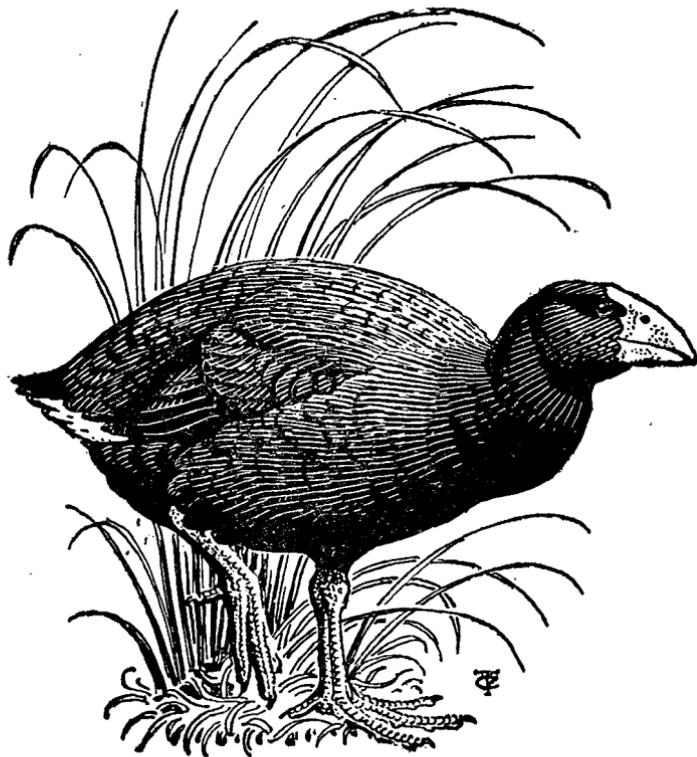


NOTORNIS



QUARTERLY JOURNAL

of the

Ornithological Society of New Zealand
(Incorporated)



Volume Fourteen, Number Three, September, 1967

NOTORNIS

In continuation of New Zealand Bird Notes

Volume XIV, No. 3

SEPTEMBER, 1967

JOURNAL OF THE ORNITHOLOGICAL SOCIETY OF NEW ZEALAND
(Incorporated)

Registered with the G.P.O., Wellington, as a Magazine

Edited by R. B. SIBSON, 26 Entrican Avenue, Remuera, S.E. 2

Annual Subscription: Ordinary Member, £1; Endowment Member, 30/

Life Membership, £20 (for members over thirty years of age)

Subscriptions are a minimum of £1 a year, payable at the time of application and the first of each year thereafter.

OFFICERS 1967/68

President — Dr. G. R. WILLIAMS, Wildlife Division, Department of Internal Affairs, Private Bag, Wellington

Vice-President — Mr. A. BLACKBURN, 10 Score Road, Gisborne

Editor — Mr. R. B. SIBSON, 26 Entrican Avenue, Remuera, Auckland S.E. 2

Assistant Editor — Mr. A. BLACKBURN, 10 Score Road, Gisborne

Treasurer — Mr. J. P. C. WATT, P.O. Box 1168, Dunedin

Secretary — Mr. B. A. ELLIS, 36 Hartley Avenue, Christchurch 5

Members of Council:

Mr. B. D. BELL, Wildlife Branch, Department of Internal Affairs, Private Bag, Wellington

Dr. P. C. BULL, 131 Waterloo Road, Lower Hutt

Dr. R. A. FALLA, 41 Kotari Road, Days Bay, Wellington

Mrs. J. B. HAMEL, 42 Ann Street, Roslyn, Dunedin

Mr. B. D. HEATHER, 10 Jocelyn Crescent, Pinehaven, Silverstream

Mr. F. C. KINSKY, Dominion Museum, Wellington

Mr. N. B. MACKENZIE, Pakowhai, Napier, R.D. 3

Organiser of Nest Records Scheme — Miss M. M. NEILL, 40 Glen Road, Kelburn, Wellington, W. 1

Organiser of Beach Patrol Scheme — Mr. B. W. BOESON, Box 30 Carterton

Organiser of Recording Scheme — Mr. A. T. EDGAR, Inlet Rd., Kerikeri

Despatch of *Notornis* and Enquiries for Back Numbers —

Mrs. H. M. McKENZIE, P.O. Box 45, Clevedon

Librarian — Mrs. H. M. McKENZIE, Box 45, Clevedon

Convener of Card Committee — Dr. G. R. WILLIAMS, Wildlife Division, Dept. of Internal Affairs, Private Bag, Wellington

Contents of Vol. 14, No. 3: September, 1967

An Auckland Island Rail (R. A. Falla)	107
Plate XV — Adams Island Rail	108
Plate XVI — Adams Island Rail at Time of Capture	110
Short Note — Sightings of Kermadec Petrels at Sea	113
Some Portraits of Kermadecs Seabirds (M. F. Soper)	114
Plate XVII — Black-winged Petrel	114
Plate XVIII — Kermadec Petrel	115
Plate XIX — A Pair of Wedge-tailed Shearwaters	116
Plate XX — Blue-faced Booby	117
Plate XXI — Red-tailed Tropic Bird	118
Plate XXII — Sooty Tern	119
Plate XXIII — Grey Ternlet	120
Plate XXIV — White-capped Noddy	121
Snares Island Birds (John Warham)	122
Plate XXV — Snares Island Biological Station	124
Short Note — Inland Over-wintering of Banded Dotterel in the South Island	139
Notes on Recoveries and Breeding Behaviour of Adelie Penguins of Known Age at Cape Hallett (B. E. Reid, F. C. Kinsky, H. J. Cranfield, R. C. Wood)	140
History and Status of the Dominican Gull in Wellington (R. A. Fordham)	144
Short Note — Unusual Records of Birds at Sea	153
Census Records of Knot for Firth of Thames and Manukau Harbour (H. R. McKenzie)	154
Avian Remains from New Caves in the Taumatamaire District (David G. Medway)	158
Plate XXVI — <i>Capellirallis karamu</i> skeleton <i>in situ</i>	159
Plate XXVII — Skull, sternum and tibia of <i>Notornis m. mantelli</i>	159
Short Notes — Status of Australian Coot near Rotorua; Coots at Lake Okareka; Food Passing by Breeding Harriers; Green-shank at Timaru	160
Review	162
Notices	164
Request for Information	164

AN AUCKLAND ISLAND RAIL

By R. A. FALLA

In the course of the joint Dominion Museum - D.S.I.R. expedition which visited the Auckland Islands from January 14th to February 14th, 1966, a small rail, which was seen several times by members of the southern party under the leadership of Dr. E. J. Godley, Botany Division, D.S.I.R., in the vicinity of their camp on Adams Island was eventually captured by them and brought back alive in the care of Mr. J. L. Kendrick of the Wildlife Division, Department of Internal Affairs, to the Department's Native Bird Reserve and aviary at Mount Bruce, near Masterton. Here it has continued to thrive under the attentive care of the custodian, Mr. C. Roderick. At the time of its capture it had the general appearance, plumage texture, and colour pattern usually associated with immature birds. The general features of pattern were those of the *Rallus pectoralis* - *R. aquaticus* group of rails, but they were dull and ill-defined. In the subsequent year and more of confinement the basic pattern common to all races of *R. pectoralis* has become better defined. The measurements used in the tables and taxonomic discussion below are as of June 1966, with a further check in July 1967. They are below average, especially of wing and bill of a random series of all described races of *R. pectoralis* but this may be of less significance if the study specimen should prove to be a young female. In adequate series of carefully sexed specimens of *R. pectoralis* the bill length of adult males exceeds that of females by as much as 20%, and much the same proportional sex difference can be found in *Gallirallus*, *Cabalus* and some other genera.

DESCRIPTION

The general proportions, appearance and plumage pattern are well shown on the accompanying photograph by Mr. J. Kendrick. The crown is chestnut, streaked with the black centring of the feathers: shoulders, mantle, back, rump, upper-tail coverts and tail are chestnut obscurely streaked with blackish brown centres of the feathers. A few barred black and white feathers matching those of the flanks are scattered among the long tertial coverts. Lores blackish brown; superciliary streak, cheeks, sides of neck and nape, are rich rufous; chin and throat whitish, deepening to grey on foreneck and breast which is tinged with olive. The feathers of flanks, belly, and under-tail coverts are black, transversely banded with white, and buff tipped: underwing coverts and axillaries grey, tipped white. Primaries are uniformly dark greyish brown. Soft parts are not strongly pigmented, the bill being dull flesh pink, brown on the ridge of the culmen; feet pinky grey. The iris, dull hazel at the time of capture, is now a somewhat richer brown. Colour changes generally, which seem to indicate progress to maturity, have been in the direction of heightened colour and clearer definition of pattern. In the wing 7th and 8th primaries are sub-equal (at 78 mm.) the 9th shorter (at 73 mm.) and 10th shortest (at 60 mm.). The bastard wing (alula) is flexible and tends to project (at 35 mm.) when the wing is opened. The longer contour feathers are soft and flexible to the touch in the living bird, a characteristic which might not be so noticeable in a dried skin.



[J. L. Kendrick

Plate XV — Adams Island Rail at Native Bird Reserve, Mount Bruce.

BEHAVIOUR

At the time of its capture, and in subsequent confinement the bird has shown all the speed and stealth of movement for which small rails are noted, and has been shy, alert and wary. It was initially caught because of a habit of returning to scavenge at a garbage dump. In confinement it has had enough foraging space to find much of its own insect and other invertebrate food, but is provided with mealworms and mash. It has not so far given much indication of vocal accomplishments. Sharp single notes recorded shortly after capture seem to be distress calls. In less extreme states of agitation it utters brackets of two notes "Kek, Kuk," and has latterly developed the more muffled and deep-seated sounds like faint thumps which are characteristic of many rails. It can fly, under duress, quite strongly and purposefully, but again in the ralline fashion that might be described as "low gear."

The capture of this bird thus establishes that there are still indigenous rails at the Auckland Islands — on Adams Island, at least. The records of earlier observers indicate how elusive they are, and give very little evidence of former distribution or abundance. Thos. Musgrave (1865, 39) caught, to quote his own words "a bird like a waterhen" on the main Auckland Island on high country north of his camp at the site of the "Grafton" wreck in 1864, but this could well have been a gallinule or coot, both of which have occurred as accidental vagrants at islands further South. He has nothing to say about bringing back the rail skin with which he was later credited, as discussed later in this paper. As feral cats, spreading from the north end of the island were already appearing in the south before Musgrave left, the main island can be ruled out as a continuing habitat for small rails. Their discovery now on Adams Island confirms the sight observations of Dr. C. A. Fleming (*pers. comm.*) when on coastwatching duties in 1942, of small ralline birds which he was unable to confirm by capture or close inspection. Ewing Island is another possibility for it was here in 1942 that Mr. L. Seebeck (*pers. comm.*) saw a bird which he later identified (from an illustration of *Grex grex*) as a "corncrake." The present writer, after hearing nocturnal calls on Ewing Island in 1943 distinguishable from those of ducks and snipe set drop traps in which, however, only flightless ducks were caught. Subsequently, in 1962 both Dr. L. Gressitt and Mr. T. Dumbleton, familiar with the common birds, described birds seen on Ewing Island as being small and rail-like.

The remaining past record of rails from the Auckland Islands depends on two specimens said to have been procured there. The first was purchased by A. von Hugel in New Zealand in 1874 and mentioned by him in a letter published in *Ibis*, 1875, p. 392. The supposed second specimen was sent from the Stuttgart Museum to Rothschild in 1893 or slightly earlier by Count von Berlepsch who had received it from Baron von Muller of Melbourne. It has even been suggested by Buller (1905, p. 42) that it was the same specimen, passed by von Hugel to von Muller to von Berlepsch. Be that as it may, Rothschild described the Stuttgart bird as the type of a new species, *Rallus muelleri* (1893, p. 40). Later (1907, p. 204) he elaborated his description and published a colour plate by Keulemans. The same illustration, re-drawn by Frohawk, was published by Mathews. Another version, in black and white (by D. M. Reid-Henry) was

published by Greenway (1958, p. 215). It is assumed, though not specifically stated anywhere, that the type went back to Stuttgart. If so it was lost between 1939-1945 when war damage destroyed most of the collections (N.Z. Department of Internal Affairs files, 1966). There is no record that it was ever re-examined, which is strange, because the specimen bearing von Hugel's label found its way into the Rothschild collection and was examined at Tring by Mathews and Iredale (1913, p. 20) and later at the American Museum of Natural History, New York, by Greenway (l.c.). All concluded that it was a typical *Rallus pectoralis pectoralis*, and Greenway adds the further comment that "it may be doubted that the specimen was collected on Auckland Island."

We have then the unsatisfactory situation that the specimen briefly described by Rothschild was never re-examined and is now considered lost, and that von Hugel's specimen which does survive is not readily separable from typical *Rallus pectoralis pectoralis* (Lewin's Rail of Tasmania and southern Australia, which has distinguishable subspecies elsewhere on the continent and from New Guinea through archipelagoes north to the Philippines). It may be added that the doubts expressed about this specimen dismiss it too lightly. In August 1966, by kind permission of Dr. Dean Amadon, and with the assistance of Dr. Charles Vaurie, I re-examined it at the American Museum of Natural History. Its registration number is now 545046 and it bears two labels. The Rothschild label simply bears a name "H. brachypus" (= *R.p.* brachypus). The second is von Hugel's original printed label



[J. L. Kendrick

Plate XVI — Field photograph of Adams Island Rail at time of capture, January, 1966.

bearing neat inscription in two different inks, but the same handwriting. In faded brown ink it has "Auckland Island, November 1874, purchased Invercargill" and in stronger black ink "*Rallus brachyopus*" — "freshly skinned." On the reverse of the label the inscription is "Procured at Invercargill from skipper of boat just arrived from Auckland Island" and initials "A.V.H." It can be ascertained from contemporary records that von Hugel arrived in Invercargill by the S.S. Albion from Melbourne on 19th December, 1874. Less than two weeks earlier the schooner "Mabel Jane" owned by Dr. F. A. Monckton, who had leased part of Auckland Island, returned from a trip of four months duration with a party of Monckton's friends who had collected all they could in the way of marketable mammal skins and curios, and no doubt a few birds. There was a ready agency in Invercargill in the taxidermy business of James Morton in Tay Street. There had also arrived one day before von Hugel a French barque which had just landed a German astronomical party at Auckland Islands, but the "Mabel Jane" is the more likely source. This hypothetical reconstruction of events tallies fairly well with von Hugel's written account except for a reference to Captain Musgrave who was at Auckland Islands in 1864/65, a date inconsistent with a label note "freshly skinned" made in 1874/75. The full reference in von Hugel's letter to Bowdler Sharpe (1875, p. 392) follows comment on skins of other species and continues "But my luck with Auckland things did not end here; for I have received a Rail killed on that island by the unfortunate Captain Musgrave of the 'Grafton.' As soon as I got the bird I was struck with its resemblance to one of the Rallidae I was acquainted with, but for some time could not make out which. At last it struck me that it must be the Australian *Rallus brachyopus*; and on comparing the Auckland (Island) with the Australian bird, I found them to agree very closely, though the colouring seemed different; but as the Canterbury Museum specimen appears to be very old and faded, it is impossible to judge. It is curious, my falling in with so many things from the Auckland Isles, and especially a Rail, now that I am working on them. I shall be able to determine if my Rail is *Rallus brachyopus* or new as soon as I get to Melbourne, there being a good series there. At all events it is the first Rail known to have been procured in the group . . ." In the light of what he had earlier written on his label it seems possible that he intended to indicate that he had received a specimen of the rail killed on that island by Captain Musgrave, for everyone in interested circles would have known about Musgrave's "bird like a water-hen." However, it is the specimen itself that is important. It is a good professional skin of a typical large (probably male) specimen in full plumage of *Rallus pectoralis brachyopus* and not readily separable from Tasmanian examples. That it had flown from Tasmania to Auckland Island is not inherently unlikely, but it could well be that it is a representative adult male of the population established there.

The validity of *Rallus muelleri* Rothschild depends now on an assessment of Rothschild's diagnosis and its relevance to the characteristics of the little bird now running about at Mount Bruce. It, at least, was captured on Adams Island. In size (see measurements below) it is very close to the dimensions given by Rothschild. The plumage description of the type specimen would also fit it, except for the predominant reference to rufous as also depicted in the colour plates.

In the Adams Island bird rufous plumage is confined to brow, cheeks, side neck and nape, as in all other described races of *Rallus pectoralis*. Rothschild's diagnostic comment on his specimen is: "This little Rail in general appearance resembles *Rallus lewini* from Australia, but on comparison presents so many important differences that it might almost be separated generically. The chief distinguishing feature of the new species is the enormous development of the feathers on the back and rump, which have become a huge bunch like that of the Puff-birds (*Bucco*) of South America." The Adams Island bird certainly has soft plumage but it lies conformably with the body contours and looks normally ralline. Allowing for the dried-up antiquity of most available museum specimens of *R. pectoralis* their plumage is not significantly different. Nor does our live bird differ sufficiently in wing formula and limb proportions to comply with the requirements of the new genus *Hyporallus* proposed by Mathews and Iredale (1926, p. 76) to accommodate Rothschild's type.

Taxonomic opinion cannot be very conclusive when it is based on a lost type, a skin of which the authenticity has been doubted, and a live bird of unknown age and sex. Future field study may disclose that there are, or have been, representatives at the Auckland Islands of more than one derivative of Australian rails: but present indications are that an endemic rail on Adams Island differs from *Rallus pectoralis pectoralis* perhaps in being on average smaller in size and softer in plumage; and, less conclusively, having indications of degeneration in the wing formula. With some reservations about the pertinence of the original diagnosis by Rothschild its relationships would seem to be best expressed sub-specifically — *Rallus pectoralis muelleri* (Rothschild).

TABLE OF MEASUREMENTS

These include examples of several races of *R. pectoralis*. Those taken from the living bird at Mount Bruce are as of June 1966, checked in June 1967.

B.M. = British Museum; A.M.N.H. = American Museum of Natural History.

Specimen	Locality	Collector & date.	Sex	Wing (lgst pmry)	Tail	Tarsus	Toe	Culmen
Type of <i>R. muelleri</i>	Adams Island	J. Kendrick & B.D. Bell 1966 per von Muller	-	78 mm	28.5	27	29.9	25 x 8 deep
A.M.N.H. 545046	"Auckland Island"	per von Hugel	-	83	33	28	33	28
B.M.41.1349	Tasmania	J.Gould 1838	juv	103	43	32.5	40	35 x 8.5
B.M.1930.3.5. 28	Victoria			100	45	30	35	33 x 8
B.M.1953.17. 43	N.Guinea (<i>cantus</i>)			106	42	32	35	34 x 9
B.M.1953.17. 45	"			92	35+	29	33	29 x 8
B.M.1949.62. 14	N.Guinea (<i>alberti</i>)			87	32	28	34	28 x 7.5

ACKNOWLEDGEMENTS

Study facilities in museums in which specimens were examined are gratefully acknowledged, as is the ready help given by officers of the Wildlife Division, Department of Internal Affairs, Mr. Kendrick with photographs, Mr. B. D. Bell with transport to Mount Bruce and Mr. C. Roderick for patience when his small detainee was under examination.

REFERENCES

- BULLER, W. L., 1905: Supplement to Birds of N.Z. 2 vols. London.
 GREENWAY, J. C., 1958: Extinct and Vanishing Birds of the World. New York.
 Von HUGEL, A., 1875: Letter to Bowdler Sharpe. Ibis, 1875.
 MATHEWS, G. M., 1936: Supplement to the Birds of Norfolk and Lord Howe Islands etc. London.
 MATHEWS, G., & IREDALE, T., 1913: A reference list of the birds of N.Z. Ibis 1913.
 MATHEWS, G., & IREDALE, T., 1926: (New generic names) Bull. Brit., Orn. Club, 46.
 MUSGRAVE, T., 1865: Castaway on the Auckland Isles. Melbourne.
 ROTHSCHILD, W., 1893: Bull. Brit. Orn. Club, 1 (8) 40-41.
 ROTHSCHILD, W., 1907: Proc. 4th Internat Orn. Congr. (figure).



SHORT NOTE

SIGHTINGS OF KERMADEC PETRELS AT SEA

In 1963 and 1966 I was in vessels trading between Auckland and Island Ports and during this time made 30 passages between Fiji and Auckland.

On this run it is normal to pass Raoul Island at distances of between 300 and 330 miles depending on the port of destination, i.e. Suva or Lautoka. On 29 passages Kermadec Petrels (*P. neglecta*) were seen on only one occasion, this being in April, 1966, when about 25 birds were seen feeding with Sooty Terns over a shoal of fish.

In December, 1966, the vessel sailed from Suva to Lyttelton and on this passage passed Raoul Island at a distance of 180 miles. The actual distances from the island on 11th December being:

0800 hrs.	226 miles
1200 hrs.	197 miles
1800 hrs.	184 miles

Kermadec Petrels were in sight throughout this day from dawn to dusk, never in large numbers, but four or five birds were in sight at all times.

From the above it would seem that the Kermadec Petrel does not normally range much more than 250 miles to the westward of its breeding area. This area between Fiji and the north of New Zealand is very sparsely populated by sea birds of any kind, as has been noted by numbers of observers who have passed through it.

The low population of this area, though it is surrounded by islands with large petrel populations, would seem to indicate that the area is poor feeding ground and is avoided. This in turn could account for the very few records in New Zealand of sea birds from the islands to the north of this country, though the distances to these islands are not great.

— JOHN JENKINS

SOME PORTRAITS OF KERMADEC SEABIRDS

The findings of the Society's 1966-67 expedition to the Kermadec Islands are now being analysed and a series of articles on individual species, accompanied by numerous photographs, will appear in Notornis. In this number it is our privilege to give a foretaste of what is to come by publishing Dr. M. F. Soper's brilliant portraits of eight oceanic species which are typical of the Kermadecs.



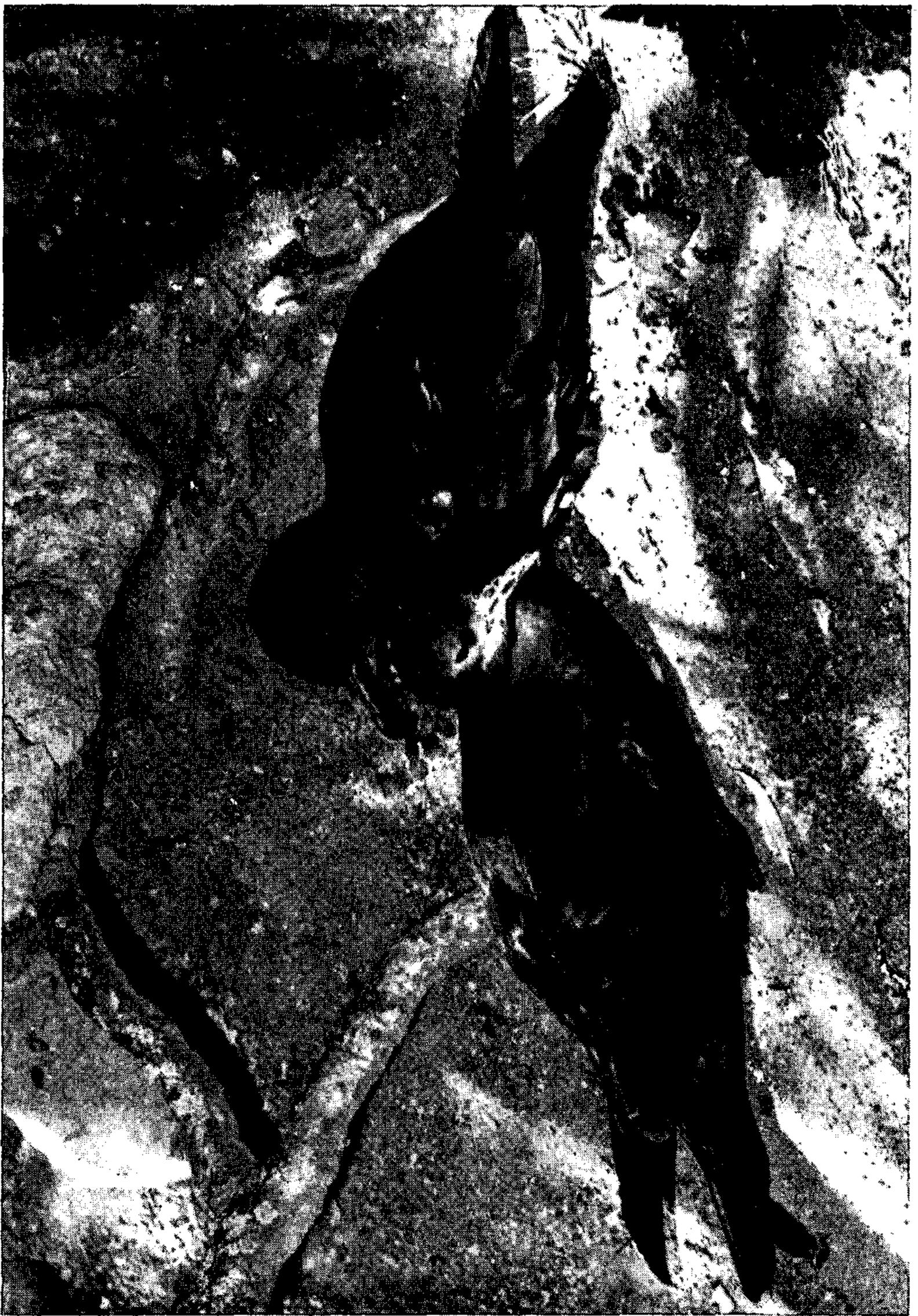
[M. F. Soper

Plate XVII — Black-winged Petrel (***Pterodroma nigripennis***) typically soaring and showing diagnostic underwing pattern (v. Notornis 12, 246).



[M. F. Soper

Plate XVIII — Kermadec Petrel (*Pterodroma neglecta*). This is a variable species. The subject of this portrait belongs to the pale phase.



[M. F. Soper

Plate XIX — A pair of Wedge-tailed Shearwaters (***Puffinus pacificus***).
No birds of the light phase were seen.



[M. F. Soper

Plate XX — Blue-faced Booby (*Sula dactylatra*), also known as the Masked Gannet. Its subspecific name **personata** refers to its "mask."

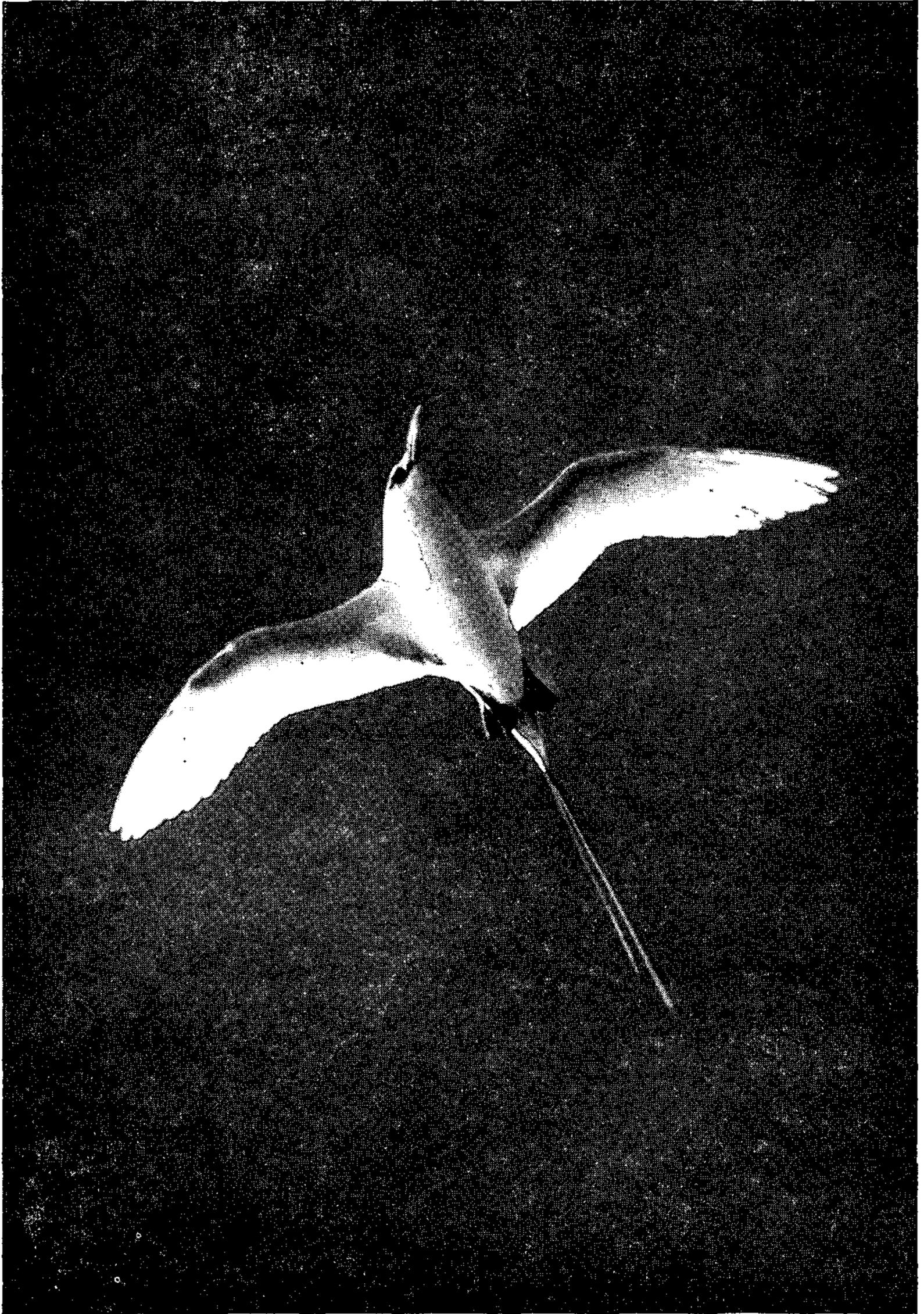


Plate XXI — Red-tailed Tropic Bird (*Phaethon rubricauda*). Many pairs nest on the cliffs of Meyer Island.

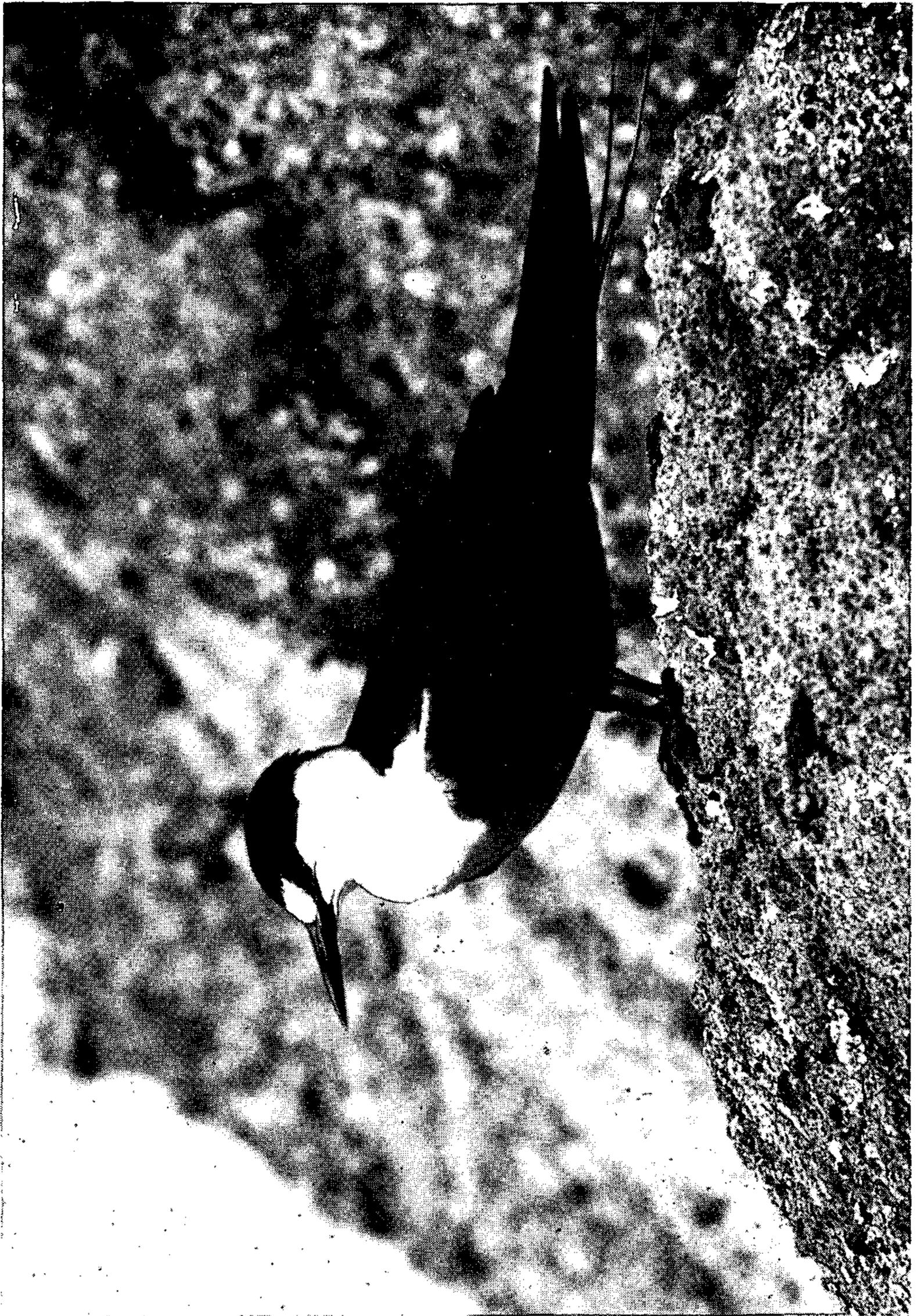
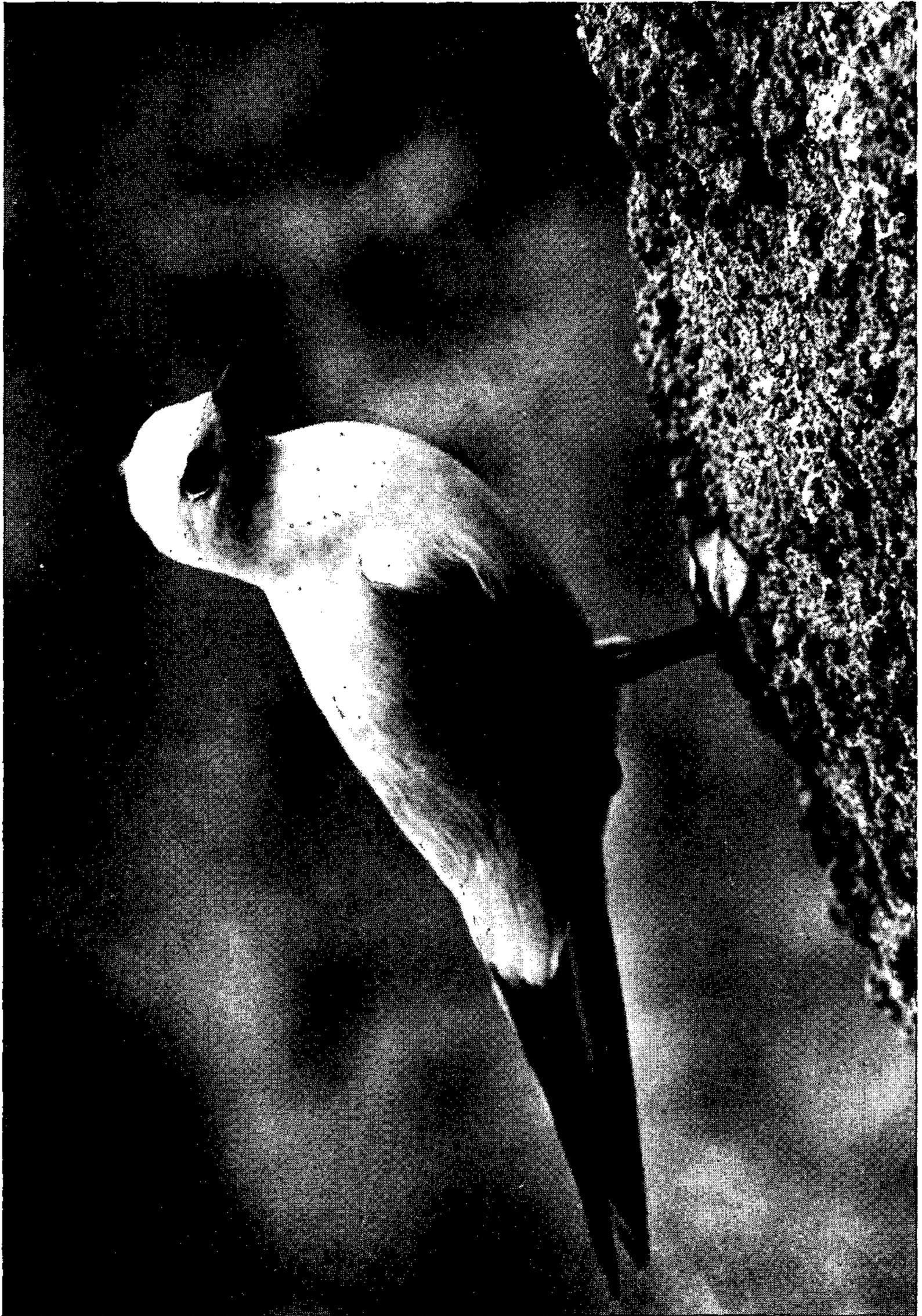


Plate XXII — Sooty Tern (*Sterna fuscata*). The biggest colony of Wideawakes is in Denham Bay, where despite regular predation by cats and rats it continues to thrive.



[M. F. Soper

Plate XXIII — Grey Ternlet (***Procelsterna albivitta***). A cliff-nesting species, especially abundant at the Herald Islets. When feeding over the sea, they behave rather like Storm Petrels.



[M. F. Soper

Plate XXIV — White-capped Noddy (**Anous minutus**). A tree-nesting species, especially common on Meyer Island.

SNARES ISLAND BIRDS

By JOHN WARHAM

Zoology Department, University of Canterbury

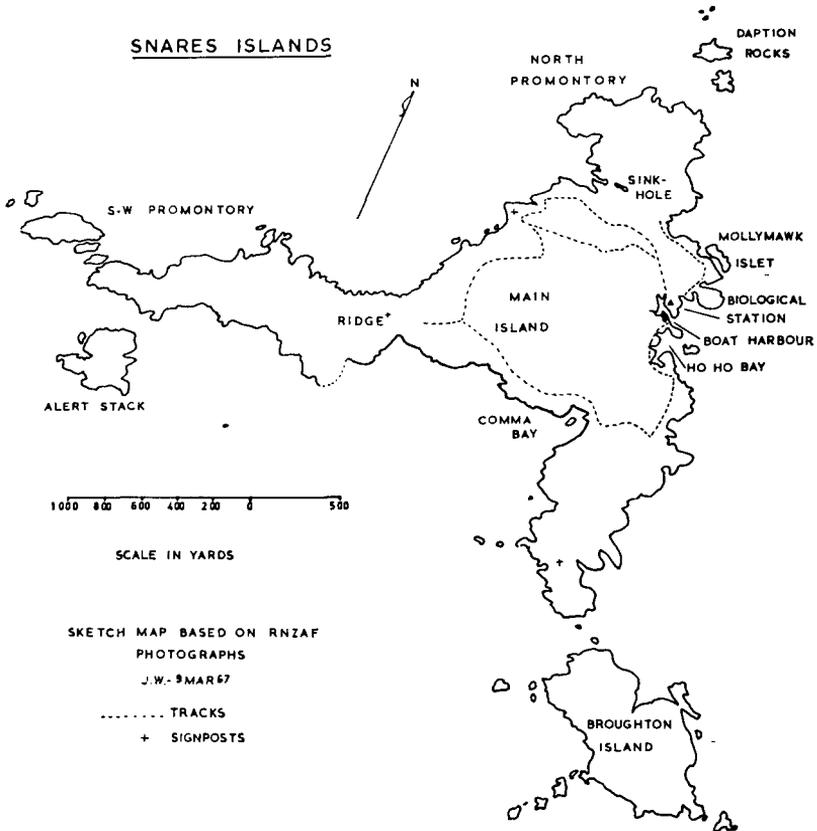
Though small in area, the Snares Islands at 48°S, 166°E are important zoologically in being one of the very few southern island groups whose condition has not been modified substantially by introduced or alien animals and plants. Despite the attentions of the sealers in the last century which involved the presence ashore of parties for extensive periods, rats and mice have not become established. Only two alien plants, Chickweed (*Stellaria media*) and the grass *Poa annula* are now present and the non-indigenous birds consist of small passerines that do not appear to compete significantly with the avian endemics.

The University of Canterbury plans to continue its research on the main islands where a Biological Station was erected in 1961 and this seems to be an appropriate time to set out the present status of the birds of the group so far as this is known.

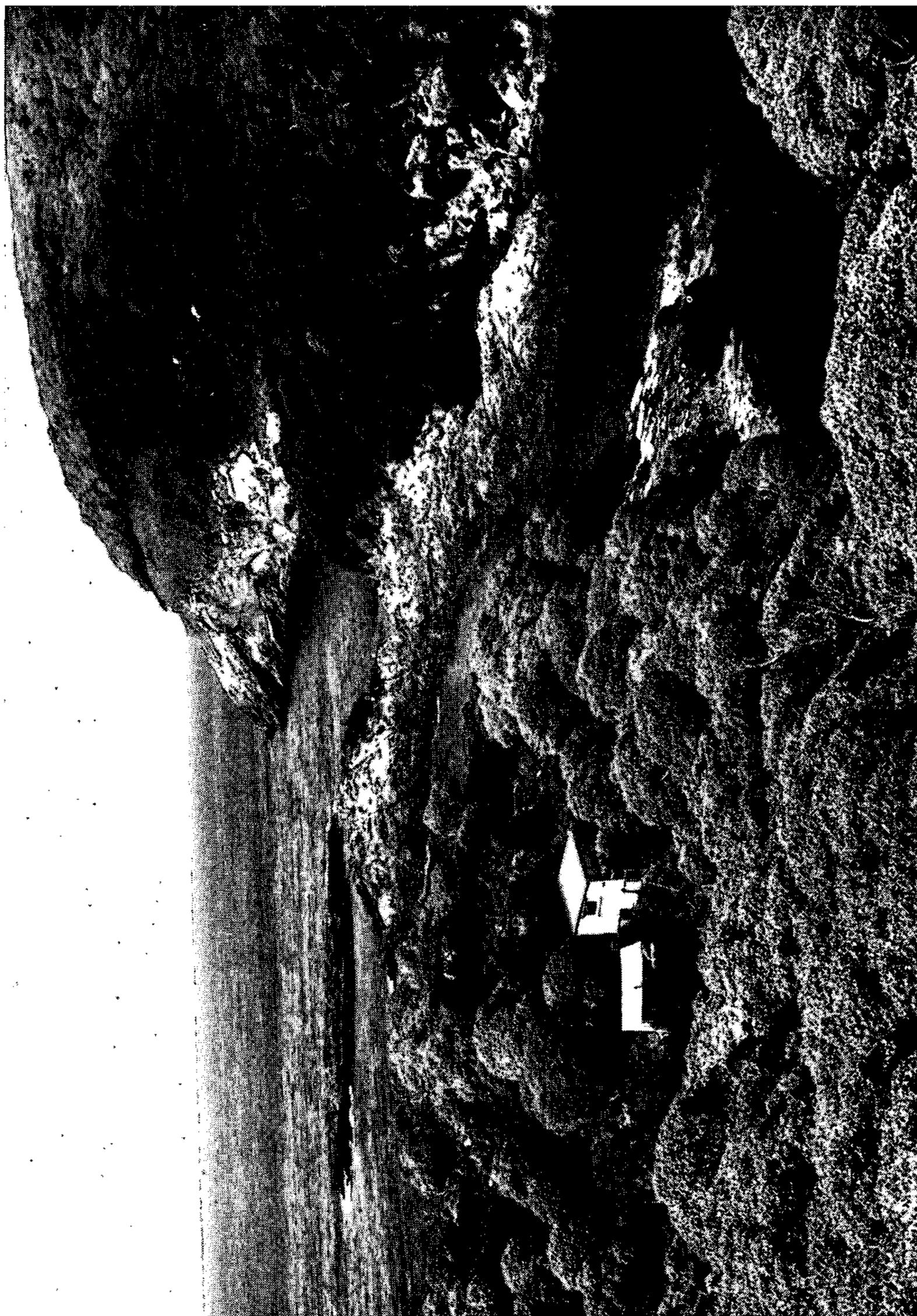
Most of these visit the islands only for breeding and obtain their food at sea. Their effects on the environment are varied. The nutrients they deposit ashore either in faeces or in the bodies of those, old and young, that die on land are presumably beneficial both to the plants and to the invertebrate fauna and W. F. Harris (in Fleming *et al*, 1953) suggests that the relatively high level of fertility of the Snares Island peat could be due to its enrichment by the animal population. On the other hand, the sparsity of plants on the floor of the forest has often been attributed to trampling by sea-birds, notably by *Puffinus griseus*.

The flora of the main island has been reported on by several investigators in the past, most recently by Finneran (1964 and *in press*). For details of the geology reference should be made to the paper by Fleming, Reed and Harris (1953). The map accompanying the present paper is based on R.N.Z.A.F. photographs taken in January 1967 and is more detailed and rather different from that previously published which was based on a survey by T. S. Millar and dated 1891.

A. Reischek (1888) seems to have been the first to report on the fauna. He landed on the main island on 22 January of that year and published a brief account. F. R. Chapman (1890) spent part of a day ashore, also in January, and adds a little further information while the botanist T. Kirk apparently landed on the same occasion and in his report on the flora (Kirk, 1890) mentions some of the birds he saw. The collector H. H. Travers also visited the islands probably in May 1894 and brought back specimens of the local Fernbird *Bowdleria punctata*. This was described (as a new species) by Buller in 1894. On 2 January 1901 and 7 January 1902 the Earl of Ranfurly visited the Snares in the course of a trip through the southern islands to collect specimens for the British Museum. On the first of these he was accompanied by F. W. Hutton, then curator of the Christchurch Museum. Specimens of most of the common birds were collected and were reported on by Ogilvie-Grant in 1905. In 1907 the Philosophical Society of Canterbury's Expedition to the Sub-Antarctic Islands spent most of 15 November ashore and E. R. Waite followed this up by a visit in February 1908 (Waite, 1909).



All these visits were brief, the periodical rounds of the government steamships to replenish the castaway huts on the southern islands being utilised to get the investigators to and from the Snares. E. F. Stead was on the main island on 31 January 1929 and some of the eggs he collected then are in the Canterbury Museum but he appears to have published no account of that visit. R. A. Falla also landed briefly in 1944, but until 1947 no biological party had stayed at the Snares. In that year a group of ten, led by R. A. Falla, was on the main island from 24 November until 6 December. The trip was sponsored by the N.Z. Government and the American Museum of Natural History. Dr. and Mrs. R. C. Murphy, together with a party of New Zealand scientists, made extensive observations and collected some birds as a basis for a New Zealand exhibit in the American Museum (Murphy, 1948). Rather little was published on the findings of this expedition. There was a popular account by Mrs. Murphy (G. B. Murphy, 1948) and a brief but useful digest by Fleming (1948). The account by Wilson (1959) adds little to either of these and contains some in-



[John Warham

Plate XXV — Snares Island. University of Canterbury Biological Station
and Boat Harbour.

accuracies. A whole issue of "New Zealand Notes" was however devoted to the expedition but this report is strangely incomplete as no mention is made of the commonest bird present, the Sooty Shearwater, or of the Mottled Petrel (*Pterodroma inexpectata*) or the Prions (*Pachyptila turtur*) and (*P. vittata*) (Stead, 1948).

There was activity again the following year when L. E. Richdale and W. M. C. Denham camped in the old castaway hut from January 9 to February 26. One result was a useful popular account (Richdale, n.d.) and the first sustained study of a Snares Island bird, Buller's Mollymawk (*Diomedea bulleri*) (Richdale, 1949 a and b).

Following these visits there appear to have been no further investigations by vertebrate zoologists until the 1961 University of Canterbury Expedition. A four-man team was in the field from 17 January to 13 February and although the major work was in the building of a Biological Station and in sampling invertebrate populations a good deal of information on the birds was gained and a programme of banding Buller's Albatrosses started. In addition, some of the birds banded by Richdale were re-sighted. The second University of Canterbury team of six was in the field from 2 January to 10 February 1967 and worked on the invertebrates and on certain of the birds. Studies of behaviour in the Snares Crested Penguin (*Eudyptes pachyrhynchus atratus*) (= *E. robustus*) were started, based on flipper-banded animals; and detailed measurements of samples of adults, yearlings and young were made. Some specimens were collected and are being used as the basis of an examination of the taxonomic status of this bird (Stonehouse, *in press*). Detailed observations supplemented by tape recordings and film were made on *Puffinus griseus*, *Pterodroma inexpectata* and *Pachyptila turtur*. Some breeding Buller's Mollymawks were measured and banded birds re-sighted. Samples of stomach oil were taken from all the Procellariiformes present and most species and their nests were examined for ectoparasites of which a comprehensive collection was made.

The following list includes only those species that were seen on or over the island and does not therefore include the Royal Albatross (*Diomedea epemophora*) frequently, and the Wandering Albatross (*D. exulans*), less frequently seen out at sea.

For convenience the scientific names used follow the 1953 "Checklist of New Zealand Birds" although this should not be taken to imply agreement with the nomenclature of that list particularly in regard to its treatment of the genus *Eudyptes*. Rockhopper Penguin (*Eudyptes crestatus*)

Reischek gives the impression that this species (*E. chrysocomus*) was plentiful at the Snares and Waite, while giving no details, lists the islands as inhabited by Rockhoppers. Our experience agrees with that of Fleming (1948) who notes that Rockhopper Penguins are extremely rare there. Although Falla, Turbott and Sibson (1966) imply that small numbers may nest, they give no evidence and it seems rather unlikely that they are more than stragglers, possibly from the nearest breeding station, the Auckland Islands.

Two birds were found on 1st February 1967. They were short-crested yearlings with the light grey throats characteristic of this age group (Warham, 1963) and weighed 2600 and 2850 g. respectively.

They stood on the rocks by the sea in company with Snares Crested Penguins and were subdued and silent. Compared with the latter their small size and small heads with marked occipital crests were noticeable. Their eyes were bright red, appreciably brighter than those of adult *E. p. atratus* and the Rockhopper is the only species of genus in which the yearlings have such brightly pigmented irides. A bird, possibly one of the above two, was in heavy moult by 7 February, by which date yearlings at Macquarie Island are mostly in a similar condition.

New Zealand Crested Penguin (*Eudyptes pachyrhynchus pachyrhynchus*)

The Checklist of New Zealand Birds gives the Snares Islands as within range of this bird. This is not surprising in a penguin that straggles to eastern Australia and breeds around Stewart Island, which is visible from high ground at the Snares in clear weather.

In 1967 all the frequent examples encountered were yearlings judging by their brown eyes, whitish throats and short crests. At least one was ashore by 11 January; and by 21 January many were in the dull faded plumage that precedes the moult. Some had moulted by 31 January, but a few almost moulted birds were still ashore on 8 February.

The majority remained in retreats among the coastal rocks, but some moved inland and stood around and among colonies of the Snares Crested Penguin, where they were quiet and subdued. No interactions were noted between the two forms. The New Zealand Crested Penguins were readily separated from the others by the light streaks on their cheeks, by their relatively small bills and by the absence of fleshy edgings to the base of the beak.

Snares Crested Penguin (*Eudyptes pachyrhynchus atratus*)

This was by far the most abundant penguin and the only one known to be breeding in 1961 and 1967. It was readily distinguished from the New Zealand Crested Penguin by its bigger bill, by the absence of the white streaks on the cheeks seen on many examples of the latter species and by the edgings of bare skin around the base of the bill.

As described by Stead (1948) and Richdale (n.d.) these penguins bred in relatively small scattered colonies to which they gained access from landing places on the eastern side of the island. Many colonies were quite close to the sea, others well inland were served by access trails which followed the lines of the streams. A prominent landing place was an area of shelving rock south of the extreme eastern point of the Northern Promontory and evidently birds nesting as far away as the Sinkhole area used that landing place. No counts of the colonies were made but the species appears to be as plentiful as ever and we encountered no sign of the disease which, according to Reischek's puzzling reference "left thousands rotting among the black sand." As there is no black sand on the main island, indeed no sand beach at all apart from a tiny strip at the end of a tunnel which is not frequented by penguins, it is not at all clear where Reischek saw these dead penguins, if indeed it was on the Snares at all.

According to Fairchild, then captain of the *Hinemoa* (Chapman, 1890) the birds lay on 1 October and hatch their eggs about 5 November. This agrees well with the known incubation periods for other members of the genus e.g. for *E. crestatus* of 34 days.

On 3 January 1967 the breeding birds were caring for large young, most of which still wore down. Some were being guarded by the males. The latter were easily separated from the females by their deeper, longer, and wider bills, differences that were usually very clear when members of a pair were seen together. No pair was seen feeding more than one chick although two eggs are evidently laid and, judging by old eggs that were found, in this species, as with other *Eudyptes*, the first egg is small and unincubated and only the second and larger egg is actually hatched in the normal course of events.

Although few records were gained of marked chicks being fed by marked parents, it was observed that individual chicks were being fed by the same adults on different days so that most probably parents feed only their own offspring as in the Rockhopper Penguin (Pettingill, 1960; Warham, 1962).

Some of the chicks were down-free by 7 January when departures began; and it was about this time that short-crested birds, presumably yearlings, started to come ashore. The colonies were still full of adults; there were those with chicks standing on nests and other adults that stood singly or in pairs around the edges of the colonies. It was only among such pairs that coition still occurred. This was infrequent, but was seen as late as 3 February. Such adult birds without chicks were probably pre-breeders.

Departure of the chicks reached a peak between 13 and 20 January but at least two chicks were ashore on 5 February. By about 20 January the numbers of yearlings ashore had reached their maximum and about half of them had started the moult with a few moulted by 22 January.

Some yearlings and other pre-breeders moulted among the rocks well away from the colonies, but many penetrated inland and moulted on the nesting grounds. By 7 February most of the yearling group had moulted and many had returned to the sea. Meanwhile rather larger crested birds, possibly two-year-olds, were now moulting and a few fully crested birds, fat and bronze-backed and evidently older still, had begun to shed their feathers. Concurrently the numbers of birds on the colonies decreased steadily with the departure of chicks and their parents and this decrease continued up to our leaving the island on 8 February. By this date very few if any of the successful breeders had returned from their pre-moult fattening up period at sea.

At the time of their departure the Snares Crested Penguin chicks had small yellowish crests, narrow anteriorly, where they rose close to the bill, fanning out to very short tufts posteriorly. Their throats were grey, becoming lighter towards the bases of the mandibles due to the light tips of the dark feathers clothing this region. There was a narrow band of bare flesh around the bases of mandible and maxilla. Their slightly glossy bills were blackish-brown for the proximal two thirds of their length, then light brown for the remainder except for a pale cream-horn blotch close to the tip which spread out over mandible and maxilla.

Most of the chicks went to sea in twos and threes mixed up with outgoing adults who showed not the slightest solicitude for their welfare and quite frequently attacked the younger birds. These tended to turn back from the outgoing columns once the sea was reached. And, whereas the old birds remained submerged until far from the shore, the chicks tended to surface much sooner and looked around apparently to get their bearings before diving and proceeding out to sea. At least one chick was heard to use a loud "cheep" on surfacing although for most of them this call had been largely replaced by a more powerful note.

The presumed yearlings had dark grey-black throats due to the light tips to the feathers of this region, no trace of stripes on their cheeks, short and rather pale crests, dark brownish or reddish-horn bills duller than those of the adults, and chocolate brown eyes. They were readily distinguished from yearling New Zealand Crested Penguins by the presence of bare skin at the base of the bill.

Some predation of the newly fledged young by Giant Petrels (*Macronectes giganteus*) occurred, parties of which waited off the departure rocks and coves and presumably killed weakly or ill-orientated chicks, although the assault of seaborne individuals was not seen. Small groups of these petrels were often found feeding on penguin carcasses around the coastal rocks, and a chick, entangled in the kelp, was assaulted by a Giant Petrel that came out of the sea to attack. The chick escaped and returned to dry land. However, it was bleeding profusely and its survival seemed doubtful. Skuas were also found eating penguins along the shoreline; but no attacks were seen, although skuas were occasionally found near to inland colonies even under thick *Olearia* forest.

No melanistic birds were observed, but examples with patches of black feathers on their otherwise white bellies and upper breasts were occasionally noted. A few had white areas on the throat instead of being wholly dark as was the great majority. The patterns of the under flippers were somewhat variable, but none was as boldly marked with black as in the Erect-crested Penguin (*E. p. sclateri*). Eye colour in the adults also varied quite widely, and some of either sex had much pinker eyes than the majority whose irides were reddish-brown.

During the first three weeks of 1967 a succession of sunny days dried out much of the ground at the more open colonies and adults and chicks lay prostrate in the sun often with a flipper stretched out on either side. None was seen to pant although the birds kept their bills open. Later, after considerable rain, the colonies became extremely muddy and many single birds and others in pairs built large nests from sticks or from beakfuls of bright green *Callitriche antarctica* and *Tillea moschata* which they tore up from the vegetated areas beyond the boundaries of the colonies.

Erect-crested Penguin (*Eudyptes pachyrhynchus sclateri*)

One bird was ashore on 8 January 1967 and another, a pre-moult "fat," on 7 February. Both were adults with dark chins and no light-throated juveniles were seen, although sought for. The species was expected but does not appear to have been seen by previous parties.

Buller's Mollymawk (*Diomedea bulleri*)

On arrival off the island in 1967 groups of this albatross were resting on the water not far offshore but at this date most nest sites were unoccupied and few birds were on land. Their numbers increased thereafter and the first egg was found on 5 January, 11 days earlier than the first egg reported by Richdale in 1948 (Richdale, 1949 a and b). By 8 January at least four eggs were known to have been laid: over the island as a whole many more must have been present at that date. Eggs now began to appear with increasing frequency and by 16 January of 192 nests having birds in attendance 43 (22%) contained eggs. New nests were still being constructed as late as 29 January and in some of these eggs were laid within a few days of the nests' completion. By 3 February the ratio of nests with eggs to attended nests had risen to about 80% and it seemed that laying, although continuing, was almost complete.

No attempt was made to count the actual breeding pairs. The most concentrated group of nests was above a bay south of Ho Ho Bay on the east coast provisionally named Mollymawk Bay. There were 123 occupied nests in a more or less continuous colony at different levels on the cliffy slopes. Another large assemblage, but composed of rather more scattered groups, was in the vicinity of Comma Bay where there were 192 occupied nests, this being the same area referred to by Richdale (his A and B colonies) who plotted 132 nests in 1948. However, nests were scattered on cliffs and slopes around the island except for the low coastline in the vicinity of the Biological Station. They were also found in small groups in the forest, not always close to cliffs, on small and large offshore stacks, and at least six birds could be seen on nests on Broughton Island and rather more than this on Mollymawk (Rocky) Islet.

In 1961 and 1967 241 adults were ringed and a total of 79 adults previously banded were re-sighted.

Richdale (1949 a) spent six weeks studying behaviour patterns and display in this species and gives a detailed account of events before hatching. Separately he has discussed his incubation data (Richdale, 1949 b). The only behaviour pattern seen in 1967, but not recorded by him, were two separate and extreme examples of interference by bystanders with copulation. Such interference has been recorded before among birds; but the present instances were rather bizarre in that when coition was occurring on a nest a third bird, presumably a male, attempted to mount the male already engaged so that a three tier arrangement of birds was formed! Whether these intruder males were stimulated by the females' submissive postures or by the actions of the copulating males could not be determined and the precise status of any of the participants was unknown. Quite possibly none of the males involved were the established mates of the females in question.

Shy Albatross (*Diomedea cauta*)

Reischek was the first to mention this species and apparently saw both adults and young. He does not indicate where this was; but the *Stella* in which he travelled may have come close enough to the Western Reefs for him to have seen birds there. Stead notes in his catalogue to the Stead collection of eggs now in the Canterbury

Museum "Many young fluffy grey birds on nests on Western Snares that looked like mollymawks, but as we could not land, I was unable to identify them." The date was on or around 31 January 1929. The breeding of the sub-species *salvini* on the Western Reefs was confirmed by the 1947 expedition (Fleming, 1948). Close-up photographs of these islets taken for the University of Canterbury by the R.N.Z.A.F. do not reveal the presence of any birds there in January 1967, though perhaps these are not large enough to show up at the taking distance employed. Shy Albatrosses were not seen at sea from the main island, but they were present about two miles offshore on 30 December 1966.

Light-mantled Sooty Albatross (*Phoebastria palpebrata*)

A single bird was gliding along the southern slopes of the South-west Promontory on 12 January. It was not seen to alight; and there is no evidence that this sub-antarctic species ever breeds here.

Giant Petrel (*Macronectes giganteus*)

The 1967 party examined the main island carefully for signs of breeding without success; and it is very doubtful if these birds nested there that year although they could have done so on Broughton Island. Nor were any nests or young noted in 1961. Various people in the past have speculated that Giant Petrels breed here; and the Snares are given as a breeding station, but without supporting evidence, by Falla et al, 1966. Giant Petrels are very susceptible to disturbance on their nesting grounds and it does seem rather strange that these islands, so seldom visited, should have no resident population when they still nest only about 80 miles away off Stewart Island.

Reischek writes that "the nelly, with its full-grown young, busied itself upon the water." But in his time the blackish-brown, glossy plumage of the Giant Petrel does not seem to have been recognised as that of the fledgling and this casts doubt that any such birds were present.

Most previous writers mention the presence of *Macronectes* and of its preying on penguins. The species was present throughout the expeditions of 1961 and 1967, the favoured location being the sheltered waters of Ho Ho Bay where many emerged to sleep and rest on the ledges just above the *Deauvillea* belt. There were usually about 50 birds dotted about in this bay, the maximum number recorded being 124 on 2 February 1967. On the same date a group of about 30 was resting high on a windswept saddle of the South Promontory.

Many of these Giant Petrels had started moulting the flight feathers, the second to fourth outermost primaries being short and not fully grown. Most had fairly uniform brownish-grey body feathers devoid of gloss, dark grey crowns and somewhat freckled necks. Their throats tended to be lighter and the cheeks pale creamish shade. Bills were mostly dull olive-green with a tinge of brown or brownish-red on the ridge of the maxilla. A few birds appeared to have dark marks on the nails of the bill. The eyes were brown or grey. About five in every hundred had lighter and markedly freckled heads, but no really light-headed examples were seen.

The grey-eyed birds were evidently quite old, as Giant Petrels begin life with brown eyes which lighten with age. Both these and the dark-eyed examples fit the characters for the northern form recently described as a separate species *Macronectes halli* by Bourne and Warham

(1966) and resembled birds of this form seen a few days before at Campbell Island. Such birds nest early from about mid-August to early September generally among quite thick vegetation and not in the tightly-knit colonies usual in the southern *M. giganteus*. At the times of our visits large chicks should still have been ashore and even had the young flown the nests would have been easy to identify from their large size and from the egg shells trampled into them.

The groups in Ho Ho Bay indulged in some social activity billing each other and braying quietly. When feeding round a dead penguin the petrels adopted the tail-cocked threats described and figured by Warham (1962).

No birds ascribable to the southern form were seen. However, immatures of this form, being highly migratory, would be expected to occur and that they do is shown by Wilson's reference to a white-phase bird in the British Museum collected at the Snares (Wilson, 1907) and by Chapman's sighting of a white bird on 9 January 1890.

Cape Pigeon (*Daption capensis*)

During the 1947 Expedition Falla confirmed long-standing accounts of the breeding of this species (the sealers are said to have eaten large numbers of eggs) when he found incubating birds on the Western Reefs. Fleming (1948) also reports seeing these petrels flying into and sitting in crevices along the South-west Promontory, and the 1967 party saw birds flying into possible nest-sites but did not investigate these. A favoured feeding spot after hard weather was the charted shallow ground just off Seal Point 300 yards N.E. of the Biological Station, but many birds in calm weather swam close inshore in deep water pecking small unidentified food items from close to the surface. This occurred mostly along the sheltered eastern side of the island and in the passage between this and Broughton Island.

Broad-billed Prion (*Pachyptila vittata*)

Live birds of this species seem never to have been observed, but like Fleming, we found evidence of their presence in Skua castings. The best collections came from the ridge of the South-west Promontory. The species lays early and the young would mostly have fledged by the times of our arrival in 1961 and 1967.

Fairy Prion (*Pachyptila turtur*)

This species was found nesting solely in rock crevices and talus debris as reported by the 1947 expedition, although Richdale states that they were breeding in holes in the ground. The birds did not appear to be very numerous and they were feeding chicks in heavy down.

A pair nesting in a crevice near the Biological Station was inside a cave and gave excellent opportunities to observe parent-chick feeding. The mode of food transfer was similar to that adopted by many other Procellariiformes like *Puffinus puffinus*, *P. carneipes* and others studied by the writer and the albatrosses studied by Richdale. The chick inserted its bill across and inside the opened beak of the parent almost at right angles. As the chick's mandible lay on top of the parent's tongue, the regurgitated food was readily diverted from one bill to the other, after which each participant swallowed.

The prions did not come ashore until after dark and although occasionally seen offshore by day, no rafts of these birds were observed. The cave-dwelling group seemed to fly straight to the entrance after the usual preliminary circlings, landing right at the cave mouth.

Sooty Shearwater (*Puffinus griseus*)

This was by far the most numerous bird on the island, the thick peaty soil being extensively burrowed, except in areas which readily became water-logged after rain. The birds not only trampled the vegetation but actively increased their denuding effects by carrying the large fallen leaves of the *Olearia lyalli* trees underground in their bills for lining their nests. Many nests also occurred among the tussock meadows between the cliffs and the forest edge and a few birds utilised rocky crevices, but they avoided the open peat scours and were not numerous beneath the more dense *Hebe elliptica* thickets.

The breeding timetable parallels that of the bird elsewhere in Australasia and eggs were found hatching from about 12 January. By that date numbers of pre-breeders were evidently ashore and pairs without eggs were often seen and heard calling from burrows by day. Copulation was noted on the ground outside the burrows from 4 January and again such birds were presumed to be pre-breeders. The seldom-observed behaviour during copulation in any member of the genus was preceded in the present species by violent billing actions in which the male thrust his beak at the head and neck of its partner before mounting. Copulation lasted several minutes with the male waving outstretched and dangling wings about except during intromission. The mounted male thrust his opened bill into the feathers of his mate's neck and she tended to turn her beak upwards and to probe the male's throat in a manner similar to that seen in *Macronectes* (Warham, 1962).

Rafts of Sooty Shearwaters formed off the main island at any time from about noon onwards unless the sea was rough. The birds tended to form into long columns six or more abreast as newcomers added themselves to the downwind tails of the columns just as *P. tenuirostris* does off the Bass Strait islands. Numbers increased in late afternoon and the columns tended to drift in closer to the shore. Odd birds were seen flying over the island at all times of the day, under clear skies or overcast, and the return of the main body took place long before dusk so that the vanguard was ashore in broad daylight and even in sunshine. Dispersal to individual burrows and courtship could thus be watched with ease. Similarly, the departure of birds back to sea in the morning was sufficiently extended after dawn to enable photographs to be taken with the available ambient light.

This behaviour in coming ashore early is in marked contrast to that of this species elsewhere, even at nearby Stewart Island. It is more in line with that of *P. gravis* at Nightingale Island or of tropical shearwaters like *P. nativitatis*. It has been assumed that such behaviour is possible only in the absence of diurnally-active predators. These are not absent on the Snares which supports a population of Southern Skuas (*Stercorarius skua*) and these certainly eat Sooty Shearwaters, although they were not seen to attack the early arriving birds or those that delayed their departure until after first light. It may be noted that skuas did sometimes penetrate into the forest apparently in search of food, dead mutton-birds being their most likely targets.

As is customary among Procellariiformes, the incoming shearwaters circled the general areas of their nests several times before alighting. The final descents were made through openings in the *Olearia* canopy. As often occurs in such situations, a few lodged in the trees providing the rather incongruous sight of petrels perched with webbed feet straddling a branch. Such birds simply fluttered and flopped to the ground which many of the incoming shearwaters struck with considerable force. No injuries were seen to result nor were any birds found trapped in the branches.

Some alighted quite close to their burrows, but perhaps because of the limited number of access points through the canopy, many did not. Measured distances from alighting spot to disappearance down a burrow were 8, 8½, 17, 17 and 35 yards but some travelled greater distances than these. The paths taken to the burrows were mostly fairly direct, the birds hobbling along with wings almost closed or only slightly lifted from their bodies.

Departure followed the pattern in other members of the genus e.g. that of *P. tenuirostris* (Warham, 1960), this being preceded by a pre-dawn chorus of song. The birds hurried to exposed take-off rocks or grassy slopes and sailed out to sea, streams of birds pouring down the gullies on the eastern slopes. In places the grass was extensively worn by the tread of many feet and appeared to be dying. Below some of the small take-off rocks long trenches had been cut through the tussock by the strike of birds that failed to get enough lift to become airborne. Run-off after rain appeared to be deepening these trenches.

It was noticed that the alleged diagnostic white-wing lining was a rather variable character among the Snares Island population. Some lacked any exposure of white in this region having wing linings virtually identical with those of *P. tenuirostris*. Such birds would be impossible to separate on this character under the viewing conditions usual at sea.

Fluttering Shearwater (*Puffinus gavia*)

According to Waite (1909) an example of this bird collected by Travers at the Snares was in the Rothschild Museum. It is not stated whether the specimen was taken on land or at sea and no one has yet reported any black and white shearwaters on these islands.

Mottled Petrel (*Pterodroma inexpectata*)

Richdale (1964) has given some data on egg sizes and body weights in this species based on material collected during his stay on the Snares. Here the birds are common and they were incubating eggs that on 6 February 1967 seemed to be within a week of hatching. The nests were concentrated in the narrow *Poa astoni* belt at the tops of and part way down the cliffs, particularly along the island's western edge. Some nested also at the bases of the thicker *Poa foliosa* tussocks but none beneath the *Olearia* forest. All were in chambers at the ends of burrows.

Mottled Petrels were not seen off the island by day nor were they seen to form rafts offshore. This parallels the behaviour of *Pterodroma lessoni* at Macquarie Island (Warham, in press) and perhaps significantly, they did not alight until dark. Then some landed very

close to their nests after the usual preliminary circlings. In the early part of the night there was a good deal of aerial activity, in which pairs and trios chased through the sky calling.

The voice included a sharp succession of notes. The sequence usually recorded as "ti, ti, ti . . ." etc. This gives only a vague idea of this call which at close quarters was a high-pitched and hysterical laugh. This often trailed off into a deeper, throaty, chattering "quurrrr, quurrrr . . ." whose final syllables tend to become slurred. Both these calls were rather variable and seemed to be homologous with those of *P. macroptera* described by Warham (1956) and by *P. lessoni*: they may well be important in sex recognition.

Mottled Petrels seemed to be feeding well away from their nesting grounds. On 2 January 1967 they were fairly plentiful in an area about 50 miles S.S.E. of the Snares but the birds' numbers decreased as the islands were approached, none being seen closer than 30 miles from the group.

At sea the birds were readily identified at a distance by their light underparts and their grey upperwings with whitish patches towards the wing tips giving a mottled pattern to the upperwing when the birds banked towards the observer. The effect arises from the way in which the white areas on the posterior vanes of the primaries are revealed when the flight feathers are separated during the course of the birds' aerial manoeuvrings. The underwing stripe figured by Fleming (1954) was also useful, but closer views were generally needed to pick this out.

At the Snares as elsewhere this species was being extensively preyed upon by the Southern Skuas. The habitats of the two coincided and many birds, killed only the previous day, were incorporated into the skeletal collections.

Diving Petrel (*Pelecanoides urinatrix*)

Diving Petrels had large and well feathered chicks on our arrival in 1967 and many fledged young were seen from the beginning of February. The species was not met with out at sea far from the islands but from 30 miles out at 1000 hours on 2 February many were encountered, most of them flying in the general direction of the Snares. This was at a time when the Mottled Petrels were rapidly decreasing in numbers.

At night these birds did not alight until after dark, flying at high speed and alighting with a revealing thud. Contrary to Richdale's observations at Whero Island, most of these petrels did not land near their burrows but ran some distance from the alighting points before disappearing underground.

Of all the noturnal species this was the most phototaxic and could be pulled down from considerable heights with the aid of a spotlight.

Pied Shag (*Phalacrocorax varius*)

Two birds were seen together around the coast in 1961 and single birds on several occasions. A cormorant's nest on a limb of an *Olearia* overhanging the Boat Harbour found in 1961 and still present in 1967 appears to have been that of a White-throated Shag (*P. melanoleucos*). No shags were seen in 1967.

Grey Duck (*Anas superciliosa*)

Not more than three birds were seen at any one time, the most usual places being the pools on Sinkhole Flat and among the coastal rock holes at Station Cove. Ducklings seen on 6 January 1967 were not more than three days old.

Australian Harrier (*Circus approximans*)

A single bird soared over the southern slopes on 8 February 1967.

Snares Island Snipe (*Coenocorypha aucklandica*)

The Snares Island race *huegeli* was plentiful and likely to be found anywhere on the island but particularly in damp situations. The birds were not elusive and were easily caught by hand at night with the aid of a torch. Adults with small downy chicks at heel were seen within a few days of our arrival and as late as 8 February. No nests were found. Some of the snipe frequenting the area around the Biological Station were banded and colour ringed. The calls were of two types: a single note "keerk, keerk . . ." or "kurk, kurk . . ." repeated 10 to 15 times about twice per second that often led to a disyllabic call "queeyoo, queeyoo . . ." repeated 4 to 8 times.

Southern Skua (*Stercorarius skua*)

Breeding skuas mostly had well feathered free-flying young on our arrival in January 1967. They had evidently bred in the open grassy areas above the cliffs and preferred the short wiry *Poa astoni* tussock to the deeper *P. foliosa*. The biggest group of skuas was stationed on Skua Point north east of the Station where quantities of bleached bones from Skua castings were scattered over the rocks. The remains were mainly of *Pachyptila turtur*. The skua predation on the Mottled Petrels has been noted above and skuas were also seen eating dead shearwaters, crested penguins and diving petrels but no birds were seen being killed by skuas. Their predation on the mutton-birds appeared to be quite insignificant in comparison with the large breeding population of that species. How important the breeding sea-birds are to the skua's economy on the islands and how much food they acquire at sea as a result of their own efforts was not determined.

Skuas on the Snares appeared on average to be appreciably lighter in colour than their counterparts seen at Campbell Island a few days previously, suggesting some degree of isolation between the two populations.

Southern Black-backed Gull (*Larus dominicanus*)

Recorded in 1947 and 1948 but uncommon then and not seen in 1961 or 1967 although sought for.

Red-billed Gull (*Larus novaehollandiae*)

Present in scattered groups around much of the coast. Breeding seemed to be almost over and on our arrival in 1967 several pairs were feeding large free-flying young although a small chick was still present on 5 January.

These gulls fed much out at sea but they were also found in ones and twos under the thick *Olearia* canopy usually near penguin colonies. The attraction seemed to be the food often spilled by the adult penguins when feeding their chicks. These items the gulls were

quick to retrieve and in such situations perched freely in the trees and from their reluctance to move when approached were quite at home in the forest.

Antarctic Tern (*Sterna vittata*)

The adults all seemed to have black foreheads during the 1967 visit except for one with a whitening forehead noted on 6 February. The species was noted at several places around the coast but they were most obvious on the south side of the Boat Harbour where there were several nests. One held two 2- to 3-day-old chicks on 5 January; but two days earlier there was at least one fledged chick in the same area.

Snares Black Tit (*Petroica macrocephala*)

The well differentiated local race *dannefaerdi* was tame and plentiful. No nests were seen and the breeding season had evidently ended for adults were feeding free-flying young. A good deal of intra-specific threat and chasing was seen which involved wing fanning and shaking and the erection of the feathers of the crown. Although much food was collected from the ground free-flying insects were also taken. Stead gives useful observations on this subspecies and Fleming (1950), in his important review of the genus, includes the observations he made during his visit with the 1948 party.

Snares Island Fernbird (*Bowdleria punctata*)

This bird, subspecies *caudata*, was very common and ubiquitous in its distribution among the various habitats available on the main island. Feeding was mainly done on the ground, the feet being used for scratching the surface and also for turning over leaves almost as big as the birds themselves. They were often seen entering petrel burrows and had the habit of peering into crevices and also of hanging upside down below branches like *Parus* titmice. Large terrestrial amphipods were taken and chicks were fed largely on the larvae of a noctuid moth. The adults scratched their heads indirectly, i.e. over the drooped wing.

Breeding was in progress and like Stead we found them nesting in the bases of clumps of *Polystichum* fern and also in the *Poa* tussocks. Birds were carrying feathers to line nests on 12 and 13 January but at least two pairs had 3-egg clutches by 16 January. Both sexes brooded the young.

Song Thrush (*Turdus ericetorum*)

Present in small numbers within the forest. Shy. A bird was singing on 3 January but no song was heard thereafter. A free-flying young bird was recorded on 20 January.

Blackbird (*Turdus merula*)

Present in small numbers. Shy. Eggs were seen in nests on 3 January and 3 February but no young were noted. No song was heard. A Blackbird was feeding on a dead mutton-bird on 9 February.

Hedge Sparrow (*Prunella modularis*)

Stead reports a bird seen in 1947. Richdale does not refer to the species; and neither the 1961 or 1967 parties observed or heard this bird.

New Zealand Pipit (*Anthus novaeseelandiae*)

Chapman (1891) refers specifically to this bird which he says was very tame. It has not been recorded since. There are areas at places like Skua Point and Sinkhole Flat that would seem capable of supporting a few pairs, but it is unlikely that the 1967 and previous parties would miss any that were present.

Bellbird (*Anthornis melanura*)

Reischek states that the Bellbirds on the Snares are darker than on the mainland. No one else has reported the species on the islands.

Tui (*Prothemadera novaeseelandiae*)

An immature bird was seen by Bernard Stonehouse in 1961.

White-eye (*Zosterops lateralis*)

Probably the most plentiful of the passerines after the fernbirds and black tits. No nests were seen.

Goldfinch (*Carduelis carduelis*)

Reported by previous parties but not encountered or heard in 1961 or 1967, although looked for.

Lesser Redpoll (*Carduelis flammea*)

Quite common near the Station where they fed on the seeds of the introduced *Poa annula* and also among the sedges. Young birds in their streaked plumage were present and unlike the rest of the self-introduced British birds these were tame.

Chaffinch (*Fringilla coelebs*)

Only two or three of these birds were seen in 1967. A male was singing on the day of our arrival after which no song was heard. Chaffinches were very shy and gave few opportunities for clear observation. They were not seen by the 1961 party.

House Sparrow (*Passer domesticus*)

House Sparrows had evidently nested under the iron roof of the old castaway hut and were only seen near the Biological Station, where there appeared to be two males and one female. All were extremely timid and it will be interesting to see how the birds fare now that the castaway hut has been re-covered and offers no nesting sites.

Starling (*Sturnus vulgaris*)

Rare. Not observed at all in 1961 and not more than three were seen at any one time in 1967. As on other sub-antarctic islands the birds were shy and unapproachable.

DISCUSSION

No major changes among the bird populations of the Snares Islands are revealed by the present account. It was to be expected that there would be additions to the list of species recorded by past visitors. Perhaps the most notable absentees are the almost complete lack of shags and of the Yellow-eyed Penguin and Southern Black-backed Gull. It will be noted that Reischek's account contains a number of inconsistencies and his record of the Grey-headed Mollymawk

(*Diomedea chrysostoma*) has been excluded. He writes, "On the cliffs were adult and almost fully-grown young of the mollymawk, the grey-headed albatross (*Diomedea chlororhyncha*) and the shy albatross (*Diomedea cauta*)." He was there much too early in the year to encounter Buller's Mollymawk chicks (though he should have seen the adults) and the Snares seem too far north for *D. chrysostoma*, a bird of sub-antarctic seas.

Small petrels like *Garrodia nereis*, *Fregatta tropica*, *Pachyptila crassirostris* and *Puffinus assimilis elegans* will be looked for in future but the small size and low elevation may militate against the presence of breeding populations of larger species like *Procellaria cinerea* and *P. aequinoctialis*.

Changes in the status of the Goldfinch and Hedge Sparrow suggest that the smaller self-introduced passerines, like the alien plants, have only a tenuous footing here.

ACKNOWLEDGEMENTS

Grateful acknowledgement is made to the help provided by Comdr. J. D. Venable, H.Q. Christchurch, and to the officers and crew of U.S.S. T. J. Gary (Cmdr. J. J. Kingston) and U.S.S. Mills (Cmdr. J. A. Felt) all of the United States Antarctic Research Programme for providing transportation in 1967. A grant from the University Grants Committee supplemented departmental funds and the 1967 party benefited from the support given to the 1961 party by the Nuffield Foundation. The R.N.Z.A.F. kindly flew a special flight and has provided stereo-aerials from which maps more accurate than available hitherto are being prepared. The writer is also grateful to members of the 1961 Expedition for the use of their observations in the preparation of this paper.

REFERENCES

- BOURNE, W. R. P., and WARHAM, J., 1966. Geographical variation in the Giant Petrels of the genus *Macronectes*. *Ardea*, 54: 45-67.
- BULLER, W. L., 1894. On a New Species of Fernbird (*Sphenoeacus*) from the Snares Islands. *Trans. Roy. Soc. N.Z.*, 27: 127-132.
- CHAPMAN, F. R., 1890. The Outlying Islands south of New Zealand. *Trans. N.Z. Inst.*, 23: 491-522.
- FALLA, R. A., SIBSON, R. B., and TURBOTT, E. G., 1966. A Field Guide to the Birds of New Zealand.
- FINNERAN, B. A., 1964. An Outline of the Vegetation of the Snares Islands. *Trans. Roy. Soc. N.Z. (Bot.)*, 2: 229-235.
- FINNERAN, B. A., in press. Flora of the Snares Islands, New Zealand.
- FLEMING, C. A., 1948. The Snares Island Expedition 1947. *N.Z. Bird Notes*, 2: 181-184.
- FLEMING, C. A., 1950. New Zealand Flycatchers of the Genus *Petroica* Swainson. *Trans. Roy. Soc. N.Z.*, 78: 14-47; 127-160.
- FLEMING, C. A., 1954. A North Island Record of the Black-winged Petrel. *Notornis*, 6: 20-21.
- FLEMING, C. A., REED, J. J., and HARRIS, W. F., 1953. The Geology of the Snares Islands. *D.S.I.R. Cape Exp. Ser. Bull.*, 13: 42 pp.
- KIRK, T., 1890. On the Botany of the Snares. *Trans. N.Z. Inst.* 23: 426-431.
- MURPHY, G. E. B., 1948. A Naturalist's Wife in the Sub-Antarctic. *Nat. Hist. N.Y.*, 57: 344-349, 412-416, 468-474.
- MURPHY, R. C., 1948. A New Zealand Expedition of the American Museum of Natural History. *Science*, 108: 463-464.
- OGILVIE-GRANT, W. R., 1905. On the birds procured by the Earl of Ranfurly in New Zealand and the adjacent Islands. *Ibis* (8) 5: 543-602.
- PETTINGILL, O. S., Jr., 1960. Creche behaviour and individual recognition in a colony of the Rockhopper Penguin. *Wilson Bull.*, 72: 209-221.

- REISCHEK, A., 1888. Notes on the Islands to the South of New Zealand. Trans. N.Z. Inst., 21: 378-389.
- RICHDALE, L. E. (n.d.). Wild Life on an Island Outpost. (Privately printed, Dunedin).
- RICHDALE, L. E., 1949a. The Pre-egg Stage in Buller's Mollymawk. Biol. Monographs No. 2. (Privately printed, Dunedin).
- RICHDALE, L. E., 1949b. Buller's Mollymawk: Incubation Data. Bird Banding, 20: 127-141.
- RICHDALE, L. E., 1964. Notes on the Mottled Petrel *Pterodroma inexpectata* and other Petrels. Ibis, 106: 110-114.
- STEAD, E. F., 1948. Bird Life on the Snares. N.Z. Bird Notes, 3: 70-79.
- STONEHOUSE, B., in press. The Snares Crested Penguin.
- WAITE, E. R., 1909. Vertebrata of the Subantarctic Islands of New Zealand in The Subantarctic Islands of New Zealand ed. Chas. Chilton, 2: 542-600.
- WARHAM, J., 1956. The Breeding of the Great-winged Petrel *Pterodroma macroptera*. Ibis, 98: 171-185.
- WARHAM, J., 1960. Some Aspects of Breeding Behaviour in the Short-tailed Shearwater. Emu, 60: 75-87.
- WARHAM, J., 1962. The biology of the Giant Petrel *Macronectes giganteus*. Auk, 79: 139-160.
- WARHAM, J., 1963. The Rockhopper Penguin *Eudyptes chrysolome* at Macquarie Island. Auk, 80: 229-256.
- WARHAM, J., in press. The biology of the White-headed Petrel *Pterodroma lessoni* at Macquarie Island.
- WILSON, E. A., 1907. Aves, Nat. Ant. Exp. 1901-1904, 2. Zoology: 1-121.
- WILSON, R. A., 1959. Bird Islands of New Zealand.



SHORT NOTE

INLAND OVER-WINTERING OF BANDED DOTTEREL IN THE SOUTH ISLAND

One of the best "birding" places during the winter in Central Otago is near the mouth of the Matukituki River where it enters the western side of Lake Wanaka. The river being low in the cold weather, there are usually plenty of sandbanks and bars for gulls and herons; and nearby, on the damp, lake-edge paddocks of Mr. J. R. Ewing's property, are favourite feeding habitats for Spur-wings (*L. novaehollandiae*). The lake, of course, provides refuge for ducks, geese and swans.

The past three winters we have recorded flocks, totalling up to 50 birds, of the Banded Dotterel (*C. bicinctus*), and to check the fact that they were really over-wintering and not just early arrivals, I have this winter kept a tag on them every month since January, when the usual exodus begins. By 25/2/67 there were only 48 left that I could find (these feeding on bare soil among turnip seedlings); and from the rather scattered groups in the area since that date, I should say that this is the total of the over-wintering ones this year. I counted 39 on 8/7/67, but some others were hidden in hollows. Most of these feed on the damp, grassy pastures among the sheep, although a few are to be found along the muddy, weedy lake-edge or river sand-bars. On 8/7/67 some males were showing brighter breeding plumage bands, although all the females seemed to be still in winter dress.

So far this is the only area where I have been able to find Banded Dotterels in winter in Central Otago, and it would be interesting to know if there are any other far-inland places in the South Island where this behaviour occurs.

— PETER CHILD

NOTES ON RECOVERIES AND BREEDING BEHAVIOUR OF ADELIE PENGUINS OF KNOWN AGE AT CAPE HALLETT

By B. E. REID, F. C. KINSKY, H. J. CRANFIELD, R. C. WOOD

INTRODUCTION

Sladen (1958) provisionally classified Adelie Penguins (*Pygoscelis adeliae*) in adult plumage into three classes:

- (a) established breeders (i.e. experienced)
- (b) unestablished breeders (i.e. inexperienced)
- (c) non-breeders (i.e. wanderers)

and listed behavioural and breeding criteria to distinguish between these. His placing of physically identical birds into different age and breeding categories was based on thorough observation and astute deduction, but as he stresses, proof of status can only come from birds of known age. Subsequent to his pioneer studies he has, through both personal co-operation and through the United States Antarctic Bird Banding Program assisted the diversified ecological studies by New Zealanders and others at several rookeries in the Antarctic. The aspects of the Cape Hallett studies dealt with in this discussion were initiated by Sladen and B. E. Reid in January 1959 and may best be regarded as preliminary work on certain phases of breeding biology and population ecology which are now being extensively studied by Sladen and Wood at Cape Crozier. Results obtained in consecutive seasons up to and including the 1965/66 summer are dealt with.

AIMS OF STUDY

Considerable information has been collected on egg loss and pre-fledging mortality (Sladen, 1958; Taylor, 1962; Reid, 1964; etc.). Chicks are known to leave the breeding grounds when about two months old, and because of the distinctive plumage markings of yearlings, Adelie Penguins are known not to breed at the end of their first year. However, from this time on data on young birds are negligible. This study was therefore undertaken to provide some information on the behaviour and breeding of young birds.

THE STUDY AREA

The Cape Hallett rookery is the summer home of some 140,000-150,000 Adelie Penguins. The breeding population varies between 56,000-62,000 pairs. These nest in several hundred colonies (some containing fewer than 10, others more than 1,000 pairs) situated on raised mounds and ridges of the 100 acre shingle spit (Reid, 1964).

During the four summers 1958/59 to 1961/62 inclusive, over 5,300 birds were banded as part of various population studies. This particular investigation of breeding age and behaviour of young birds is based on 457 chicks banded on well-defined colonies (A, B, C, D, E, F, K1, K3, K4, K20 and K22; Reid, 1964) at the eastern end of the rookery, where human interference has remained negligible.

The behaviour of the species (Sladen, 1958), along with the size and physical complexity of the Cape Hallett rookery, makes the

locating of all banded birds difficult. Nonetheless, because of the comparable pattern and intensity of search effort throughout this study, we may reasonably assume that the differences in the number of chicks recovered in various age classes do, in fact, reflect the relative strength of each age class in the population.

RECOVERIES AND AGE OF BIRDS AT RETURN TO THE ROOKERY

Only 31 individuals (i.e. 6.8%) of the 457 chicks banded have subsequently been recovered*. In a total of 50 different recoveries (consisting of two 2-year-old, eight 3-year-old, eighteen 4-year-old, seven 5-year-old, nine 6-year-old and six 7-year-old birds) two were first recaptured when two years old, seven when 3 years, seventeen when 4 years, three when 5 years, one when 6 years, and one was not seen until it was 7 years old. Twenty of the 31 birds were recovered in one season only, six in two different seasons, two in three seasons and three in four seasons.

Although a few yearlings return to the rookery every summer for a short time and a small number moult there later, none of the banded chicks were recovered as yearlings. Not until the birds are two years old do they frequent the rookery in appreciable numbers. Recovery rates based on the limited data available from this study suggest that 5-10% of the surviving 2-year-old birds come ashore during the summer months, some 25-30% of the surviving 3-year-olds and approximately 80% of the surviving 4-year-old birds return to the rookery (Reid et. al., unpublished). Thus, probably all birds aged five and more years return to land during the breeding season.

BREEDING AGE

A preliminary statement on results from Cape Crozier (Sladen, et. al. 1966) mentions that a small number of 3-year-old birds bred. The earliest breeding age recorded at Cape Hallett was 4 years (Table 1). Of the birds in this age class (a total of 18) that were recorded on shore, only 25% bred. However, recoveries suggest that between 80/90% of 5-year-olds and 85-95% of 6-year-old birds breed.

CLUTCH SIZE

Data obtained (Tables 1 and 2) show that only one egg is laid by 4-year-old females. Some 5-year-old males were paired with females of unknown age, which had laid two eggs. However, the two breeding 5-year-old females laid only one egg each. Both 6-year-old females laid 2 eggs each.

WANDERING

Some birds ('Wanderers,' Sladen, 1958) are always on the move. They visit colonies but never occupy nest sites for more than a day or two. Data from this study show that both 2-year-olds, three of the seven 3-year-olds and two of the eighteen 4-year-olds were wanderers. This behaviour seems to be characteristic for younger birds, and the proportion of wanderers decreased with increasing age. No 5-year-old or 6-year-old birds were recorded as wanderers (Table 4).

* This low recovery rate does not reflect mortality alone and considerable band loss must occur.

Breeding Status and Clutch Size, ALL BIRDS.

Age	Status, All Birds				A as % A & B	Clutch Size		Ave. Clutch Size	
	A	B	C	Total		1E	2E	A	A & B
2	0	2	0	2	0	-	-	-	-
3	0	4	4	8	0	-	-	-	-
4	3	9	6	18	25	3	0	1.00	0.25
5	5	1	1	7	83	3	2	1.40	1.17
6	7	1	1	9	88	1	6	1.86	1.62

A = Breeding, B = Not Breeding, C = Status Unknown

Breeding Status and Clutch Size, FEMALES only.

Age	Status, Females			A as % A & B	Clutch Size		Ave. Clutch Size	
	A	B	Total		1E	2E	A	A & B
4	2	2	4	50	2	0	1.00	0.50
5	2	1	3	67	2	0	1.00	0.67
6	2	0	2	100	0	2	2.00	2.00

A = Breeding, B = Not Breeding.

Date Birds First Located in Rookery

Age	Week Starting								Total Birds	
	November					December				
	1	8	15	22	29	6	13	20		27
2								1	1	2
3						1		3	1	5
4		2	3	1	1	1	2	2	1	13
5	2	3	1				1			7
6	6	2	1							9

Number of Wanderers and Number of Birds occupying Central or Peripheral Nest Sites in Each Age Class

Age	Nest Position		Percent Central	Wanderer	No Detail	Total
	Central	Peripheral				
2	-	-		2	-	2
3	1	3	25	3	1	8
4	4	10	29	2	2	18
5	4	2	66		1	7
6	7	2	78			9

TIME OF RETURN TO ROOKERY

None of the 2-year or 3-year-old birds was seen until late in the season (i.e. during the 're-occupation period,' Sladen, 1958). Five of the thirteen 4-year-old birds arrived during the middle of the 'occupation period,' one late during this period and the remaining seven arrived at the rookery during the 're-occupation period.' All 5 and 6-year-old birds arrived during the 'occupation period,' the majority of the 6-year-olds returning earlier than the 5-year-olds (Table 3). Thus older birds tend to arrive in the rookery earlier in the season than younger birds.

STRENGTH OF COLONY BOND

Fifty percent (i.e. 15 of the 31 recoveries) of the birds, when first recovered, were found on their colony of origin. Although this may be higher than the true percentage, because search efforts were greater at, and in the vicinity of these colonies, the results indicate a strong tendency for chicks, on reaching the age of 3-5 years, to return to their colony of origin. Of the remaining 16 birds, all except 4 were within 100 yards of their colony of origin, and eight of these were on colonies neighbouring their parents' colonies.

Five out of six young birds bred on the same colony they originally settled on, in the following year(s). The sixth bird (a female), a 4-year-old when first breeding, bred at a neighbouring colony in her fifth year, and returned to the same neighbouring colony to breed in her sixth year.

PAIR BOND

In several instances, when birds were recovered in two or more seasons, their partners were not identified. Nevertheless, data on three 4-year-old birds show that they had different partners the following year. Two 6-year-old birds, however, had the same partners when recovered again a year later. Thus, pair bonds between young breeders may not be as durable as those formed by older birds.

NESTING SITES

Young birds, particularly those breeding for the first time (and also non-breeders, seeking territories during the 're-occupation period') tend to occupy peripheral nest sites. Established breeders, however, tend to shift to more central areas of the colonies, as nest sites in these areas become available (Table 4).

DISCUSSION

Because of the relatively small number of chicks banded during this study and consequently the small number of recoveries made, many of the above preliminary results require confirmation. No results were obtained on other points such as dispersal of young birds to other rookeries; the social status of young birds within each colony; irregularities in incubation routines by young birds; nest building; and the breeding success of inexperienced breeders. All these must await the analysis of very extensive data resulting from current American studies at Cape Crozier.

LITERATURE CITED

- REID, B. E., 1964: The Cape Hallett Adelie Penguin Rookery. *Rec. Dom. Mus.*, 5 (4): 11-37.
 SLADEN, W. J. L., 1958: The Pygoscelid Penguins. *F.I.D.S. Rpt.*, 17: 1-97.
 SLADEN, W. J. L., WOOD, R. C., and EMISON, W. B., 1966: Antarctic Avian Population Studies, 1965-1966. *Antarctic Journal U.S.* 1 (4): 141-142.
 TAYLOR, R. H., 1962: The Adelie Penguin at Cape Royds. *Ibis*, 104 (2): 176-204.

B. E. Reid, *Wildlife Service, Dept. Internal Affairs, Wellington*

F. C. Kinsky, *Dominion Museum, Wellington*

J. H. Cranfield, *Fisheries Laboratory, Marine Dept., Wellington*

R. C. Wood, *Johns Hopkins University, Baltimore, Md., U.S.A.*

HISTORY AND STATUS OF THE DOMINICAN GULL IN WELLINGTON

By R. A. FORDHAM

Zoology Department, Victoria University of Wellington.

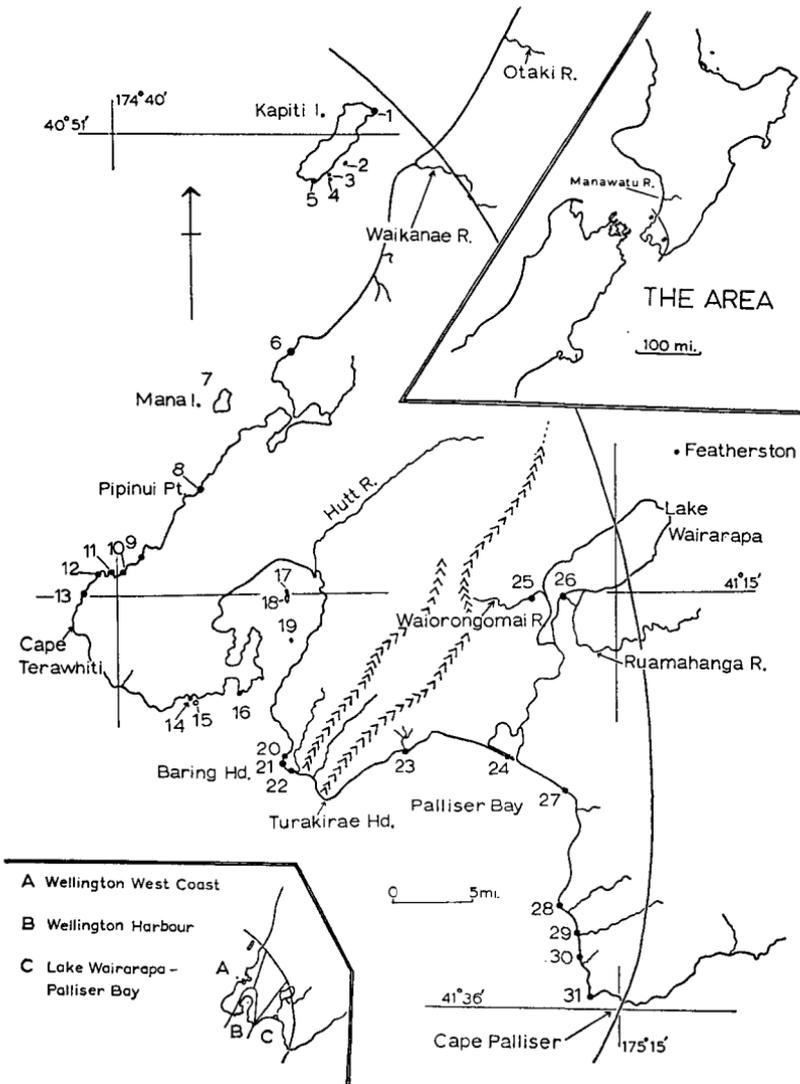
Present address: Culterty Field Station, Newburgh,
Aberdeenshire, Scotland.

ABSTRACT

In this paper, the Wellington area is defined as south-west of a curved line from the north end of Kapiti I. through Lake Wairarapa to Cape Palliser. The Wellington population of Dominican Gulls began to increase before 1890, and has grown rapidly in the last quarter century. In this latter period, six colonies show marked increases in size: Baring Hd. x ca. 11, Somes I. x ca. 9, Mana I. x ca. 8, Ward I. x ca. 5, Kapiti I. x ca. 4 and Palliser Spit x ca. 2. Kapiti I. and Palliser Spit are not near any prominent food source, and apparently have not grown as rapidly as the four other colonies mentioned, which are much closer to major feeding sites. Increase of the population has been influenced by the establishment and subsequent growth of meatworks and refuse tips. The histories of breeding colonies in Wellington are summarised. There are 31 breeding colonies in the Wellington area, 21 on the mainland and 10 on islands, which together with scattered breeding pairs, comprised ca. $5,700 \pm 500$ pairs in 1963-64. There are 16 permanent roosting sites and possibly seven others in the area; most are at breeding colonies. The total number of birds in breeding colonies and in flocks outside breeding colonies during peak occupation of the colonies in December, 1963, is estimated at ca. $15,200 \pm 1,700$ birds.

INTRODUCTION

Available records show that in recent years numbers of Dominican Gulls (*Larus dominicanus*) have increased markedly in the Wellington area, particularly around the harbour. The increase has been rapid in the last quarter century, but had begun before 1890 (Buller, 1888). Data summarised in this paper were collected between 1961 and 1965 during a study of the Wellington gull population, and comprise a brief record of the history of the population, and its status in 1964. The study area extends from Kapiti I. on the west coast to Cape Palliser at the south tip of the North I. and is bounded by a curved line through Lake Wairarapa (see Figure). In 1964, the nearest major breeding colony on the west coast was about 41 miles north of Kapiti I. (two miles north of the Rangitikei R.) while on the east coast there were only a few small colonies for a considerable distance north of Cape Palliser. Colonies at the north end of the South I. were not considered. As there were no major colonies immediately adjacent to the area, and as dispersal of Dominican Gulls from their natal colonies is limited (Fordham, in press), it was considered that colonies in the study area supplied the bulk of the Wellington population.



HISTORY OF THE WELLINGTON POPULATION

Few New Zealand birds have increased as rapidly in recent years as has the Dominican Gull. In Wellington, their numbers have risen noticeably in living memory. The increase has not been restricted to Wellington, however, and in parts of the country, the gull is now considered a danger by some sheep farmers and aviation authorities. Little has been published on the history of Wellington gull colonies, but information from local people provided some evidence of the increase, and suggested that some of the small colonies, e.g. Island Bay and Moa Pt., are recent in origin, comprising birds spread from larger colonies nearby. A description of the harbour wildlife in 1839 was given by Heaphy (1879). He wrote: "I remember, especially, the enormous number of water-fowl frequenting the shallows at the mouth of the Hutt River. Cormorants, ducks, teal, oystercatchers, plovers, sandpipers, curlew, and red-legged waders, were there in pairs, detachments, and masses, and so tame that it was slaughter rather than sport, to shoot them." Heaphy did not list gulls by name, yet if they had been numerous he would probably have mentioned them, so that I assume they were not as prominent as they are today. Nearly 50 years later, however, Buller (1888) noted an increase in their numbers in the harbour. Today, mammalian predation affects some mainland colonies, and hedgehogs, stoats, and ferrets may be found round almost the entire Wellington coast, while feral cats are present from Baring Hd. west to Pukerua Bay (pers. obs., J. A. Bartle, P. Chandler, B. M. Fitzgerald).

In summer 1963-64, the Wellington area contained 31 breeding colonies; 21 on the mainland and 10 on islands. These varied in size from a few scattered pairs to approximately 2,000 pairs (Mana I.) and single pairs were scattered all round the coast. Along the west coast between Ohariu Bay and Pipinui Pt., and between Oteranga Bay and Island Bay there were isolated nests (C. Summers, P. Chandler, G. Jensen); and at Tongue Pt. a mile north of Karori Stm. there were ca. four pairs (G. Jensen). On Kapiti I. nests were scattered along the north, north-west and east sides. There were two pairs on Miramar peninsula, Wellington Harbour, and one pair on the east side of Palliser Bay.

In colonies with marked nests (i.e., those visited weekly), the nests were counted at the end of season, while in others, estimates were made from one or more nest-counts during the season, or information from other persons. Allowance was made in the estimates for the seasonal spread of laying (Fordham, 1964). Other data were collected during an aerial survey of the area on 23 November, 1964, in which the extent of known breeding colonies was noted, and special efforts made to locate unrecorded colonies. In the table which follows, the colonies have been listed according to the localities shown in the figure, and note has been made of important factors (e.g., flooding) which have, or may have, affected breeding.

HISTORY OF DOMINICAN GULL COLONIES IN WELLINGTON

Figures represent nests counted or estimated.

— = no data. Superscript numbers refer to the list of references

COLONY	1900-20	1921-40	1941-50	1951-60	1961-65	NOTES
<u>WELLINGTON WEST COAST</u>						
1. Kapiti I.	present ⁴	nested ³⁷	129+25 ¹⁷ 120 ¹⁷	-	600 (estimate on 23/11/63; 19 with chicks, 455 with eggs, 115 empty)	Maoris & whalers present before 1900. Norwegian rats now common.
2. Tokomapuna I.	-	<50 ³⁷	54 ¹⁷	-	35 ⁴¹	
3. Fisherman's I.	-	-	-	-	5?(1963-64)	
4. Brown's I.	-	-	-	-	5?(1963-64)	Rats present
5. Wharekohu Bay Kapiti I.	-	-	16 ¹⁷	-	10-20 ²³	
6. Pukerua Bay	-	"Nested for a long time"		7+ ²⁴	7(1963-64) unsuccessful	1½ miles S. of Pukerua Bay. Wildcats & mustelids present (B.M. Fitzgerald)
7. Mana I.	"A small number nested" S.W. end ⁴⁵	-	250 ^{19&20}	Nested on most slopes and beaches ³⁰	2,000 (1963-64) Estimate partly based on a comparison with the Baring Id. colonies	Farmed for many years. No mammal predators.

COLONY	1900-20	1921-40	1941-50	1951-60	1961-65	NOTES
8. Pipinui Pt.	-	-	-	nested ²²	31 ²⁵	ca. two miles N. of Pipinui Pt. Wildcats & probably mustelids present
9. Opau Bay	-	-	6 ¹³	6 ⁵⁵	5 ⁴⁴	
10. Te Ikaamaru Bay	-	-	-	20 ⁵²	20 ⁵²	
11. Ohau Bay	-	-	-	nested ³²	12 ³²	
12. Ohau Pt.	-	-	-	-	4 ³²	
13. Cape Terawhiti	-	-	-	-	40 ³²	
<u>WELLINGTON HARBOUR</u>						
14. Island Bay	-	-	-	-	6 ⁴³	S.W. edge of Island Bay
15. Taputeranga I.	n e s t e d ⁵¹			nested	155 (estimate on 30/11/63) 118 nests found	Norwegian rats common
16. Moa Pt.	-	-	-	-	75(1963-64)	Cats and possibly rats present
17. Leper I.	-	-	increased ⁴⁶	26 ¹⁴	25 (estimate 1963-64)	Possibly no mammal predators
18. Somes I.	Present before 1914, absent 1914-18 ⁴⁰	1938 occupied part of S. end. ²⁶ Nested, S.E. pt ⁴⁶	nested ⁴⁶	1953 most nests S.E. pt ³⁶ 1959 nests all round I. ⁴⁶	1,419 ⁵ 1,475 (estimate 1963-64)	Occupied by man for more than 100 years including periods of great activity. Now largest colony in the harbour. No mammal predators
19. Ward I.	-	-	20+ ²¹ 45 ¹¹	-	110 (estimate on 5/12/63; 77 nests found with chicks or eggs; none empty)	Was once main harbour colony ²⁹ , possibly no mammal predators

COLONY	1900-20	1921-40	1941-50	1951-60	1961-65	NOTES
20-22. Baring Hd: 20. Northern 21. Lighthouse 22. Lagoon	-	-)) 250-60 ¹²))	-	Estimated on 29/11/65; 80 (71 counted) 250 (231 counted) 310 (279 counted)	Northern colony may be recent. Lagoon subject to flooding. Wildcats & stoats present
<u>LAKE WAIRARAPA-</u> <u>PALLISER BAY</u>						
23. Mukamuka R. mouth	-	-	-	nested ⁵⁸	45 (1963-64); 25 (1964-65)	Stoats & wild pigs present
24. Palliser Spit	"Small no. nested ⁵⁵ "	present ⁵⁵	Gulls moved ca. 500 m. west ⁵⁵ 137 ³	55 ¹¹ 209 ²	220 ²⁴ 265 (estimated on 9/11/65; 210 with eggs or chicks & 43 empty)	No evidence of mammal predators
25. Waiorongomai R.	-	-	-	nested ⁵⁹	75 (1963-64); 5 (1964-65)	Subject to total flooding. Ferrets present
26. Ruamahanga R. mouth	-	present 1935 ⁵⁴	present	54	24 (1963-64)	Subject to total flooding
27. Whangamoana cliffs	-	-	"present"		12 (1963-64)	Nests scattered
28. Te Hlumenga Pt.	-	-	nested ²⁷	42 (18 empty) ²⁸	50+ ²⁸ 58 (1963-64); 1 (1964-65)	Wild pigs ate eggs during breeding ca. 1952 & 1953 (N. Crew)
29. Otakaha R. mouth	-	-	-	ca. 7 ²⁸ 10 ²⁸	6 (1963-64); 10 (1964-65)	
30. Whale Pt.	-	-	-	-	8 (1963-64)	½ mile N. of Waiwhero Stm.
31. Ngawihi Pt.	-	-	-	4 ²⁸	6 ²⁴ 4 (1963-64); 6 (1964-65)	Stoats present

Four small colonies in Wellington have become defunct; two in Wellington Harbour, and two in the Lake Wairarapa-Palliser Bay area. A colony ca. two miles north of Pencarrow (R. A. Falla) dispersed before 1960 following road works. About 1960, gulls began nesting on a roof in Eastbourne, Wellington, and by 1963, there were five pairs (Miss M. Wood). This colony was then removed by the authorities. From about 1925 onwards, there was a colony one mile north of Turakirae Hd. in Palliser Bay from which eggs were collected (R. C. Nelson), but no gulls were seen during an aerial survey in November, 1964, and it therefore appears that this colony dispersed before 1964. There was a small colony in Hopai Lagoon at the north end of Lake Wairarapa but it dispersed when the lake level rose sometime after 1950 (J. Luttrell & E. Holmes).

To summarize: The Wellington population has grown rapidly since 1900 and some of the small colonies for which there are no early records may be of fairly recent origin. Further, six colonies show a marked increase in the numbers presumed breeding up to the 1963-64 season.

<i>Colony</i>	<i>Approximate Rate of Increase</i>	<i>Period Involved</i>
Baring Hd. --- ---	x 11	since 1943, 20 years
Somes I. --- ---	x 9	since 1938, 25 years
Mana I. --- ---	x 8	since 1944, 19 years
Ward I. --- ---	x 5	since 1949, 14 years
Kapiti I. (north end)	x 4	since 1941, 22 years
Palliser Spit --- ---	x 2	since 1948, 15 years

The first four colonies are close to Wellington City, or other centres of human population with major feeding sites such as refuse tips or meat-works, but the other two (Kapiti I. and Palliser Spit) are a greater distance from any prominent food source and apparently have not grown so rapidly. The two meat-works on the edge of the harbour began operations in 1883 and 1889 respectively and the city council abattoir opened in 1909. Since 1905, at least 13 refuse tips have opened in the Wellington area, 10 of these have been in the last 20 years, and seven of the nine still operating are now major tips. Four sewers have also been built this century but do not attract many birds. The scavenging habits of Dominican Gulls are well known, as is their attraction in large numbers to refuse of various kinds and effluent from meat-works. Almost 86% by volume of the food eaten by Wellington gulls in 1961 and 1962 was offal and refuse (Fordham, in prep.). Unlike in the northern hemisphere, the expansion this century of the fishing industry in New Zealand has not been on a large scale and has apparently not affected gull populations significantly. Analysis of mortality and production of young (Fordham, in prep.) shows that since at least 1961, production of fledged young in Wellington has been about twice that required to maintain the population, and the annual growth rate of the population has been not less than 7.2%. Although the change in numbers of birds in this period has been dramatic, the events in Wellington are not unique, for Dominican Gulls, aided by an enlarged food supply, have increased in other parts of New Zealand (c.f. Stead, 1927). In other countries, gull populations have also expanded as a result of freely available food of human origin (Sparck, 1950; Gross, 1955; Vermeer, 1963; Murray and Carrick, 1964).

ROOSTING FLOCKS

There are at least 16 permanent night roosting sites in the area, and possibly seven others. Eight permanent flocks are much larger than the others (in particular, Kapiti, Mana and Somes Is. and Baring Hd.) and between them provide for the bulk of the Wellington population. At these places there may be one or more flocks comprising several hundred to over a thousand birds. Flight movements of gulls at dawn and dusk suggest the existence of one or more roosting sites on the south-west coast, and the most likely places are Cape Terawhiti and Karori Stm. mouth. Roosting flocks are listed below; figures in parentheses refer to localities in the figure. Other sites used for roosting include Tokomapuna I. (2), Fisherman's I. (3), Brown's I. (4), Pipinui Pt. (8), Cape Terawhiti (13), Karori Stm. (south-east of Cape Terawhiti), Otakaha R. mouth (29).

ROOSTING FLOCKS IN THE WELLINGTON AREA

Wellington West Coast

Kapiti I., north end (1)	large
Mana I. (7)	large
Te Ikaamaru Bay (10)	(E. C. Hall)

Wellington Harbour

Taputeranga I. (15)	large
Mooring dolphins (W. side of harbour)	
Leper I. (17)	
Somes I. (18)	large
Ward I. (19)	large
Baring Hd., Northern flock (20)	
Baring Hd., Lighthouse flock (21)	large
Baring Hd., Lagoon flock (22)	large

Lake Wairarapa - Palliser Bay

Palliser Spit (24)	large
Waiorongomai R. (25)	
Ruamahanga R. mouth (26)	
Whanagmoana cliffs (27)	
Te Humenga Pt. (28)	

All the large and some of the small breeding colonies serve as roosting sites in winter and summer, although the gulls often roost at sea adjacent to the site. Very small breeding colonies near large roosting sites may not serve as roosting sites themselves (e.g. Island Bay). Some birds roost on or near their summer nesting sites, but the majority usually gather in groups and are not widely dispersed as when nesting. These groups regularly form in the same general area each night, while in coastal colonies roosting flocks often move away from the upper beach terraces where nests are built, to below the high tide mark.

TOTAL POPULATION

The population of the Wellington area during breeding is composed of two main categories of birds; those in breeding colonies and those outside the colonies in feeding or resting flocks. An estimate of the population (based largely on monthly transects round the harbour) was made in December, 1963, during peak occupation of the breeding colonies, and was affected by at least two sources of error. First by

immature birds visiting the clubs of breeding colonies, and second by breeding adults present in flocks for feeding, bathing, etc. On 20 December, 1963, ca. 1,800 gulls were counted on the Harbour transect and 500 ± 200 birds estimated for the west coast between Titahi Bay and Waikanae (on 17 December, 1961, there were ca. 450 gulls for this part of the west coast). For the rest of the Wellington area, i.e. in or near the city, and the Lake Wairarapa-Palliser Bay region $1,500 \pm 500$ birds were estimated, making a total of $3,800 \pm 700$ in flocks. With an estimated $5,700 \pm 500$ breeding pairs (the estimated error is mainly associated with Mana I.), this suggests a total population at the height of breeding of ca. $15,200 \pm 1,700$ birds. By comparison, aerial surveys in autumn 1964 and 1965 indicated that the peak population in the non-breeding season was in excess of 12,000 birds (Fordham, in press).

ACKNOWLEDGEMENTS

The work was carried out during tenure of the Internal Affairs Wildlife Scholarship. I am much indebted to Dr. R. W. Balham for his advice and supervision throughout, and to all the people who provided historical information. Dr. C. A. Fleming and Dr. G. R. Williams made helpful criticisms of the manuscript.

REFERENCES

A. Published

1. BULLER, W. L., 1888. A History of the Birds of New Zealand. 2nd Ed. published by the author.
2. CHALLIES, C. N., 1961. Classified summarised notes. *Notornis* 9 (7): 244.
3. CUNNINGHAM, J. M., 1949. Classified summarised notes. *Notornis* 3 (7): 212.
4. DRUMMOND, J., 1909. Birds on Kapiti Island. *Trans. N.Z. Inst.* 41: 30-32.
5. FORDHAM, R. A., 1964. Breeding biology of the Southern Black-backed Gull 1: Pre-egg and egg stage. *Notornis* 11 (1): 3-34.
6. ——— in press. Dispersion and dispersal of the Dominican Gull (*Larus dominicanus*) in Wellington, New Zealand.
7. ——— in prep. Mortality and breeding of Dominican Gulls in Wellington, New Zealand.
8. GROSS, A. O., 1955. Changes of certain sea bird populations along the New England coast of North America. *Proc. XI Int. Orn. Congr.*, 1954: 446-449.
9. HEAPHY, C., 1879. Notes on Port Nicholson and the natives in 1839. *Trans. N.Z. Inst.* 12: 32-39.
10. MURRAY, M. D., & CARRICK, R., 1964. Seasonal movements and habitats of the Silver Gull, *Larus novaehollandiae* Stephens, in south-eastern Australia. *C.S.I.R.O. Wildl. Res.* 9 (2): 160-188.
11. OLIVER, W. R. B., 1953. Classified summarised notes. *Notornis* 5 (3): 97.
12. SECKER, H. L., 1943. Classified summarised notes. *Notornis* 1 (3): 22.
13. ——— 1944. Classified summarised notes. *Notornis* 1 (7): 70.
14. ——— 1954. Nest records of the O.S.N.Z. (unpublished).
15. SPARCK, R., 1951. The food of the north-European gulls. *Proc. X Int. Orn. Congr.*, 1950: 588-591.
16. STEAD, E. F., 1927. Native and Introduced Birds of Canterbury. In: *Natural History of Canterbury*: 204-225. Simpson & Williams Ltd.
17. STIDOLPH, R. H. D., 1948. Relative abundance of birds on Kapiti. *N.Z. Bird Notes* 3 (1): 13-16.
18. VERMEER, K., 1963. The breeding ecology of the Glaucous-winged Gull (*Larus glaucescens*) on Mandarte Island, B.C. *Occ. Pap. Br. Columbia Prov. Mus.* 13: 1-104.
19. WODZICKI, K. A., 1944. Classified summarised notes. *Notornis* 1 (7): 70.
20. WODZICKI, K., & OLIVER, W. R. B., 1944. Mana Island. Effect of farming conditions on wild life. *N.Z. Sci. Rev.* 2 (2 & 3): 10.
21. YALDWIN, J. C., 1949. Classified summarised notes. *Notornis* 3 (7): 212.

B. Personal Communications

22. ARTHUR, D. Pipinui Pt. 1956-57.
23. BARTLE, J. A., Wharekohu Bay, Kapiti I., October 1962; Pipinui Pt., January, 1965.
24. CHALLIES, C. N. Pukerua Bay 1958-59; Palliser Spit November 1961 & 1962.
25. CLARKE, K. Ngawhi Pt. 1962-63.
26. CLEVERLY, R.
27. CREW, N., & McLEOD, F.
28. CUNNINGHAM, J. Te Humenga Pt., December 1954 and January 1961; Otakaha R. mouth 1952-53 and October 1954; Ngawhi Pt. 1952-53.

29. FALLA, R. A.
30. GAULT, J.
31. GRECO, J.
32. HALL, E. C.
33. HALL, S. Palliser Spit ca. 1920.
34. HALL, S., & HALL, R.
35. HUNT, F.
36. HUNTER, S. S.
37. LOVELL, S.
38. LUTTRELL, J.
39. LUTTRELL, J., & MATTHEWS, J.
40. OWEN, P. D., & WAGSTAFF, E.
41. PAUL, L. J. Tokomapuna I. 28 October, 1963.
42. SECKER, H. L. Pipinui Pt., March 1959.
43. STOOPS, D. Island Bay, December 1963.
44. SUMMERS, C. Opau Bay, 1962-63.
45. VELLA, W. Mana I. ca. 1908.
46. WEIR, A.

BREEDING COLONIES

- | | |
|------------------------|----------------------------------|
| 1. North end Kapiti I. | 17. Leper I. |
| 2. Tokomapuna I. | 18. Somes I. |
| 3. Fisherman's I. | 19. Ward I. |
| 4. Brown's I. | 20. Northern colony Baring Hd. |
| 5. Wharekohu Bay | 21. Lighthouse colony Baring Hd. |
| 6. Pukerua Bay | 22. Lagoon colony Baring Hd. |
| 7. Mana I. | 23. Mukamuka R. mouth |
| 8. Pipinui Pt. | 24. Palliser Spit |
| 9. Opau Bay | 25. Waiorongomai R. |
| 10. Te Ikaamaru Bay | 26. Ruamahanga R. mouth |
| 11. Ohau Bay | 27. Whangamoana cliffs |
| 12. Ohau Pt. | 28. Te Humenga Pt. |
| 13. Cape Terawhiti | 29. Otakaha R. mouth |
| 14. Island Bay | 30. Whale Pt. |
| 15. Taputeranga I. | 31. Ngawihi Pt. |
| 16. Moa Pt. | |



SHORT NOTE

UNUSUAL RECORDS OF BIRDS AT SEA

The winter months of 1967 have been a period of very strong Trade Winds in the South Pacific. This has accounted for some rather unusual bird sightings.

1. A picture of a Wandering Albatross (*D. exulans*) was published by the Fiji Times on 6/7/67. The bird had been found on one of the outer islands and been brought into Suva for identification.
2. On 31/7/67 a Wandering Albatross (*D. exulans*) followed "Matua" throughout the day and was seen at dusk (1800 hrs.) in position 19° 40' S 176° 55' E. The wind then was East 24 knots and the sea temperature 76°F.
3. Whilst "Matua" was at anchor at Lifuka Island, Ha'apai Group, Tonga (19° 48' S 174° 22' W) on 10/8/67, wind East 30 knots and sea temperature 70°; between 1500 hrs. and 1530 hrs. a Giant Petrel (*M. giganteus*) was seen flying about the anchorage.
4. On 29/7/67 at 1730 hrs. with the ship in position 31° 00' S 17° 38' E. A Song Thrush (*Turdus ericetorum*) flew on board in a very exhausted condition. The wind was Ex N 24 knots which put the ship downwind, 360 miles from Raoul Island. It seems probable that this bird was blown from Raoul, where Song Thrushes are common, to the position of the vessel.

— J. A. F. JENKINS

CENSUS RECORDS OF KNOT FOR FIRTH OF THAMES AND MANUKAU HARBOUR

By H. R. McKENZIE

The Knot (*Calidris canutus rogersi*) is an eastern species of the genus *Calidris*. Its habits as observed in New Zealand are very much in line with those of the Eastern Bartailed Godwit (*Limosa lapponica baueri*). It has been of equal importance with the Godwit in the census work on the above two wader haunts. The Knot is perhaps more selective in its choice of living quarters than is the Godwit. It is very plentiful in the Firth of Thames and Manukau Harbour; but is hardly ever seen with the 1000 or so Godwits at the Wairoa South (Clevedon) River estuary. At the harbours of Whangarei and Ohiwa, Bay of Plenty, where 3000 Godwits or so may be expected, Knots are virtually absent. There are, however, no wader places where there are Knots and no Godwits, though Knots will outnumber the larger birds on occasions.

Some comparisons with the census records of Godwits (Notornis 14, 18-21) may be discussed briefly. Migratory behaviour varies but little, as far as we know. Both species leave about the same time but possibly not together. It is very difficult to tell when Godwits are really setting off, even when they fly right out of sight. The writer has seen only two small late flocks leave Parengarenga Harbour in a manner which very strongly indicated definite departure. No Knots were with them and none was seen which appeared to be leaving. The "going away" dress of the Knot is a little more pronounced in colour. The under surface is a more "solid" red, especially in the males; and the upper surface a rich reddish brown, mottled with blackish. Non-breeders staying through our winter vary in numbers from year to year but are fewer in proportion in this respect than the Godwit. Greater care has to be taken in counting Knots as when resting they pack tightly in "blanket" formation so that a fold in a shellbank can conceal several hundreds of birds. Also there can be a dense flock in the middle of a flock of the larger Godwit where they can be missed or underestimated, especially by inexperienced observers. The Knot roosts of the two census areas, though not so numerous as those of the Godwit, still make it necessary to depend mainly on full censuses and not "stab" counts of only one or just a few roosts. On the chart "stab" counts are shown in brackets, and are used only where they are larger than the census counts or when there has been no census. They may be of only one place, or several, but not all.

Some readers may be inclined to question the counting where say "5000" is shown on one date and "6611" on another. The latter could be an estimated 6000 in one place, 600 in another and 11. Great care is taken in making these estimates.

FIRTH OF THAMES, SUMMER COUNTS

The stab count of 5000 on 10/2/51 is more realistic than the 302 for 29/4/51. Nearly all, no doubt, had left by the end of April. The other figures are reasonably even, the only odd one being of

Knot Census Totals for Firth of Thames and Manukau Harbour
From Feb. 1951 to Dec. 1966.

FIRTH OF THAMES			MANUKAU HARBOUR		
Date	Summer	Winter	Date	Summer	Winter
29- 4-51	302 (5000 on		25- 2-51	5550	
24- 6-51	10-2-51)	632	6- 5-51		10
2-12-51	5200		1951- 52	----	
13- 7-52		223	14- 6-52		127
1952- 53	(3000 on		1952- 53	----	
2- 8-53	7-12-52)	400	14- 6-53		1053
13-12-53	4627		22-11-53	102	
1954		----	1954		----
1954- 55	(7000 on		1954- 55	(200 on	
	12-12-54)			11-12-54)	
26- 6-55		1400	24- 7-55		57
4-12-55	8062		1955- 56	----	
17- 6-56		19 (42 on	8- 7-56		800
		12-7-56)			
25-11-56	5398		4-11-56	300 (5000 on	
1957		----	1957	16-2-57)	----
1957- 58	(4000 on		1957- 58	(6500 on	
1958	20-1-58)	----	1958	22-2-58)	----
1958- 59	(5000 on		1958- 59	(5000 on	
	13-12-58)			29-3-59)	
1959		----	21- 6-59		498
6-12-59	6611		8-11-59	538	
1960		----	10- 7-60		3614
27-11-60	7320		4-12-60	1183	
2- 7-61		590	30- 7-61		300
26-11-61	8520		10-12-61	2500	
24- 4-62		78	22- 7-62		550
2-12-62	4500		16-12-62	3120	
14- 7-63		170	23- 6-63		607
8-12-63	2606 (3000 on 4-11-63		3-11-63	41 (7000 on	
	5000 on 3-3-64)			31-1-64)	
17- 5-64		123	14- 6-64		465
8-11-64	3750		22-11-64	25	
4- 7-65		352 (580 on 1- 8-65			195
		2-6-65)	12-12-65	650 (4000 on	
14-11-65	7060			9-1-66)	250
24- 7-66		18	5- 6-66		
4-12-66	5456		11-12-66	690 (5000 on	
				28-2-67)	

8/12/63, which does not seem to be an error as it and 4/11/63 are so nearly the same. This is the only summer count at Firth of Thames which, by the stab count of 3/3/64 indicates an autumn build-up.

FIRTH OF THAMES, WINTER COUNTS

As with the Godwit these vary rather widely. The 1400 on 26/6/55 is a large number but not at all unlikely. For example, W. Ridland and R. B. Sibson estimated more than a thousand present in July, 1941. Counts of under 100 are more surprising. Knots are seldom seen in fields, even in very wet weather, so there is less likelihood of their being missed than is the case with the Godwit.

MANUKAU HARBOUR, SUMMER COUNTS

It is unfortunate that so many of these are missing in the first half of the chart. The reasons are given in the Godwit account, p. 20. Here the stab counts are useful in partly filling the gaps; and seasonal movements shown by both census and stab counts will be discussed later.

MANUKAU HARBOUR, WINTER COUNTS

Here again, on 10/7/60, is an oddly large number. It is composed of a reliable count of 3575 at Karaka Shellbank and small lots of 24 and 15 elsewhere. It will be noted that the Firth of Thames and Manukau Harbour summer counts are, on the whole, very similar; but that in spite of this the winter counts are very much in favour of Manukau.

COMMENTS ON VARIATIONS IN NUMBERS OF SUMMER POPULATION IN MANUKAU HARBOUR

Except for 1954-55 the stab counts are all later in the season than the census counts. Years ago D. A. Urquhart drew attention to the almost complete lack of Knots at Karaka early in the season and the very large influx later. The chart supports his observations. It can be seen that for the most part the numbers up to late December are small; then swell very quickly in January and February. Movement from Firth of Thames could not account for this, though there could be a little traffic at odd times. Where the influx comes from remains to be determined. It comes to mind that the most likely source is Farewell Spit. There is no other large population elsewhere to the south. The Invercargill flock, even if the whole of it moved, could not account for the large numbers. The total for the census of Farewell Spit on 24/1/61 (Notornis IX, 150) was 27,370. This is a large number but since a December tally has not been made it cannot be taken for granted that the population was not larger in December and had been decreased by January 24 by the departure of the flock which builds up at Manukau from early January. Against this there seems to be no reason why this quite regular movement should not continue until the Farewell Spit flock was exhausted. This does not happen. The food situation at the Spit would hardly necessitate about 6000 leaving the area in order to leave enough food for the larger part of the flock.

Knot counts made on the 1967 Farewell Spit Field Study Course were felt to be rather unsatisfactory. A count of 26000 on 14/1/67 was in line with that of 27370 on 24/1/61 but a census count of 13000 on 24/1/61 was puzzling. Intermediate counts were up to 16000 for part of the Spit. A stab count at Karaka Shellbank only was c.7000 on 31/1/67 as against 690 at the full Manukau Census on 11/12/66. The movement of 7000 to Karaka Shellbank, and perhaps of some to other parts of the Manukau Harbour and possibly others to the Firth of Thames, might account for a large part of the Farewell Spit discrepancy. In any case the evidence for such transfers is further supported.

SUNDRY NOTES

The Firth of Thames does not normally have the pre-Christmas shortage and the post-Christmas build-up. Unusual occurrences over long distances as described for Godwit have not been observed. Even in their regular movements Knots seem to be more secretive, perhaps travelling mostly at night. Besides the devoted band of census takers who work when populations are mainly steady, some observers make frequent checks throughout the year so that odd flight behaviour other than local would be noted.

The only local flight of some distance observed by the writer and a party of watchers is mentioned on p. 21. This was a flight of c.800, with Godwits, from outside Puketutu Island in the Manukau Harbour, over to Whitford, $12\frac{1}{2}$ miles. This however was only because of the difference in tides between the two coasts and they flew back again in a few hours. This was near outward migration time when wader behaviour becomes irregular. In the more settled part of the season, when censuses are taken, Knots have not been recorded at Whitford.

Outside the censuses period of 1951 to 1966 records of Firth of Thames were kept by R. B. Sibson, H. R. McK. and others from 1941 to 1951. These were in the nature of stab counts, not so comprehensive as censuses but containing much useful information. Notes of arrival from overseas indicate a build-up to normal numbers during late September, all of October and early November. An odd spring record reads: "To south (of Miranda) c.20,000 mixed Godwit and Knots. Great preponderance of Knots." No doubt about half of each species would pass on elsewhere. For the departure period odd notes are: "18/3/45, 10,000+, with c.3000 Godwit"; "19/3/49, 20,000 to 25,000 Godwit and Knots; more Knots than Godwit." The latter occasion made a fine study for C. M. Roberts, Hetty M. McKenzie and H. R. McK. as the birds raced about, high and low, near and far, or rested briefly on shell-banks between Kaiaua and Miranda. It was a grand and exciting display of pre-migration fighting. Other pre-departure records of the 1941 to 1951 period are practically in line with the period of the censuses, 1951 to 1966. The reason for the odd larger numbers can at present be only conjectured. It is obvious that further information can best be acquired by continuing the census method at these two places and by more observation at other wader resorts.

AVIAN REMAINS FROM NEW CAVES IN THE TAUMATAMAIRE DISTRICT

By DAVID G. MEDWAY

Since the formation of the Taranaki Caving Club in 1964, members have discovered and explored a number of limestone caves in the area between Awakino and Mahoenui to the west of the New Plymouth - Te Kuiti state highway. The majority of the known caves are to be found near the Taumatamaire Road in hilly country, now largely cleared of its original bush cover, some five miles from the west coast.

In the course of these explorations a number of sub-fossil avian remains have been found. These remains are of interest for they give an idea of some of the bird-life of the area as it was in years gone by. Of the species so far recovered the Cave Rail (*Capellirallus karamu*), North Island Notornis (*Notornis mantelli mantelli*) and Little Extinct Woodhen (*Gallirallus minor*) are extinct and the Little Spotted Kiwi (*Apteryx oweni*) is extinct in the North Island; the Kakapo (*Strigops habroptilus*) is probably extinct in the North Island; the Black Petrel (*Procellaria parkinsoni*), Blue Duck (*Hymenolaimus malacorhynchos*) and North Island Weka (*Gallirallus australis greyi*) have not, so far as is known, been recorded live from this locality; the New Zealand Pigeon (*Hemiphaga novaeseelandiae*) and Tui (*Prosthemadera novaeseelandiae*) are still present and no doubt the North Island Kiwi (*Apteryx australis mantelli*) is to be found in the extensive forest to the immediate west and north. The North Island Kokako (*Callaeas cinerea wilsoni*) still occurs in parts of that forest: Macdonald 1966 (Notornis 13, 2: 102).

This note mentions the species (except Moas) recovered between June 1964 and June 1967. Moa remains have been found in most caves in the area. While the majority of these are as yet unidentified, *Dinornis giganteus*, *Dinornis novaeseelandiae*, and *Eurapteryx geranoides* (among others) appear to be represented. As would be expected, the majority of the specimens so far recovered (86%) are referable to flightless species and of these the Kakapo and Cave Rail are numerically predominant.

SPECIES RECOVERED

Strigops habroptilus: Eleven Kakapos are represented mainly by leg-bones found principally in Robbers Hole and Aussie Cave. The number of remains recovered would appear to indicate that the Kakapo was common in former years in the area in question.

Capellirallus karamu: The recovery from Robbers Hole and Skyline cave of bones attributable to ten specimens of the Cave Rail would seem to indicate that this extinct rail, like the Kakapo, was formerly common in the area.

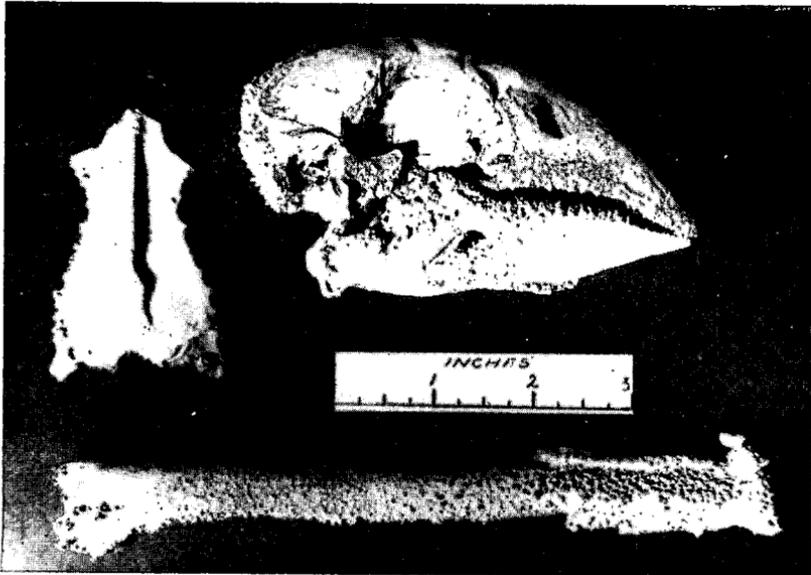
Apteryx australis mantelli: A total of six North Island Kiwis are represented by bones found in Robbers Hole, Skyline and Swiss Cheese.

Apteryx oweni: Leg-bones of two Little Spotted Kiwis were recovered from Robbers Hole on 8/1/1966.



[W. J. Guild

Plate XXVI — **Capellirallus karamu** skeleton in situ. Skyline cave, 26/9/1965.



[W. J. Guild

Plate XXVII — Skull, sternum and tibia of **Notornis m. mantelli** from Porthole cave, July 1965.

Gallirallus australis greyi: Four North Island Wekas are represented by bones found in Robbers Hole and Skyline.

Notornis mantelli mantelli: In 1960 when G. R. Williams published his paper on the Takahe (Williams 1960, Trans. Roy. Soc. N.Z., 88: 235-258), the North Island sub-species was not known to have formerly occurred on the western side of the North Island north of the Waingangoro River in South Taranaki. The recovery of one skeleton from Porthole Cave in July 1965 and of another from Swiss Cheese on 14/11/1965 constitutes a valuable addition to our knowledge of the former distribution of the Notornis in the North Island.

Gallirallus minor: An almost perfect skeleton found in Swiss Cheese on 21/11/1965 and a left caracoid found in Skyline cave on 20/2/1966 form a valuable record of the former occurrence of the Little Extinct Woodhen in the area.

Procellaria parkinsoni: A worn left humerus attributable to the Black Petrel was found in Skyline cave on 15/5/1966.

Hymenolaimus malacorhynchos: One part left humerus referable to the Blue Duck was found in Robbers Hole on 12/6/1966.

Hemiphaga n. novaeseelandiae: A part-skeleton of a New Zealand Pigeon was found in Robbers Hole on 8/1/1966.

Eurystomus sp.?: One part-skeleton (sub-adult) found in Skyline cave on 20/2/1966 has been tentatively identified as being of this genus. The Broad-billed Roller (*Eurystomus orientalis pacificus*) is an occasional straggler to New Zealand.

Prothemadera n. novaeseelandiae: Bones of a Tui were found in Swiss Cheese on 14/11/1965.

Callaeas cinerea wilsoni: One part right tibio-tarsus of a North Island Kokako was recovered from Robbers Hole in September 1964.

I am grateful to Mr. R. J. Scarlett for identifying the bones recovered and to Mr. W. J. Gould of the Taranaki Caving Club for the photographs which illustrate this note. The majority of the bones recovered have been deposited in the Canterbury Museum.



SHORT NOTES

STATUS OF AUSTRALIAN COOT NEAR ROTORUA

Although there are some 75 or more Coots (*F. atra*) on Lake Okarcka at present, there appear to have been no successful broods reared during the 1966/67 breeding season. Mr. and Mrs. W. Broun, who live beside the lake, have kept a very close watch on the birds. Although they saw the birds pairing and choosing territories they could find no nests with eggs. Obviously it is very difficult to ascertain the reason for the non-breeding, but perhaps the lowering of the lake could be the chief cause.

On 10/6/67, while driving past Okere with H. Lyall, I spotted a Coot just off the landing stage for the launch which tours round Lake Rotoiti. We both took a second look and confirmed that it was indeed a Coot. There appeared to be no other Coots about.

— R. JACKSON

COOTS AT LAKE OKAREKA

Lyll (Notornis X, 353) and Jackson and Lyll (Notornis XI, 82) have written accounts of the establishment of the Australian Coot (*Fulica atra*) on Lake Okareka up to the winter of 1964 when there were 21 birds on the lake. Since then numbers have risen to the present, apparently stable, level of about 70. Pairs have been reported to raise as many as three broods (not substantiated by banding) of up to 9 young. Occasional birds have been reported from other lakes in the Rotorua district but a second colony does not seem to have been established. Jackson and Lyll made a number of comments on the possible habitat preferences of these birds, but the following factors could also be of importance:

1. The area utilized by the coots on Lake Okareka has a depth of 3 to 10 feet and is very gently sloped so that any change in the lake level still leaves the birds with some water of this depth. Similar suitable looking areas on lakes Rotoehu and Rotoma all have a depth of over 7 feet. The coots on Lake Hayes feed in areas with a depth of about 4 feet (M. M. Small *pers. comm.*).
2. The aquatic plant composition of the area, *Nitella hookeri* and *Myriophyllum propinquum* with *Potamogeton ochreateus* occurring occasionally, and areas of *Elodea canadensis* nearer the shore, is to be found in other lakes although in different proportions. One area of Lake Rotoiti of approximately 4 feet in depth has only *Lagarosiphon major* growing in very solid beds.
3. Lake Okareka is a scenic reserve and therefore is not hunted during the game season.

— C. R. VEITCH



FOOD PASSING BY BREEDING HARRIERS

For several years I have suspected that a pair of Harriers (*C. approximans*) has been nesting among the bracken and flax on the southern slopes of the Josephville hill, Southland. One day during December, 1966, I decided to watch the hillside while I ate my lunch. After a short time a Harrier appeared and took up station, perching on a low bush. Some fifteen minutes later a second Harrier arrived from the south, flying high and carrying something in its talons. The perching bird took flight and approached the incoming bird but at a much lower altitude. When they were within range of one another, the higher bird dropped the item of food which it was carrying, and which fell for a distance of at least 150 feet. The lower bird appeared to roll over in flight, extending its talons upwards to take the most perfect pass. After flying in a tight circle, it landed in the bracken where I later found the nest in which were two well-grown young Harriers.

This was a spectacular feat which I believe is seldom seen. I would be interested to know if such a long pass is usual.

— R. R. SUTTON

GREENSHANK AT TIMARU

On the morning of 6/5/67 a strange wader was observed among Pied Stilts at Washdyke Lagoon, Timaru, from the sand bar which divides lagoon and sea. A closer examination was made possible by approaching the bird from the other side of the lagoon and notes were taken on its appearance and feeding habits.

Although it was once observed flying as part of a tight flock of Stilts, it kept largely to itself and was occasionally harassed by Stilts and Red-billed Gulls. The wader was streamlined in shape, grey above with darker wing primaries, and white below. The bill was dark and slightly upcurved. In flight the feet projected beyond the tail, and an inverted V of white extending up the back from the rump was very obvious. Although the leg colour was not ascertained we were left in no doubt that this bird was a Greenshank (*Tringa nebularia*), and our opinion was strongly confirmed on consultation with various reports and field guides.

The bird was again observed on 7/5/67 and 10/7/67. On both occasions the call was recorded as a fairly high-pitched, rather flute-like "teu-teu-teu."

The Greenshank was not found on 22/5/67, presumably having continued on a northward journey.

— B. R. KEELEY

— P. M. SAGAR

[Accumulating records seem to show that one or two immature Greenshanks remain in New Zealand during most winters. — Ed.]



REVIEW

Population Studies of Birds, David Lack, F.R.S., 1966. Clarendon Press, Oxford. New Zealand price \$8.20.

Any book by David Lack, the Director of the Edward Grey Institute of Ornithology at Oxford University, demands the attention of ornithologists in particular and of animal ecologists in general, especially if they are interested in population dynamics. Lack's present book is essentially a sequel to his *The Natural Regulation of Animal Numbers*, published in 1954, which created considerable interest then and which took one side of a controversy, the other side of which was supported by Andrewartha & Birch in their book, *The Distribution and Abundance of Animals*, which appeared in the same year.

The controversy, still very much alive, concerns whether natural populations of animals fluctuate essentially by chance between ill-defined limits (Andrewartha & Birch) or whether numbers are regulated between restricted limits by factors which tend to decrease dense populations and increase sparse ones (Lack). There are other distinguished ecologists on either side and my attempt briefly to define the controversy has oversimplified it.

In 1962 Wynne-Edwards tried to resolve it with his interesting and contentious book, *Animal Dispersion in Relation to Social Behaviour*. This offered the theory (not very sympathetically received) that although food supplies ultimately limit natural populations, animals "avoid" reaching starvation level and destruction of their environment

by displays and other social behaviour which prevent overcrowding.

Now Lack has tried to settle the argument anew. Unlike his earlier book, which dealt with the population ecology of many groups of animals, this one is limited to population studies of birds, and for perhaps that reason, it presents a stronger case for density-dependent regulation of numbers. Thirteen major studies have been selected for review, solely on the grounds of duration and sufficient detail, and one of these is Richdale's study of the Yellow-eyed Penguin. Eleven minor investigations have been discussed because of their relevance to the major ones. "In all, thirteen passerine species, eight other land birds and four sea birds have been included and they exhibit a wide diversity of feeding and breeding habits." Most of the studies were made in Britain and the rest are about equally divided between the tropics, Europe, Australasia and the United States.

Lack's main conclusions are:

- "(a) That the reproductive rates of birds have been evolved through natural selection and so are, in general, as rapid as the environment and the birds' capacities allow;
- (b) that mortality rates balance reproductive rates because bird populations are controlled by density-dependent mortality;
- (c) that starvation outside the breeding season is much the most important density-dependent factor in wild birds (but not necessarily in other animals);
- (d) that breeding pairs are dispersed broadly in relation to food supplies through various types of behaviour which are as yet little understood, but which are to be explained through natural selection."

This summary, by Lack himself, may make his book sound formidable reading but it is pleasant and full of stimulating ideas and illustrated by many graphs and charming line drawings. The author is not too procrustean in fitting other people's results to his own convictions but as far as some of the graphs are concerned — particularly in the earlier chapters — I should have liked some mathematical discussion (for example, Figure 8 does not seem very convincing evidence for what it is supposed to show and Figure 15 *could* be either a linear or curvilinear regression).

The long appendix on the theoretical controversies concerning animal populations is an extremely valuable and lucid summary of the subject, though I could not help feeling that the attack on Wynne-Edwards which goes on throughout the book is rather unnecessarily protracted.

Three minor errors caught my eye: G. M. Dunnet's name is consistently misspelt in the text (but not in the bibliography); *Ondetra* occurs once for *Ondatra*; and that insidious and persistent variant, *adaption*, got under the author's guard once, too.

A second reading of *Population Studies of Birds* convinces me that critical studies of population limitation in the wild (designed *a priori* rather than *a posteriori*) are still needed and that these could be done in New Zealand.

This is a very important book.

— G. R. WILLIAMS

NOTICES

Mrs. Hazel Waters, of Wanstead, R.D. 2, Waipukurau, H.B., writes:—

"I have a small cottage at Opoutere, ten miles north of Whangamata on the Coromandel Peninsula. It has occurred to me that some members of the O.S.N.Z. might care to use this cottage, which is situated in very good country for birding. The cottage has five beds. There are electric stove, refrigerator, etc. It would be necessary to bring linen and food."

Any members who would like to avail themselves of Mrs. Waters' generous offer should communicate with her at her Wanstead address.

The Honorary Secretary has for sale copies of the revised edition of "A Field Guide to the Waders," by Condon and McGill.
Price: 60c, posted.

ANZAAS 40th CONGRESS CHRISTCHURCH, 24th - 31st JANUARY, 1968

Circular No. 2, which contains full details of Section programmes and other Congress activities, has now been issued and will be sent to all those who have enrolled.

Additional copies and enrolment forms may be obtained from Mr. C. M. Harris, C/o Chemistry Department, University of Canterbury. All intending participants are urged to enrol without delay.



REQUEST FOR INFORMATION

The breeding statistics of the Southern Black-backed Gull (*Larus dominicanus*) are at present under study in the Napier district. Comparisons with colonies elsewhere in New Zealand are of interest and a request for information is here extended to O.S.N.Z. members. Information required is:

- (a) Approximate size and location of colony.
- (b) Date of commencement of laying within colony.

Very large colonies may commence egg-laying in late September; smaller colonies may be considerably later. Visits to colonies may not co-incide with first eggs, but useful data is still obtainable; please state if no eggs were found or the number of nests containing eggs. Should the number of nests with eggs be small, i.e. less than 15, please measure length and breadth (in millimetres) and weigh (in grams) the eggs of individual nests. An approximate laying date can be calculated from this data. A 100 gram Salter spring balance is ideally suited for egg weighing.

Please send all relevant data to:

Mr. T. A. Caithness, Research Section, Wildlife Service, Department of Internal Affairs, Wellington.

NOTICE TO CONTRIBUTORS

Contributions should be type-written, double- or treble-spaced, with a wide margin, on one side of the paper only. They should be addressed to the Editor, and are accepted on condition that sole publication is being offered in the first instance to "Notornis." They should be concise, avoid repetition of facts already published, and should take full account of previous literature on the subject matter. The use of an appendix is recommended in certain cases where details and tables are preferably transferred out of the text. Long contributions should be provided with a brief summary at the start.

Reprints: Twenty-five off-prints will be supplied free to authors, other than of Short Notes. When additional copies are required, these will be produced as reprints, and the whole number will be charged to the author by the printers. Arrangements for such reprints must be made directly between the author and the printers, Te Rau Press Ltd., P.O. Box 195, Gisborne, prior to publication.

Tables: Lengthy and/or intricate tables will usually be reproduced photographically, so that every care should be taken that copy is correct in the first instance. The necessity to produce a second photographic plate could delay publication, and the author may be called upon to meet the additional cost.

Illustrations: Diagrams, etc., should be in Indian ink, preferably on tracing cloth, and the lines and lettering must be sufficiently bold to allow of reduction. Photographs must be suitable in shape to allow of reduction to 7" x 4", or 4" x 3½".

Proofs: First proofs of papers will be sent to authors at the discretion of the Editor, or upon request. They should be returned without delay.

Nomenclature: Contributors should follow the Checklist of N.Z. Birds for both the scientific and vernacular names. Scientific names of species and genera are printed in italics, and in the script should be underlined; and the specific or subspecific name should be enclosed in brackets if following the vernacular name, thus: Stewart Island Kiwi (*Apteryx australis lawryi*). It is necessary to give the scientific name as well as the vernacular the first time the latter is mentioned, but thereafter only one of the names. Capital letters should be used for vernacular names.

References: If listed, these should be in the form of the following examples:

1. Atkinson, I. A. E., 1964: Feeding stations and food of the North Island Saddleback in August. *Notornis* 11, 2, 93-97.
2. Buller, W. L., 1888: A History of the Birds of New Zealand (2nd ed.) 2 vols., the author, London.

The references should be serially numbered, and in the text, should be shown thus: Atkinson 1964 (1), and Buller 1888 (2). If references are cited in the text, the following shortened form may be used: Atkinson 1964, *Notornis* 11, 2: 93-97.

Publication: Contributions will normally be published approximately in the order in which they are received by the Editor, but at his discretion. He may seek the opinion of the Editorial Committee, appointed by the Council of the Society, on any matter including the general suitability of the contribution for publication.

Authors are requested to take care that the submitted text is correct. Only too often the Editor is asked to make a number of alterations or additions, which are not always clearly expressed or tidily presented.