more or less flat summit, separated into two portions by an irregular wall of projecting columns. To this pinnacle, which is occupied by a gannetry and which has apparently never been named, we apply the name of Gannet Stack.

Gannet Stack, which Buddle (1948 a, p. 40) states is 25 yards in diameter and about 75ft. high, rises steeply from deep water, and there is no prospect of landing, much less of scaling the vertical walls. From the sea, the nesting gannets on the flattish top can be seen but not clearly enough for counting. The population is obviously not large, and has usually been grouped with the larger Sugarloaf gannetry in estimates. A photograph by R. A. Falla in 1932 shows that the rock was occupied at that date. On the afternoon of February 24, 1934, the "Will Watch" passed Gannet Stack close enough for the gannets on its summit to be seen; they were thought to total considerably less than 200 birds (C.A.F.). On January 11, 1948, G. A. Buddle and M. Johnson examined the stack; Buddle (1948 a) reported that the flat top was closely packed with nesting gannets, which he estimated to total about 150 birds.

On January 14, 1947, a number of aerial photographs of the Poor Knights Rocks were taken from different directions, but only one of these (Fig. 11) shows Gannet Stack clearly enough to allow a count to be made; 43 gannets can be counted on the flat top in the front of the picture, and 14 on the pinnacles behind. The total of 57 birds visible includes at least three pairs and we adopt a figure of 50 nests. However, it is clear from photographs that there is a further flat area beyond the central high points, and since Buddle writes of the top being "closely packed with nesting birds" (a description that does not apply to the part photographed from the air), the total nesting population must exceed 50 nests. In default of more precise data we assume that the hidden area supports as many nests as are visible on the aerial photograph and arrive at a provisional figure of 100 nests.

Summary.—No nineteenth century reports, but probably long established; breeding regularly, 1932 to 1948; 1946-47 estimated (partly counted), about 100 nests; 1947-48, estimated 150 birds.

(10) Sugarloaf.

The Sugarloaf lies about a mile to the south of the Poor Knights Rocks (Fig. 10). It is an irregular conical mass some 100 yards in diameter and 150 feet high, composed of almost vertical columns rising from deep water, the tops of individual columns providing innumerable ledges occupied by nesting gannets (Figs. 12 and 13). It is possible to land at the broken west end of the rock in calm weather, and to climb for some distance, though it is doubtful if more than a small part of the rock could be scaled.

Gannets have nested on the Sugarloaf for over 56 years according to M. Johnson (letter, April 1948) and have been noted by every observer who has passed the rock in the breeding season. The irregular surface, and the diffuse scatter of gannets on all sides of its summit, have hindered assessment of its population, and most ornithologists who have examined the rock have been chary of estimating the number of nesting birds.

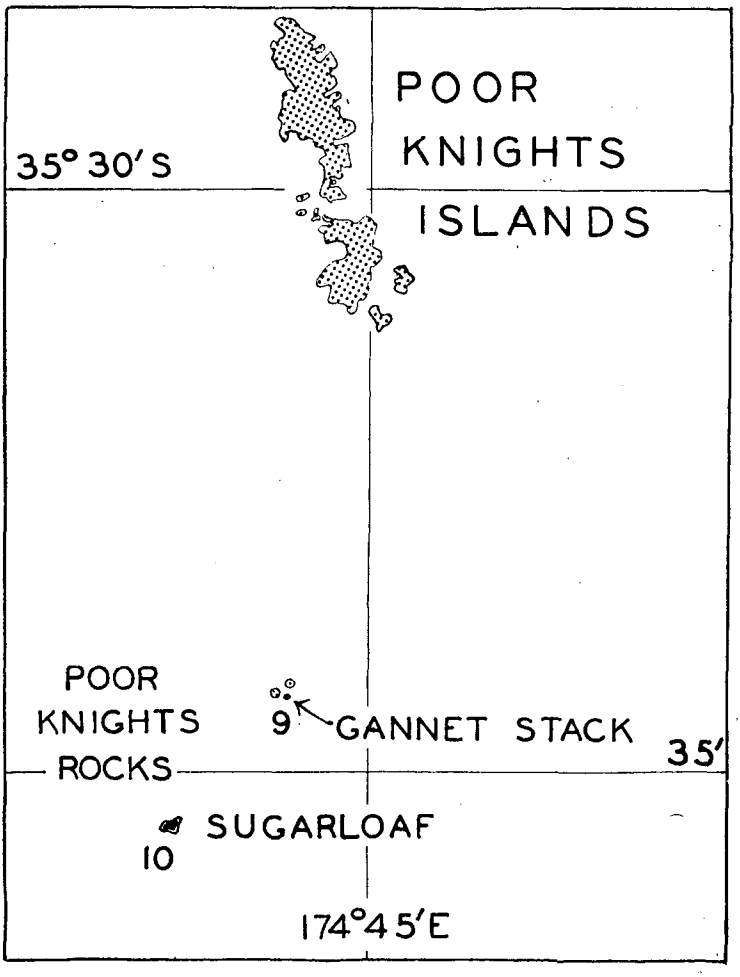


Figure 10.—Sketch-map of Poor Knights Islands to show position of gannetries.

In 1932, R. A. Falla estimated the population of the Poor Knights gannetries (presumably both Gannet Stack and the Sugarloaf) as about 200 pairs (Wodzicki and McMeekan, 1947, p. 431). Photographs of the rock taken on February 24, 1934, and the opinion of observers who saw the rock from the "Will Watch" at the time, suggest that there may have been some increase in the population since then, but it is unlikely to have been on such

a scale as comparison of Falla's 1932 estimate with Buddle's 1948 figure (both made from boats) would indicate. Comparison of a photograph of the north face taken by Buddle on January 11, 1948, with similar photographs by A. N. Breckon and G. T. S. Baylis on February 24, 1934, shows an apparent increase of white patches on the summit and on some of the ledges. On the other hand, M. L. Johnson who has known the colony since 1892, when he lived on the mainland opposite, considers that gannets were then as numerous as they are now (letter to C.A.F., April 12, 1948).

G. A. Buddle, with M. L. Johnson, examined the rock closely on January 11, 1948, and estimated the number of gannets as 1,200 to 1,500 birds, but, as the top of the island was not visible, this was considered only a rough guess (Buddle, 1948 a, p. 41).

Six oblique aerial photographs of the Sugarloaf were taken in poor visibility on January 14, 1947. Fortunately, all sides of the island were photographed, and by careful comparison it is possible to follow round from one face to the next without duplicating the count of gannets present on the ledges. Nesting birds cannot be distinguished from idle birds, so that the total number of gannets counted probably exceeds the number of nests. The surface of the island was divided into four parts for counting:

(a) Western ridge: 44 to 62 birds, the mean of 7 counts being 54.
(b) South face: Totals for this area range from 430 to 480, the mean of 5 counts being 452.
(c) East face, clearly visible on one photograph only: 432 to 572 gannets (3 counts) mean 503.
(d) North face, visible on one photograph only: 329 to 515 birds (5 counts) mean 401.

Judged from the photographs, the total number of gannets on the rock is 1,237 to 1,629, the mean being 1,410, a figure which may be compared with Buddle's estimate of 1,200 to 1,500 birds in the following season. In default of better data, the figure of 1,410 nests is accepted for census purposes but the margin of error is large.

Summary.—Breeding 1892, probably before, and continuously since; 1946/7 count (from aerial photograph) 1,410 pairs; 1948 estimate from yacht, 1,200–1,500 birds.

MOKOHINAU ISLANDS.

(11) Groper Rock.

The establishment of a small gannetry on Groper Rock, the northernmost of the Mokohinau Archipelago, was first reported to G. A. Buddle and C. A. Fleming by an officer of the Public Works Department, Auckland, on December 1, 1946, and Buddle (1947 a, p. 70) published a reference to the report. There is no indication that gannets had been ashore on the islet prior to the 1945/46 nesting season when they were first noted. R. A. Falla and other observers had examined the island on several occasions between 1920 and 1936 without recording nesting gannets. During the war, Burgess Island, three miles to the south-east, was occupied by servicemen and one of us (C.A.F.) visited the group in October 1944. At that time there was no suspicion that Groper Rock might be a gannetry. Mr. W. Wood had reported that the birds were on the north-west side of the island in 1945/46 but we have no details of their number nor any indication that they were nesting. Groper Rock was not visited during the 1946/47 census programme.

Summary.—Not present before 1945; 1945/46 present, probably breeding; 1946/47, no information.

(12) Cathedral Rocks.

Two prominent, bare rocks, a mile north-east of Fanal Island, Mokohinau, are not named on the Admiralty charts, but were christened

Cathedral Rocks by the wartime inhabitants of Burgess Island. They were examined with binoculars in October 1944 (C.A.F.), but though the summits were somewhat whitened, no birds were seen ashore. On February 25, 1948, M. L. Johnson sailed close, and counted 16 adult-plumaged gannets, representing, we consider, about 12 pairs. He could see no young, but considered that the birds were nesting.

Summary.—Not present 1944; 1947-48, c. 12 pairs attempted breeding.

GREAT BARRIER ISLAND.

(13) Stack off Arid Island.

G. A. Buddle observed a few gannets ashore on a prominent stack off the south end of Arid Island in November 1944, and wrote (letter to C.A.F. April 4, 1948): "We observed with glasses from Arid Island and I should say there were 30-40 birds ashore. On a previous occasion, in 1937, while fishing alongside the stack, my recollection is that the number of birds was about the same." A photograph of the stack by A. N. Breckon, taken "approximately 1920" (Fig. 14) shows that it was then occupied, as a roost or nesting place, by red-billed and black-backed gulls, and that no gannets were then present. We have no later reports from this stack, which is apparently a roost for a small number of gannets.

Summary.—Not present about 1920; 1937 and 1944, roosting; no evidence of breeding.

(14) Mahuki.

Mahuki, locally known as Gannet Island, is the most south-westerly of the Broken or Pig Islands, a group situated off the south-west coast of Great Barrier Island, south of the southern entrance to Port Fitzroy. Mahuki has an area of about 180 acres, and rises to about 140ft. above sea level; most of the island is in grass and supports a small flock of sheep and a few cattle. The narrow north-west promontory is occupied by the gannetry (Fig 15).

An island off the Great Barrier, undoubtedly Mahuki, is mentioned as a breeding place of gannets in most of the earlier summaries of the distribution of the species. Hutton (1868, p. 105) recorded that "Mahuke Island" was a gannetry. An islet off the Great Barrier was one of four or five breeding places of gannets known to Captain Fairchild (Buller, 1888, p. 181). It was certainly in use in 1906 (G. A. Buddle, pers. comm.), and so far as is known, occupation of Mahuki has been continuous for at least 80 years and probably much longer.

No early estimates of the population are available. R. A. Falla estimated the population at 600 pairs in 1928 (Wodzicki and McMeekan, 1947). C. A. Fleming visited Mahuki in January 1934 and found that the gannets had reared a considerable number of chicks to the half-feathered condition. No count was made at the time, but photographs suggest that there were more pairs present than the 300 estimated in 1946 (see below). In one photograph covering only a portion of the colony, 97 chicks and 30 adults can be counted on the ground, i.e., 76 per cent. of birds on the ground are young. Another photograph shows about 200 birds too indistinctly to separate adults from fledglings, but if 76 per cent. are young (as in the other) there are about 150 of them in an incomplete view of the colony. Since the nesting success of 40 per cent. to the fledgling stage seems higher than is usually attained, the population is likely to have been greater than 375 pairs. Fleming considers that there were about 400 pairs nesting at Mahuki in 1934. Some time since 1934 a low wall was built around the south-east margins of the gannetry to conserve "guano." W. M. Hamilton on January 15, 1935, estimated that there were 300-400 birds "in all stages from eggs and newly hatched nestlings to birds nearly able to fly. Most of the adult birds flew away on our approach and landed on

the water not far away. Those with eggs or very young nestlings remained" (excerpt from diary). In 1935, G. A. Buddle (pers. comm. from diary) made observations which suggest that the number of gannets at Mahuki exceeded 350 pairs. M. L. Johnson (letter, April 12, 1948) considers that the population of Mahuki gannetry is a lot smaller now than 25 years ago, perhaps owing to frequent visitors and the earth wall which, he thinks, interferes with the gannets' "take-off."

W. M. Hamilton and others visited Mahuki to make a census on December 27, 1946 (Hamilton, 1947, p. 128). The birds were extremely wary; only one chick and 50 fresh eggs were seen, and Hamilton concluded that the colony had been raided a week or so previously. The adult birds which took wing were estimated at 600-700, and the population at 300-350 breeding pairs. An estimate of 600-700 birds actually present at a colony would usually indicate more than 350 pairs, since many nests are attended by one bird only. On the other hand, the percentage of mates present may have been raised by the interruption of the normal cycle through loss of chicks and eggs. A Port Fitzroy resident, quoted by Hamilton (loc. cit.) estimated the normal population at 300 pairs. The three estimates quoted (1928, 1934 and 1946) suggest that the Mahuki population may have decreased during the past 20 years, a hypothesis that could be tested by a count in the spring, in a more normal nesting season than that of 1946-47.

Summary.—Long established, breeding before 1867, and continuously since; 1928, estimate 600 pairs; 1934, 400 pairs; 1946-47, 300-350 pairs.

MERCURY ISLANDS.

(15) The Sisters.

"The Sisters" is the name applied by Mercury Bay fishermen to two small stacks off Huruhi Bay on the south-west coast of Great Mercury Island. On the outer of the two, marked on Admiralty Chart No. 2543 by a dotted circle near a 17-fathom sounding, Lieut. J. Holt, then commanding officer of H.M.N.Z.S. Humphrey, told P. C. Bull that he had seen gannets nesting in pre-war years (Bull and Fleming, 1947, p. 63) and this was confirmed by a local resident. P. C. Bull examined the stack on August 10, 1942, and noted guano, but no birds present; on October 2, 1942, a single bird was resting on the stack, but none had been seen at intervening dates. C. A. Fleming received independent reports that gannets were sometimes ashore on one of the Sisters, and on October 20, 1946, he examined the stacks closely by launch, noting droppings and smell of gannets, but no nests or birds. In 1942 and 1946, therefore, the rock was used at intervals as a roost only. B. Sladden has told us that he did not notice gannets ashore on this rock, during regular cruising in the "nineteen-twenties" and later, so that its occasional occupation is apparently a recent phenomenon. W. Gilliver found no gannetry near Huruhi Bay in early 1948 (letter April 11, 1948).

Summary.—Not occupied in "nineteen-twenties"; 1935-38 (?), unconfirmed report of breeding; 1942, one bird roosting; 1946, not breeding, but evidence of roosting; 1947-48, not breeding.

COLVILLE (COROMANDEL PENINSULA).

Gannetries are situated on three of the islands named Motukawao Group on Admiralty Chart No. 2543, 2 to 3 miles off the west side of Coromandel Peninsula, south-west of Colville (Fig. 16). We treat the three islands separately; straits between them are over a mile and about half a mile wide.

(16) Double Island.

Double Island, one of the largest of the Motukawao group, has a promontory to the north-west. Off this north-west point a semi-detached stack (Fig. 17b) supports a small gannetry. Photographs and reports of

visitors in about 1930, and in January 1942, show that the Double Island gannetry was not occupied in those years. Mr. W. Gilliver, Marine Department, for many years District Inspector of Fisheries at Coromandel, told us in January 1947 that the Double Island stack was first occupied about four years before, i.e., about the 1942-43 season, and J. Ngapo, Coromandel, stated (September 9, 1946) that it was established during his absence from the district on war service.

During a visit to Bush Island on September 9, 1946, C. A. Fleming counted 6 to 10 gannets ashore on the Double Island stack; some appeared to have nests, and the population was put at five pairs (Fleming, 1947 b, p. 113). The party that visited the Colville gannetries on February 26, 1948 (R. A. Falla, E. G. Turbott, P. C. Bull, G. A. Buddle) did not closely examine Double Island, but estimated the number of young birds at 20. Neither of these estimates was based on a critical examination, but it appears that the Double Island population is still increasing.

Summary.—Not occupied till 1942-43; 1946, breeding, estimated 5 pairs; 1948, estimated 20 pairs.

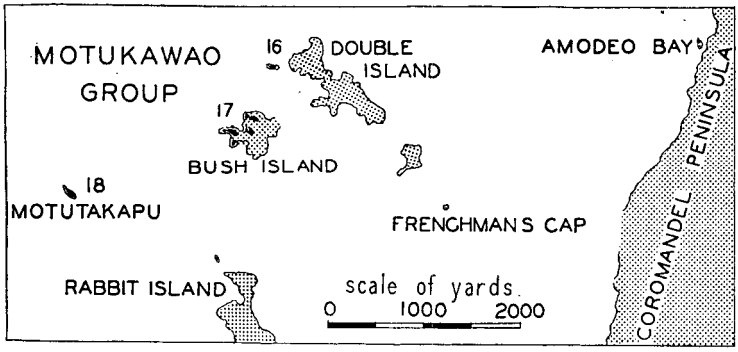


Figure 16.—Sketch-map to show location of Colville gannetries.

(17) Bush Island.

Bush Island (Figs. 17a, b, 18, 19) is one of the long-established gannetries of the Hauraki Gulf, included by Fairchild (in the phrase "some small islands in the Hauraki Gulf, near Coromandel") as one of the four or five gannetries known to him in the "eighties" (Buller, 1888, p. 181).

Reischek (1930, p. 81) writes of visiting uninhabited islands off Coromandel to study seabirds. His account is confused: he was at Coromandel in March-April, 1880, yet he goes on to speak of "the three larger and three smaller islands which make up the Broken Islands" (i.e., Great Barrier), where, in September he found "literally no single square yard of ground that was not covered with eggs" and "in some nests there were little downy young," an unlikely condition in September. The account seems to apply to gannets, which are mentioned in the next paragraph. Perhaps visits to both the Mahuki and Colville gannetries have been combined in this account, which is thus of little value except as evidence that the gannetries were in use in 1880.

A photograph showing part of the central group of nesting gannets at Bush Island was published in the Auckland Weekly News of April 7, 1910, and the continuity of occupation throughout the present century is well attested.

R. A. Falla (Wodzicki and McMeekan, 1947) estimated the population of the Colville gannetries in 1928 as 1,000 pairs, a figure that includes

Motutakapu as well as Bush Island. Allowing 200 pairs for Motutakapu, this leaves 800 as an approximation for Bush Island.

Photographs by A. N. Breckon in January, 1931, show that the areas designated North Promontory, Central Group, and West Promontory by Fleming (1947, b, p. 110) were then occupied much as they were in 1946.

In 1940, P. Wood made frequent visits, recording (letters to C.A.F.) early laying (August 27), a successful hatch of eggs by November 25 (one egg remaining in 20 to 30 nests, chicks in all stages, no vacant nests), and the final departure of young in April and early May (last present in late April but gone by May 24). In this season he estimated the total population of the Colville gannetries, including Motutakapu, at about 1,200 pairs. If the proportions on the two islands have remained constant, this indicates a population of about 1,000 pairs at Bush Island.

R. B. Sibson visited Bush Island on January 5, 1942. He found two main colonies, estimated to contain 400 pairs each, and 2 smaller ones, each with some scores of pairs. These colonies (Figs. 17a, b, 19) were North Promontory, Central Group, West Promontory, and South Promontory, which is known to have been first occupied about 1938-39 (see below). Sibson's estimate for the Bush Island colonies was c. 900 pairs, but West Promontory is known to have contained well over 100 nests both before and since Sibson's visit, so that his estimate of "some scores of pairs" for that colony was certainly conservative; if we assume that it contained 200 nests (it contained over 197 in 1930 and 282 in 1946) the figure for Bush Island in 1942 can be raised to about 1,100 pairs.

A marked increase in the size of the Bush Island colonies occurred between 1938 and 1948. Mr. W. Gilliver informed us in 1947 that West and North-west Promontory and Central Group (the three colonies photographed by Breckon in 1931) were the only areas of breeding gannets when he first knew Bush Island. South Promontory was first used about 8 years before (i.e., about the 1938-39 season); the lower ledges of North-west Promontory (108 nests in 1946) were first occupied three years before (i.e., about 1943-44); and the Central Group had expanded, particularly down the seaward slope, to ledges below the main colony at the same time. In 1945 the South-west Stack, used as a roost in 1946-47 and 1947-48, was occupied by nests; its capacity was estimated as 20 nests in 1946. If the number of nests counted in 1946 on the "new" areas are deducted from the totals for the Bush Island colonies in 1946 (both sets of figures from Fleming, 1947 b, pp.113-114) the approximate increase since 1938 can be deduced.

TABLE II.

Population Changes at Bush Island.

	1946	New Areas.	Difference
North-west Promontory	651	108	543
Central Group	472	97	375
West Promontory	282	? None	282
South Promontory	108	108	nil
Total	1,513	313	1,200

W. Gilliver and J. Ngapo agree that not only were new areas occupied, but the older colonies expanded at the same time, so that a still lower figure, say 900 to 1,000 nests, is the probable strength of the Bush Island population in 1938. This may be compared with the figures based on P. Wood's estimate in 1940 (c. 1,000 pairs) and R. B. Sibson's in 1942 (c. 1,100 pairs).

The results of a census of the Bush Island gannetries on September 9, 1946, have been published elsewhere (Fleming, 1947 b, pp. 113-114), and Table II. presents the number of occupied nests as its first column of figures

(total 1,513). Minor encroachment into the scrub by nesting gannets is further evidence that the Bush Island gannetries had been expanding. The taking of "guano" from Bush Island, reputedly in February, does not seem to have adversely affected the gannets. In the last week of January, 1947, N. Hamilton reported that the Bush Island gannetries appeared well-filled with young birds, an observation which suggests that these gannetries escaped the high mortality recorded elsewhere in the 1946-47 season.

Bush Island was visited on February 26, 1948, by a party including R. A. Falla, E. G. Turbott, G. A. Buddle and P. C. Bull (accompanied by Dr. R. C. Murphy). The following census of chicks and fledglings made by several members of the party has been supplied to us by E. G. Turbott:

North-west Promontory, upper part	43 above
Detached areas below	39
Central Group	200
West Promontory	50
South Promontory	28
Total—Bush Island	360 young

The 360 young reared in 1947-48 by the Bush Island gannets represent a nest success of about 24 per cent. if the breeding population was 1,513 pairs, as assessed in 1946-47. Apparently the breeding population in 1947-48 was at least as high as that of 1946-47.

Summary.—Breeding 1880, probably continuously since. Estimates: 1928, 800 pairs; 1930, over 700; 1938, under 1,200; 1940, about 1,000; 1942, about 1,100; 1946, count 1,513 pairs.

(18) Motutakapu. (Fig. 16).

The name "Gannet Rock" has been applied to several islets or stacks on which gannets breed in New Zealand, and we prefer to use the Maori name of this islet, which, though it means literally "Gannet Island," does not seem to be in use for another gannetry. Motutakapu, the western-most of the Kawao Group, is a boat-shaped rock about 130 yards in length, the top accessible at the narrow north end, from which the rock rises and expands to a width of about 20 yards before narrowing to the vertical-sided south end. (Fig. 20.)

Judging by its name, Motutakapu has been occupied by a gannetry since pre-European times, probably without interruption, although there are few records that mention the islet specifically. R. A. Falla's and P. Wood's estimates for the Colville gannetries, if correcty apportioned between Bush Island and Motutakapu, attributed some 200 pairs to the latter islet in 1928 and 1940. Sibson, viewing Motutakapu from Bush Island on January 5, 1942, wrote in his field notes that it was white "with probably 400 to 500 pairs."

A count of occupied nests and nest sites on Motutakapu on September 9, 1946, gave a total of 288 nests (Fleming, 1947 b, p. 113), but there seemed room for more than that. It is the only count made on shore at Motutakapu that is available to us, other estimates being based on views from the sea. Possibly the gannetry was not fully occupied so early in the season.

On February 26, 1948, Motutakapu was examined carefully from the sea by P. C. Bull and others who estimated that there were 100 young (plus or minus 10) on the islet at the time. If the colony's nesting success was the same as has been inferred from counts at Bush Island in the same season (24 per cent.), this figure of 100 young indicates an adult population of about 400 pairs. This total agrees rather with Sibson's (1942) estimate than with Fleming's count of 288 nests early in the 1946-47 season.

Summary.—Long-established. Estimates: 1928, 200 pairs; 1940, 200 pairs; 1942, 400-500 pairs. Count: 1946, 288 pairs; 1948, 100 young; estimated 400 pairs.

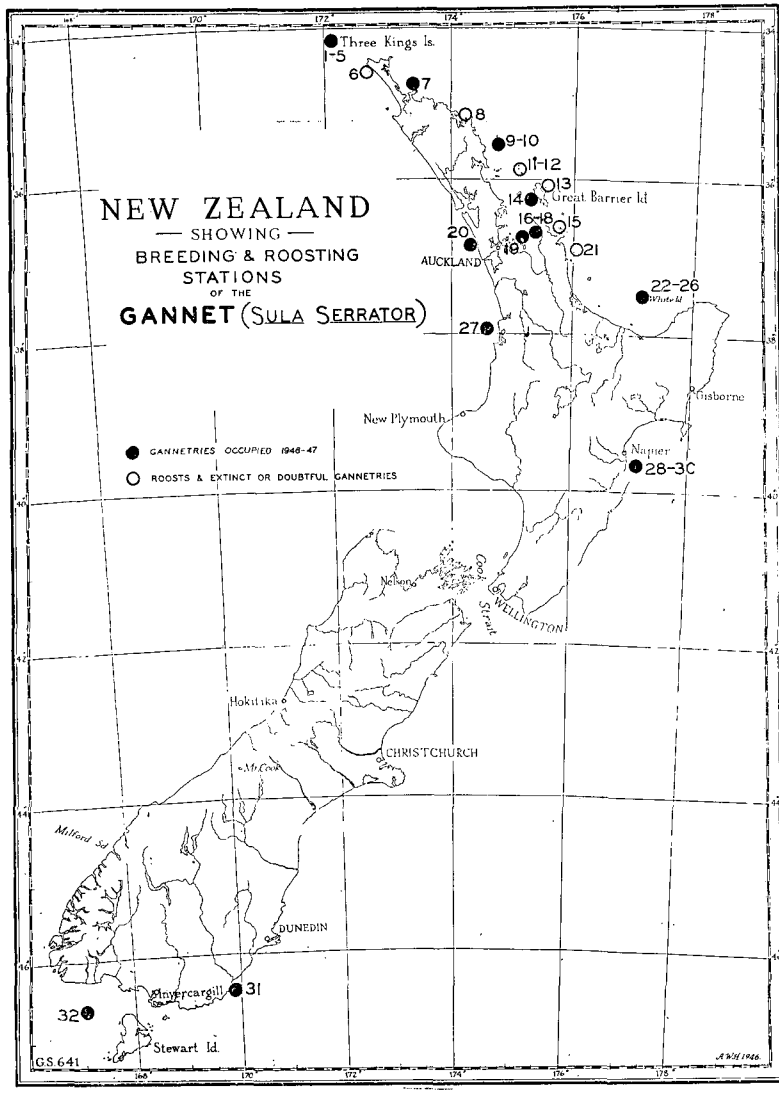


Figure 1.—Map to show Breeding Stations and Roosts of the Gannet in New Zealand. Numbers correspond with those of Table I. Breeding stations in 1946-47 marked with asterisk.

*1- 5—Three Kings Islands
6 —Matapia.
*7 —Cape Karikari Stacks.
8 —Bird Rock, Bay of Islands.
*9-10—Poor Knights Islands
11-12—Mokohinau Islands.
13 —Arid Island Stack.
*14 —Mahuki.
15 —The Sisters, Mercury Island.
*16-18—Colville.
*19 —Horuhoru, Waiheke.
*20 —Oaia, Muruwai.
21 —Sugarloaf, Alderman Is.
*22-24—White Island.
25-26—White Island.
*27 —Gannet Island, Kawhia.
*28-30—Cape Kidnappers and neighbouring gannetries.
*31 —Nuggets, Otago.
*32 —Little Solander, Foveaux Strait.

Figure 2—See page 46.

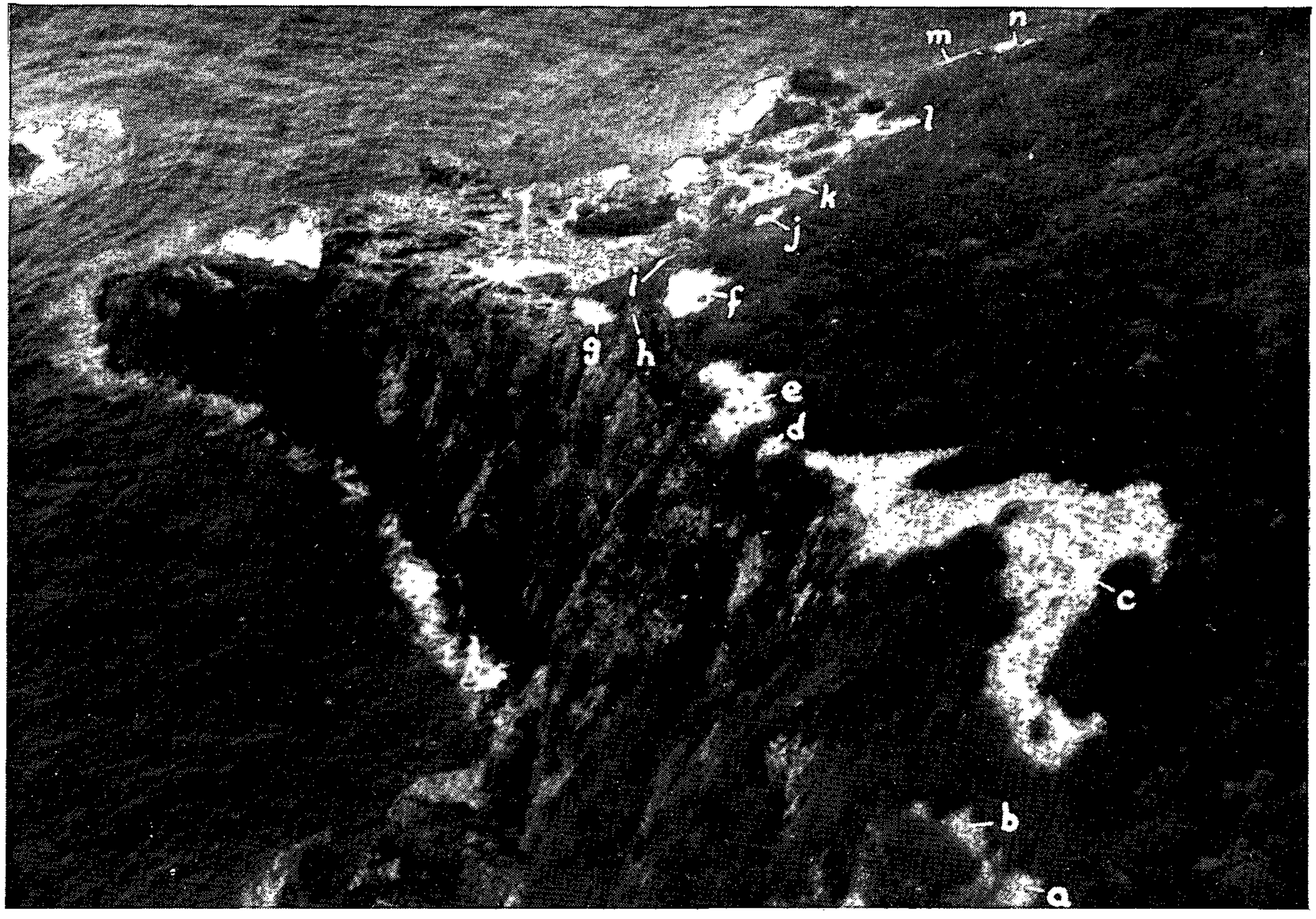


Figure 3.—Oblique aerial view of southern end of South West Island, Three Kings, January 13, 1947, showing location of gannet colonies, a–n. Photo: R.N.Z.A.F.

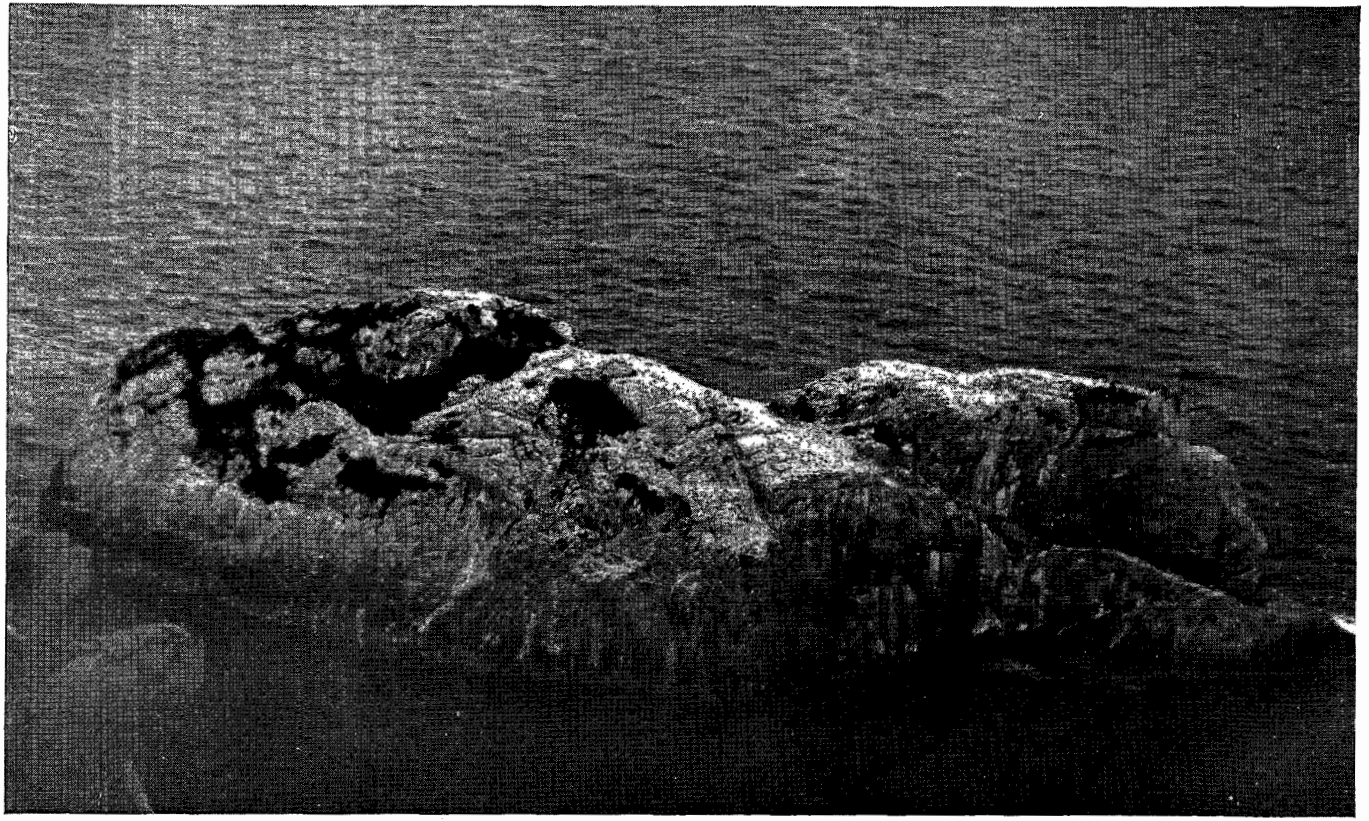


Photo: R.N.Z.A.F.

Figure 4.—HINEMOA ROCK, Princes Islands, from the south, January 14, 1947

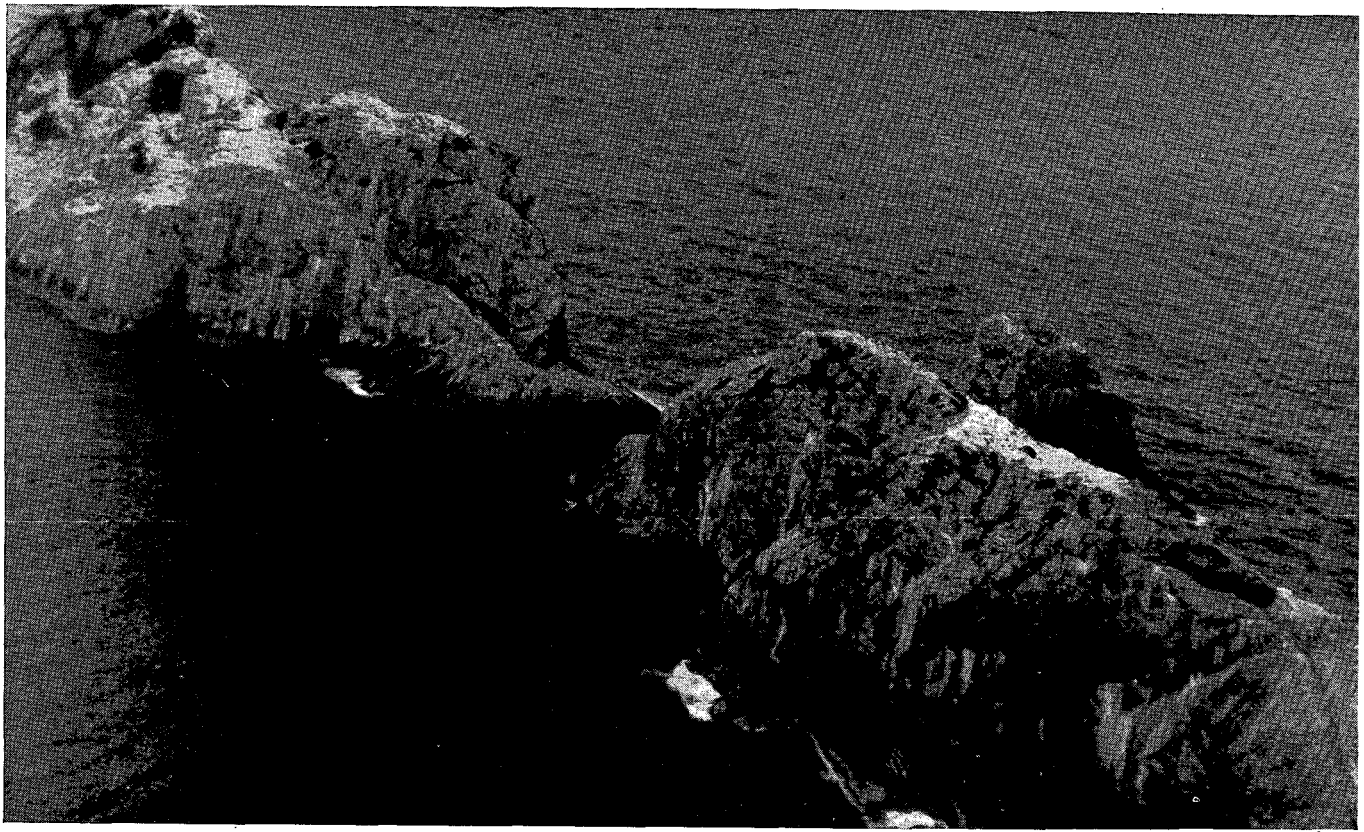


Photo: R.N.Z.A.F.

Figure 5.—HOLE-IN-THE-WALL (*right*) and TUTANEKAI ROCK (left) from the south-east.

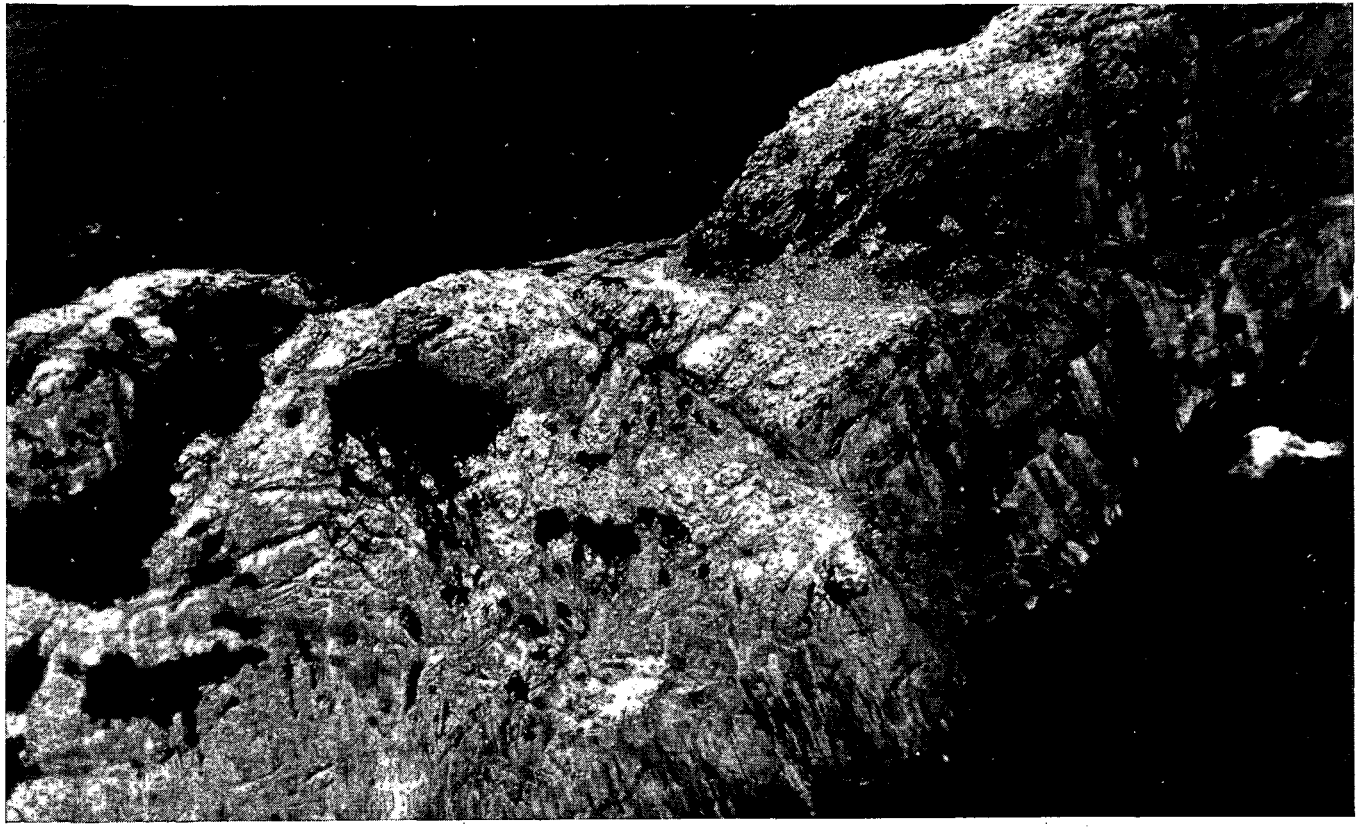


Photo: R.N.Z.A.F.

Figure 6.—HINEMOA ROCK, Princes Islands, showing nesting gannets on saddle, summit ridge and south slope.

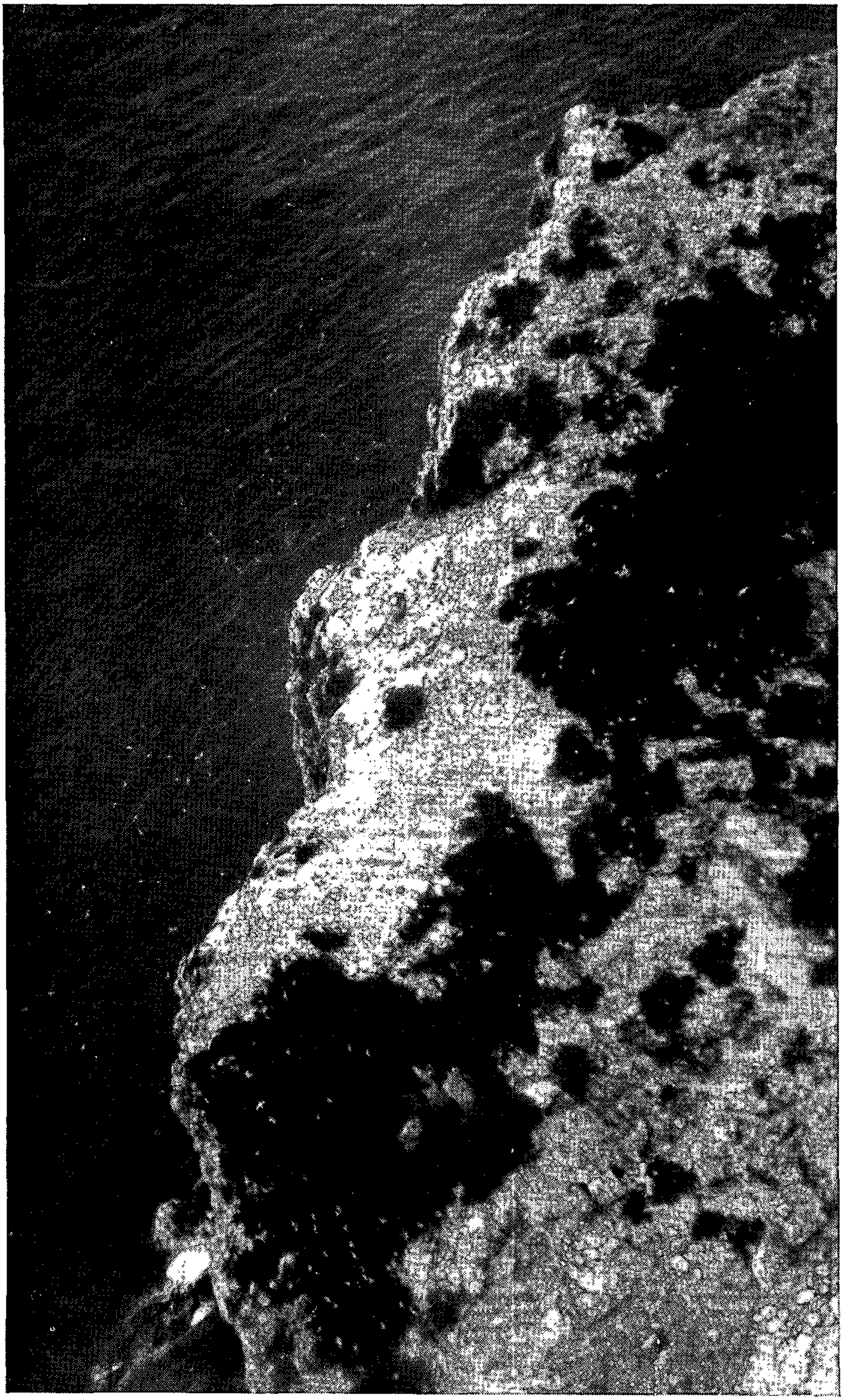


Photo: R.N.Z.A.F.

Figure 7—HOLE-IN-THE-WALL ROCK, Princes Islands, showing gannetry on summit ridge, January 13, 1947. Most of the flying birds are red-billed gulls.

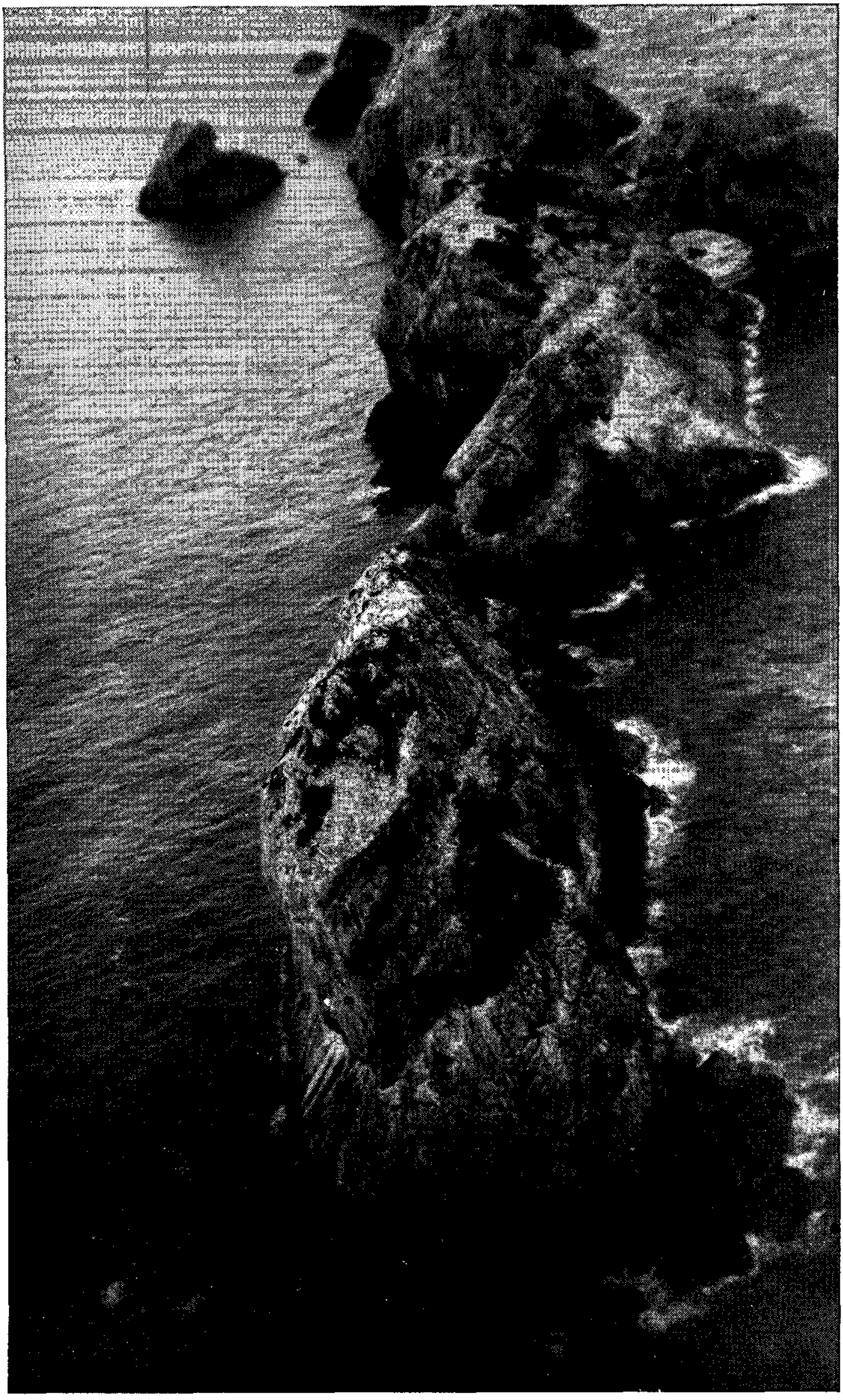


Photo: R.N.Z.A.F.

Figure 8.—PRINCES ISLANDS, from the east. Tutanekai Rock, in foreground, Hole-in-the-Wall and Hinemoa behind, showing gannetries.

Photo: R.N.Z.A.F.

Figure 9.—ARBUTUS ROCK, Princes Islands, from the east, showing southern slope occupied by nesting gannets and red-billed gulls. Figure 10—See page 52.

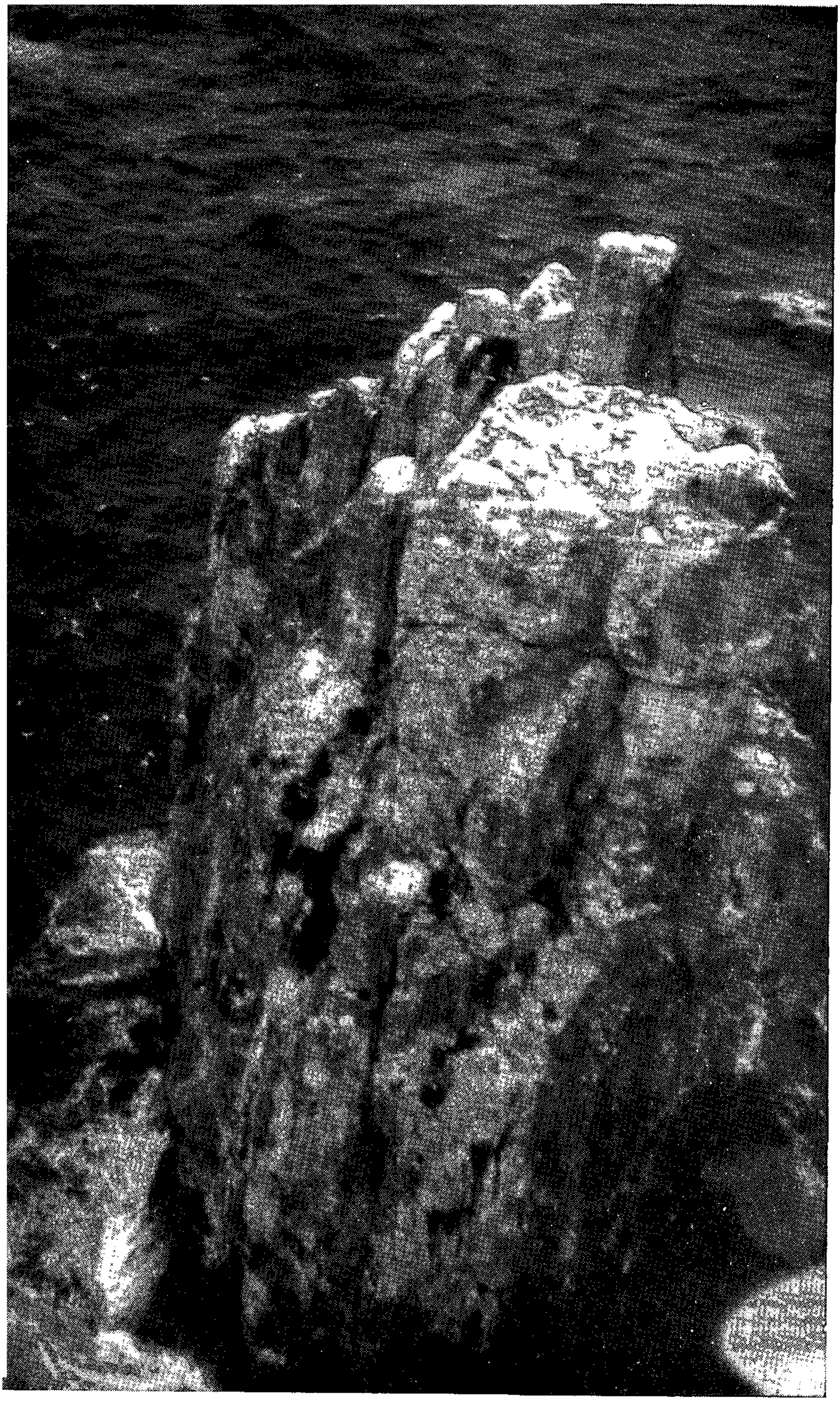


Figure 11.—GANNET STACK, Poor Knights, January 14, 1947. Fifty-seven gannets can be counted on the summit, others are probably hidden by the pinnacles. Photo: R.N.Z.A.F.

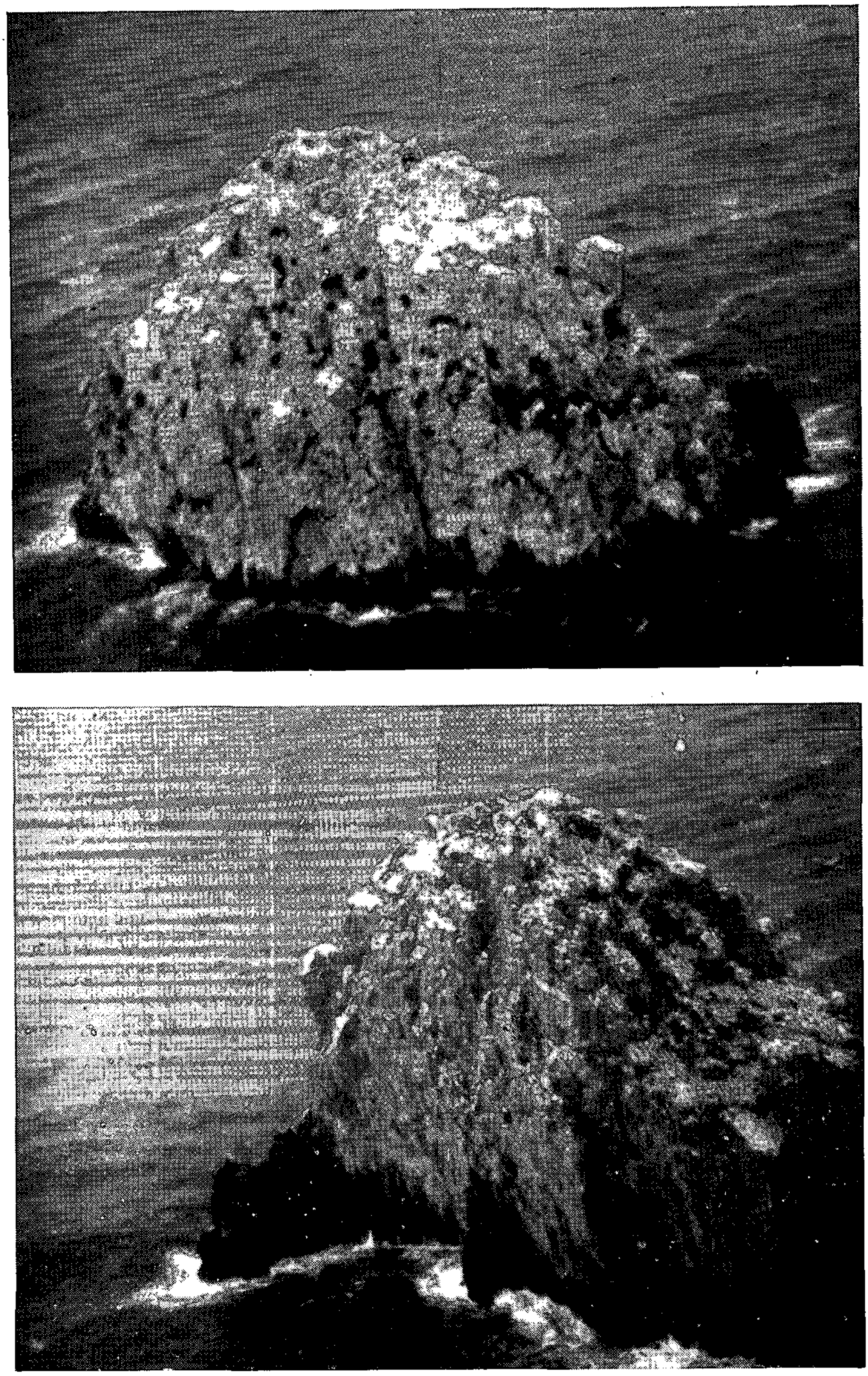


Photo: R.N.Z.A.F.

Figures 12 (top) and 13.—SUGARLOAF, Poor Knights, January 14, 1947. Views from north (above) and south, showing the whitened ledges occupied by nesting gannets.

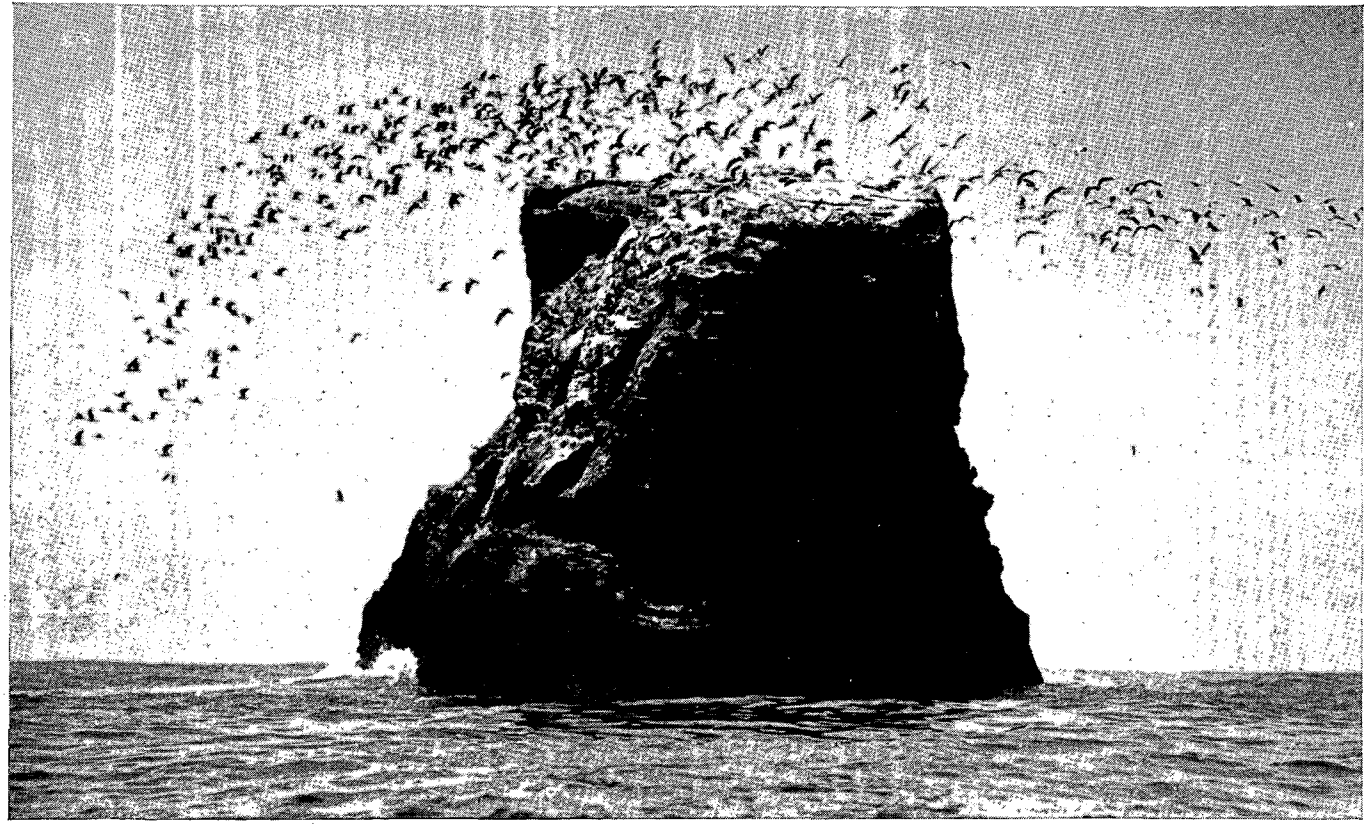


Photo: A. N. Breckon, c. 1920

Figure 14.—STACK OFF ARID ISLAND, Great Barrier, on which roosting gannets were observed in 1937 and 1944. The flying birds are red-billed and black-backed gulls.

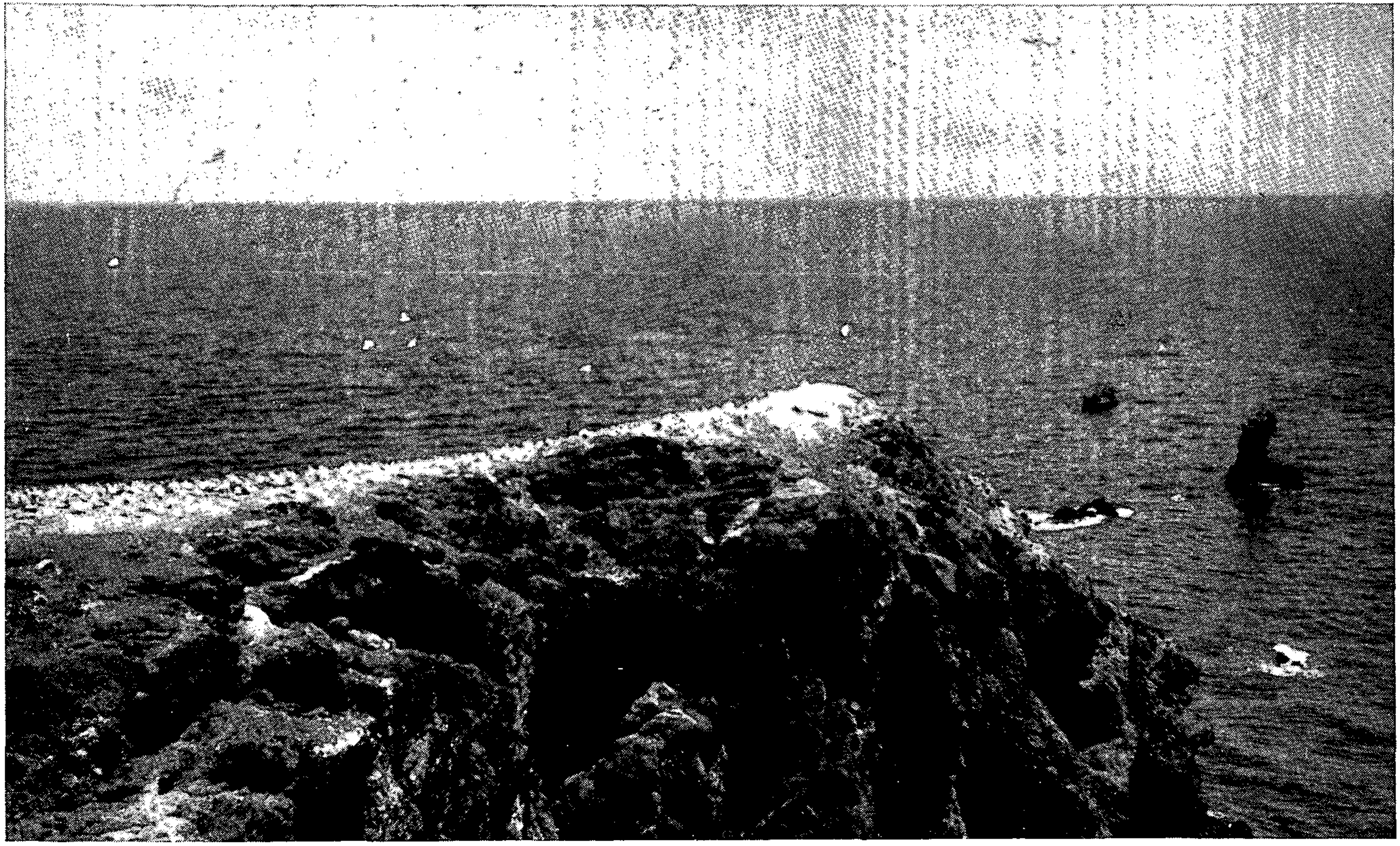
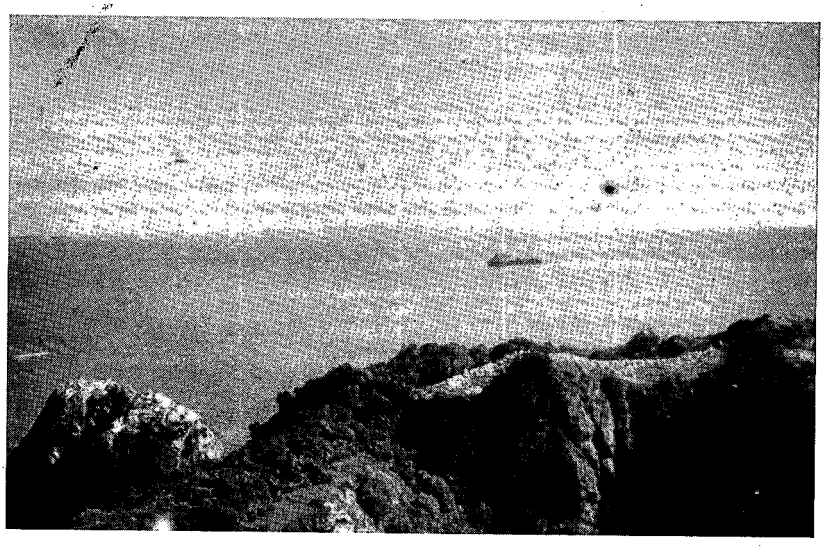
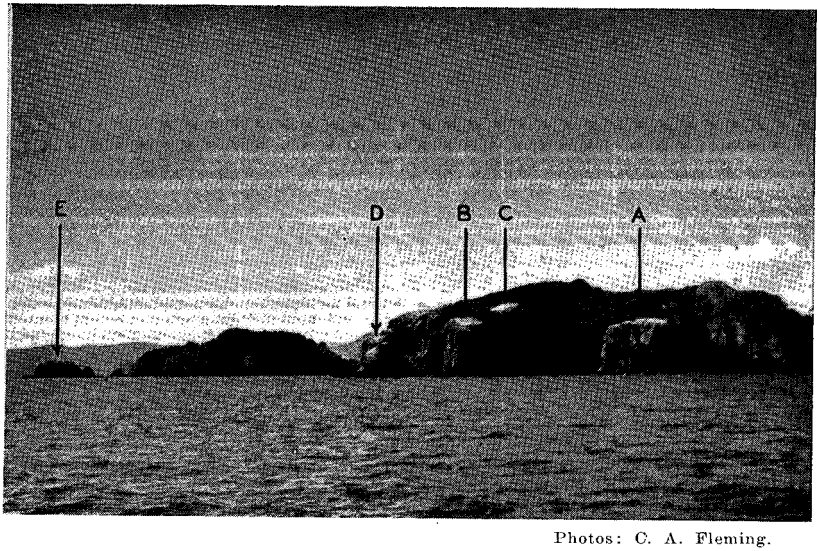


Photo: C. A. Fleming.

Figure 15.—GANNETRY AT MAHUKI ISLET, Great Barrier. View from south, 1934.

Figure 16—See page 56.





Photos: C. A. Fleming.

Figure 17.—(a) BUSH ISLAND, Colville, showing gannetries on South Promontory (left) and West Promontory (centre right) and Motutakapu in distance.

(b) Bush Island (right) from north-west showing gannetries. A: South Promontory; B, West Promontory; C, Central Group; D, North Promontory. Double Island on left with gannetry on outlying stack (E).

Photo: A. N. Breckon, c. 1930.

Figure 18.—BUSH ISLAND, Colville. Part of gannetry on West Promontory, to show relation between nesting gannets and low coastal forest.

Photo: C. A. Fleming.

Figure 19.—BUSH ISLAND, September, 1946. View from West Promontory looking north-east, showing Central Group of nesting gannets (right) and groups on North Promontory (centre and left).

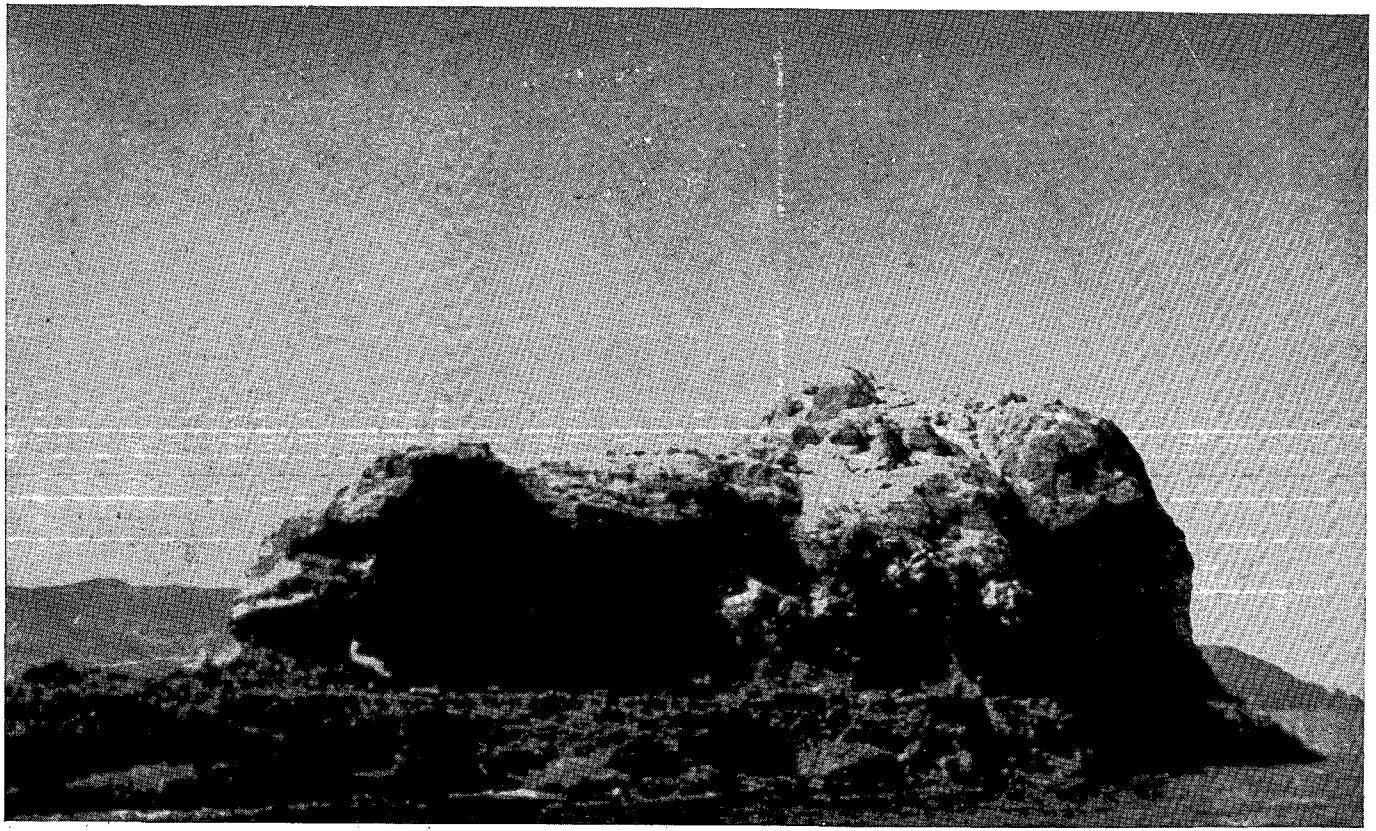


Photo: C. A. Fleming.

Figure 20.—MOTUTAKAPU, Colville, from north-west, September, 1946.

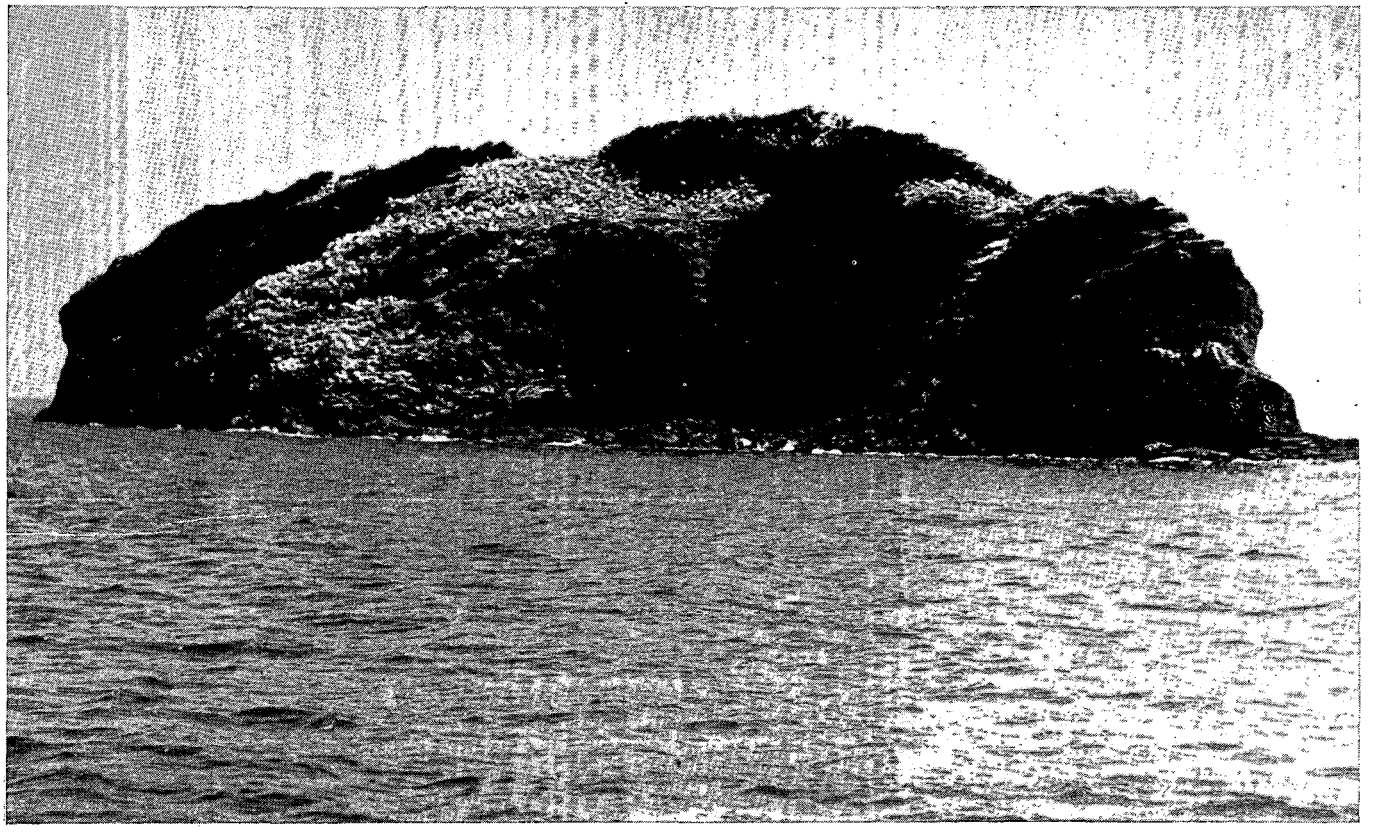


Photo: W. N. Breckon.

Figure 21.—HORUHORU, Waiheke, from south-west, c. 1934.

Photo: R.N.Z.A.F.

Figure 22.—OAIA ISLET, Muriwai, from east, January 14, 1947, showing gannetry on summit and scattered idle birds on slopes.

Photo: R.N.Z.A.F.

Figure 23.—OAIA ISLET, Muriwai, from north-west, showing steep outer slope which has not previously been photographed, and gannetry on summit.

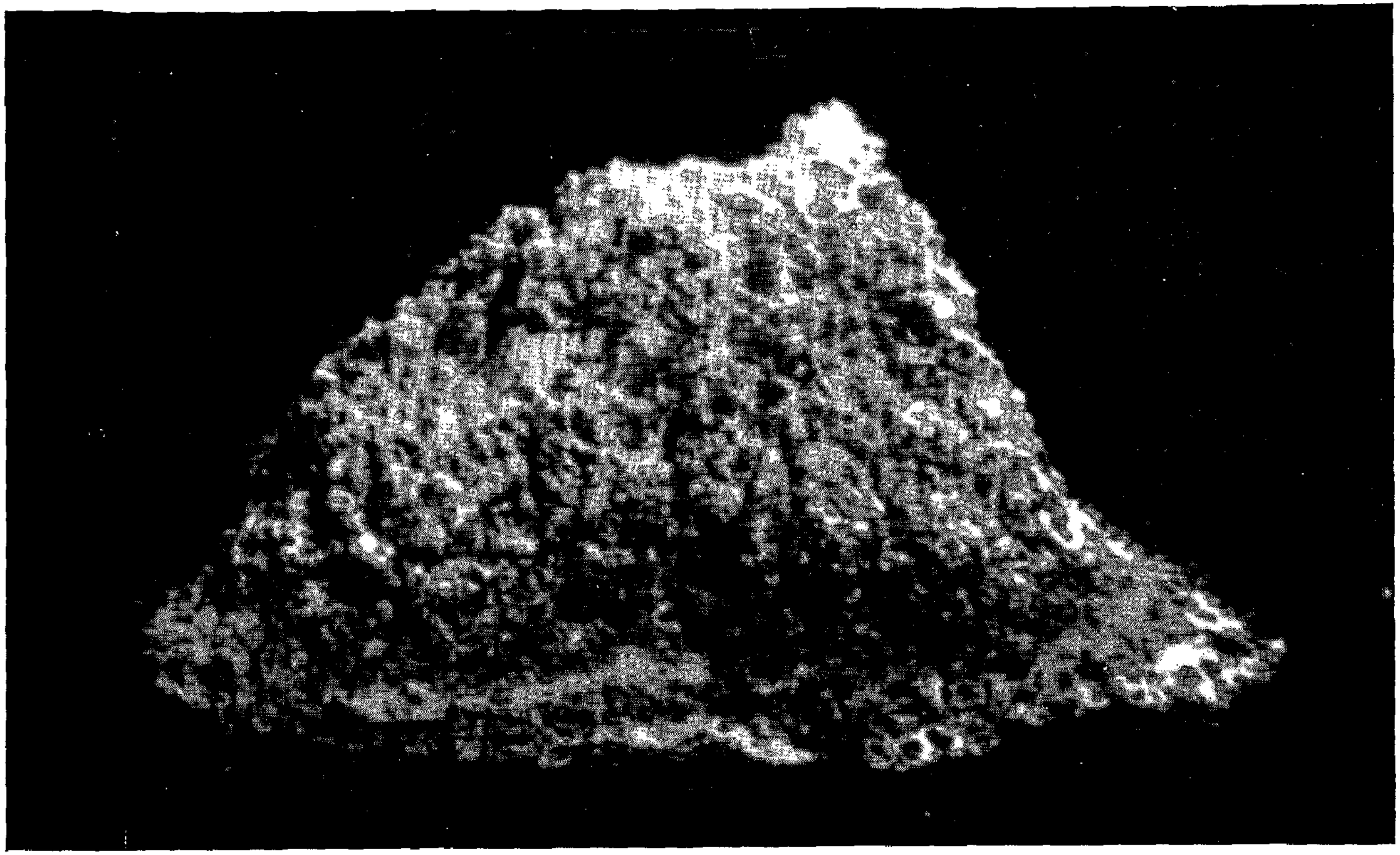


Photo: R.N.Z.A.F.

Figure 24.—SUGARLOAF ROCK, Alderman Islands, January 13, 1947, site of an abandoned gannetry.

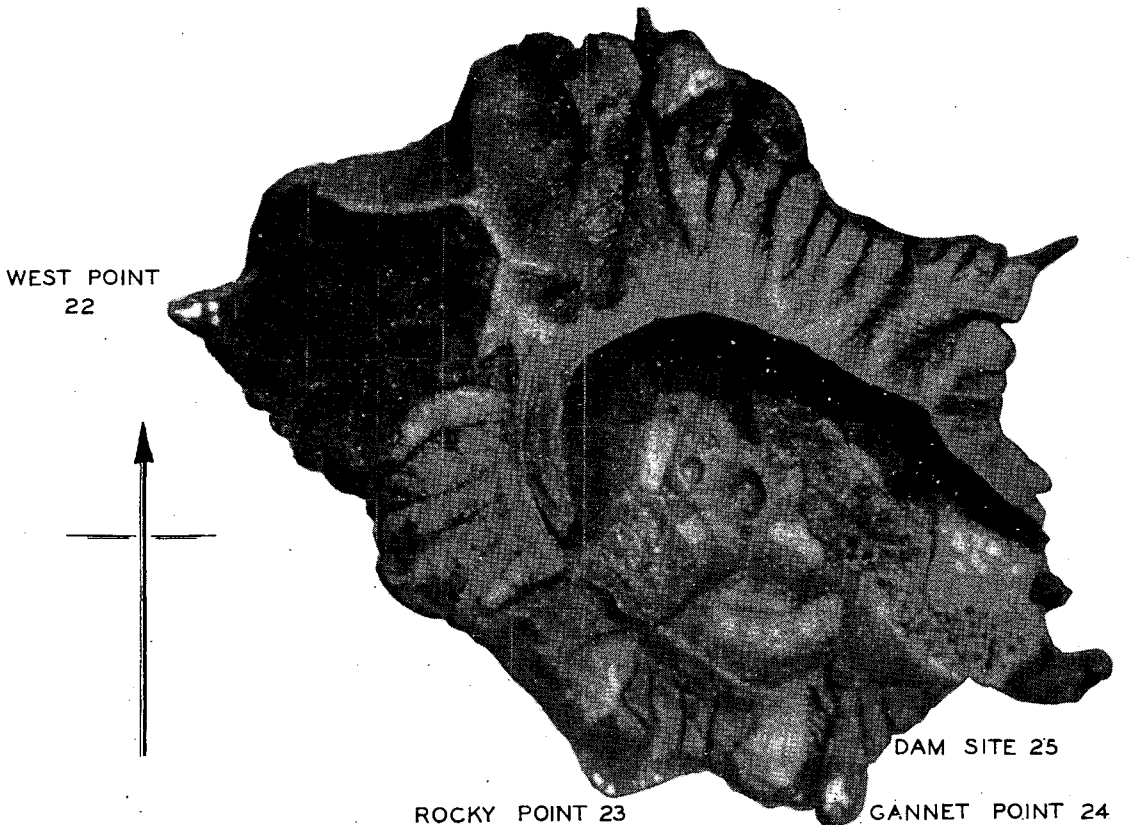


Figure 25—WHITE ISLAND; photograph of model by N.Z. Geological Survey, to show location of gannetries.

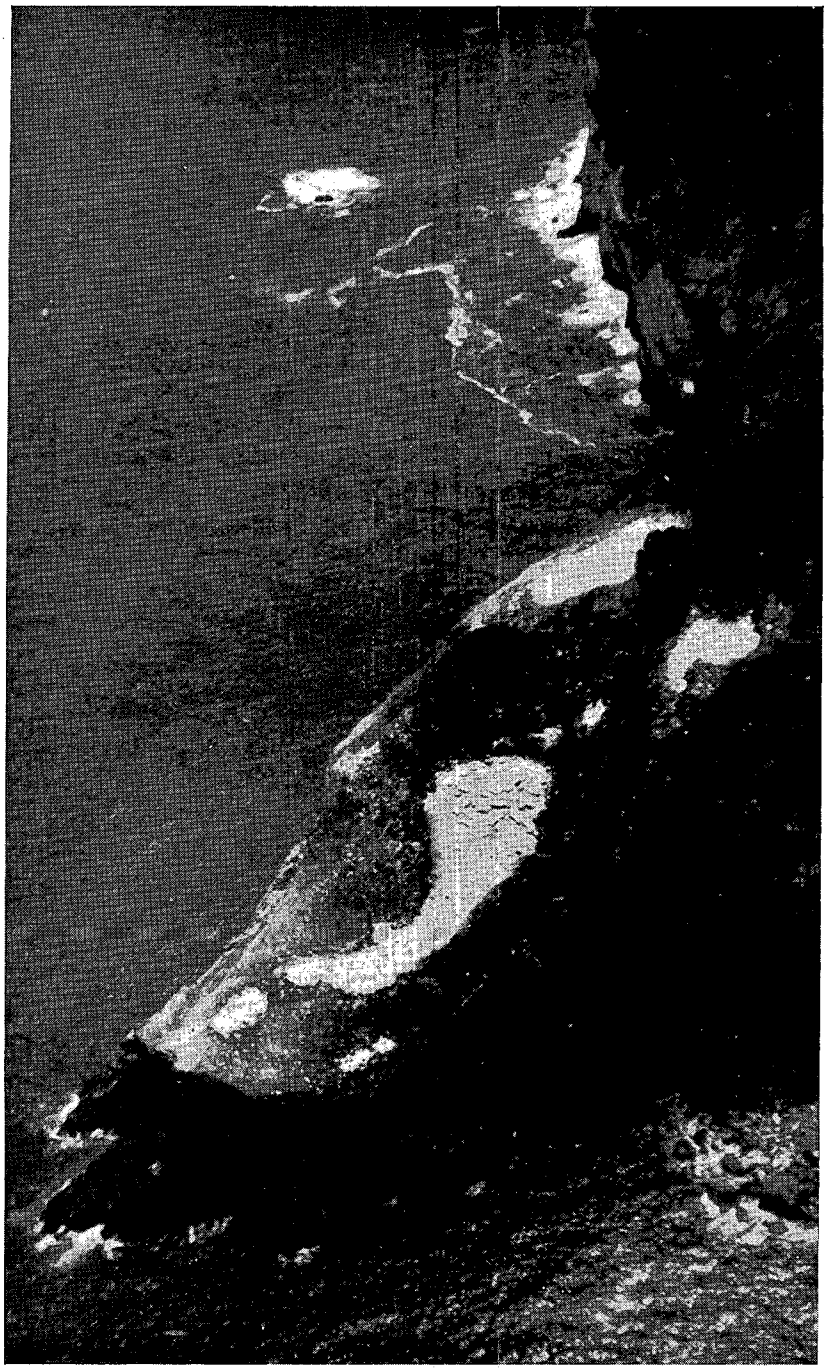


Photo: R.N.Z.A.F.

Figure 26—WEST POINT GANNETRY, White Island, January 13, 1947, showing the main areas of nesting gannets.

Photo: R.N.Z.A.F.

Figure 27.—ROCKY POINT GANNETRIES, White Island, January 13, 1947.

From right: (a), (b), (c) on the point divided in two parts by a ravine and (d), the small white area on the left, used as a roost. Remains of the camp buildings, cisterns, etc., are visible in clearings in the pohutukawa forest.

Photo: R.N.Z.A.F.

Figure 28.—Southern Slopes of White Island, looking west, showing Gannet Point gannetry (areas A and B).

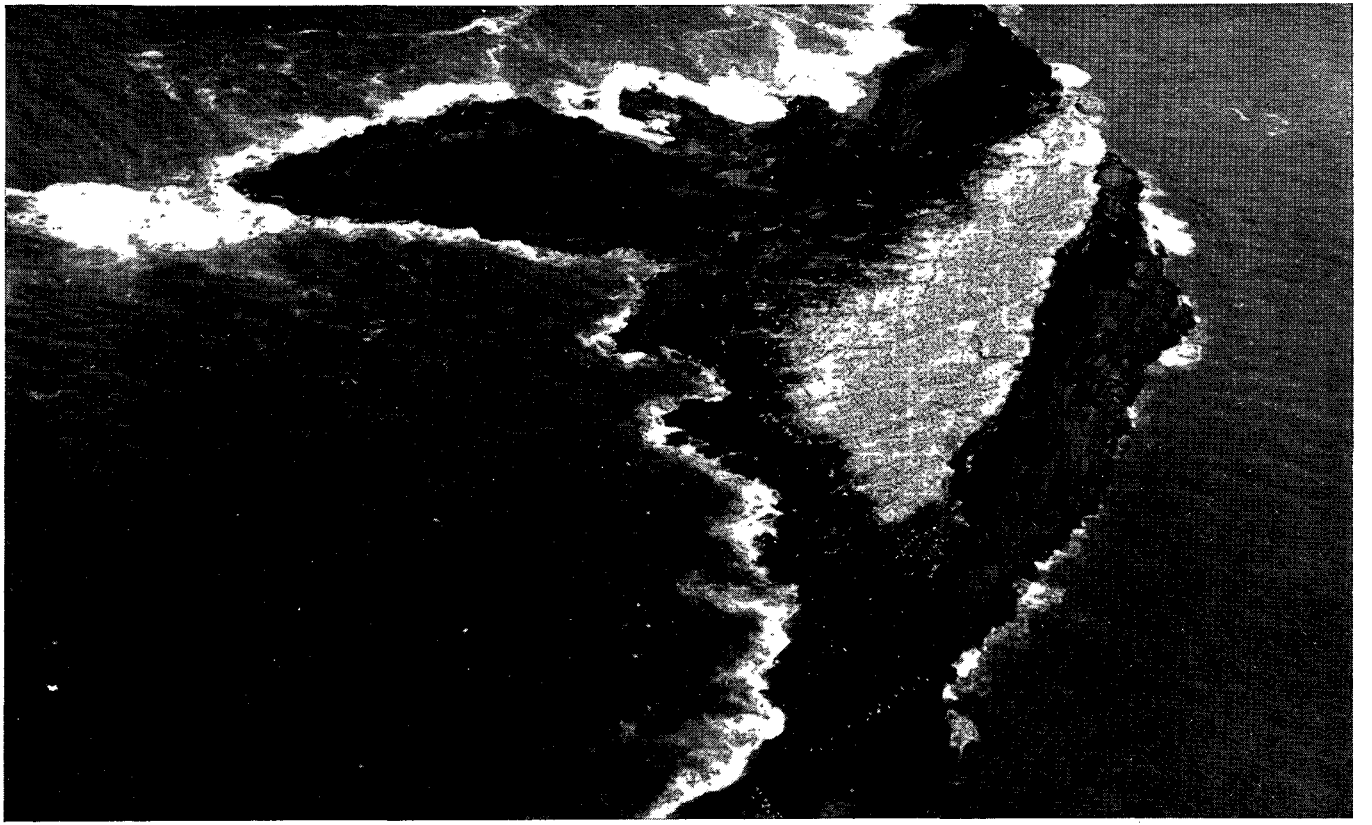


Photo: R.N.Z.A.F.

Figure 29.—GANNET ISLAND (Karewa), west of Kawhia. View from south-east, January 14, 1947.

Photo: R.N.Z.A.F.

Figure 30.—BLACK REEF, Hawke's Bay, November 21, 1946. View looking north-east from shore, showing groups 2 (foreground), 3 and 4 (centre), 5 (right), and 6, 7 (top). In 1946, gannets nested on 2, 3, 4 and 6, and roosted on 5 and 7.

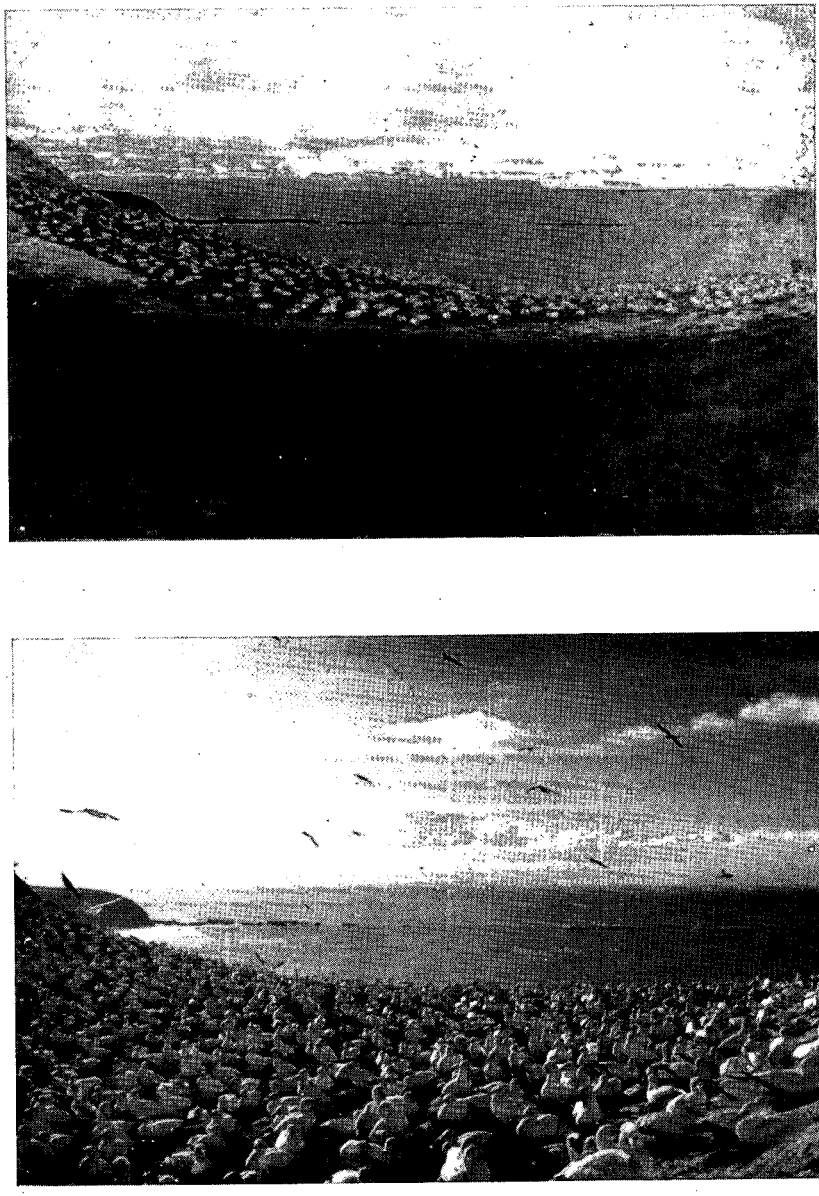


Figure 31.—CAPE KIDNAPPERS, looking north towards Black Reef from southern edge of saddle (top) about January, 1890, photo by Jas. Chambers, and (bottom) September 24, 1950, by K. A. Wodzicki. During the intervening 60 years the gannetry has extended across the grass occupying the foreground of the 1890 photograph.

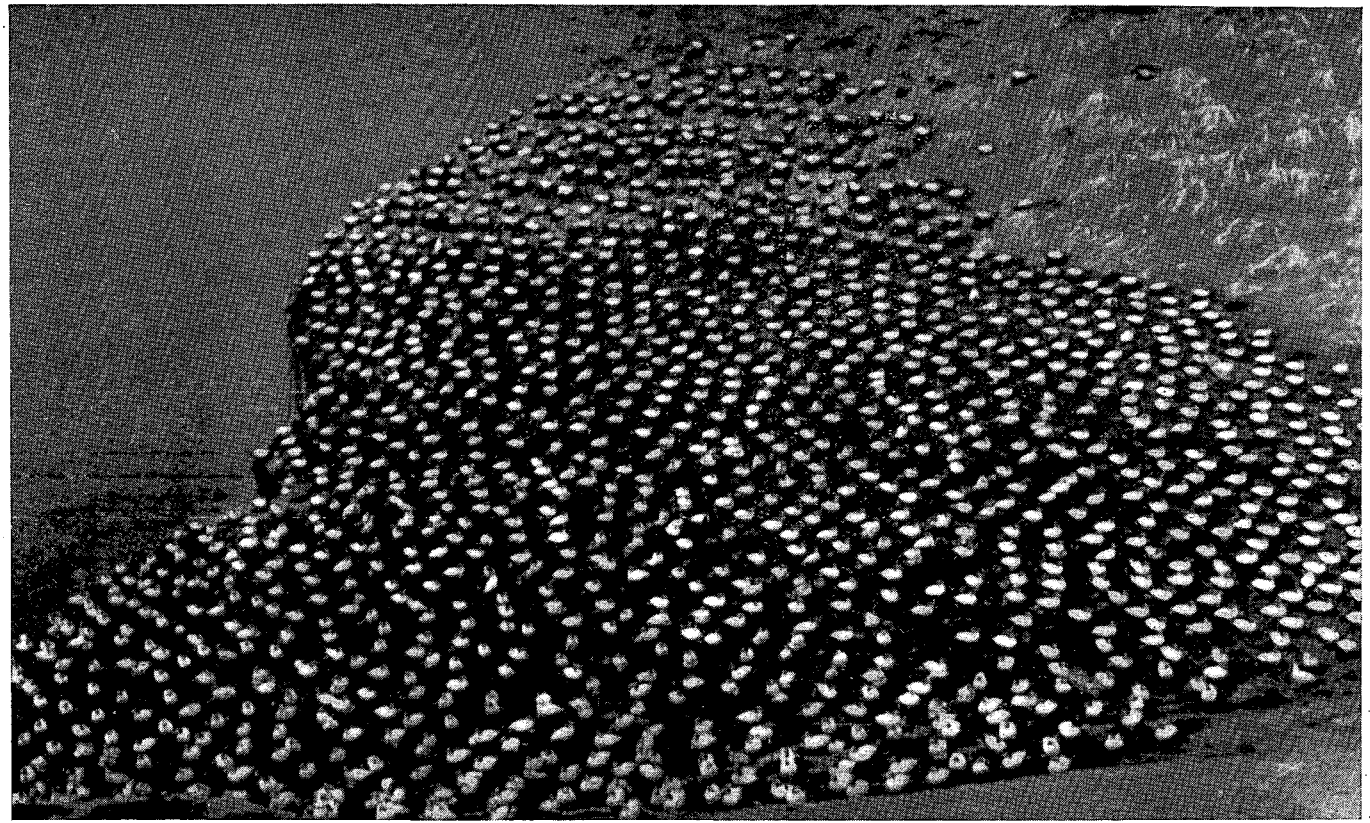


Photo: R. Symons.

Figure 32.—CAPE KIDNAPPERS, view north-east across central saddle, probably November 9, 1903, showing extent of gannetry. (Compare Fig. 33.)

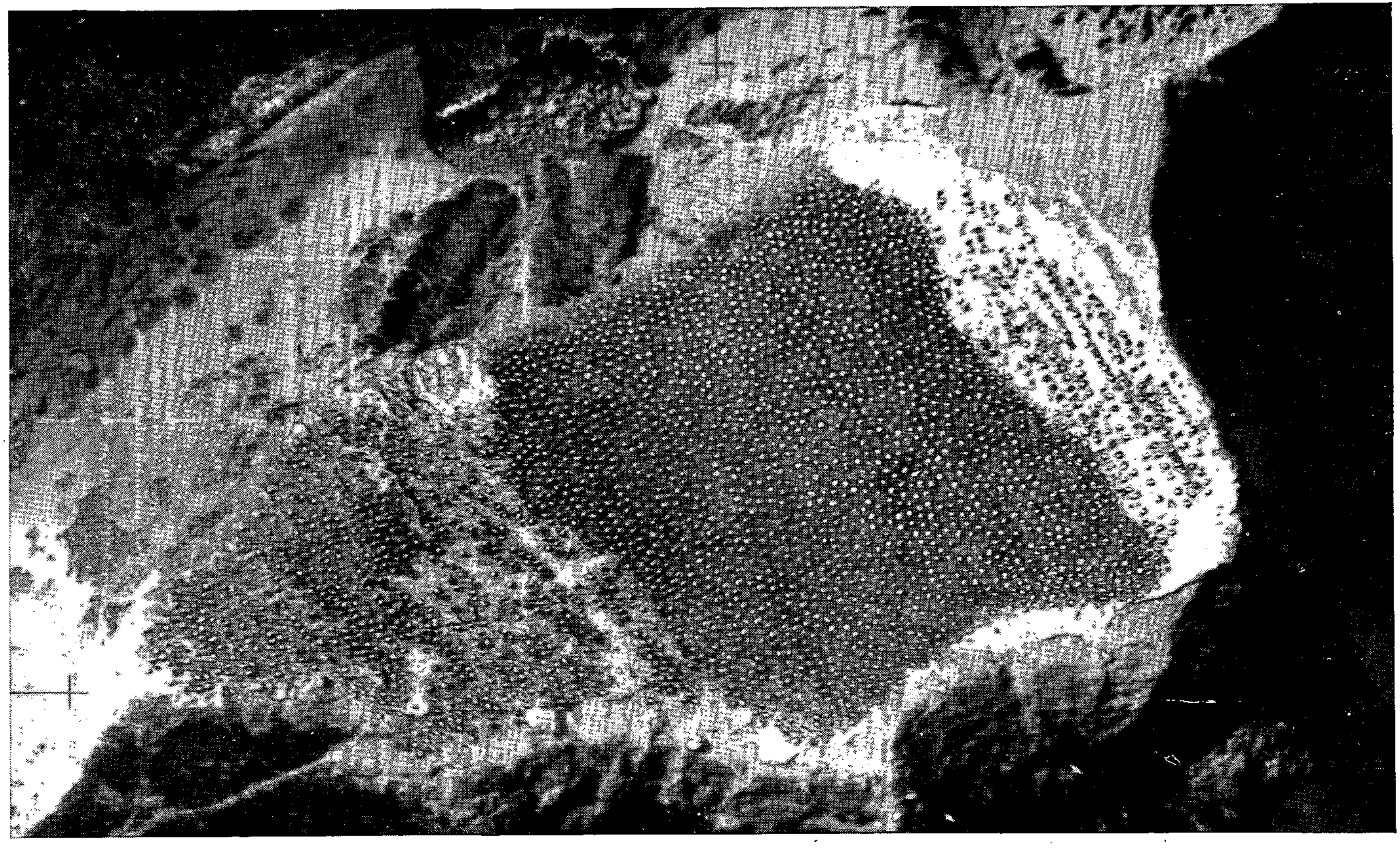


Photo: R.N.Z.A.F.

Figure 33.—CAPE KIDNAPPERS. View from south showing access track (left) below western slope, concentrated gannets nesting in dark area of saddle, and ledges on eastern slope. (November 21, 1946)

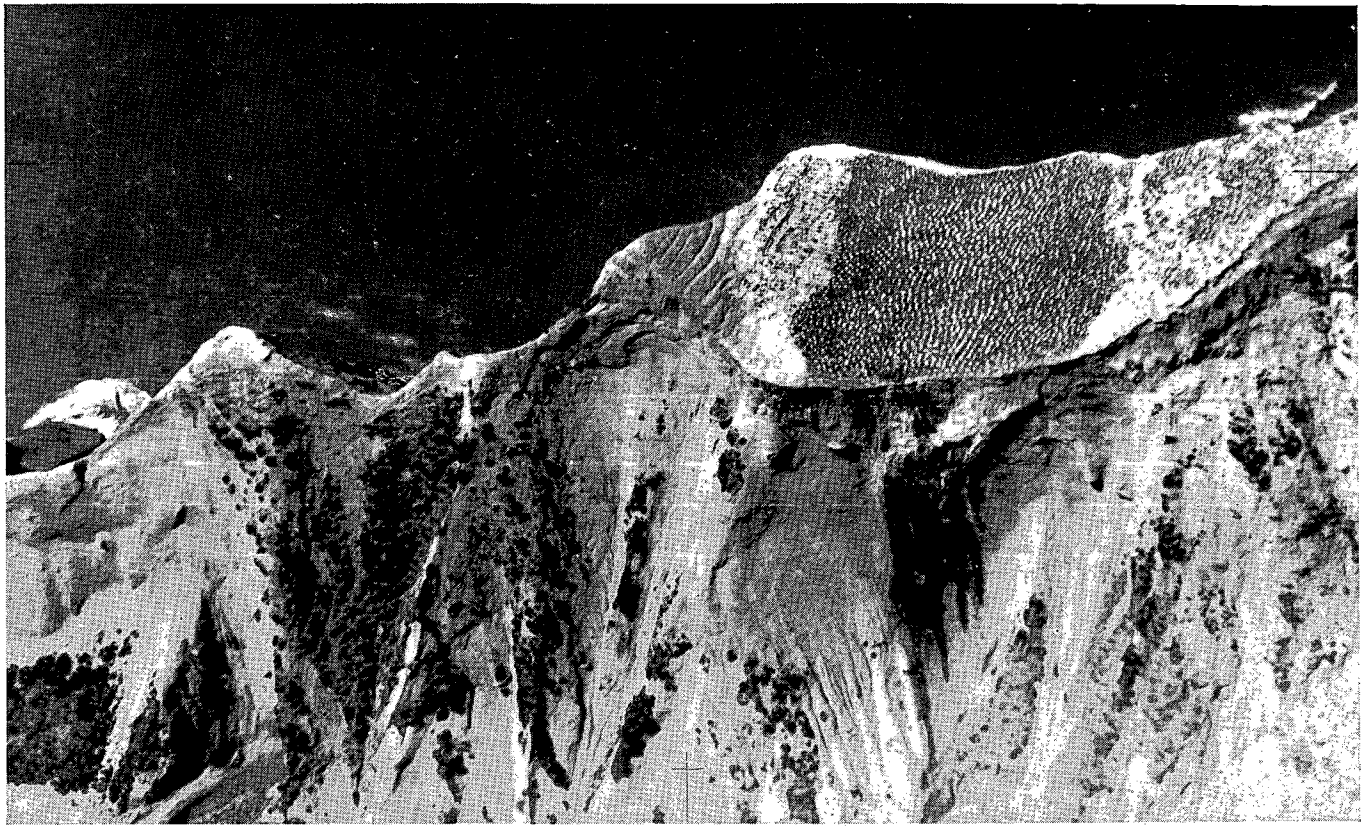


Photo: R.N.Z.A.F.

Figure 34.—Aerial view of Cape Kidnappers from north.
Figure 35—See page 71.

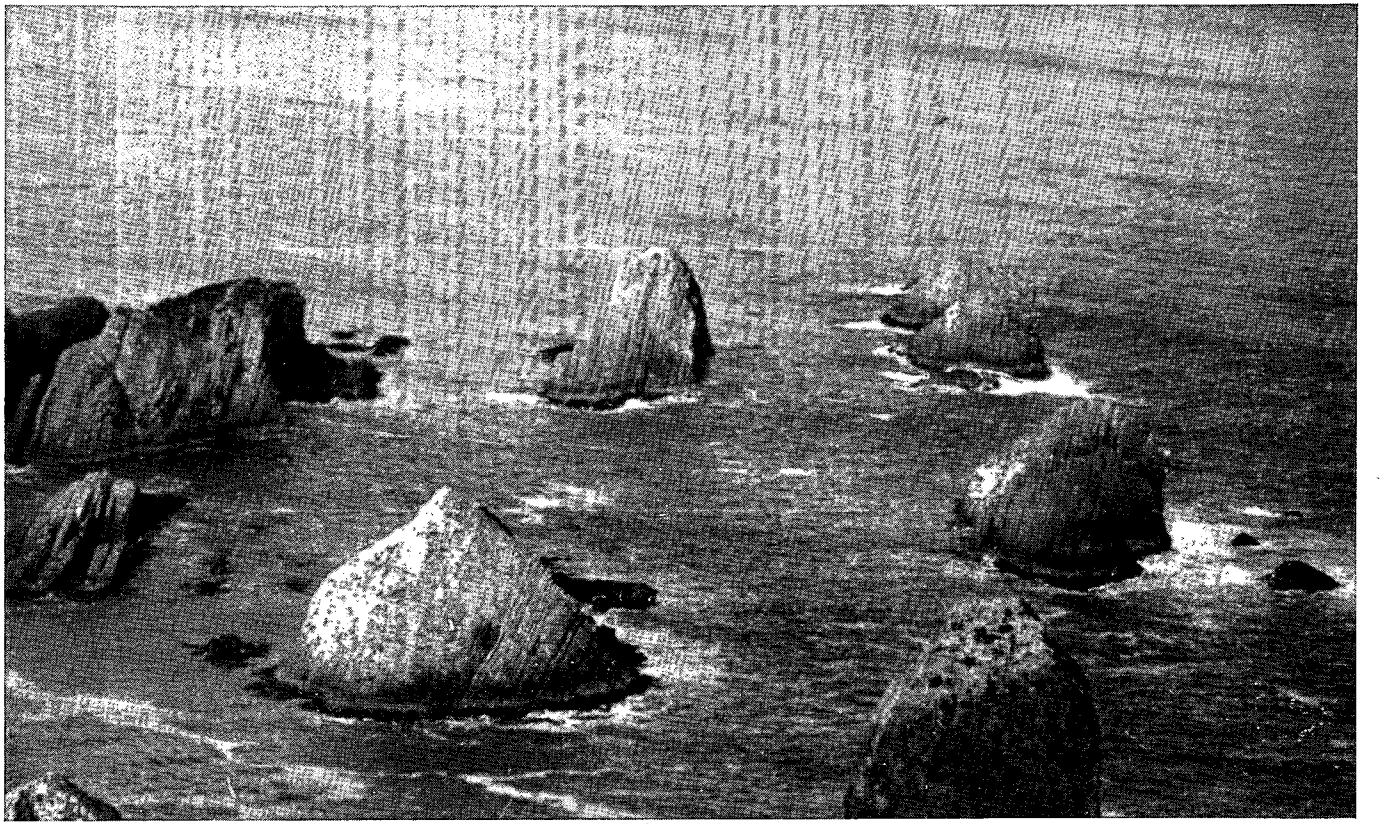


Photo: K. A. Wodzicki.

Figure 36.—NUGGET POINT, Otago. View south-east from Lighthouse, showing small gannetry on summit of conical stack in centre of picture.

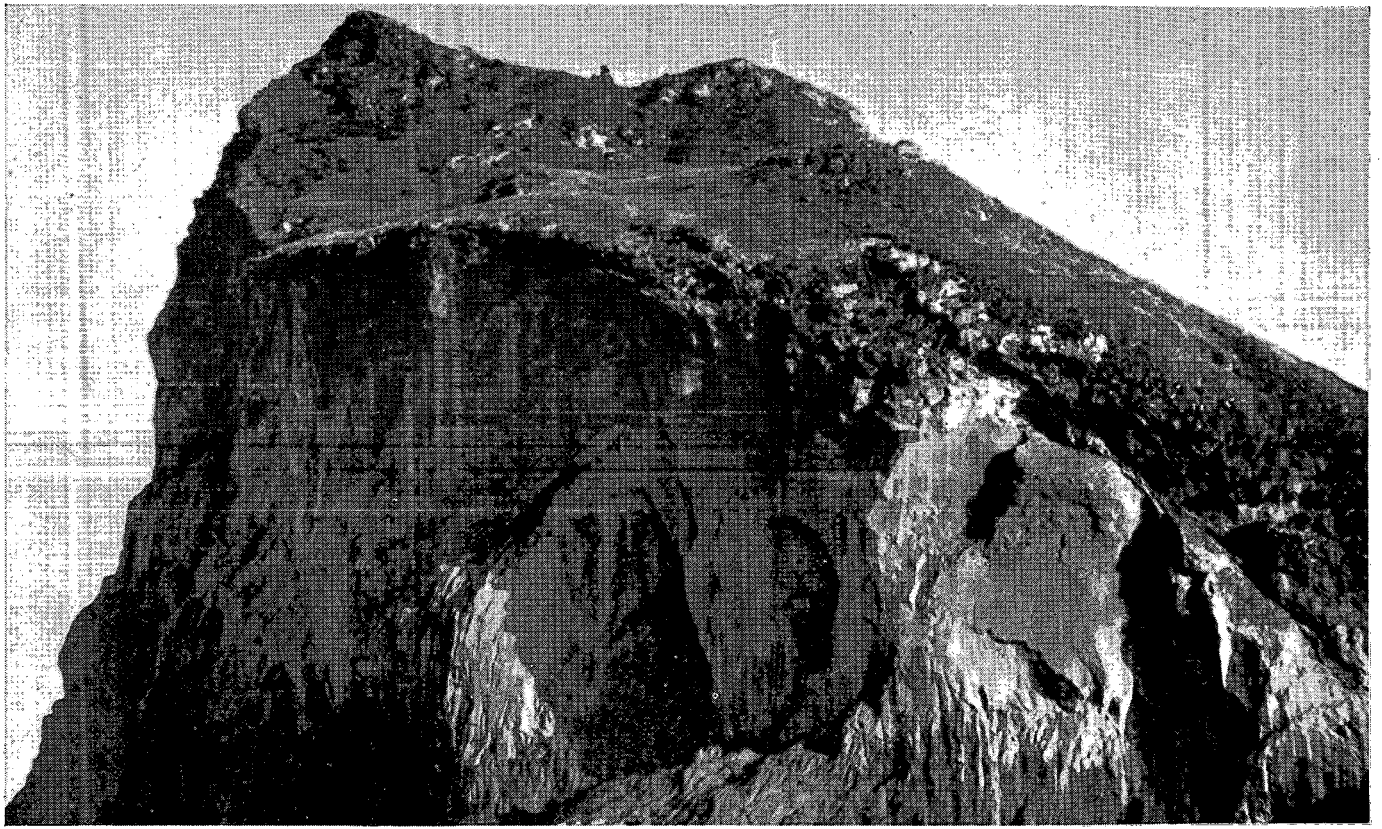


Photo: R. A. Falla.

Figure 37.—LITTLE SOLANDER ISLAND, Foveaux Strait, May 7, 1950. The gannetry is in a gully below the summit.

Summary of Colville Gannetries.

The changes in the three islands' population are doubtless interrelated, and several observers have grouped them in their estimates, so that it is convenient to summarize here the estimates of their population. In the sections above we have presented the evidence for changes in the population at the separate islands, in some cases apportioning, somewhat arbitrarily, to Bush Island and Motutakapu respectively, estimates made to cover both islands. The figures are presented in the table below together with the totals for the Colville gannetries, which are a more satisfactory basis for discussing the nature of the population changes. Figures in brackets are based on estimates for the whole group.

TABLE III.

Population Changes at the Colville Gannetries.

	1928	1938	1940	1941	1946	1947
(16) Double Island ...	–	–	–	–	5	20
(17) Bush Island	800	(950)	1,000	1,100	1,513	(1,513)
(18) Motutakapu	200	(200)	200	200	288	?400
Total Colville gannetries	1,000	1,150	1,200	1,300	1,806	?1,933

(The year at the head of each column is the year in which laying occurred for the season to which the counts apply, e.g., the January, 1942, estimate is to be found under 1941.)

Fisher and Venables (1938) have shown that an increase of over 12 per cent. per annum in a gannetry's population indicates that it has probably been colonized from another area, and that an annual increase of over 25 per cent. is a certain indication of such colonization. Among the Colville gannetries, Double Island is known to have been colonized about 1942 for the first time. Judging by the figures tabulated, the increase in the whole Colville group between 1928 and 1947 was an average rate of 4.9 per cent. per annum, so that it is doubtful whether any of this increase is due to colonization from other areas.

Summary of Colville Gannetries.—Long established. Estimates: 1928, 1,000 pairs; 1938, 1,150 pairs; 1940, 1,200 pairs; 1941, 1,300 pairs. Count: 1946, 1,806 pairs; estimate, 1946-47, 1,933 pairs.

WAIHEKE ISLAND.

(19) Horuhoru.

Horuhoru (or Gannet Rock), a little under a mile due north of Thumb Point, Waiheke, is an irregular, steep-sided, narrow islet some 150 yards long and 40 yards wide, reaching a height of 75 feet. Areas of taupata scrub on the top of the island separate four main groups of nesting gannets, and a fifth group occupies the semi-detached North Stack. Cliffs rising above a tidal rock platform bound the main island except in the centre of the west side; there the surface slopes westward from the eastern cliff and allows access to the summit ridge. (Fig. 21.)

Although Horuhoru has been known to Auckland ornithologists, yachtsmen, and others, as a gannetry for over 50 years, there are no early published references to the islet, unless it is included in Fairchild's phrase, "small islands in the Hauraki Gulf, near Coromandel" (Buller, 1888).

R. A. Falla (Wodzicki and McMeekan, 1947, p. 421) gave an estimate in round figures of 1,000 pairs as the gannet population of Horuhoru (Gannet Rock).

No actual counts were made on several visits to Horuhoru between 1930 and 1946 by Auckland ornithologists, but the general impression is

that the gannetry maintained a fairly steady level of population.

During the 1946-47 nesting season, Horuhoru was visited several times, and the counts of occupied nests, eggs, and surviving chicks, at different dates permitted fairly close documentation of that season of low nesting success (Fleming, 1947 a; Cunningham, 1947; Clark and Roberts, 1948; Fleming, 1948). The count of occupied nests on October 2 (1,228) before the onset of the perhaps abnormally high losses, is accepted as the adult breeding population for 1946-47.

Summary.—Well established before 1900, but no population records; estimate, 1928, 1,000 pairs; count, 1946-47, 1,228 pairs.

MURIWAI.

(20) Oaia Islet.

Oaia (Figs. 22, 23) is a small dome-shaped islet, nearly a mile off Muriwai Beach, Auckland West Coast. No ornithologist has landed and observation of the gannets that nest on its summit has been by binoculars and telescope from points on the adjacent mainland, supplemented by oblique aerial photographs taken on January 14, 1947.

Oliver (1930) was apparently the first to record a gannetry on Oaia, but its existence had been known and its gannets watched periodically for at least sixteen years before 1930: A. W. B. Powell (oral comm., 1948) stated that the gannetry was well established in 1914. The outer, western face of the island cannot be seen from the shore, and it was always felt that the gannetry might be larger than it appeared. The aerial photographs now available show that the western face falls steeply from the crest (Fig. 23), so that the whole gannetry is visible from the mainland; but other factors—the foreshortening of the relatively flat summit and the poor visibility caused by a haze of spray—have prevented an accurate census of the Oaia gannetry.

R. A. Falla's estimate of 100 pairs in 1946 (Wodzicki and McMeekan, 1947, p. 431) is the last of a series of estimates made over many years, during which the strength of the colony seemed to remain fairly constant. Fleming and Sibson (1947, p. 62) made counts throughout 1940, the highest being about 200 birds in February and in November, the count at the latter date, free from possible complication by young birds, suggesting a minimum population of 160 pairs. On September 9, 1942, when the number of adults ashore may have been exceptionally high owing to nest-building and mating activity, Sibson estimated 250-300 birds ashore at Oaia, and the number of visible nests was "taken as 150 to 225." The discrepancy between these figures and the estimates of about 100 pairs is perhaps due to a personal factor in making the counts or estimates, and cannot be taken as a definite indication of changes in the population.

The oblique aerial photographs taken on January 14, 1947, show that all estimates from the mainland have fallen well short of the mark. The main, and perhaps the only area of nests is a strip of ground along the summit ridge, sloping towards the east from the top of the western cliff, where the birds show up clearly against a background of dark "guano." North and south of this nesting area other birds are perching on bare white patches and are diffusely scattered on the lower eastern slopes, amid a broken cover of low vegetation (probably **Disphyma australis**). In the clearest photograph there are approximately 540 gannets visible, in the air, and on the ground, so that the population is certainly greater than 270 pairs, since the whole population of a gannetry is never on shore at one time. In the nesting area there are about 338 occupied nest sites (mean of 3 counts) of which at least 37, and probably more, are attended by 2 birds. In addition, there are about 168 gannets on the ground outside the main nesting area. At other gannetries, peripheral areas sometimes contain nests, but there is no way of telling whether there are any such

nests at Oaia. From the photograph, then, we assess the breeding gannet population of Oaia as 338 pairs, and suggest that there may be a considerable number (168) of roosting birds attached to the colony, so that the total population may exceed 800 birds.

Summary.—Breeding from at least 1914. Estimates: 1920 to 1946, 100 pairs; 1940, 160 pairs; 1942, up to 255 pairs. Count: 1946-47, 338 pairs, and about 168 roosting birds.

ALDERMEN ISLANDS.

(21) Sugarloaf Rocks.

Sladden and Falla (1928, p. 285) reported a small gannetry at the Aldermen Islands on the taller of the two Sugarloaf Rocks, some two miles north by east of Hongiora. The gannets "occupy a small plateau which caps this inaccessible cone of rock, and cannot number more than five or six nests. Chicks in white woolly down could be seen in January." This account was the result of observations between 1921 and 1927. Sladden (letter to C.A.F., April 4, 1948) states that the gannetry had been established for at least several years when he first saw it in 1921 or 1922, and implies that it was occupied until war-time conditions prevented him visiting the Aldermen Islands. Falla (in Wodzicki and McMeekan, 1947) gave a revised estimate of 10 pairs for the 1926 population. Gannets can be recognized on photographs of the Sugarloaf taken in 1926, but not sufficiently well to judge their numbers.

In October, 1946, Fleming attempted, without success, to visit the Aldermen Islands gannetry from Whitianga. On aerial photographs taken on January 13, 1947, no gannets are visible in flight near the rock, and, although the flattened summit of the cone and the tops of many of its rock-columns are white, no gannets can be seen. (Fig. 24.) Nor does it appear that red-billed gulls and white-fronted terns, which have at times nested at the rock, were breeding there in 1946-47. Mr. W. Gilliver, formerly District Inspector of Fisheries, Tauranga, examined the Sugarloaf on December 30, 1947, and February 11, 1948, and found that there were no gannets on the rock. Mr. B. Sladden writes (1948) that the gannets have been away from the Sugarloaf long enough for all traces of the nesting mounds and guano to have disappeared, i.e., at least two years.

Summary.—First observed breeding 1921 or 1922; breeding 1925-26, 1926-27 (estimate, 5 to 10 pairs) and later seasons before 1939; inferred not breeding 1945-46; not breeding 1946-47 and 1947-48.

WHITE ISLAND.

The existence of nesting gannets at White Island has been noted by most of the visitors to this island volcano. Buller (1873, p. 324) quoted Fairchild and Colonel Haultain, who visited White Island on Christmas Day(year not stated, before 1872) and "found thousands of young gannets there." Buller (1888, p. 179) also quotes Captain Fairchild's statement that gannets were "so thick on certain points that you could not stick another gannet in." He alleged that they evacuated the island at the time of the Tarawera eruption in June, 1886. Sladden (1926, p. 209) has pointed out that gannets regularly evacuate nesting areas before June, and that their absence on June 11 requires no special explanation.

The gannetries were next mentioned by Buddle (1906, pp. 637-8). He noted at the end of one of the rugged spurs visible from the lip of the crater, "a vast colony of gannets—thousands upon thousands—packed together like regiments of soldiers." Apparently he refers to one of the Gannet Point gannetries (see below).

In December, 1912, W. R. B. Oliver visited White Island and published an account of its gannets and other birds (1914, pp. 86-90). Oliver recorded

that there were "about six colonies of gannets on the south coast of White Island, and one on a rock a little distance from the shore." He visited two of the colonies, but gave no data on their population. The existing colonies on the south coast of White Island could easily account for his tally of "about six," but the "rock a little distance from the shore" (i.e., Club Rocks) was not recorded as a nesting place in later years.

In an article in the "New Zealand Herald" (about 1924, but our cutting is undated), Rolf Ward described a visit to White Island in late October, noting that "an approximate estimate of the gannet population of the island in the nesting season showed that there were not less than ten thousand pairs in the various rookeries," a figure that cannot be taken seriously.

Mr. Bernard Sladden has provided us with an account of the White Island gannetries based on three trips in the years 1925 to 1927. Falla's estimate of 1,200 breeding pairs for White Island in 1926 (Wodzicki and McMeekan, 1947) was based upon Sladden's observations. Eight separate areas where gannets were observed or suspected to have been ashore were listed by Sladden and located on a map. The outlying rocks were habitually frequented by idle birds, without nests, so that the staff of the sulphur extraction works referred to them as "the bachelors' club," and the name "Club Rocks" has been adopted in this account. A small colony, estimated at "perhaps 100-150 birds" was located on a flat cliff-top near the site of the dam later constructed to conserve water for the sulphur works. Sladden commented that it "may not be regularly tenanted." It was not occupied in 1912, when Oliver photographed the site, nor in January, 1947, and did not appear to have been in use for years. Another area, on the northern slopes of the volcano, appeared "to be an abandoned breeding ground of considerable extent, as viewed from the sea, but difficult to get at except by landing on that side of the island." This area was investigated in 1947, but no evidence of its having been a gannetry was obtained; it is perhaps an area on which vegetation had been killed by volcanic fumes. Apart from the areas noted above, all the nesting areas of 1925-27 were easily recognized in 1947, and the estimates of the population are discussed below, under separate headings, in accordance with the plan adopted in this paper.

In July, 1926, The White Island Products, Limited, issued a prospectus in which the White Island gannetries are mentioned as a potential source of guano.

From January 8 to 14, 1947, an expedition of the Department of Scientific and Industrial Research camped at White Island, and during this time K. A. Wodzicki and F. H. Robertson, with assistance from W. M. Hamilton and C. A. Fleming, were able to conduct a census of the gannetries (Robertson and Wodzicki, 1948). The White Island gannets were unusually shy and had lost many eggs and chicks; we later learned that they had been disturbed before our visit. This work has been supplemented by aerial photographs of the gannetries taken on January 13, 1947. The results are summarized below. The situation of the White Island gannetries is shown in Fig. 25.

(22) West Point.

This gannetry is probably of considerable age, though not particularly mentioned until Oliver (1913) included it among the gannetries of White Island. It is pictured in the prospectus of White Island Products Limited, published in 1926, as a potential source of guano. The only record we have of an examination of this gannetry from the land, prior to the 1947 expedition, is of a visit by Bernard Sladden, with the resident engineer, Mr. Kennedy, in the 1926-27 breeding season. They undertook the somewhat hazardous climb from the Rocky Point landing towards the highest point

of the island, and then down the narrow western ridge to the promontory on which the gannetry is situated. Sladden (letter to C.A.F., August 11, 1946) considered the gannetry to comprise "possibly 500 birds." Since the population is estimated at 1254 pairs in 1947, we consider his estimate, made on a hurried examination, to be conservative.

In the 1946-47 season losses of eggs or chicks had been abnormally high, and adult birds were unusually wary so that precise counting was difficult (Robertson and Wodzicki, 1948, pp. 38-40). On January 9, counts gave a total of 710 occupied nests (= breeding pairs). An aerial photograph of the colony taken four days later (Fig. 26) has enabled us to supplement the observations made on the ground with counts of the number of adults present in undisturbed conditions. The abnormally large number of idle birds, standing on the **Disphyma** meadow south and west of the lower nesting area, is taken to reflect the high nest losses. The total number of adults visible in the air photograph is more than 1277 birds, so that, allowing for the absence of an appreciable percentage of birds at sea, the figure of 710 occupied nests, based on land counts, is certainly conservative. The total breeding population may well be sufficient to fill the colony: there are well over 1,200 nest sites in the nesting areas alone, and additional nests, some still occupied in January, on the slope between the three main areas, and on peripheral ledges. We consider the figure of 710 pairs, based on the ground observations, to be the absolute minimum population, and we prefer a figure based on the total number of nest sites, i.e., 1,254.

TABLE IV.

West Point Gannetry, White Island, January, 1947.

Area.	Counts.			
	Of occupied nests on ground, 9/1/47	From photographs, 13/1/47		
		Occupied nests	Idle birds	Nest sites
A	161	223	40	319
B	105	103	27	133
C	374	490		724
D	25	18	317	18
E	25	24		30
F	12	11		17
G	c. 8	8		13
(Ledges) Birds in air		–	16	
Total	710	877	400	1254

Figures in columns 2 to 4 are means of 4 or 5 counts.

Summary.—Breeding in 1912; 1926-27, "perhaps 500 birds"; 1946-47, 1,254 pairs.

(23) Rocky Point.

Gannets now breed in three areas on the south coast of White Island on either side of the encampment constructed about 1926. (Fig. 27.) After the establishment of the camp, there are several references to the gannetries in its immediate vicinity (e.g., Walsh, 1930; Ward, c. 1924). An undated plan, showing the layout of the buildings at Rocky Point, shows the areas occupied by nesting gannets when the buildings were erected (probably about 1926). In the plan, four gannet rookeries are indicated, corresponding with the existing areas of nesting gannets. Several of the camp installations were built close to or within the limits of gannetry C, which must surely have suffered from the occupation of the camp.

Bernard Sladden (letter) has recorded that in the years 1925-27 there was "a somewhat straggled group (or groups) of about 200 birds, alongside Rocky Point landing place," and "one of the more extensive colonies, probably 500 birds, situated close to the huts; the condenser shed is located on the corner of the nesting area." These two groups correspond with Rocky Point groups A and B (near the old derrick at the landing) and C (on the point itself) of the 1947 census (Robertson and Wodzicki, 1948). Sladden's estimates appear conservative in the light of the 1947 counts, and old photographs (Oliver, 1913; Crosbie Walsh, published in 1930) certainly do not indicate substantial increases during the past quarter century. Sladden's observations were usually made late in the season when the population had fallen below its maximum.

In January, 1947, there were two nesting areas (A and B) near the landing, with 245 and 40 occupied nests, and a large area (C), divided by a gully into two parts, on Rocky Point itself, containing 322 occupied nests. In each area large numbers of unoccupied nest mounds suggested that the population had been much higher at the beginning of the season.

TABLE V.

Rocky Point Gannetries, White Island, January, 1947.

	Sub-Colony			
	A	B	C	Total
Gannet pairs	245	40	322	607
Empty mounds	178	70	553	801
Total Nests	423	110	875	1408
Eggs	98	18	111	227
Chicks	5	2	11	18
Total Eggs and Chicks	103	20	122	245

When Rocky Point was photographed, some of the birds had been disturbed a few minutes before the plane appeared, so that counts of the number of birds ashore are of little value. The number of nest sites visible confirms the figures for "total nests" in Table V. A small additional area, D, north of C. was used as a roost by 3 or 4 birds in 1946-47. In view of the high losses suffered by White Island gannetries in 1946-47, and on the inference that each nest mound was occupied at the beginning of the season, the total population is assessed at 1408 pairs.

Summary.—Breeding prior to 1912 and continuously since. Estimate, 1925-27, 700 birds; count, 1946-47, 1,408 nests occupied by 607 pairs in January, 1947.

(24) Gannet Point.

The first headland west of Crater Bay may be conveniently named Gannet Point, since it is occupied by the largest White Island gannetry, divided into two unequal areas (A and B) by a ravine (Fig. 28). They are known to have been in existence in 1906 (Buddle, 1906), in 1910, 1912, and 1913 (from dated photographs). In the years 1925 to 1927 Sladden estimated that the two areas were occupied by 500 and 200 birds respectively, but his visits were late in the season (e.g., March 17, 1925). A photograph of uncertain origin, but taken before 1926, shows the large area early in the season; there are more than 800 adults present in part of area A.

Photographs taken by Tudor Collins, Warkworth, of the larger, eastern part of the colony (filed with "Auckland Weekly News," February, 1935) show that it was approximately of its present size; some 1,500 to 1,800 nests can be counted. A photograph by M. L. Johnson (New Year, 1944) of part of the larger gannetry shows a high percentage of half-fledged young, indicating a much more successful season than 1946-47.

Counting on the ground, in January, 1947, was limited by the relatively small number of nest mounds occupied by chicks and eggs, by the difficulty of viewing the colonies as a whole, and by the shyness of the adult birds. The figures obtained account for 1,280 pairs in the larger eastern area (A) and 465 pairs in the smaller western area (B). No attempt was made to count the additional empty nest mounds lacking attendant birds, so that the population may be greater than the total of 1,745 pairs counted. Aerial photographs of the colony are of good quality and were taken at about 9 a.m. when the gannets had not been disturbed by observers.

Counts of the number of birds ashore on the smaller western area (B) average 394, of which about 300 are attached to nest sites, the rest idle birds outside the nesting area. Nest sites, occupied and empty, total 446, a figure which approaches the total counted on the ground (465). Apparently fewer birds were present when the aerial photographs were taken than a few days previously when the birds were counted from the forested slope above, and the higher figure is accepted for the purpose of the census.

For the larger eastern area (A), several counts gave the following mean figures: occupied nest sites, 1,660; mates present, 160; idle birds outside nesting areas, 190. Considering that only 21 chicks and a few hundred eggs were present in the nests, and that more than 300 empty nest mounds were unoccupied in January, the total population at the beginning of the season is assessed at 2,100 pairs.

The Department of Scientific and Industrial Research expedition found evidence that the Gannet Point (and other) colonies had been disturbed by mutton-birding parties some weeks before the beginning of January, 1947. Such disturbance must account to some extent for the very low nesting success, the eggs laid late in the season (after the disturbance, perhaps replacing losses), and the unusual timidity of adult birds.

Summary.—Breeding 1906, and probably much earlier; 1910; 1912; 1913; 1925-27, estimate 700 birds; 1935, some 1,500-1,800 nests in east part; 1946-47, count 2,565 pairs, but possibly more early in the season.

(25) Dam Site.

On the flat top of a low cliff at the mouth of the dry ravine a concrete dam was constructed to hold rain-water for the sulphur works, about halfway between Crater Bay and Gannet Point. This was indicated as a small gannetry by Bernard Sladden (letter to C.A.F., 1946) from his observations in 1925-27. He estimated the gannetry at "perhaps 100-150 birds" and commented that it might not be regularly occupied. It was not occupied in 1912, when W. R. B. Oliver took a photograph clearly showing the site, nor in 1947, when the area was occupied by a vigorous growth of **Disphyma australis.**

Summary.—Not breeding 1912; 1925-27, breeding, estimate, 100-150 birds; 1946-47, not breeding.

(26) Club Rocks.

This name is applied to the group of small rocks off the south coast of White Island. A photograph published in 1910 is unfortunately too distant to judge whether the gannets were nesting. Oliver (1913) mentioned a gannetry "on a rock a little distance from the shore of White Island." Later observers (Sladden, letters, 1925-27, and others) have noted gannets ashore, but not nesting, on the Club Rocks, and have considered that the rocks were used as a roost only.

In January, 1947, we noted white-fronted terns (**Sterna striata,** Gmel.) on the rocks, but no gannets were seen ashore.

Summary.—Breeding 1912; 1925-27, birds present, not breeding; January, 1947, no birds present.

Summary of White Island Gannetries.

Table VI. summarizes the available information on White Island gannetries.

TABLE VI.

White Island.

1912 (Oliver).	1925-27 (Sladden)	1947
West Point—		
Breeding.	Breeding, est. 500 birds.	Breeding, count 1,254 pairs
Rocky Point—		
Breeding.	Breeding, est. 700 birds.	Breeding, count 1,408 pairs
Gannet Point—		
Breeding.	Breeding, est. 700 birds.	Breeding, count 2,565 pairs
Dam Site—		
Not occcupied	Breeding, est. 100-150 birds.	Not occupied.
Club Rocks—		
Breeding.	Roost only.	Not occupied.
Total	"About 2,000 adult birds"	5,227 pairs

Two small gannetries reported by Oliver and Sladden are no longer in use. Although Sladden's estimates were probably conservative, the total gannet population of White Island appears to have increased in the last 20 years, since the sulphur works were abandoned.

KAWHIA.

(27) Gannet Island or Karewa. (Fig. 29)

Since the Maori name for the Kawhia gannetry is in current use for an island bird sanctuary in the Bay of Plenty, we accept the widely-used name of Gannet Island given by Captain James Cook to the first New Zealand gannetry to be seen by Europeans, and suggest that the name should not be used for other islets which have been loosely so called (Horuhoru and Motutakapu). Gannet Island is the largest New Zealand gannetry.

On January 10, 1770, Captain Cook's "Endeavour" "was abreast of a Point of Land which rises sloping from the Sea to a Considerable height; it Lies in the Lat. of 37° 43' S; I named it Woodyhead. SW ½ W. 11 miles from this Head is a very small Island which we named Gannet Island, on account of the Great Number of these Birds we saw upon it."* (Cook, 1893, p. 179.)

Gannet Island was known to the Maori as a source of food, and Mr. E. H. Schnackenberg, Kawhia, recorded (letter to Auckland War Memorial Museum, February 11, 1947) that March was the period chosen to collect fat young gannets for food. He quoted a chant composed as a lament "centuries ago by a woman who was born in this locality" (Kawhia) "but was married and lived at Taupo with her Ngatituwharetoa husband. As she lay dying the scenes of her girlhood came back to her memory. Addressing her husband, she chanted—

"Let us return hence
To where the ocean waves
Break in frothy foam
O'er sunken Rewatu.
Where the Karoro sits nesting
At the harbour's mouth
We shall see the watchful takapu
Searching for food in tidal waters,
Then flying to their islet abode
The birds of your ancestor Kaupaenga."†

* Sir Joseph Banks (1768-71, p. 103) more cautiously writes of "a small Island or Rock which seem'd almost totally covered with Birds probably Gannets".

† Rewatu: A submerged rock near Aotea with an ancient legendary history. Karoro: Black-backed gull. Takapu: Gannets.

In European times, Gannet Island has been visited with some regularity by fishermen from Kawhia Harbour, for the surrounding seas are rich fishing grounds, but few records of landing have been published. Captain Fairchild, of the Government vessels "Stella' and "Hinemoa" made periodic landings in the seventies and eighties of the nineteenth century, and Buller quotes his somewhat unorthodox views on second broods and two-egg clutches. Fairchild is quoted as saying that he found "an almost incredible number breeding" at Gannet Island. Percy Buller's account of a visit to the island in December, 1883 (Buller, 1888, p. 181) when he was unable to land, is influenced by the captain's views; and contains the statement that "a space of about three acres . . . was literally one mass of Gannets, there being tens of thousands." This type of uncritical estimate was common among nineteenth century observers, but it indicates that the gannetry was thriving at that date.

Another visitor to Gannet Island with Captain Fairchild was Andreas Reischek, who records his visit without comment (1930, p. 248). Near the turn of the century an unsuccessful attempt was made to exploit the "guano" from Gannet Island, using a ketch, the "Giroffla," stationed at Kawhia. The "Graphic," Christmas number, 1900, includes a photograph of "young gannets near Kawhia," and another photograph, by A. H. Babbage, dated "about 1901" records a visit by the Northern Steamship Company's vessel "Gairloch." A newspaper article (unsigned, but written by E. H. Schnackenberg, c. 1930) records that "during the breeding season thousands of gannets assemble on the rough tableland which forms a surface of about four acres from 30 to 70 feet above sea level." Severe storms have "driven huge rollers completely over the island, and swept thousands of the fledgling gannets . . . . into the surging sea," to be washed up on mainland beaches and the nearby harbours. None of these visits contributed estimates of the strength of the colony.

Air photographs of the islet, taken on January 14, 1947, allow the population to be assessed. (Fig. 29.) A photograph from vertically above the colony at a relatively low level shows some 80 gannets in the air, and about 4,000 birds on the ground, so that the population is considerably greater than 2,000 pairs. Of the birds on the ground, 360 are standing outside the limit of the main area of whitened rock, and are unlikely to be at nests. Within the whitened area, most birds are probably at nests, but there are restricted areas where the birds are scattered more widely than elsewhere, and such diffusely scattered birds may be unemployed. The mean of three counts of the birds in the nesting area is 3,715, but the actual number of nests is probably somewhat less than this.

Summary.—Breeding in ancient Maori time, say 1500 A.D.; breeding 1770 ("almost totally covered with birds"); 1883, "literally one mass of gannets"; c. 1900; 1901; c. 1930 ("thousands of fledglings swept into sea"); 1946-47, counts, 3,715 breeding pairs.

HAWKE'S BAY.

The well-known gannetry at Cape Kidnappers has increased in population since it was discovered, and two additional gannetries have been established nearby during the past two decades. The latter are discussed separately below under the names Black Reef and Kidnappers Plateau.

(28) Black Reef.

The occupation of stacks at Black Reef, one mile west from Cape Kidnappers, by nesting gannets, is one of the more spectacular later events in the history of progressive increase which the Kidnappers gannetry has shown. Black Reef was unoccupied by gannets before 1931, when R. H. D. Stidolph (letter to K.A.W., 1946) found the rocks occupied by a colony of white-fronted terns (**Sterna striata** Gm.). The first use of the locality by

gannets was reported in the 1938-39 season ("Hawke's Bay Daily Mail," July 22, 1939).

In 1948, Mr. R. Keys informed the Rev. F. H. Robertson that gannets had nested at Black Reef "for a long time," and that gannets and terns occupied the rocks in alternate breeding seasons, for some years.

Wodzicki and McMeekan (1947, p. 436) recorded that there were nesting gannets on ledges on the mainland cliffs and on five of the higher stacks of the reef, an additional rock being in use as a roost. On December 18, 1945, they found a total of 376 breeding pairs of gannets, distributed as in Table VI. Aerial photographs taken on November 21, 1946, make possible fairly accurate counting of Rocks 2, 3 and 4, but Rocks 6 and 7 are not so clear, and the mainland ledges (1) are not visible. (Fig. 30). The Rev. F. H. Robertson made a census on December 16, 1946, and reports that the mainland ledges were unoccupied. The counts are presented in Table VI., and suggest that there was a decrease between 1945 and 1946; the largest group contained fewer occupied nests at the later date and the ledges were not in use.

TABLE VI.

Black Reef Gannetry, 1945-46, 1946-47.

Group.	Dec. 18, 1945	Nov. 21, 1946	Dec. 16, 1946
1	13	0	0
2	8	(roost: 33)	5 occupied nests
3	30	36	30 occupied nests
4	300	175	216 occupied nests
5	(roost)	(roost: 8)	(roost)
6	18	(roost: 30)	12 occupied nests
7	7	(roost: 29)	(roost)
Total	376 pairs	211 pairs	263 pairs

Summary.—Probably not occupied before 1938-39 when breeding reported; breeding 1945-46, count 376 pairs; 1946-47, 263 pairs.

(29) Cape Kidnappers.

No authentic references to a gannetry at Cape Kidnappers have been found in Maori tradition (Wodzicki and McMeekan, 1947, p.432).

Cape Kidnappers was named by Captain Cook in October, 1769, at which date a gannetry would be fully occupied. Cook and his companions made no reference to nesting seabirds, a significant circumstance, since such natural phenomena were consistently recorded, and there is, indeed, a reference by Banks (1768-71, p. 41-2) to feeding "**Nectris munda**" (**Puffinus** sp.) near the Cape.

Cottrell (1923) recorded an early copy of Cook's map of New Zealand on which gannetries were marked at White Island and Great Barrier, but not at Cape Kidnappers, and claimed that this was evidence that Kidnappers was not occupied by gannets in Cook's time. The marking of gannetries at Great Barrier and White Island cannot be attributed to Cook, but there is, in fact, no evidence that Cape Kidnappers was occupied before the middle of the nineteenth century.

On February 3, 1827, Dumont D'Urville, in the "Astrolabe," in company with the naturalists Quoy, Gaimard and Lesson, passed "not more than a league" from Cape Kidnappers ("Mata Mawi") and described its appearance in some detail (D'Urville, 1950, p. 112). He mentioned using a telescope a few hours previously and doubtless scanned the Cape closely. Four days before, D'Urville had recorded gannets at sea north of Cape Palliser, and noted them again near East Cape, so it is reasonable to suppose that he would have seen a gannetry if one had been established at that date.

The late Mr. Henry Hill, veteran Hawke's Bay naturalist, was reported in 1929 to have stated that he first visited Cape Kidnappers "fifty years ago" (i.e., c. 1879) and that the number of gannets did not then exceed fifty (Annual Report on Scenery Preservation for the year ended 30th March, 1929, Appendix F, Cape Kidnappers Bird Sanctuary Board, p. 16). Since this first record there has been a steady rise in the population, well documented by photographs during the last 50 years, so that the gannetry was probably established about 1850.

The first accurately dated report of gannets at Cape Kidnappers was made by J. C. McLean on January 19, 1885. His notes mention that "The gannets nest on a cliff near the Cape, about 100 nests were made of seaweed and earth . . ." This may be an underestimate, because on December 21, 1888, he wrote: "The distance of the nests from each other —centre from centre—varies from 27-33 inches, so taking the colony as measuring 15 x 30 yards and a nest to every square yard, there must be nearly 500 nests."

A photograph taken by Jas. Chambers during a visit with J. C. McLean (apparently two years later, in January, 1890) is reproduced with a 1950 photograph. (Figs. 31a and b.) Only a fraction of the area occupied today was covered with nests and the remaining larger southern part of the present nesting site was thickly covered with grass. A count of the birds (including chicks and unemployed birds) gives a total of about 320. The eastern part of the colony is not visible in Chambers' photograph. A strip round the nests is denuded of grass, which may indicate expansion of the nesting site. The breeding population in the 1889-90 season was probably between 400 and 500 pairs.

Buller (1897) recorded "probably over a thousand birds nesting" on December 30, 1896.

Fig. 32 is from a negative provided by Mr. Roy Symons and is believed to have been taken between 1900 and 1903. An almost identical picture was taken by J. C. McLean on November 9, 1903, so that the Symons photograph was probably taken on the same date.

The photograph shows that only a small area on the north side of the central saddle was then occupied. Almost the whole area of nesting gannets is pictured, and 1,269 birds can be counted, representing about 1,211 nests (deducting 58 visible mates). Judging by other photographs, about 15 nests may be excluded from the photograph on the left.

From 1904 onwards, photographs of Cape Kidnappers taken from a vantage point on the mainland west of the knife-edge ridge leading to the Cape itself, appeared at irregular intervals in New Zealand illustrated papers, and allow the growth of the colony to be roughly gauged. One such photograph ("Weekly News," June 9, 1904) confirms the general position indicated in the Symons photograph, perhaps taken earlier in the same season. By 1907, gannets were occupying the summit of the most landward of the three peaks of the Cape (Chegwidden, photo). G. L. Adkin photographed the Cape early in the 1913-14 season. The outermost stack, buttressed to its neighbour in 1907, was by then isolated. There are few birds visible at this early date, but the nesting area is clearly defined; since 1903-4 the gannetry had extended two-thirds of the distance across the saddle. The number of nests present is estimated, very roughly, as about 1,300.

A photograph by C. Beken, taken about 1920, shows further increase to perhaps 1,800 nests, occupying almost twice the area covered by gannets in 1903. The nesting area had then extended almost to the southern edge of the saddle (leaving a vacant strip about 12ft. wide) and up the western slope to the crest above the track leading to the gannetry. On the opposite (eastern) slope, the birds had not occupied any higher levels than in 1903,

but had extended a little to the south. By 1923 the Cape looked, superficially, much as it does now, for the outermost stack, prominent in photographs from 1913 to 1920, had been reduced to a reef, but there was a large patch, bare of nests, and on the south side of the western slope, a patch which persisted at least until 1931 ("Weekly News," November 26, 1925, and February 25, 1931) but is now occupied.

Cottrell (1923 and 1926) gave "a rough estimate of the number of nests . . . let us say 2,000. That represents 4,000 adult birds," as the 1923 population. The "New Zealand Herald," (November 6, 1924) published an opinion that there were more birds in 1924 than in 1923; along the southern edge of the "plateau" (i.e., the saddle) a strip of 6ft. or more wide was "bare of nests" in 1923-24 but "entirely occupied" in 1924-25.

On March 12, 1930, a photograph appeared in the "Auckland Weekly News" which was later published (Wodzicki and McMeekan, 1947, p. 137, Fig. 1) dated in error "the end of October, 1940." This shows the nests occupying the western slope up to its top, but the concentrated nesting area of the saddle (shown by the limit of dark "guano") did not reach so far up the eastern slope as in 1945. Also, on the upper parts of the eastern slope, now occupied by successive horizontal terraces of nests, there were, in 1930, merely scattered birds which were probably not nesting. Mr. Rolf Keys, Hastings, dug ledges on the steep eastern slope in the hope of inducing gannets to occupy them. By tracing the 1930 boundary on a grid based on a 1947 air photograph, the approximate number of nests involved has been calculated, and the 1930 population deduced to have been no more than 2,000 pairs. This figure may be too high, for it takes no account of possible changes on the western slope.

Photographs published in 1931 ("Auckland Weekly News," February 25) show the western slope to be fairly well filled, though not so densely as in 1947, and the eastern slope the same as in 1930. Judging by these photographs, the 1931 population was a few hundred pairs below that of 1945-46, that is, less than 2,000 pairs. Cottrell's figure for 1923 was but a "rough estimate," so that no definite decrease need by deduced, but the rate of increase cannot have been rapid.

The first attempt to count the Cape Kidnappers gannet population with precision was made by Wodzicki and McMeekan and their assistants on December 18, 1945 (1947, p. 437). The main gannetry ("Colony A") contained 2,265 occupied nests, of which 1,590 were estimated on the central saddle, 200 on the eastern, and 475 on the western slope.

Aerial photographs taken on November 21, 1946, have been used as a basis for the 1946-47 census. (Figs. 33 and 34). The photographs show nearly 3,000 nests, of which, however, 600 are unoccupied nest mounds. The number of occupied nests is 2,337 (mean of 11 counts). There is no way of telling whether the unoccupied nests belonged to pairs which began to breed but did not continue. There is, however, no great number of unemployed birds on the area. The total population is assessed at 2,337 pairs.

Summary.—No early records; probably established in middle of nineteenth century. Estimate, 1879, "did not exceed fifty"; 1885, 100 pairs; 1888, "nearly 500 nests"; 1890, 400-500 pairs; 1896, "over a thousand birds nesting"; 1903, 1,226 nests; 1913, 1,300 pairs; c. 1920, 1,800 pairs; 1923, "let us say 2,000" pairs; 1930, 1931, no more than 2,000 pairs. Counts, 1945, 2,265 pairs; 1946-47, 2,337 pairs.

(30) Kidnappers Plateau.

The above name is used for the recently established gannetry situated on the plateau 500 yards south-west of Cape Kidnappers (Colony "B", Wodzicki and McMeekan, 1947, pp. 435-6, fig. 2). The area was not occupied during the 1930-31 season (R. H. D. Stidolph, letter, 1946), but

had been used by roosting birds for a long time before the first record of nesting on December 16, 1945. At that date 196 nests were occupied (159 with eggs and one with a chick), but on February 4, 1946, only one newly-hatched chick had survived, although 150 birds still attended empty nests.

On December 16, 1946, F. H. Robertson counted 160 occupied nests and 180 roosting birds on the cliff edge and on ledges below. The 1946-47 population is thus taken as 160 breeding pairs. In both 1948-49 and 1949-50 increases in the breeding population have been reported.

Summary.—Established between 1931 and 1944; first reported breeding 1945-46, 196 pairs; 1946-47, 160 pairs.

Summary of Hawke's Bay Gannetries.

Cape Kidnappers gannetry increased from "less than 50 pairs" in 1879 to c. 2,000 pairs in 1931-32; Black Reef was colonized c. 1938 and Kidnappers Plateau between 1931 and 1944. The total population of Hawke's Bay gannetries was 2,837 in 1945-46 and 2,760 in 1946-47.

Discussion.

The accompanying graph (Fig. 35) has been drawn from the data presented in preceding sections. We have followed Fisher and Vevers (1944) in plotting population on a logarithmic scale to enable ready calculation to be made of annual percentage increases. From 1879 to 1931 Cape Kidnappers was the only gannetry. After the establishment of Black Reef and Kidnappers Plateau gannetries, the populations of each gannetry and the total for the group have been plotted separately.

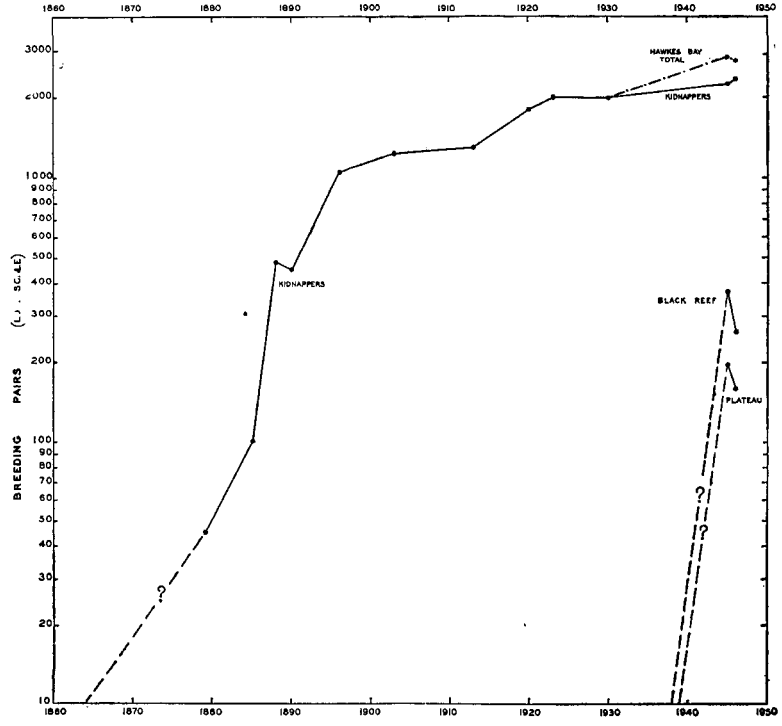


Figure 35—The population (in pairs) of Hawke's Bay gannetries 1879-1946

From 1879 until 1903, Cape Kidnappers increased at an average annual rate of 17 per cent., a rate which according to Fisher and Venables (1938) indicates almost certain colonization by adult birds from other areas. From 1903 to 1931 the gannets continued to increase, but at rates of less than 5 per cent. per annum, which are probably due to natural increase without colonization. Between 1931 and 1944 two new stations were colonized, probably by Kidnappers birds. Cape Kidnappers continued to increase at a still slower rate while the subsidiary colonies were being established. In the 1946-47 season the subsidiary colonies suffered a minor setback from which they have now (1950) recovered, judging from unpublished counts by K. A. Wodzicki and F. H. Robertson. The total population of the Hawke's Bay gannetries, after Black Reef and Kidnappers Plateau were colonized, continued to increase at about the same rate as Cape Kidnappers had done for the previous thirty years, until in 1946-47 it fell slightly, reflecting the general trend in that unsuccessful breeding season.

OTAGO.

(31) The Nuggets. (Fig. 36.)

Although gannets have apparently nested on a stack at The Nuggets for a quarter of a century, the first published account of a gannetry there was when L. E. Richdale (1940) reported in December, 1936, "about 30 birds apparently building nests on the far islet," and "three pairs, apparently an overflow, on the flat island nearby." In the same publication, B. J. Marples reported "about a dozen sitting on top of the conical rock, apparently the nesting site," in January, 1940.

Mr. F. H. Arthur, Nugget Bay, Kaka Point, has supplied the following information (letter to K.A.W., March 20, 1949). Gannets had bred at The Nuggets as long as he remembered, and had increased steadily during the 26 years before 1949. Mr. Arthur had noticed gannets only on the steep stack, 100ft. high, and, in common with other observers, had noted sitting gannets, chicks, and fledged young. In the 1946-47 and 1947-48 seasons, he estimated that there were about 40 pairs nesting.

Summary.—Occupied before 1923, "increased steadily" until 1946-47 (estimate 40 pairs).

FOVEAUX STRAIT.

(32) Little Solander Island. (Fig. 37.)

Falla (1948, p. 54) has summarized what is known of the gannet at the Solanders. For many years the reports of fishermen and sealers (Drummond, 1921) remained unconfirmed, until on December 9, 1947, R. A. Falla and R. C. Murphy, approaching Little Solander from the north-west in the launch "Alert," saw several gannets alight on it and disappear out of sight in a small gully of scrub near the top.. They concluded "that there could not have been more than 20 nests, probably fewer."

On July 20, 1948, Falla landed on Little Solander and found 14 birds occupying nest sites at this early date. The nests were all flattened molly-mawk nests, 11 in the gully, 3 on the spur above, and 6 at the foot of the slope, 20 in all.

Lacking information for the 1946-47 season, we take the figure of 20 pairs as the probable population.

Summary.—Reputedly long-established. Estimate 1947-48, 20 pairs; count, 1948-49, 20 nests.

CONCLUSIONS.

The Present New Zealand Population of Gannets.

Table I. presents the adopted figures for the number of pairs occupying each gannetry during the 1946-47 breeding season. Group totals are given separately. The total New Zealand population is assessed as 21,033 pairs. The large margin of error in the census counts is discussed below; possibly, the population is as low as 18,000 pairs, or as high as 24,000 pairs. It is the writers' opinion that the actual population is above, rather than below, the figure adopted. In any case the population is far higher than the only previous estimate, published by Wodzicki and McMeekan (1947, p. 431). Their figure of 11,000 to 12,000 breeding pairs was based partly on counts, mostly on estimates, and partly on guesses, the counts and estimates dating from 1926 to 1946. The difference is chiefly due to the greater precision of the 1946-47 census methods.

Population Variables and Margin of Error.

Gannets belong to the small group of animals which congregate conspicuously for breeding at a limited number of sites. Theoretically, their whole breeding population may be counted. The experience gained during the 1946-47 census has shown, however, that a number of variable factors must be assessed before counts of birds in a gannetry can be interpreted in terms of its breeding population. Some of such variables are due to the nature of the gannet breeding cycle, while others arise from shortcomings of census techniques.

The number of birds present at a gannetry is subject to inter-seasonal and intra-seasonal fluctuations, which are not necessarily fluctuations of its population. The importance of inter-seasonal fluctuations has lately been shown in an unpublished six-year study by Robertson and Wodzicki at Kidnappers Plateau. Several gannetries (e.g., Three Kings, Mahuki, White Island) appear to have suffered a set back in 1946-47, and empty nest-mounds suggest larger populations than were actually present at the time of the counts. Intra-seasonal fluctuations were demonstrated at Horuhoru during 1946-47 by four counts of occupied nests (Fleming, 1948, p. 152). Judged solely by the number of occupied nests the number of breeding pairs at Horuhoru dropped from 1,228 in early October to 316 on December 29, and the number of attendant adults had also declined, so that a census in December would have given a much smaller figure than one earlier in the season. At Cape Kidnappers, Robertson and Wodzicki have found that the peak period of occupation varies from year to year depending on the date of arrival of the birds at the gannetry. This varies from late June to early August at Kidnappers and the peak period of occupation is about three months later. In 1946-47 some of the census data were obtained in the earlier half of the breeding season (Horuhoru, Colville and Kidnappers) and the rest later, probably after the number of birds ashore had begun to decline.

North Atlantic gannets in immature plumage can be recognized among those ashore at a gannetry and a census result corrected accordingly. In New Zealand, immature birds of previous seasons cannot be recognized among the birds ashore at a gannetry (page 42), so that counts of the total number of birds, as above, (e.g. from air photographs) may exaggerate the breeding population.

There are several sources of error in the actual counting of gannets. For some gannetries counts on the ground were supplemented by air photograps which allowed repeated checking of results in known terrain. Some gannetries were assessed during brief visits solely from counts on the ground which could not be repeated. Other gannetries could not be visited and counts are based entirely on air photographs.

The personal error in counting nesting gannets varies with the size and configuration of the colony. A small gannetry (up to 100 nests) can be counted without significant error. A large gannetry composed of several or many groups of nests, separated by easily-defined boundaries, gives results almost as satisfactory as a small gannetry. Repeated counts of large unbroken aggregations of a thousand or more nests, such as Cape Kidnappers, Gannet Point (White Island) and Gannet Island (Kawhia), generally differ by up to about 10 per cent. In such cases psychological differences incline one observer to accept higher totals than another. Whereas nesting gannets are normally unaffected by the presence of man, at Mahuki and White Island in 1946-47 they had been disturbed and were hard to count (see pages 55 and 65).

The aerial photographs taken during the census are not of even quality. Most were taken on January 13 and 14. The weather deteriorated during the flight so that some lack clear definition, and some were taken at too great a height for confident recognition of birds. Steep-sided irregular stacks, with gannets nesting on ledges, are difficult to photograph. For one or more of these reasons some of the photographs (Tutanekai, Arbutus, Sugarloaf, Gannet Island) are less satisfactory than others. With good photographs the margin of error in counting nesting gannets is small, for nesting adults can be distinguished from idle birds, mates, chicks, and from red-billed gulls which share some of the colonies. Each photograph was counted several times by each of the writers, and the figures used are means. With poor photographs the margin of error may be up to 25 per cent.

Fisher and Vevers (1943, p. 207) claimed to have determined the 1939 population of the North Atlantic gannet as 165,600, plus or minus 9,500, breeding individuals, i.e., plus or minus 5.7 per cent. The 1946-47 population of gannets in New Zealand is assessed at 21,033, plus or minus 3,000, breeding pairs, i.e., plus or minus 14 per cent.

From the information available it appears that inter-seasonal variation in the size of a New Zealand gannetry may be as high as 20 per cent. a year. Intra-seasonal variation, i.e., the difference between the peak population of a gannetry and its population later in a season, may amount to 75 per cent. (Fleming, 1948, p. 153). Errors in counting are thus on a smaller scale than known inter-seasonal and intra-seasonal fluctuations at a gannetry.

The field work for the 1939 North Atlantic gannet census was spread over five months (April to August) but Fisher and Vevers did not discuss the possibility of intra-seasonal variation in the number of adults ashore. Nor did they take into account possible significant inter-seasonal fluctuations in the population of a gannetry. The reasons for both types of fluctuation in population in New Zealand are obscure and merit further study.

Distribution of Breeding Population.

It is clear from Table I. that the gannet population is not evenly distributed throughout the New Zealand breeding range of the species, which extends over 14 degrees of latitude. 99.7 per cent. of the total breed between 34° and 40° S. latitude, whereas the remainder of the breeding range, from 40° almost to 47° S., is occupied by a mere 60 pairs (0.3 per cent.). The northerly concentration of breeding gannets is actually greater, for 86 per cent. of the population breeds between S. latitude 34° and 38°. The concentration north of 38° S. was apparently even greater a century ago, before the establishment of the Hawke's Bay gannetries.

With the exception of The Nuggets and Little Solander Islet, all New Zealand gannetries lies north of the Sub-tropical Convergence as mapped by Deacon (1937). The two exceptions lie in the belt of mixed water which in New Zealand separates the Sub-tropical from the Sub-antarctic Zone of surface water, and their small population serves to emphasize the degree of

correlation between the breeding range of the Australasian gannet and the cooler waters of the Sub-tropical Zone. Judged by available surface temperature data (M.O.M. 1945) the Australian gannetries lie in the same hydrologic zone, but the North Atlantic gannet breeds in somewhat cooler seas. Murphy (1936, p. 827) has characterized the true gannets as occupying "relatively cool-current regions" in contrast with the pan-tropical range of boobies, but the Australasian gannet is, in fact, almost entirely sub-tropical in its breeding range.

Population Trends.

Historical data on the past status of New Zealand gannetries are so scanty that it has seldom been possible to determine population changes during the past century. Of the thirty-two gannet stations listed in Table I. two (Bird Rock and Sugarloaf, Aldermen Islands) were formerly gannetries but are not now used for nesting. Possibly Matapia is also an abandoned gannetry. At nine stations there is evidence of increase, in some cases by colonization. Cape Karikari Stacks and two of the Mokohinau Islands were colonized recently, but their status is still somewhat uncertain. One of the Colville gannetries (Bush Island) has certainly increased during the past twenty years and another (Double Island) has been established recently. Finally, the oldest of the Hawke's Bay gannetries was evidently established about a century ago, and two subsidiary gannetries have since been colonized (pp. 67-71) so that the Hawke's Bay gannetries now rank as the fourth largest group of breeding stations in New Zealand. Other gannetries may also have increased, but we judge the early estimates of their strength too uncertain to be considered in this discussion. The gannetries that have decreased or that were abandoned were all small and were perhaps never firmly established; some of the newly established stations are also small and may only be temporary. However, the clear increase at the Colville and Hawke's Bay gannetries is far greater than the known decrease at other gannetries. We conclude, therefore, that the general trend of the New Zealand gannet population has been one of increase during the past century.

The reason for the suggested increase in total population cannot be stated. The Maoris used young gannets as food but this was probably on a small scale. During the nineteenth century, Maori use of gannets became negligible. The gannet was protected in the Animal Protection Amendment Act, 1910. The effect of legal protection cannot have been great, for there was no habitual use of gannets as bait by fishermen, or as food, before the Act was passed; yachtsmen and others may have occasionally raided gannetries and shot gannets for "sport," but there is no record of destruction on a large scale.

Use of gannet guano on a commercial scale was once contemplated (p. 62), but it has never been taken regularly in large quantities. A little guano is still removed from some gannetries (Mahuki, Colville) at the end of the season, but we have no evidence that this affects the success of breeding.

We consider the change in man's influence on gannets inadequate to account for their increase in New Zealand in the last century. The apparent trend is perhaps due to fundamental changes in the ecology of the sea, possibly of cyclic nature.

SUGGESTIONS FOR FUTURE WORK.

The 1946-47 census has led us to make the following suggestions for future work on New Zealand gannet populations:—

(1) Further censuses at intervals of about 10 years to determine future changes in population and distribution.

(2) Continuous observation of at least one gannetry to determine the extent of inter-seasonal and intra-seasonal changes in its population and the variation in nesting success.

(3) Precise description of the changes in plumage between neoptyle down and adult teleoptyle, particularly during the period after the young bird has left the colony. Rearing of captive birds is the most direct way of obtaining this information.

(4) Studies of ringed birds at one or more colonies with a view to determining:
   (a) The age at which the young gannets begin to breed
   (b) How many non-breeding birds (if any) frequent a gannetry, roosting or building nests.
   (c) Whether individual gannets breed annually.
   (d) Whether mates of incubating birds ever build "play nests" or spend time roosting in other parts of the colony.
   (e) Exchange of individuals between gannetries.

(5) Studies to determine the ecological factors limiting the size of a gannet population to allow of interpretation of the causes of changes in numbers, such as interrelationship of gannets with other marine organisms, and the effects of climatic factors, parasites, and disease.

ACKNOWLEDGMENTS.

The 1946-47 gannet census was undertaken with the approval and co-operation of the Ornithological Society of New Zealand (Wodzicki and Fleming, 1946), and its success is largely due to the work of the following ornithologists who visited gannetries: The late Major G. A. Buddle, Messrs. P. C. Bull, V. I. Clark, J. M. Cunningham, Dr. W. M. Hamilton, Major M. L. Johnson, Mr. T. M. Roberts, and the Rev. F. H. Robertson. Some of these gentlemen also provided records of visits in other years.

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SUMMARY.

In the 1946-47 breeding season the Ornithological Society of New Zealand conducted a census of the gannet (**Sula serrator** Gray) in New Zealand, the results of which form the subject of this paper. The distribution and annual cycle of the gannet are outlined, field work and methods of estimating the gannet population are described, and historical records summarized. In the main part of the paper, 32 gannet stations are catalogued and described, and their status and population assessed with the help of aerial photographs to supplement observations on the ground. The gannet population is assessed as 21,033 pairs, but may be as low as 18,000 or as high as 24,000, the large margin of error being due to inter- and intra-seasonal variables which cannot be determined at present. Although gannet colonies are distributed from the north to the south of the main islands of New Zealand (34° to 47° S. lat.), 99.7 per cent. of the population breed north of 40° S. in sub-tropical waters. Scant historical data suggest that the population has increased during the past century. Finally, suggestions are made for future work on the gannet in New Zealand.

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OCCURRENCE OF LITTLE EGRET IN HAWKE'S BAY.

By D. H. Brathwaite, Napier.

In October, 1951, while in Melbourne, I visited the Altona Salt-works with members of the Bird Observers' Club. Amongst the birds observed there, I saw a little egret (**Egretta garzetta**) and noticed (with rather mixed emotions) that it appeared to be identical with a bird which had frequented the Ahuriri Lagoon, Napier, during the preceding months of June-September, in association with three white herons (**E. alba**). At that time the white heron itself was a new bird to me and its reputed rarity made a group of three of them an exciting enough occurrence; it never occurred to me until I saw **garzetta** in Melbourne that the smaller, black-billed, but otherwise similar bird with the white herons might be anything but a juvenile.

After my return to New Zealand, I was fortunate in seeing the bird once more, on December 19, and examination through binoculars strengthened my suspicion that it could be a little egret. This tentative opinion, together with a description, was forwarded to Dr. Falla, who informed me that it was definitely not a juvenile **alba** which has "the beak completely yellow, and bright at that, and in any case does not differ appreciably in size from adults." Subsequent correspondence with Dr. Falla and others resulted in the conclusion that the bird was probably **E. garzetta**, but that the plumed egret (**E. intermedia**) could not entirely be eliminated as a possibility. The white phase of the reef heron (**D. sacra**) also was not

altogether ruled out but was considered unlikely for various reasons which need not be enumerated, consequent on the bird's reappearance.

On June 7 this year the bird was again located, this time on the bed of the Tuki Tuki River, in company with a white heron, and has been seen since by myself, on June 15 in the same place, and on July 26 on Ahuriri Lagoon. Several other people have also reported seeing it in June and July. The following description has been compiled from field notes made on the various occasions when favourable views have been obtained:—

A "miniature" of the white heron, identical in proportions but appearing only about half the size. Bare skin of face, and base of bill is yellow; distal three-quarters of bill, black. Legs black or blackish-slate, according to light, and projecting conspicuously beyond the tail in flight. Flight of typical heron type but wing-beats rather more rapid than usual.

The long legs eliminate the white reef heron as a possibility; in that species the legs are shorter and do not project noticeably beyond the tail in flight. So far as the plumed egret is concerned, Glenister (1951, p. 102) and Hachisuka (1932, vol. i., p. 355) both state that the bill is black in the breeding season. Dr. Falla (in litt.) says that in **alba** the black bill could not possibly survive the breeding season, and as **intermedia** has rarely if ever been observed in Australia with the bill any colour but yellow, it seems likely that the black bill is equally transitory in that species. In **garzetta** the bill is permanently black; the individual observed at Napier from June to September, and December, 1951, and again in June-July, 1952, has had the bill black whenever seen. Another field character reported for **intermedia** is that the tibia is paler than the tarsus, though various authorities differ slightly as to the exact colours. This feature has been looked for since the bird reappeared this year, but, so far as I can ascertain the legs are uniformly dark. No ornamental plumes have been noted at any time since the bird was first seen.

In view of the fact that in two successive winters the bird has retained the bill colours of **garzetta**, and that I have been able to detect no difference in the colour between tibia and tarsus, there seems little doubt that its identification as the little egret is justifiable.

Mr. E. L. Kehoe, of Greymouth, informs me (in litt.) that a bird of similar appearance has been seen in Westland this year. The bird was observed in July at Lake Ryan, near Greymouth, and about a week later the same bird (or another of similar size) was noted with a white heron near Westport. In the latter case, however, the colour of legs and bill could not be determined.

It seems likely that the recent marked increase in white herons seen throughout New Zealand may be explained by an invasion from Australia, and the occurrence of one, and possibly two, little egrets appears to support this view.

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THE SOCIETY'S ACTIVITIES.

Many of the society's investigations and inquiries are designed to enable as many members as possible to help, and to make their knowledge known. Members are invited to participate in all the following projects:—

PERMANENT INVESTIGATIONS.

RINGING.—A considerable number of black-billed and red-billed gulls, white-fronted tern, banded dotterel and pied stilts have been ringed in

several parts of New Zealand with the "zonal colour" rings, i.e., a different colour is used in each district. N.Z. dotterel and some blackbirds and thrushes have also been colour ringed, in these cases each bird being distinguished according to pre-arranged plans, with a different combination of colours. Members are requested to immediately report any ringed birds seen. Care should be taken to state the colour of the rings, and which leg or legs they are on, and also if both legs were examined to make sure all rings were seen clearly. The date and locality should be given.

Members are advised that the Dominion Museum has taken over the rings and records, and the society is indebted to the museum for this service. Mr. J. M. Cunningham has relinquished the convenership of the Ringing Committee, and Mr P. C. Bull has taken his place. All correspondence on ringing matters should, therefore, be addressed to Mr. Bull, 131 Waterloo Road, Lower Hutt.

NEST RECORDS.—This is an investigation in which almost all members can help. Cards should be filled in for all species—when nests with eggs or young are found, even if the nest is visited only once, or if it is deserted or destroyed. The commonest birds are worthy of attention as there are many gaps in our knowledge of these birds. Cards are available on request from Mr. J. King, Box 448, Masterton.

BEACH PATROL.—Mr. R. K. Dell, c/o Dominion Museum, Wellington, is now organising this investigation, and cards should be obtained from and returned to him. In the case of all petrels found, black-billed and red-billed gulls, and other species showing some similarity, the diagnostic feature should be mentioned in the square "identification confirmed by" or else the name of an authority who has examined the specimens and confirmed their identification.

INQUIRIES.

The following are still current. Members who have not yet supplied information they may have, are invited to give it to the respective organisers immediately.

DABCHICK SURVEY.—Organiser: Mr. R. B. Sibson. Information is still being gathered on the numbers and distribution of this bird in all parts of the country. The full questionnaire was published in the cyclostyled Bulletin No. 1, 1941-2.

BANDED DOTTEREL.—Organisers: Messrs. C. A. Fleming and R. H. D. Stidolph. The second interim report was published in Notornis, V. 4, No. 4.

GODWIT.—Organiser: Mr. R. H. D. Stidolph. The first interim report was published in Notornis V. 4, No. 6.

MYNA.—Organiser: Mr. J. M. Cunningham. Information supplementary to that published in N.Z.B.N., V. 3, No. 2 and Notornis V. 4, No. 4, is being collected for publication in a further report. Records of all birds seen in the Bay of Plenty area, Auckland northern suburbs and North Auckland, are desired, as well as any changes noted in the other parts of the North Island.

WEKA IN GISBORNE-EAST COAST.—Organiser: Mr. J. C. Davenport. The information required is of numbers and movements, and is detailed in Notornis V. 4, No. 2.

CORRECTION.—Portion of the caption on page 10 of the July, 1952, number should read: Part of the stigma shown detached at bottom of plate. Lateral petal is shown in dotted line in the main figure.

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