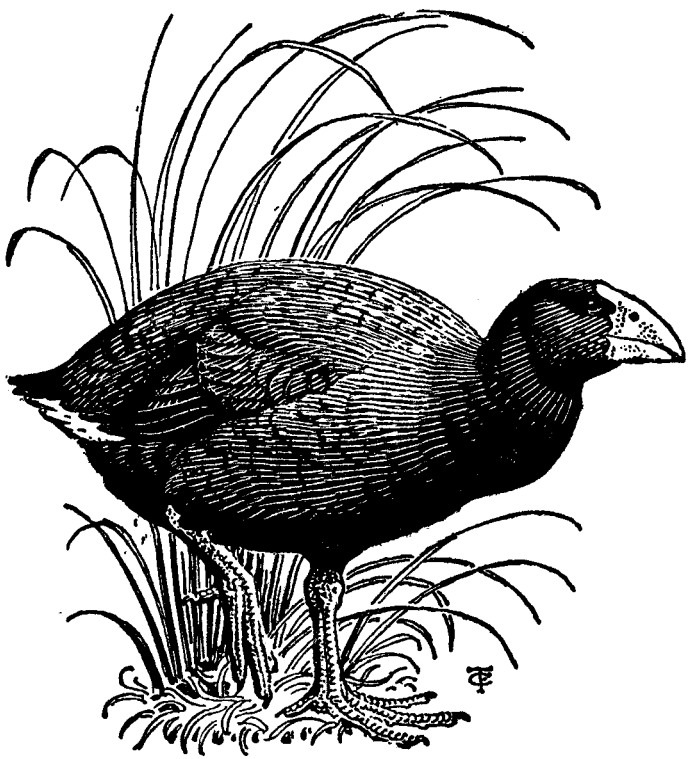
NOTORNIS

Journal of the Ornithological Society of New Zealand



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AGE STRUCTURE AND SEX RATIO OF LIVE-TRAPPED SAMPLES OF SOUTH ISLAND PIED OYSTERCATCHERS (Haematopus ostralegus finschi)

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ABSTRACT

Ten samples of South Island Pied Oystercatchers *(Haematopus ostralegus finschi)* were trapped between August 1969 and June 1971. Nine catches were made at the Heathcote-Avon Estuary and one at Parapara Inlet in northwest Nelson. In late summer large numbers of immatures and adults arrived at the Estuary. Decreasing frequencies of juveniles in later samples suggest that young birds tend to move further north than most adults. Males outnumbered females in all samples except the one in February 1971 when there was an excess of females. This seasonal shift in sex ratio could arise from a staggered migration and/or differential mortality of the sexes. Further systematic trapping at strategically placed coastal haunts is needed to substantiate and elaborate the above findings.

INTRODUCTION

In recent years wintering populations of the South Island Pied Oystercatcher *(Haematopus ostralegus finschi)* have undergone a spectacular irruption, and increasing numbers of birds have moved north in search of new coastal wintering areas (Baker 1973; Sibson 1966). The regular northward movement in autumn and the reverse movement in spring are now sufficiently well defined to be termed migrations. Vernal migration from wintering sites in northern New Zealand begins in early July and continues through to late August, by which time many adults are on territory at their breeding grounds. Following the breeding season large numbers of birds move north again, movement beginning in late December, reaching a peak in January - February and continuing through to about April in the far north (Falla, Sibson & Turbott 1966). Many of the birds that frequent northern harbours and estuaries are immatures (Sibson 1945; Falla

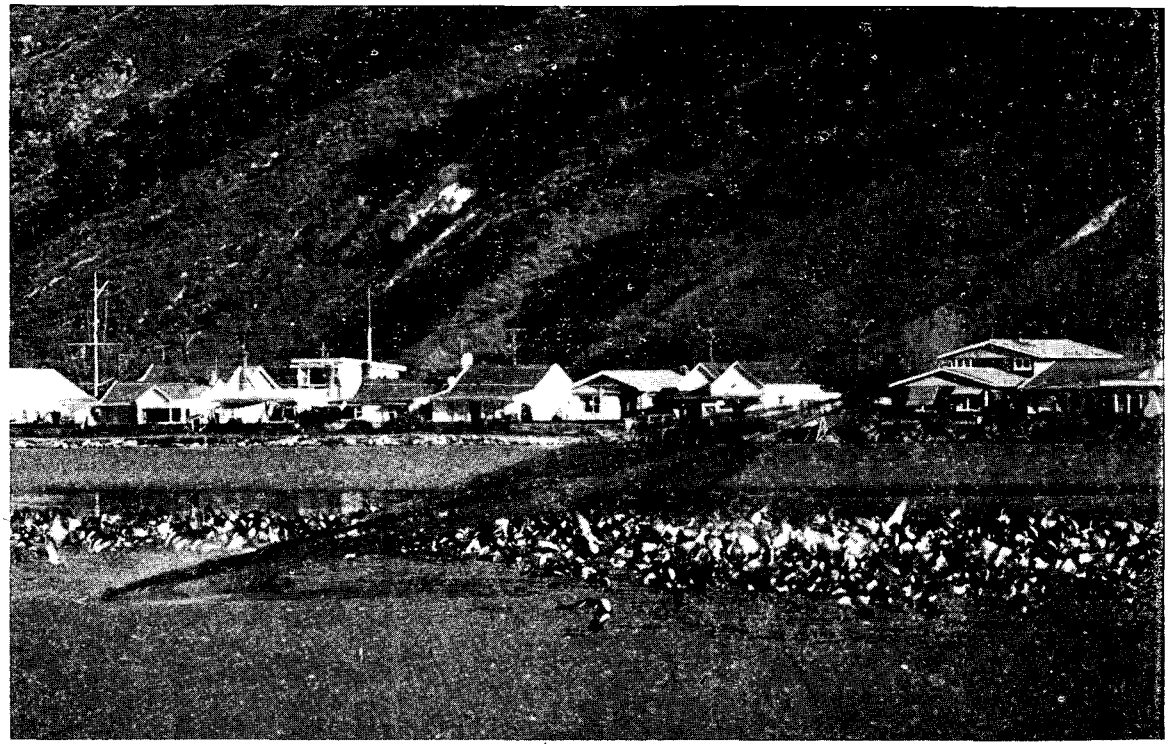

FIGURE 1 — Trapping a sample of South Island Pied Oystercatchers at the Heathcote-Avon Estuary with a projectile net.
Photo: H. Best

et al. 1966), but actual proportions of adults and immatures in the wintering flocks do not seem to be known with any precision.

The pattern of movement of migratory flocks of South Island Pied Oystercatchers (deduced from sight records in *Notornis* and Recording Scheme data) consists of a series of relatively short flights interrupted by brief stop-overs en route for feeding and resting (Baker 1975*b*), typical of the 'intracontinental migrant' strategy proposed by Helms & Smythe (1969). Usually such flocks comprise only a few birds, typically from two to twenty birds, though larger flocks have occasionally been sighted in flight near the upper reaches of some South Island rivers (see "Classified Summarised Notes" in *Notornis*).

Beyond the limited information outlined above little is known about the composition of migratory and wintering populations of the South Island Pied Oystercatcher. As part of a systematic study of New Zealand species of oystercatchers (Baker 1975*a*) samples of *H. o. finschi* were periodically live-trapped at coastal localities. The purpose of this short paper is to report the age composition and sex ratio of these samples in relation to migratory movements.

MATERIALS AND METHODS

Ten samples of birds were live-trapped with a projectile net (Fig. 1) over the period August 1969 to June 1971 inclusive. Nine of the catches were made at the Heathcote-Avon Estuary and one at Parapara Inlet in northwest Nelson Province (Table 1). A total of 674 birds were trapped, of which 143 were first year juveniles, 133 were second year birds, 112 were sub-adults and 286 were adults. After capture each bird was weighed and measured for eight standard morphological variables (Baker 1975 *a*). Most birds were colour-banded prior to release. Age and sex were determined using the criteria listed in Baker (1974).

AGE COMPOSITION OF SAMPLES

The age composition of live-trapped samples of South Island Pied Oystercatchers is shown in Table 1. The proportion of each age class captured in each sample was largely dependent upon the date of netting. Both June samples in 1970 and 1971 were composed mainly of adults, consistent with the great preponderance of this age class present at the Heathcote-Avon Etsuary in mid-winter. Adult numbers begin to decline in late July as the migration of breeding adults away from the Estuary to inland breeding sites commences. Consequently, the frequencies of the other age classes in the catches increase through spring to summer. However, some sub-adults and second year birds also move inland during the breeding season, and thus deplete coastal summering populations. Five such birds were trapped in November in 1970 on the Waimakariri riverbed approximately 40 km inland from the Canterbury coastline, and of these, three were second year birds and two were sub-adults.

TABLE 1. Age composition and sex ratios of projectile-netted samples of South Island Pied Oystercatchers.

Date	Locality	N	Age Classes				Sex Ratio	X^2
			Juv	2Yr	Sub-ad	Ad	Males:Females	
26 August 1969	Heathcote-Avon	43	6	5	18	14	1.53:1.00	3.94*
30 April 1970	Heathcote-Avon	47	4	7	18	18	1.14:1.00	0.20 ns
16 June 1970	Heathcote-Avon	116	3	9	0	104	1.87:1.00	10.32***
29 July 1970	Heathcote-Avon	71	18	27	14	12	2.09:1.00	8.80***
24 September 1970	Heathcote-Avon	82	38	27	7	10	1.41:1.00	2.39 ns
11 November 1970	Heathcote-Avon	40	16	10	9	5	2.64:1.00	9.10***
5 February 1970	Heathcote-Avon	110	17	23	24	46	0.67:1.00	4.40*
12 April 1971	Parapara Inlet	53	31	7	4	11	1.79:1.00	4.24*
23 April 1971	Heathcote-Avon	34	5	8	2	19	1.20:1.00	0.12 ns
18 June 1971	Heathcote-Avon	78	5	10	16	47	1.60:1.00	4.15*

Significance levels denoted as follows: *** = $\underline{P} < 0.001$, ** = $\underline{P} < 0.01$, * = $\underline{P} < 0.05$, ns = not significant, $\underline{P} > 0.05$.

In late summer there is a considerable influx of adults and juveniles at the Estuary, as most breeding birds and their progeny leave inland breeding sites and migrate to coastal wintering localities at this time. This influx is clearly revealed in the February sample. The onset of autumn saw the departure of some juveniles for northern localities, and thus accounts for their drop in numbers in the April sample. At this time the Heathcote-Avon sample comprised 55.9% adults and only 14.7% juveniles. The tendency for juveniles to migrate further northwards than most adults is also apparent from the concurrent April sample captured in northwest Nelson, approximately 240 km north of the Heathcote-Avon Estuary. In the Nelson sample 58.5% of the birds caught were juveniles and only 20.8% were adults, almost the reverse of the Heathcote-Avon figures.

SEX RATIO IN SAMPLES

At the Heathcote-Avon Estuary the sex ratio in most samples favoured males (Table 1). The sample taken in February when migratory breeding birds and young of the year were arriving at the Estuary, contained an excess of females. The proportion of females progressively declined through the autumn and winter samples, the July 1970 sample containing approximately two males to each female. This disparity was not restricted to any particular age class, as is clearly illustrated by the sample in June 1970 (when 89.7% of the birds were adults) and the sample in November 1970 (when 87.5% of the birds were immatures). Since it is unlikely that there was a sexual trapping bias towards an excess of males, it seems that there may be partial geographic segregation of the sexes at the winter haunts. The progressive decrease of females in the Heathcote-Avon samples through the migratory period suggests that there is differential movement of the sexes away from the Estuary, and could be explained if females tend to migrate further north than males.

The mutually confounding effects of sexual segregation and differential mortality of the sexes are difficult to distinguish, however, especially by periodically sampling only one coastal population. The excess of females in the February sample could point up movement of females prior to males, as has been established for some scolopacids such as the Short-billed Dowitcher *(Limnodromus griseus)* (see Jehl 1963), and the Greater Yellowlegs *(Totanus melanoleucus)*, Knot *(Calidris canutus)* and Least Sandpiper *(Erolia minutilla)* (see McNeil & Cadieux 1972). If staggering of migration of the sexes does indeed occur in the South Island Pied Oystercatcher, then the shift to an excess of males in samples caught later in the year could be solely due to a natural excess of males in wintering populations, as seems to be the case for many wintering populations of monogamous birds (Mayr 1939). Mitigating against such an uneven sex ratio is the magnitude of the imbalance, which is higher in some samples than might be reasonably attributed to differential mortality of the sexes.

It is possible that both factors could act additively to produce the disparity in abundance of the sexes; heavier natural mortality of females would accentuate the effects of sexual segregation on the sex ratio of winter populations in southern localities. Clearly, more trapping effort is needed to resolve this issue. Regular and systematic netting of large samples of South Island Pied Oystercatchers at major winter haunts such as Otago harbour, Heathcote-Avon Estuary, Farewell Spit and Manukau harbour would surely provide much valuable information on the migration strategy of this species.

ACKNOWLEDGEMENTS

The research for this paper was carried out in the Department of Zoology, University of Canterbury, and I thank Professor G. A. Knox for making Departmental facilities available to me and Dr J. Warham for supervision of the project. Funding was provided by a Wildlife Scholarship from the Wildlife Branch of the Department of Internal Affairs. The Wildlife Branch also kindly loaned me their projectile-netting equipment and I would like to thank Dr G. R. Williams in this regard. J. C. Barlow and C. McGowan read the manuscript and I am grateful for their critical comments. For assistance with trapping I thank my wife Sue, H. Best, J. D. Coleman, E. H. Miller, J. A. Mills, A. Moeed and F. H. Wood.

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AN ECOLOGICAL RECONNAISSANCE OF KORAPUKI ISLAND, MERCURY ISLANDS

By G. R. F. HICKS, H. P. McCOLL, M. J. MEADS
G. S. HARDY, R. J. ROSER

ABSTRACT

Observations and data are presented from an expedition to Korapuki Island between 25 November and 2 December, 1974. The vegetation composition and communities are mapped and a checklist of plant species identified and compiled from this and former expeditions is presented.

Seven species of seabird are now recorded as breeding on Korapuki Island and their respective burrow distribution and density is outlined. A breeding record of the Sooty Shearwater is the first for the species breeding on this island. The Grey-faced Petrel is the most abundant breeding seabird on the island with an estimated 600 - 700 pairs. Fifteen species of bush bird are noted, of which the Shining Cuckoo, Long-tailed Cuckoo and Morepork are new records.

Four of the five lizard species previously collected from this island were found, the exception being *Sphenomorphus pseudornatus*. It is considered that the habitat of Korapuki Island is marginal for this species.

Stomach examination of rats trapped on the island reveal a high frequency of occurrence (49%) of bird remains. The rabbit population is considered low compared with data collected from previous expeditions.

The soil and litter fauna showed a lower diversity and abundance than that found on the adjacent Coromandel mainland. Large invertebrates were noticeably rare, due possibly to predation by rats.

An incidental insect list is also presented.

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NOTORNIS 22: 195-220 (1975)

INTRODUCTION

The Mercury Islands, lying off the east coast of the Coromandel Peninsula (36°40'S; 175°50'E — Fig. 1), consist of two sub-groups (Skegg 1963). The southernmost island of the northern sub-group, Korapuki (Rabbit Island), was visited between 25 November and 2 December 1974.

Although studies of the flora and fauna of several of the Mercury Islands have been published (Edgar 1962, Skegg 1963, 1972, Atkinson 1964, Thoreson 1967, Crook 1973, Whitaker 1973 — see also *Tane 18:* 1-121; 1972), only passing mention is made of Korapuki Island which Veitch (1974) considers the most modified of the group, due to the presence of rats and rabbits.

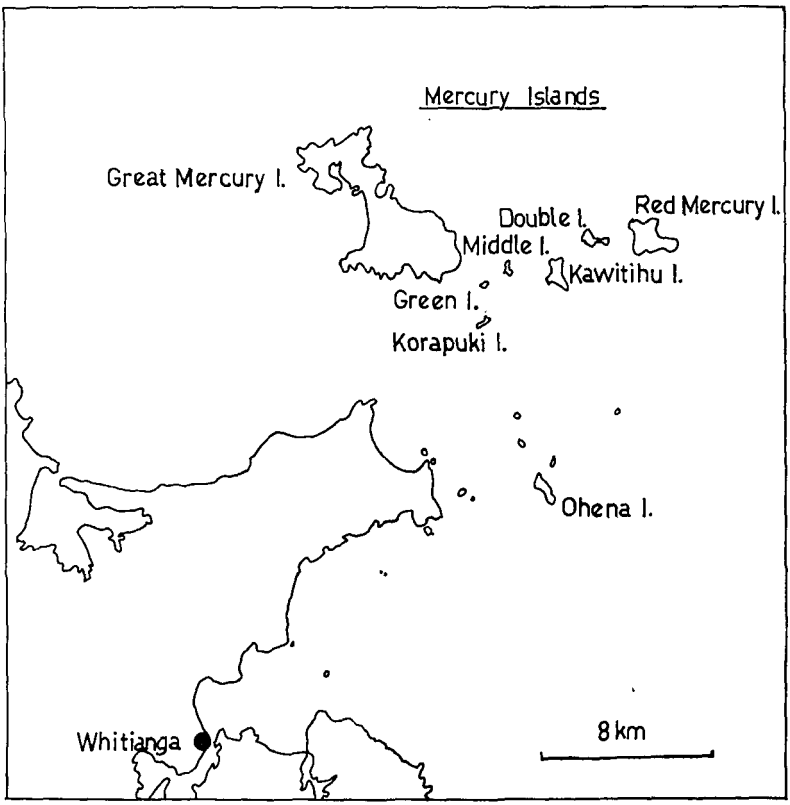

FIGURE 1 — Locality Map of the Mercury Islands, North-eastern New Zealand.

DESCRIPTION OF THE ISLAND

Korapuki Island (18 hectares) is of irregular shape (Fig. 2) and can be divided into eastern and western plateaux linked by a low saddle (Fig. 3). Boulder beaches on the north-western and southern coasts afford easy landings but the rest of the coastline is steep cliffs. There are no permanent streams; a small pond is present near East Point.

Geology

The island is volcanic in origin and the headlands and outcrops of the island are heavily altered grey basaltic lava flows. Bands of red tuffaceous material occur in cliffs to the S.E. and N. and a bench of red basalt rocks occurs at the extreme eastern point and form the Red Bench (Fig. 3).

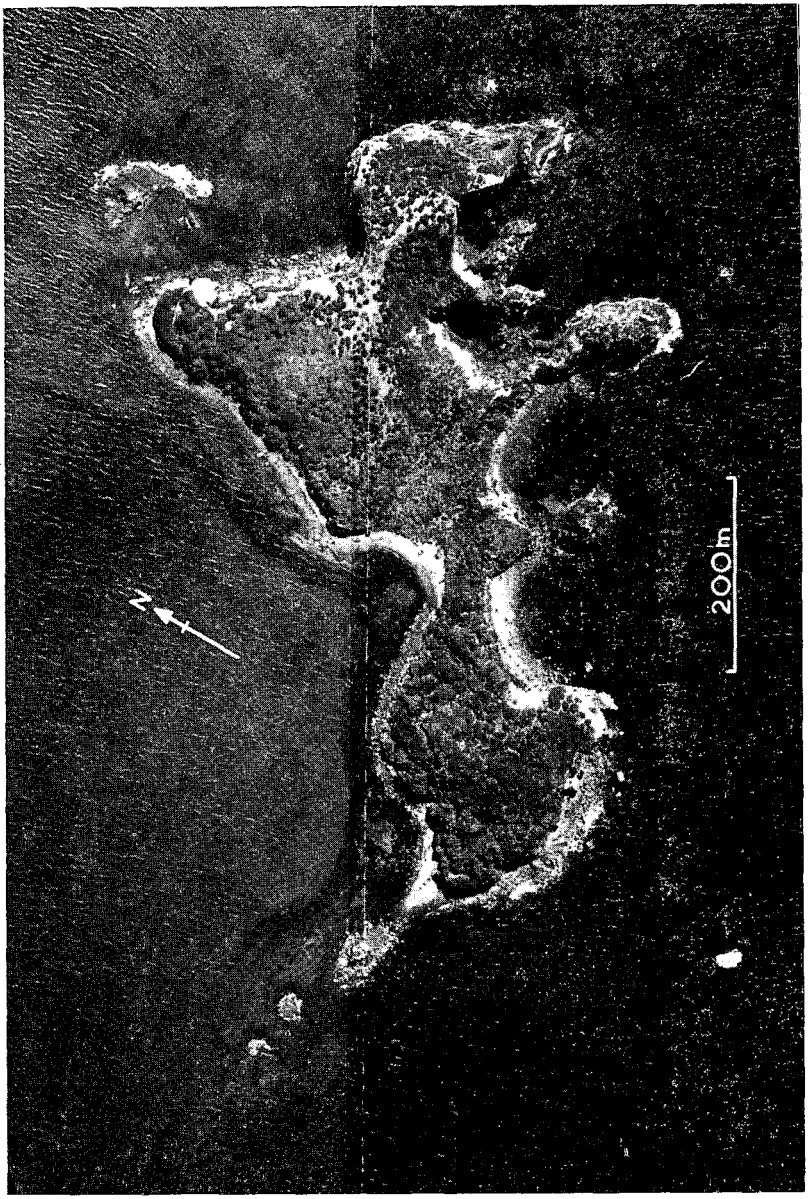

FIGURE 2 — Aerial photograph of Korapuki Island taken 16 December 1960 (N.Z. Department of Lands and Survey No. 1324). Note the extent of open grassland on the Eastern Plateau.

Vegetation

Much of the island in 1925 was apparently under grass and manuka (Edgar 1962). By 1951 regeneration of pohutukawa, flax, karo, mahoe and ngaio had taken place. By 1961 the steep slopes were covered with flax and young pohutukawas. Mahoe occurred in sheltered positions and kawakawa, poroporo and hymenanthera were also noted. Manuka or grass remained on the ridge tops (Edgar 1962). The island was visited in 1962 and 1970 by Dr I. A. E. Atkinson, who compiled a species list (Atkinson, unpubl. report 1962 and pers. comm.). We are indebted to Dr Atkinson for making this list available to us, and for the determination of specimens collected during our visit. In 1962 the seaward slopes were covered by pohutukawa forest and scrub, flax with pohutukawa, or mahoe scrub with pohutukawa. A stand of pure ngaio was noted with the mahoe scrub near the saddle area. The slopes of the plateaux and saddle were covered by pohutukawa scrub, manuka scrub (both erect and prostrate), flax and ratstail grassland. In some places flax, manuka and pohutukawa each formed almost pure stands occurring together in a mosaic pattern. The situation in 1974 was little changed from this. The major areas of vegetation are shown in Fig. 3. Table 1, based in part on that of Atkinson (unpublished report), lists the species and give frequency and locality of plant species. Where species were recorded by Atkinson but not noted by us, the initials I.A.E.A. appear beside the locality.

Western Plateau

The dominant canopy species over most of the plateau is pohutukawa, and the largest trees on the island occur in the north-western corner. Mahoe forms the understorey beneath pohutukawa in this area, and forms the canopy on some slopes above the beach on the north side.

Manuka (about 3.5m high) occurs in dense patches on the south and south-western slopes. Around these patches shrubs of mapou, karo, pohutukawa and mahoe, taupata seedlings, and flax bushes are found. Several tutu plants and some bracken occur at the north-western edge of the manuka. Prostrate manuka bushes are found near the cliff edges. A small stand of ngaio occurs at the north-eastern end of this area, on the slope to the saddle. Mapou shrubs are found in the understorey over much of the plateau, with a dense patch on the eastern end below the summit rocks. Several akepiro shrubs, a lone wharangi tree and a fine black mamaku were found on the gentle slopes in the middle of the plateau. Flax bushes occur throughout the area but there are no dense patches, except in parts on the slope down to the saddle. Toetoe and *Astelia banksii* occur on the western end of the plateau. Two hymenanthera trees were found beneath the summit rocks at the top of the northwest bluffs. Ferns, mainly *Asplenium lucidum,* were abundant amongst the summit rocks.

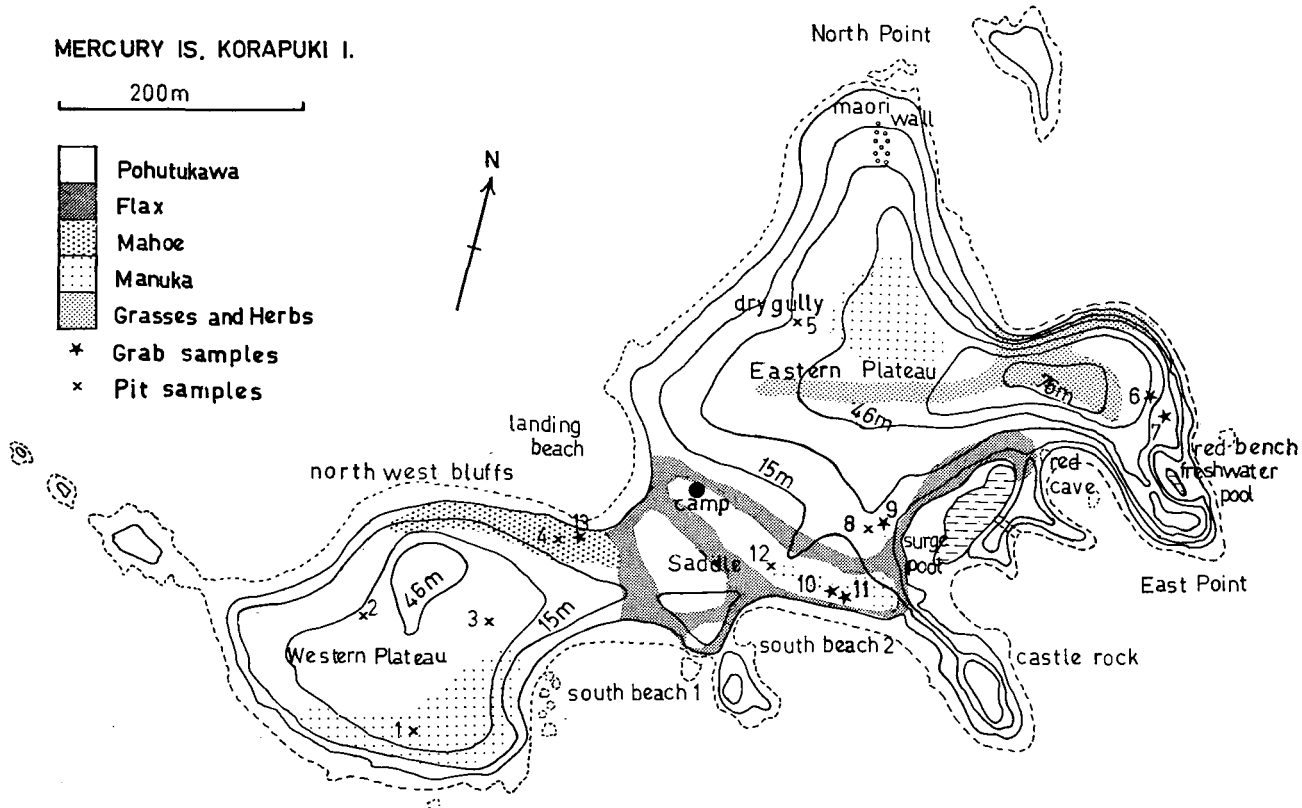

FIGURE 3 — Vegetation map and litter sample sites of K orapuki Island, November 1974. Topographic names appearing on this map and in the text are for th e convenience of the authors and are not features authorized by the N.Z. Geographical Board.

TABLE 1: VASCULAR FLORA

SPECIES		FREQUENCY	LOCALITY
TREES, SHRUBS AND WOODY CLIMBERS			
Brachyglottis repanda	rangiora	U	clifftop, above red cave
Cassinia retorta	cassinia	U	eastern cliff-tops
Coprosma macrocarpa		F	W.Plateau (local)
C. repens	taupata	U	Southern bays, W.Plateau
C. rhamnoides		U	W.Plateau
Coriaria arborea	tutu	U	Western end, W.Plateau
Corynocarpus laevigatus	karaka	U	I.A.E.A. 1962
Cyathea medullaris	black mamaku	U	middle, W.Plateau
Cyathodes fasciculata	mingimingi	U	cliff-top, above red cave
C. fraseri	patotara	A	ridge top, E.Plateau
Geniostoma ligustrifolium	hangehange		B.D.B.
Hymenanthera novae-zealandiae		U	north west bluffs
Leptospermum ericoides	kanuka		I.A.E.A. 1962
L.scoparium	manuka	A	W.Plateau, Saddle, E.Plateau
L.scoparium prostrate form		A	cliff-tops and exposed areas
Macropiper excelsum	kawakawa	F	W.Plateau
Melicope ternata	wharangi	U	W.Plateau
Melicytus ramiflorus	mahoe	A	almost pure stand north-eastern slopes W.Plateau
Metrosideros excelsa	pohutukawa	A	most areas
Muehlenbeckia complexa	pohue	U	cliffs and stable boulder beaches
Myoporum laetum	ngaio	U	W.Plateau eastern end, E.Plateau northeast slope
Myrsine australis	mapou	F	W.Plateau
Olearia furfuracea	akepiro	U	W.Plateau
Pimelea prostrata var. *urvilleana*			I.A.E.A.
Pittosporum crassifolium	karo	F	W.Plateau
Planchonella novo-zelandica	tawapou	U	eastern cliffs north of red bench
Solanum aviculare	poroporo	F	canopy gaps on E.Plateau
FERNS			
Adiantum hispidulum		U	W.Plateau summit rocks
Asplenium flaccidum		U	W.Plateau summit rocks
A.lucidum		A	beneath pohutukawa
A.obtusatum		U	castle rock
Cheilanthes sieberi		F	open areas
Doodia media		U	I.A.E.A.
Microsorium diversifolium		U	northwestern shoreline
Pellaea rotundifolia		U	A.H.W.
Psilotum nudum		F	under pohutukawa E.Plateau
Pteridium esculentum	bracken	F	W.Plateau, with manuka scrub
Pteristremula		F	W.Plateau summit rocks
Pyrrosia serpens		U	W.Plateau
HERBACEOUS PLANTS: DICOTYLEDONS			
*Anagallis arvensis**	scarlet pimpernell	A	open areas and cliff tops
Apium australe		F	I.A.E.A.
*Centaurium minus**	centaury	F	open areas in patches I.A.E.A.
*Cerastium glomeratum**	mouse-eared chickweed	U	open areas

TABLE 1: CONT'D

SPECIES		FREQUENCY	LOCALITY
Chenopodium allanii		U	open areas I.A.E.A.
*Cirsium lanceolatum**	Scots thistle	F	open areas and in canopy gaps
Dichondra repens	Mercury Bay weed	F	open areas around burrows
Disphyma australe	ice plant	A	cliffs, red bench
*Euphorbia peplus**	milkweed	A	open areas
Gnaphalium sp. (cf. *G.audax* and *G.gymnocephalum*		U	cliff edges east and south
G.luteo-album		A	open areas and cliffs
Haloragis depressa		U	I.A.E.A.
H.erecta		U	I.A.E.A.
Hydrocotyle moschata		U	I.A.E.A.
*Hypochoeris radicata**	catsear	F	cliffs
Oxalis corniculata	oxalis	A	spoil from burrows
Oxalis sp.		F	cliff tops
Parietaria debilis		U	I.A.E.A.
Peperomia urvilleana		U	I.A.E.A. splash zone
*Phytolacca octandra**	inkweed	A	open ground fringe beneath pohutukawa
*Ranunculus sessiliflorus**		F	southeastern cliff tops
Salicornia australi		F	red plateau around pool, cliffs
Samolus repens		A	cliffs, red bench
Senecio jacobaea	ragwort	U	cliff top above red cave
S.lautus lautus	shore groundsel	F	I.A.E.A.
Sicyos angulata	mawhai	U	boulders, south end landing beach
Solanum nodiflorum		U	scattered
*Sonchus oleraceus**	sowthistle	U	scattered
Spergularia media	sea spurrey	F	cliffs, red bench
Tetragonia tetragonioides	climbing N.Z. spinach	U	northern cliff, landing beach
Tillaea sieberiana		U	cliffs I.A.E.A.
*Veronica plebeja**	speedwell	F	open areas
Wahlenbergia gracilis		U	I.A.E.A.
HERBACEOUS PLANTS : MONOCOTYLEDONS			
Acianthus sinclairii		U	I.A.E.A.
Arthropodium cirrhatum	rengarenga	U	cliffs between south bays
Astelia banksii		U	W.Plateau
Carex breviculmis		U	W.Plateau eastern end
Cortaderia splendens	toetoe	U	W.Plateau
Cyperus ustulatus		U	southern bays, cliffs
Deyeuxia billardieri		F	I.A.E.A.
Notodanthonia sp.	danthonia	A	summit ridge E.Plateau
Phormium tenax	flax	A	saddle, E.Plateau, some bushes W.Plateau
Poa anceps		U	cliffs
Scirpus cernuus		U	I.A.E.A.
Scirpus nodosus		A	open areas
*Sporobolus africanus**	ratstail	A	summit ridge E.Plateau, open areas

U = Uncommon; few plants seen only at one or two points
F = Frequent; plants seen singly or in small patches in many places
A = Abundant; plants forming almost pure stands or large patches
* = Introduced species
I.A.E.A. = Plant recorded by Dr Atkinson in 1962 or 1970
B.D.B. = " " " Mr Bell but not found in 1962 by Dr Atkinson
A.H.W. = Plant collected by Mr Whitaker in 1970

Saddle Area

Dense flax covers much of the saddle area and access through this is difficult. Flax bushes fringe the low parts of the landing beach, and the low cliffs above south beach 2. Some bracken occurs at the edges of the middle strip of flax. The rest of the saddle area is pohutukawa forest, with a dense patch of manuka scrub at the south-eastern end.

Prostrate manuka is found with this, on the exposed cliff tops. Oxalis, scarlet pimpernell and *Dichondra* are commonly found growing on the heaps of soil outside petrel burrows.

Eastern Plateau

The dominant canopy species over much of this area is pohutukawa. It covers both the rolling slopes of the plateau and is also found on the cliffs and rocky headlands.

The ridge up to the summit and the summit area is open and covered with grasses (ratstail and danthonia), a recumbent prickly shrub *(Cyathodes frazeri)*, scarlet pimpernel, speedwell, milkweed and other herbaceous plants. Pohutukawa shrubs and flax bushes are scattered through this open vegetation. A large patch of wind-sculptured manuka occurs along the northern ridge to the north of the grass and herb field. Areas of dense flax occur on the southern cliffs above the surge pool and occasional flax bushes are found throughout the Eastern Plateau area. On the eastern cliffs one large and several smaller specimens of tawapou are present. A small patch of ngaio occurs at the foot of the dry gully on the north eastern slopes.

At the extreme east of the island is a bench of red basaltic rock, approximately 9m above sea level, 50m long and 28m wide. To landward, the plateau is bordered by a steep cliff of scoriaceous material, which has several stunted pohutukawas and flax bushes growing on it. Running lengthwise along the bench is a freshwater pool (see Fig. 3). Between this and the cliff are patches of ice plant, *Samolus repens, Salicornia australis* and *Spergularia media.* The pool itself has filamentous algae, a variety of insects and snails. The remainder of the bench is devoid of vegetation.

Cliff communities

These were not examined in detail. Plants noted on cliffs and those recorded by Atkinson (unpubl. report) are listed in Table 1.

Evidence of Maori occupation of Korapuki exists in the stone wall on the northern point, localised caches of marine shells and odd, widely scattered flakes of obsidian. Large numbers of water-rounded stones also exist in the upper horizons of the soil on the western and eastern plateaux.

OBSERVATIONS ON THE BREEDING DENSITY AND DISTRIBUTION OF THE SEABIRDS

Seven species of Procellariiformes have now been recorded on Korapuki Island. The island also supports a large breeding population of the Blue Penguin.

BLUE PENGUIN *(Eudyptula minor)*

Blue Penguins breed throughout the Mercury Islands with highest densities on Korapuki and Red Mercury Island (Edgar 1962, Skegg 1963). Penguin burrows are found around most of Korapuki (Fig. 4) where it is one of the most numerous of the breeding seabirds. Much of the fringing flax and shrub areas and beneath shoreline boulders is densely populated, particularly on the western and southern slopes. The flax covered cliffs of the Western Plateau also have many burrows, and some occur beneath Mahoe and Pohutukawa with the highest recorded burrow at about 53m above sea level. In other localities on Korapuki burrows are found up to 30m. Skegg (1963, 1964) recorded penguins breeding at heights of up to 92 and 214m on Red Mercury and Hen Islands respectively. In one area on South Beach 2 a small number of burrows were located high on almost vertical cliffs which were scratched and worn where penguins had struggled up to their nesting sites.

A high number of burrows contained almost fledged chicks, and, on the night of 1 December 1974, two were seen out on the northwest boulder beach from a densely occupied area beneath the rhizomes of *Microsorium diversifolium.*

On our return trip from Korapuki to Whitianga on 2 December, eight individuals were observed actively feeding, all within easy reach of nesting areas.

FLESH-FOOTED SHEARWATER *(Puffinus carneipes)*

Few sightings of this species were made, although it is known to be breeding on Ohena Island (Skegg 1963) and on Green Island (Thoreson 1967). Skegg (1963) noted breeding densities of about 43/100m^2 on Ohena although densities of up to 120/100m^2 have been recorded on Coppermine Island (Hen and Chickens) by Merton & Atkinson (1968). Only two birds were found ashore during our whole stay on the island, perhaps because our visit may have coincided with the pre-laying exodus from 28 November to 9 December (Thoreson 1967).

SOOTY SHEARWATER *(Puffinus griseus)*

This species nests in small numbers on The Aldermen (Sladden & Falla 1928), Mokohinau Islands, Whale and White Islands (Falla 1934) and the Hen and Chickens (Skegg 1964). Falla (1934: 251) stated " . . . . the sooty shearwater is not common on any of them, and the numbers of burrows of this species on any of the islands would not be more than a dozen."

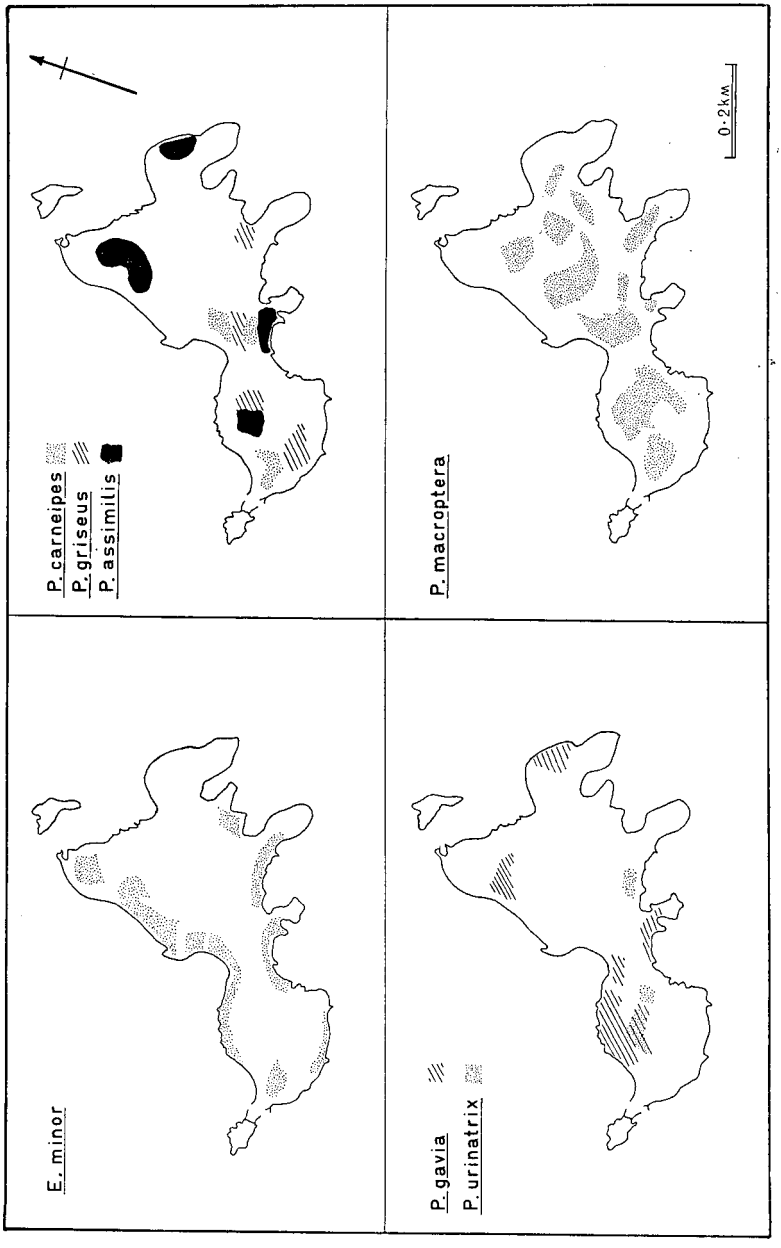

FIGURE 4 — Burrow distribution of the breeding seabirds of Korapuki Island. The shadings indicate generalised areas of occurrence not burrow density.

Four birds were observed on Korapuki. On 28 November a female with an egg in the oviduct was captured on her way to a deep, recently cleaned burrow. Three more individuals were found sitting beneath the roots of the pole manuka stand on the southern cliffs (Fig. 4) on the night of 30 November. These 'burrows' were simply shallow (<12cm) depressions beneath the manuka roots which had been overlain by falling debris (Fig. 5). Use of such unformed burrows is a characteristic of non-breeding birds (J. A. Bartle pers. comm.); however, the soil of this area was hard and stoney which probably precluded deep burrows. Normally burrows are deep and tortuous (Sladden & Falla 1928). Two similar nests were found on the eastern Peninsula and although uninhabited could well belong to *P. griseus.*

This is the first published record of *P. griseus* breeding on Korapuki Island, although it has recently been observed breeding on Kawitihu Island (Skegg 1972).

FIGURE 5 — Sooty Shearwater "burrow" beneath manuka on the southern cliffs of Korapuki Island, see text for discussion.

FLUTTERING SHEARWATER *(Puffinus gavia)*

After the Grey-faced Petrel, the Fluttering Shearwater is the most frequent tube-nose met with on Korapuki. Falla (1934) considers *P. gavia* numerically the commonest breeding petrel in northern coastal waters and Skegg (1963) records them as common on Korapuki in highly variable nesting sites.

Nesting habitats observed during the present study ranged from beneath pohutukawa roots to shallow burrows beneath flax and shoreline boulders (Fig. 4). *P. gavia* favours nesting sites on the lower coastal slopes of islands where suitable habitats are available, but Skegg (1964: 167) recorded the species as the " dominant petrel on the upper slopes " of Hen Island. On Korapuki the burrows were scattered and usually interspersed with burrows of *P. macroptera* and *P. urinatrix*. On the densely burrowed Northwest Bluffs (up to 25m high) a count of up to 19/100m^2 was made of burrows which could be directly attributed to *P. gavia*. This area appeared to be the preferred habitat on the island, although scattered areas of a similar density were recorded on the cliffs of South Beach 1, amongst *Disphyma australe,* amongst boulders and rocky fissures on Northwest and Northeast faces, or in the high shore boulders and flax together with *E. minor*.

LITTLE SHEARWATER *(Puffinus assimilis)*

Edgar (1962) found the greatest concentrations of this shearwater with *P. macroptera* in the wooded areas in Lunch Bay and Rolypoly Bay, Red Mercury Island. This habitat is almost identical to that where the greatest numbers were found on Korapuki Island. *P. assimilis* breeds only in moderate numbers in well scattered burrows, some being associated with Grey-faced Petrels and Fluttering Shearwaters beneath the dense canopy of the Northwest Bluffs or with Flutterers in short (<1m) burrows with very small entrance holes amongst shattered rock on the cliffs of North Point (Fig. 4).

Although Falla (1934) and Falla *et al.* (1970) described this bird as a winter breeder with most of the young on the wing by the end of October, there is evidence that their breeding cycle is variable and that the Mercury Island population follows a different pattern (Edgar 1962). Edgar reported freshly-laid eggs on Red Mercury Island in early September, and we found fledglings on Korapuki in late November. However, not all Little Shearwaters on the Mercury Islands follow this pattern, for Edgar also found well grown chicks in early September.

On the evening of 28 November one burrow on the Northwest Bluffs of Korapuki Island was inspected and two adult birds were seen inside with an almost fully fledged chick exercising nearby. Another fledgling with only small amounts of down on the nape of the neck and on the breast was seen scuttling amongst the boulders of the Maori stone wall on the Northern Point. *P. assimilis* is not common, and maximum densities are only about 6-8/100m^2.

GREY-FACED PETREL *(Pterodroma macroptera)*

The Mercury Islands are a stronghold of this species (Skegg 1963) which breeds extensively throughout most islands off north-eastern New Zealand (Sladden & Falla 1928, Falla 1934).

The burrowing habitat described by Heather (*in* Skegg 1964: 169) for Hen Island applies equally to Korapuki: " Particularly favoured was the soil at the foot of the bluffs, in *Astelia* and flax communities, and among boulders and the roots of big trees. They were thus distributed throughout the lower slopes where either beach or cliff is handy. In higher regions they were confined to the neighbourhood of those peaks, bluffs and rocks which pierce the bush canopy."

Falla (1934) suggested that *P. macroptera* is not gregarious or colony-forming, but in one area on Korapuki (the Southern Peninsula), a moderately densely burrowed area (24-36/100m^2) consisted almost entirely of Grey-faced Petrel burrows; the majority had chicks present, many still with large amounts of down. Within this area only two burrows were attributed to *P. gavia.* However, the general pattern of Grey-faced Petrel burrowing on Korapuki was of a diffuse and highly variable nature, the distribution of which did not indicate a high degree of habitat selection. In many areas (e.g. Western Plateau, Northern Dry Gully) the soil was very stony and hard or rather thickly littered. Areas such as these sometimes lacked burrows altogether. In such instances burrowing activity was restricted to beneath flax, between the roots of trees and beneath boulders. The preferred habitat of *P. macroptera* was beneath flax or beneath a high canopy where soft friable soil was found e.g. northwest part of the island, central slopes and the Eastern Plateau (Fig. 4). This characteristic coupled with the fact that burrows were generally short and shallow indicates the rather less developed burrowing capabilities of *P. macroptera* compared with such an adept burrower as *P. griseus.*

Edgar (1962) estimated a total population density of *P. macroptera* on Red Mercury, Stanley, Korapuki and Double Islands as about 13,000 pairs and Skegg (1963) made a burrow count of 49/100m^2 on the slopes of Rolypoly Bay, Red Mercury. The maximum burrowing density on Korapuki, however, was only 36/100m^2. Based on burrow counts and extrapolation for areas of the island unable to be visited (high Southern peninsulas) a total population estimate for Grey-faced Petrels on Korapuki was between 600 - 700 pairs.

PYCROFT'S PETREL *(Pterodroma pycrofti)*

P. pycrofti was first discovered as breeding on the Mercury Islands by Skegg (1963: 161) who found " some hundreds of pairs on Red Mercury " (see also Skegg 1972 who has since recorded them breeding on Kawitihu). A single adult bird was first recorded incubating an egg on 18 November 1972 on the Northern slopes of Korapuki by Messrs I. G. Crook and A. H. Whitaker (pers. comm.). Two further birds were seen on the southern end of the island under pohutukawa

forest on 19 November 1972. This record is the earliest recorded date of egg laying in this species (see Bartle 1968). However, Pycroft's Petrels were neither seen nor heard during our stay on the island.

DIVING PETREL *(Pelecanoides urinatrix)*

The highest breeding concentrations of *P. urinatrix* in the Mercury Islands are on nearby Green and Middle Islands where burrow counts range between 60 and 239/100m² (Skegg 1963, Thoreson 1967). Skegg estimated a total population of about 15,000 pairs but Thoreson more accurately estimated about 2,500 individuals on the six acres of Green Island.

Burrow density on Korapuki Island is considerably lower with the highest densities of Diving Petrel burrows at about 24-30/100m² in an isolated area on the slopes of Northwest Bluffs. The species tended to be localised breeders, the largest numbers being recorded between 25 and 35m up on the bluffs where their narrow entranced burrows could be found amongst the roots of Pohutukawa and Mahoe or in fissures in rocky outcrops. The only other area with Diving Petrel burrows was between the two peninsulas on the southern coast (Fig. 4).

The numbers of *P. urinatrix* coming in decreased from 16 birds between 2000-2100 hrs (N.Z. Summer Time) on 26 November to 5 during the same period on 1 December 1974. Thoreson (1969: 255) noted a similar reduction in numbers between late November and mid-December, and indicated that most of the adult birds were apparently moving away to "moult later while at sea." The bulk of the evidence now supports this with the flightless period being spent on the sea surface (Sir Robert Falla pers. comm. 1975). Falla had earlier suggested (see Vooren 1972: 258) that adults remained in their burrows for long periods during the moult.

One burrow was inspected on the Northwest Bluffs on 29 November 1974 and contained an almost fledged chick. Thoreson (1967) records the first juveniles leaving the nest on 22 November 1966 from Green Island.

Seabirds also noted as frequently occurring around the island were: Australian Gannet *(Sula serrator)*, Black Shag *(Phalacrocorax carbo)*, Pied Shag *(P. varius)*, Little Shag *(P. melanoleucos brevirostris)*, Reef Heron *(Egretta sacra)*, Black-backed Gull *(Larus dominicanus)*, Red-billed Gull *(Larus scopulinus)*, Black-billed Gull *(Larus bulleri)* and White-fronted Tern *(Sterna striata)*. The latter nests on an ice-plant covered rock off the northern coast of Korapuki (see Fig. 2). Thoreson (1967) estimated this colony to comprise at least 300 birds.

RECORDS OF BUSH BIRDS

Bush birds were recorded by direct sighting or by analysis of the song. The complete list of bush birds is presented in Table 2.

TABLE 2 BUSH BIRDS RECORDED FROM KORAPUKI ISLAND, 25 NOV. - 2 DEC. 1974

SPECIES	SONG HEARD ONLY	NEW RECORD FOR KORAPUKI	RELATIVE ABUNDANCE
* HARRIER			F
RED-CROWNED PARAKEET			A
SHINING CUCKOO		X	A
LONG-TAILED CUCKOO	X	X	U
MOREPORK		X	U
KINGFISHER			U
FANTAIL			A
GREY WARBLER			A
* BLACKBIRD			F
HEDGE SPARROW	X		U
BELLBIRD			U
TUI			U
SILVEREYE			A
* CHAFFINCH			F
STARLING			F

U: Uncommon F: Frequent A: Abundant

* Breeding record (i.e. nests or eggs found)

In order to gain an appreciation and understanding of the whole island ecosystem, of which the avifauna form the most conspicuous part, it is necessary to consider the other animal life, their habitat, distribution and their relative abundance. By providing such a broad general knowledge of this biota a valuable baseline contribution can be made for future expeditions.

REPTILE FAUNA

Five species of lizards have been previously recorded from Korapuki Island (Whitaker 1973). During the present study four of these species were recorded, the exception being *Sphenomorphus pseudornatus*. In the absence of a more recent account, the taxonomy follows McCann (1955) with the following modification. Recent

unpublished work by one of us indicates that *S. pseudornatus* (considered by McCann to occur only north of the 38°S. parallel) and *Leiolopisma aeneum* (considered to occur only south of the 38°S. parallel) are conspecific. While this paper is not intended to introduce the taxonomic confusion regarding the New Zealand skinks, it is considered beneficial at this stage to combine McCann's "*pseudornatus*" and "*aeneum*" for the sake of comparison of different island populations*.

Gekkonidae

Hoplodactylus pacificus (Gray)

Only two individuals were seen during the stay, both foraging at dusk on the boulder beach above the landing.

Hoplodactylus duvauceli (Dumeril & Bibron)

These geckos were also rare, with only six being seen — one on the boulder beach and five in the forest at the southern end of the island.

Scincidae

Leiolopisma moco (Dumeril & Bibron)

This skink was commonly observed on Korapuki. Although frequently seen on the grassy areas of the "eastern plateau" and under open forest at the northern end of the island, it was most abundant in the flax line bordering the "landing bay" and amongst boulders high up on the beach (see Whitaker 1973). In the last area, the distribution of *L. moco* overlapped with that of *L. smithi*. The pattern of pit-fall trapping used indicated that *L. moco* tends to establish territories around basking sites, a characteristic reported by Whitaker (1968).

Leiolopisma smithi (Gray)

This skink was seen commonly along the boulder beaches of the landing and the south side of the saddle.

Sphenomorphus "pseudornatus" McCann/*Leiolopisma "aeneum"* (Girard)

Whitaker's (1973) consideration that these lizards are rare on Korapuki is upheld by our failing to sight a single specimen. It is suggested that the low numbers result primarily from a lack of suitable habitat, rather than from predation. There is considerable evidence elsewhere that population densities may be little affected by kiore *(Rattus exulans)*, although effects of the latter may be obscured by latitude, climate, topography and vegetation (Whitaker 1973). *S. pseudornatus* occurs frequently on a number of kiore-inhabited islands, including Red Mercury (Towns 1972), three islands of the Hen and Chickens group (Whitaker 1973), Little Barrier, Great Barrier as well as Brampton Shoal, North of Waitangi (pers. obs.).

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* Note also that A. E. Greer has recently included the New Zealand *Sphenomorphus* under the genus *Leiolopisma*. *Aust. J. Zool., Suppl. Series No. 31*, 1974.

The assumption (Towns 1971) that *Rattus norvegicus* is mainly responsible for the low numbers of *S. pseudornatus* on Whale Island (Bay of Plenty), does not concur with the high numbers seen on Kapiti Island (southwest North Island coast) (pers. obs.), where both *R. norvegicus* and *R. exulans* are present (Dr Ben Bell pers. comm.). On Kapiti, the damp forest-covered screes and logs above high tide mark provide a highly suitable habitat. On Whale Island, as on Korapuki, these habitat requirements are much less in evidence.

Tuatara
Sphenodon punctatus

The absence of tuataras on Korapuki has been noted by Crook (1973) and was confirmed by the present party. However, a number of bones comprising part of a tuatara skull were discovered by G.R.F.H. and M.J.M. on the summit ridge of the Eastern Plateau. Whether these bones represent the remains of an animal transported from Middle or Green Islands by a Harrier, or have been excavated by the burrowing activities of rabbits or petrels poses an interesting question.

OBSERVATIONS ON RATS

Kiore (*Rattus exulans* (Peale)) have been recorded from four of the islands in the Mercury Group: Red Mercury, Kawitihu, Double and Korapuki (Crook 1973, Whitaker 1973).

During this study break-back traps were used and were set on seven nights, giving a total of 158 trap nights. Rats were widely distributed on the island but highest numbers were observed in the flax and bush fringes and it appears that these areas are the most favoured habitats. In 22 trap nights on the Eastern Plateau, despite presence of rat droppings, no rats were trapped. In 88 trap nights on the bush slopes of the Western Plateau, 14 rats were trapped, and in 48 trap nights in the flax fringe around the landing beach 16 rats were trapped. Although the total catch of 30 was too small for detailed analysis, the following observations can be made.

Size

Of the 30 rats, nineteen (8 male, 11 female) were adults with eleven juveniles from which the following measurements were obtained. Figures in parentheses indicate the maximum:

	Mean Length (mm)	Mean Weight (gms)	Mean Right Hind Foot (mm) of all specimens	Mean Ear (mm) of all specimens
Adult Males	306.7 (316)	106.9 (115)	25.5	16.3
Adult Females	298.0 (311)	96.6 (110)		
Juveniles	153.7	30.4		

These rats would therefore appear to be larger than those recorded from a number of Pacific Islands (see Mosby 1971, Twibell 1973 for reviews) but similar in size to others from New Zealand (see Watson 1956, Wodzicki & Robertson 1959 and Bettesworth 1972).

Stomach examination

Preliminary examination of the stomach contents of 29 rats indicates that vegetation is an important part of their diet (frequency of occurrence — 75.9%). Small quantities of insect remains were also commonly present. The frequency of occurrence of bird down in the stomachs (49%) suggests active predation, although distinction between scavenged and predated chicks cannot be made. One Grey-faced Petrel chick was found outside a burrow by G.R.F.H. to have been recently stripped clean of flesh and with fresh rat droppings in the vicinity. Thoreson (1967) has recorded kiore eating the eggs of *P. urinatrix* on Kawitihu Island, while Bettesworth (1972) records moderate quantities (24% occurrence) of vertebrate remains in stomachs of rats from Red Mercury. M. J. Imber (pers. comm.) has noted predation of Cooks Petrel *(Pterodroma cooki)* chicks by kiore on Little Barrier. No lizard remains were noted. Nineteen specimens of a helminth (*Physaloptera murisbrasiliensis* Diesing) were recorded from eight of the stomachs.

Abundance

Comparatively few kiore were observed by the present party with night sightings amounting to only three dozen during the whole period on the island. This contrasts with the observations made by members of an expedition in winter (28 June) 1970, when three observers noted 31 kiore in 1½ hours at night with high populations being recorded at other times (Atkinson pers. comm.). However, one would expect kiore numbers to be higher in winter (following the seasonal peak of March-April- May, see Watson) than in late November, when island populations are usually only just beginning to build up. It is perhaps of interest to note that three of the eleven females were pregnant, containing 5, 6, and 7 embryos respectively.

The rats trapped in the present study and a detailed list of body measurements will be deposited in the National Museum.

OBSERVATIONS ON RABBITS

Rabbits (*Oryctolagus c. cuniculus* L.) were introduced to Korapuki and Kawhitihu Islands during the 19th century (Skegg 1963) but since then little information other than their presence has been gathered. Dr I. A. E. Atkinson visited Korapuki in 1962 and 1970 and recorded the following information:—

September 1962: browsing noted on inkweed *(Phytolacca octandra)* and *Scirpus nodosus;* flax *(Phormium tenax)* was heavily browsed and associated with this were abundant coarse-textured droppings. Six rabbits were seen in an afternoon by another member of the party.

June 1970: browsing noted on *Notodanthonia* sp., *Psilotum nudum, Scirpus nodosus, Senecio lautus,* flax, ratstail grass *(Sporobolus africanus), Halorhagis depressa, H. erecta, Poa anceps* and *Doodia media.* A number of woody species were also being browsed. Three rabbits were seen by three other members of the party in 1 hour 30 minutes of night searching.

November 1972: (A. H. Whitaker pers. comm.) noted ngaio heavily browsed and saw a group of three rabbits near the landing beach.

During our stay on Korapuki only five rabbits were seen in a total of 130 man hours (both day and night) investigation over the major part of the island. Rabbit sign was found on the lower slopes of the shoreline adjacent to flax; on the " red plateau "; the flax above " south beach 2 "; the most easterly strip of flax on the " saddle " area, and on the open grass and herb field on the " eastern plateau." Most sign was observed in this open area. Sign encountered included rabbit-occupied petrel burrows (2), scratchings (5), dung heaps (2 fresh, 6 old) and abundant scattered pellets. The following plant species were browsed: ngaio *(Myoporum laetum),* iceplant *(Disphyma australe), Samolus repens,* spurrey *(Spergularia media), Psilotum nudum, Salicornia australis* and ratstail grass. No plants were heavily browsed, and abundant food plants and seedlings bore no evidence of browsing by rabbits. This, together with the low incidence of rabbit sightings, suggests that the population on Korapuki was lower than in 1962, 1970 and 1972. The pohutukawa crowns have clearly increased at the expense of the open grass and herb field areas since 1960 (Lands & Survey aerial photograph 1960 Fig. 2). This reduction in grazing area may have accounted for a decline in the rabbit population. The rabbits seen appeared large and healthy, but two freshly dead ones were found on the north-eastern side of the landing beach.

INVERTEBRATE FAUNA

Insects — general

Few large flying insects were observed. Only wasps and cicadas were seen during the day. Moths and Staphylinid beetles were collected at night using a 1500 cp Coleman pressure lamp. Beetles were collected from rotting pohutukawa and mahoe and also from beneath pohutukawa bark. Apart from a Noctuid larva, collected from flax, no other large species of moth or beetle were found. The Orthoptera were represented by grasshoppers only. A list of these identified insects and land and freshwater molluscs is presented in Appendix 1.

Freshwater pool

This pool was apparently unnoticed by previous expeditions, and freshwater insects have not previously been recorded on Korapuki Island. The following species were collected: *Rhantus pulverosus* (diving beetle), both adults and larvae; *Anisops* sp. (back swimmer), and *Sigara arguta* (water boatman). A freshwater snail *(Potamopyrgus antipodarum)* was plentiful.

Litter and soil fauna

Litter and soil were collected either by pit sampling in which each horizon (litter, fermentation, humification, and upper mineral soil horizons) was removed from an area of 25cm^2 or by grab sampling of material by hand, usually litter and fermentation horizons. Pit sampling permitted the assessment of animal concentrations down the profile and of population densities. Animals were extracted from the samples using Tullgren funnels at the Soil Bureau, Taita.

Seven sets of pit samples and six grab samples were collected at the sampling sites shown in Fig. 3. The animal groups present in each sample were recorded and densities estimated.

Animal groups recognised were classes of annelids, molluscs, crustaceans and myriapods, sub-classes of arachnids, and orders of insects (separating larval and adult forms). This crude breakdown of the fauna allows a reasonable assessment of faunal diversity. Depth and nature of each horizon were noted in the field. Soil descriptions of the samples from the lower horizons were made by Dr I. A. E. Atkinson. Measurements of litter and soil pH were made in the laboratory, Taita.

Animal distribution, diversity, density and dominance were examined in relation to pH, vegetation type, soil type and depth (Table 3).

(1) *Pohutukawa with no understorey plants* (samples 2, 5, 8, 6 and 9)

The profile structure varied from a dry, loosely packed litter layer overlying the mineral soil horizons, to similar litter layers overlying well developed F, H and A horizons (see Table 3). The litter layer (2-3cm thick) was composed mainly of pohutukawa leaves and twigs. Where present, the F horizon of partially decomposed litter material, was 1.5-2cm thick and less acid than the litter. Samples 5 and 8 had deep H and A horizons composed of fine mixed mineral and organic material. The mineral soil was a brown silt loam. Small round pebbles were present in the F horizon and lower horizons in samples 2 and 8.

The fauna tended to be diverse in soil profiles under the pure pohutukawa canopy, especially where organic layers were deepest, but numbers tended to be low or moderate. Millipedes were commonly the dominant group, and scarabaeid larvae and earthworms were present in the deeper organic horizons of sample 5. Lepidopteran and dipteran larvae were common in some samples. Two ant species were recorded *(Strumigenys perplexa* and *Amblyopone australis)*.

(2) *Pohutukawa with understorey plants* (samples 1, 3, 12 and 10)

The main understorey plant species for these samples are listed in Table 3. Both samples 1 and 3 were collected from the Western Plateau (Fig. 3), and had deep (4cm), dry litter composed of leaves and twigs. The litter was more acid (pH 4.7 and 4.8) than litter

TABLE 3. Analysis of invertebrates in pit and grab samples of soil and litter from Korapuki Island, November, 1974.

Sample No.	Canopy	Other Vegetation	Horizon depth (cm) L	F	H	A	Horizon pH L	F	H	A	Most populated horizons	Number of faunal groups	Animal nos. (excluding mites & Collembola)	Dominant groups
2	pohutukawa		3	2			5.3	6.5			F + H	16	<100	lepidopteran larvae, millipedes
5	"		3	1.5	2	7	5.1	6.5	6.4	6.7	H + A	21	100 - 500	millipedes, some earthworms in A horizon
8	"		2	2	6+		5.3	5.8	6.2		F, H + A	26	100 - 500	none
9*	"							5.3			-	16	100 - 500	none
6*	"							5.3			-	21	100 - 500	millipedes, psocopterans
1	"	manuka, mahoe. Coprosma macrocarpa	1.5	2.5	4	4	4.8	4.7	4.4	5.0	F, H	21	100 - 500	millipedes
3	"	mahoe, mapou, akepiro	4	4	8	2	4.7	4.5	5.1	5.4	F	19	100 - 500	millipedes
12	"	manuka, flax	1.5	5	6	4+	5.0	5.4	5.1	6.4	F	28	100 - 500	millipedes, thrips, campodeid diplurans
10*	"	manuka, flax						4.6			-	8	<100	lepidopteran larvae, thrips
4	mahoe		3	9			5.7	6.9			F + H	30	>500	millipedes, ants, beetles
13*	"							5.6			-	12	>500	psocopterans, dipteran larvae
7*	tawapou							6.0			-	19	100 - 500	psocopterans, millipedes, lepidopteran larvae, beetles
11*B	pohutukawa	manuka, flax						5.5			-	8	<100	none

*Grab sample, B bird burrow spoil, L litter, F fermentation horizon, H humification horizon, A top horizon of mineral soil

from pure pohutukawa, and few animals were collected from it. Beneath the litter was a loose, more moist, deep (3 to 4cm) F horizon with fine roots. Myriapods, particularly millipedes, were common in this horizon, and in sample 3 most animals were present. The H horizon below the F horizon was also deep and contained much mineral matter. Many millipedes were present in the H horizon in sample 1. Some A horizon material was collected but few animals were present.

Sample 12 was collected from the Saddle area and although the litter was mainly pohutukawa leaves, manuka and flax remains were also present. The litter was shallow (1.5cm), dry and more acid than pure pohutukawa litter. Few animals were collected from the litter. The F horizon, composed of fine organic matter and a fine-root mat, was deep (5cm), less acid than the litter (pH 5.4) and had a large and varied fauna. Myriapods (in particular millipedes of several families), weevils, campodeid diplurans, dipteran larvae and thrips were common. A nest of the ant *Strumigenys perplexa* was disturbed in this horizon. The H horizon was also deep (6cm), peaty and with fine roots. Millipedes were common in this horizon. Small round pebbles were found in the A horizon but there were few animals present. Apart from lepidoptera larvae and thrips, there were few animals in the litter grab (sample 10) composed of pohutukawa, manuka and flax remains, from the Saddle area.

(3) *Mahoe* (samples 4 and 13)

The forest litter in sample 4 was 3cm deep, loosely packed, composed of mahoe and with some pohutukawa leaves, and with a pH of 5.7. The fauna was varied but not large. Beneath the litter was a deep layer (9cm) of loosely packed, mixed mineral and organic matter. The pH of this was 6.9, and the largest and most diverse fauna of any sample was present. Myriapods, especially millipedes, isopods, bettles, ants, lepidopteran larvae and snails were common. Three species of ants, *Chelaner smithi, Amblyopone saundersi* and *Heteroponera brouni,* were present.

Sample 13 consisted of loose dry material from an area near petrel burrows. The fauna was of limited diversity but large in numbers. Psocopterans dominated the fauna, and beetles, beetle larvae, dipteran and lepidopteran larvae were common. Myriapods were absent. The litter was deep, but the deep mineral/organic layer that was present beneath the litter in sample 4 was absent, perhaps accounting for the absence of myriapods.

(4) *Tawapou* (sample 7)

Litter from beneath the large tawapou tree on the eastern cliffs was deep and dry, and composed mainly of tawapou leaves and twigs, but included pohutukawa and mahoe leaves. The pH of the litter was 6.0. The fauna was varied and moderately large. Millipedes, various beetles, beetle and lepidopteran larvae and psocopterans were most common.

(5) *Spoil from outside a petrel burrow* (sample 11)

This sample was composed of dark brown silt loam, with a pH of 5.5. Few animals other than several centipedes and beetle larvae were present. Litter was absent.

Remarks

The variety of animals appeared to be higher where deeper organic layers occurred (e.g. samples 4, 8 and 12), and numbers tended to be greatest in the less acid material (e.g. F and H of sample 4, F and H of sample 8, samples 13 and 7). Numbers and diversity tended to be lowest in pohutukawa litter especially where the organic layers were thin and dry. Disturbance of litter by birds near petrel burrows probably increases moisture loss from the lower horizons and reduces the suitability of these horizons for litter-decomposing invertebrates which generally have a high moisture requirement. The absence of these animals must slow down decomposition and humification of the litter.

Moisture factors are responsible for the low numbers and diversity of the invertebrate fauna of the organic horizons on Korapuki when compared with the mainland. Similar-sized grab samples of litter and organic matter from beneath montane forest on the Coromandel Peninsula (near the summit, Tapu/Coroglen Road) yielded a greater variety and larger numbers of animals than those from Korapuki.

Few large invertebrates (beetles of more than 10mm in length and millipedes of more than 20mm in length) were found in the samples and few were noted beneath logs and stones. This may be related to the presence of rats on the island which are known to eat larger invertebrates (see Bettesworth 1972).

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APPENDIX 1: List of Insects, Land and Freshwater Mollusca collected from Korapuki Island, 1974

INSECTA

ORTHOPTERA	
Phaulicridium marginale	(Acrididae)
PHASMATODEA	
Clitarchus hookeri	(Phasmidae)
HEMIPTERA	
Amphipsalta cingulata	(Cicadidae)
Kikihea cutora cumberi	"
Notopsalta sericea	"
Anisop sp.	(Notonectidae)
Sigara arguta	(Corixidae)
COLEOPTERA	
Holcaspis mucronata	(Carabidae)
Rhantus pulverosus	(Dytiscidae)
Cafius quadriimpressus	(Staphylinidae)
Cafius caviceps	"
Odontria xanthosticta	(Scarabaeidae)
Ataenius picinus	"
Pedilophorus crysopepsis	(Byrrhidae)
Eucolaspis sp.	(Chrysomelidae)
Xyloteles laetus	(Cerambycidae)
LEPIDOPTERA	
Ctenopseustis obliquana	(Tortricidae)
Prothelymna antiquana	"
Strepsicrates zopherana	"
Bactra noteraula	"
"Crocidosemioides" n.sp.	"
Grechthia exospila	(Grechthiidae)
Hectacma stilbella	"
Scrobipalpa plaesiosema	(Gelechiidae)
Pareromene auriscriptella	(Pyralidae)
Proternia philocapne	"
Scoparia sp. *nr chimeria*	"
Cellonia dejectaria	(Geometridae)
Helastia cineraria	"
Helastia venipuncta	"
Orthoclydon praefectata	"
Pseudocoremia suavis	"
"Persectania" steropastis	(Noctuidae)
HYMENOPTERA	
Polistes humilis	(Vespidae)
Amblopone saundersi	(Formicidae)
Amblyopone australis	"
Chelaner smithi	"
Chelaner antarcticus	"
Strumigenys perplexa	"
Monomorium antipodum	"
Heteroponera brouni	"

MOLLUSCA

GASTROPODA	
Cytora sp.	(Cyclophoridae)
Potamopyrgus antipodarum	(Hydrobiidae)
Therasia traversi	(Flammulinidae)
Therasia zelandiae	"
Charopa pilsbryi	(Charopidae)
Ptychodon varicosa	"
Lamellidea (Ternatellinops) novoseelandica	(Elasmatinidae)

A BRIEF RADIO-TELEMETRY STUDY ON MOREPORKS

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Ecology Division, D.S.I.R., Lower Hutt

ABSTRACT

Two pairs of Moreporks *(Ninox novaeseelandiae)* in dense rata-podocarp and open beech forest were radio-tracked between August and October 1973. The home range of both pairs (minimum size 3.5 and 5.3 ha, respectively) included each forest type, and both pairs used several roost trees. During seven years of regular mist-netting 20 different owls passed through the two territories. Some of them, possibly juveniles, were caught only once and others up to 15 times. In each territory one bird was present for more than five years.

INTRODUCTION

For several years Ecology Division of DSIR has been studying the relationship between mammalian predators (stoats and cats) and prey species (mice, rats, rabbits, and birds) in the Orongorongo Valley near Wellington. (For a description of the area see Ward 1972.) Until now the Morepork *(Ninox novaeseelandiae)*, the main bird of prey in New Zealand rata-podocarp and beech forests, has not been included, and there is generally little known of the biology of this native owl in New Zealand.

To find out more about the role and the importance of Moreporks in this type of forest research began in July 1973, using the technique of radio-telemetry that had previously been used on opossums *(Trichosurus vulpecula)* in the same area (Ward 1972). The aims of the study were (1) to locate Morepork roosting sites and there to collect food pellets, (2) to locate nests to study the development of the young and identify the food brought to them, and (3) to determine the birds' home ranges and activity patterns. A useful background to the study was some information on the owl's distribution in the valley and the longevity and the home range of a few individuals obtained during seven years of mist-netting by A. H. Whitaker.

The study was discontinued after three months before achieving objectives (1) and (2) because of increasing difficulty in recapturing the birds for renewing the rather short lived transmitter battery. Some of the technical experience gained and the results obtained may be of interest and helpful for future similar projects and are therefore reported on briefly.

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METHODS

Transmitter

The transmitters (built by G. D. Ward, Ecology Division, DSIR) produced a continuous signal of 27 MHz. To a certain extent, the birds' movements modulated the signal, permitting the listener to distinguish some activities through the receiver (e.g. flying caused a characteristic note oscillation). The current drain of the transmitter was 0.4 mA, giving the mercury cell (Eveready E 625) a theoretical life of 35 days.

The transmitter circuit was potted in dental acrylic in a rectangular box 15x15x7 mm (Fig. 1). The loop aerial (circumference 17 cm) protruded from one end and consisted of an insulated single (later multi-stranded) copper wire slid into a plastic transfusion tube. At the opposite end were two leads on to which the cell was soldered when the transmitter was put on a bird. The cell was sealed with liquid tape. The total weight of the transmitter was 9-9.5 g (ca. 6% of the bird's body weight), half of which was battery weight.

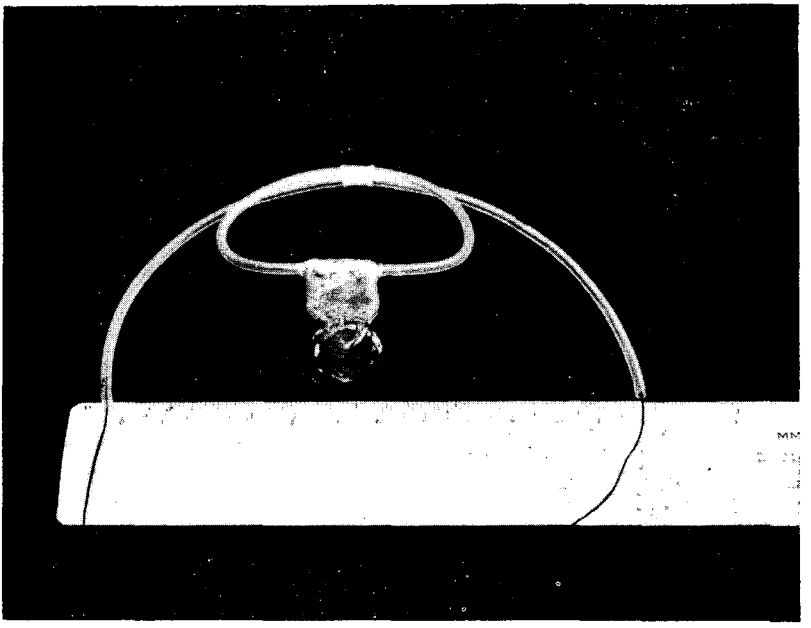

FIGURE 1 — Morepork radio transmitter with mercury cell and two harnesses.

The transmitter was placed on the upper part of the back of the bird with the loop aerial around its breast. A second plastic harness containing a waxed thread was joined to the loop aerial on its

outermost point and the two ends taken underneath the wings to the back end of the transmitter where the thread was tied to a small hook. The transmitter was completely hidden in the feathers (Fig. 2).

FIGURE 2 — Morepork carrying a radio transmitter.

Before a transmitter was attached to a wild bird, trials were made with two Moreporks in Wellington Zoo. For six weeks they carried transmitters and were fed live mice to see if their hunting ability was restricted. The birds were not adversely affected.

Whether the four Moreporks that were radio-tracked were in any way hindered by the transmitters is difficult to decide. The birds often pulled strongly at the loop around the breast, distorting the aerial and attenuating the signal, and one bird lost its transmitter after 8 days by chewing through the insulating tape holding the plastic harnesses together. The insulating tape was then replaced

by a metal ring. One bird broke a single strand copper wire loop aerial inside its plastic tube by chewing on it, which caused the transmitter to stop working. None of the three birds recaptured after 2-3 weeks showed any decrease in weight or any obvious wear of feathers. However, in December 1973 a transmitter was found in a pile of Morepork feathers. The bird (probably eaten by a cat or stoat) had been carrying a transmitter for two months and may have been in a weakened condition.

Trapping

All the birds were caught in mist nets, using different sites and attractants.

(1) Seven standard mist net rigs (Whitaker 1972) were put up at dusk. The pocket size of the mist nets was enlarged as Moreporks can escape from a small pocket of a small-mesh mist net. To reduce the chance of a bird escaping the nets were checked every 30-45 minutes. Tape recordings were tried but the birds did not respond.

(2) When a roosting bird was found, a mist net was set up before dusk in front of it and a live white mouse tethered behind the net as bait. In all instances the bird flew at the mouse in less than 10 minutes. This technique looked promising, but few roosting sites were suitable for its use and the birds avoided the net after being caught once or twice.

(3) In spring when puriri moths *(Aenatus virescens)* are abundant, Moreporks often hunt for moths attracted by the lights of the field station. Several times in September and October mist nets were set up near the lights and live mice used as additional bait. During the first trial two were caught in an hour, but subsequently the birds appeared less frequently in the yard and avoided the nets which were rather conspicuous in the bright light.

None of these catching techniques proved satisfactory and their efficiency soon decreased as the birds learned the procedure.

Tracking

The birds were mainly followed with a hand-held directional loop aerial, although some information on the bird's movements, and sometimes its approximate location, was obtained through a big stationary aerial in the field station yard.

The range of the signal varied considerably according to the bird's position. Maximum distances with the portable aerial were approx. 120 m, the mean range being only 50-60 m. Reception and range were better in beech forest where the undergrowth was thinner and the foliage generally less dense than elsewhere. During the day, if no signal could be heard through the main aerial the bird's roosting place was tracked by walking along a few transect lines.

No satisfactory way of systematically tracking the birds at night could be established. They were too mobile to be followed continuously on foot as parts of the terrain were too rough for rapid traversing. On the other hand, hourly location points (as was done with opossums) were not very meaningful for a bird which sometimes crossed its home range several times in an hour. The birds appeared disturbed when followed too closely and may have changed to other parts of their home range more often than they would normally have done.

RESULTS

Status of the Morepork in the Orongorongo Valley

Of the predators in the Orongorongo Valley the Morepork is the most abundant species. In winter and spring 1973, besides the two pairs living on the central study area, up to nine different Moreporks could be heard along 4 km of drive-way below the field station. Additional birds were calling from the other side of the valley where they seemed to be as abundant.

Mist-netting data

The general mist-netting programme begun in late 1967 indicated that during these years never more than two pairs lived in the central study area (ca. 16 ha) sharing the area in a way similar to that shown in Fig. 3. Up to September 1974 20 different owls had been caught, 11 of which were subsequently recaptured up to 15 times. Two birds, H6 and H9 (both banded as adults), were continuously present for more than five years. H6 was banded in November 1968 in territory A and was, with one exception in April 1970, always retrapped in that territory. During this period it had at least three different partners: H51 (until July 1969), H8 (first caught in May 1969, last caught in May 1971) and H17 (first caught in January 1972, last in October 1973). After H8 disappeared and before the appearance of H17 another bird was trapped twice (November 1971, January 1972) in territory A. The resident H6 died between October and December 1973 and was immediately replaced by the new bird H19 (first caught in December 1973 and controlled 7 months later). Another new bird (H20) was found in territory A in April and June 1974, presumably replacing H17.

The second of these long term resident birds (H9) was banded in October 1969 and has been living in territory B ever since. Its predecessor was probably H2 (caught three times between December 1967 and August 1969). The history of successive mates to the resident of territory B is not as clear as for territory A. Between December 1967 and October 1970, 5 different Moreporks were caught once in territory B and not recaptured at all. They may have been partners or off-spring. From November 1971 on, however, the partner of H9 was retrapped several times (H16).

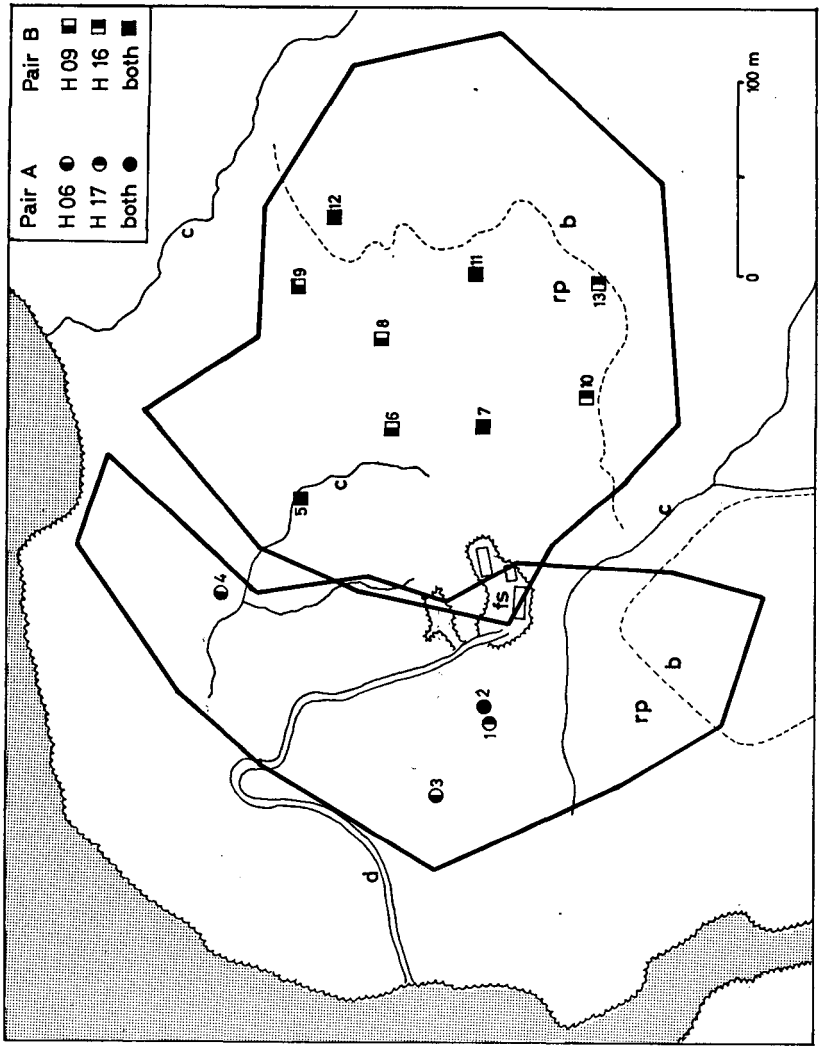

FIGURE 3 — Roosting places and home range boundaries of the two Morepork pairs as found during six weeks of radiotracking. The minimum size of the area of pair A was 3.5 and of pair B 5.4 ha. The dashed line shows the approximate boundary between rata-podocarp and beech forest. Hatched area: shingle bed of Orongorongo river. b: beech forest (uphill); c: creek; d: driveway; fs: field station; rp: rata-podocarp forest.

Home range of radio-tracked birds

During the tracking period from the end of August to the beginning of October 1973 territory A was occupied by H6 and H17 and territory B by H16 and H9. At least once, for various numbers of days, all these birds carried a transmitter.

Fig. 3 shows for each pair the boundaries of their home range as observed during these six weeks. Earlier sight or recapture data are not included. The data of pair A are based on 11½ bird-tracking-nights (ca 3.5 ha), those of pair B on 15 nights (ca 5.3 ha) which may be the reason for the larger revealed range of pair B. To determine the real size of the territories a much longer period of radio-tracking would be required. The southern boundaries are least accurate, and the birds are believed to go higher up into the beech forest.

Around the field station the territories overlap. The lights of the station attract moths and therefore the birds from either side. One evening all four were seen around the station, but pair A was perching east and pair B west of the houses. Except for counter calling no direct interactions between the two pairs were ever observed.

The home ranges of both pairs included an area of beech forest, which may be of considerable importance to the birds if hunting is easier when there is less undergrowth. I estimate that the birds spent about 35-40% of their time in beech forest although it represented a far smaller fraction of their home ranges (Fig. 3). Tawny owls, *Strix aluco,* in England are much more efficient hunters in open than in dense forest and therefore require smaller territories than in forest with dense undergrowth (Southern & Lowe 1968).

Day roosts

For pair A four, and for pair B nine, different roosts were found (Fig. 3). The birds of pair A were never seen roosting together, although they both used the same tree (no. 2) on different days. Pair B, however, roosted close together on three days in the same trees (nos. 5, 11, 12). Four days in a row was the longest period that a bird used the same tree (H17 in tree no. 1). The birds returned frequently to some roosting places (e.g. tree no. 2 for pair A and no. 4 for pair B), but used others only once or twice. By contrast Cunningham (1948) reported a Morepork that roosted in a cabbage tree (*Cordyline* sp.) for almost three months in autumn with only occasional changes to another site.

The roosts were in the following tree species:

Pukatea	*Laurelia novae-zelandiae* (tree nos. 2, 5, 6, 7)
Rata	*Metrosideros robusta* (nos. 8, 11, 13)
Rewarewa	*Knightia excelsa* (no. 1)
Mahoe	*Melicytus ramiflorus* (nos. 3, 9, 10)
Pigeonwood	*Hedycarya arborea* (no. 4)
Tree Fern	*Cyathea sp.* (no. 12)

The trees varied in size from ca. 10 cm diameter to over 300 cm, the biggest being nos. 6 and 11. The trunks of most were thickly covered with epiphytes such as *Astelia solandri* and *Collospermum hastatum,* so that the bird was often invisible from the ground. Three sites, however, were surprisingly open (e.g. site in tree fern) with the bird clearly visible from all sides but not from above. Overhead cover seems to be the most important feature of a roosting place. The height of the perches varied from 3.5 to 8 m; in one tree it was probably as high as 15 m. If the birds were not disturbed they did not change their roosting place during the day. One bird between checks in the morning and afternoon, however, changed to the other side of the same tree.

Food

Several authors have shown that the food of the Morepork consists mostly of insects, with a few small birds, mice and young rats (Cunningham 1948, Moon 1957, Hogg & Skegg 1961, Lindsay & Ordish 1964). Thus, it is not surprising that in a habitat like the Orongorongo Valley the systematic collecting of pellets proved very difficult: remains of insects produce loose and inconspicuous pellets that easily break on falling to the ground, and many would get caught in the dense epiphytes present at most roosts in the study area. Although the ground was always searched carefully below the roost only a few fragments of pellets were found. These contained only insect material (which was not further analysed). Separately, one big hind leg of a tree weta *(Hemideina thoracica),* one bird bone (humerus ?, species ?) and one colour bird band of a small passerine were collected. Earlier, on the same study area, Daniel (1972) had found a few Morepork pellets that contained insect material exclusively (green chafers, huhu beetles, cicadas). On one occasion he watched a Morepork hunting a juvenile rat just released from a live-trap.

Wetas (Order: Orthoptera) which can reach 5-7 g may be the most important and most constant food item for this forest dwelling owl (as it has been shown for the diet of the ship rat *(Rattus rattus)* by Daniel 1973) and their role might be that of voles for European owls (e.g. Southern & Lowe 1968, Southern 1969, 1970). This finds some confirmation in an analysis of 25 Morepork stomach contents by Lindsay & Ordish (1964) in which wetas were by far the most abundant single prey item. Other prey species which reach a seasonal abundance may temporarily become the prevailing food (e.g. puriri moth in spring, cicadas in summer, and mice during a population peak).

Activity

Moreporks left the roost in the evening between 1730 and 1800 hours, the time being closer to 1800 hours in October with increased daylength. When both birds roosted together they usually left the roost together or within half a minute.

The birds became restless about 30 minutes before departure, spread their wings, sometimes made subdued grunting calls and pulled

at their transmitter collars. Normally they first flew only a few metres to another perch, where they stayed a few minutes before flying another short distance. Several times a bird could be followed for half an hour, always moving only 10-20 m at a time. During these short inconspicuous movements there was still much daylight. Before dusk, hunting for small birds that are then still active may be easier, and the short movements may protect the owl from being detected by its prey species. Mr A. H. Whitaker (pers. comm.) occasionally saw Moreporks attacking birds in the mist nets at this time of the day. When dusk was well advanced the birds started flying longer distances and the birds of both pairs then very often flew to the beech forest areas. At night they could change rapidly from one area to another.

During three nights both birds of pair B carried a working transmitter. The birds spent not more than 50% of the time together. One night, at 2015 hours (1 September), a mating episode lasting over 10 minutes was heard. At first the birds appeared to be on neighbouring trees. While calling softly they moved toward each other and then began a duet of cooing and grunting calls. This obviously ended in copulation judging by the fluttering of the wings.

The time at which the birds returned to their roosts in the morning was more difficult to determine for they were then more easily disturbed by somebody following. On 31 August H17 reached its roost at 0632 hours. (At 0610 hours one could walk without a torch through the bush and the first Blackbirds were calling at 0625 hours.) On three other dates birds reached their roosts at about the same time (0615-0630 hours), but on 12 October H6 was already in its roost at 0540 hours.

In the first week of October, shortly before the breeding season, Moreporks were heard calling several times in late afternoon outside the study area. On 8 October, a warm cloudless day, the first Morepork call was heard at 1500 hours and was soon followed by others from both sides of the valley; the high calling activity continued for the whole afternoon and throughout the night.

CONCLUSIONS

Radio-telemetry appears to be an adequate technique for obtaining, directly or indirectly, information on the biology of an owl and probably also of many other nocturnal birds (e.g. Kiwi). The available equipment is reliable and adaptable to even small species. The main limitation to overcome with birds the size of Moreporks is the need to recapture them to replace the power cell. These intervals, of course, could be lengthened by using smaller but more expensive transmitter components, thus allowing more weight for the battery, or by a more sensitive receiver, requiring less power output.

The obvious application for this technique is to find out the birds' home range, habitat use and activity pattern and how these

change throughout the year. Another application may be less obvious but more important as it reveals information that could not as easily be obtained in any other way: to locate roosts and nest sites to study the birds' diet (pellet analysis or direct observation) and breeding biology.

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MORE ABOUT OYSTERCATCHERS

Another contribution to the biology of the New Zealand Oystercatchers has appeared recently:

> BAKER, A. J. 1975. Morphological variation, hybridization and systematics of New Zealand oystercatchers (Charadriiformes: Haematopodidae). *Journal of Zoology, London* 175: 357-390, text-figs 1-5. Abstract: "Variation in eight morphological variables was analysed for the three New Zealand species of oystercatchers, *Haematopus ostralegus finschi,* Martens, *H. unicolor,* and *H. chathamensis,* Hartert. Within species, significant size variation was detected among age classes and between the sexes separately in ensuing taxonomic comparisons. Analysis of morphological variation in hybridizing forms of *H. unicolor* suggests that gene exchange between the parental black and pied phases is extensive. Univariate and multivariate statistical analyses isolated three phenetic entities, consistent with three species as proposed in recent classification."

SEABIRDS FOUND DEAD IN NEW ZEALAND IN 1973

By C. R. VEITCH

ABSTRACT

During 1973, 1701 miles of coast were patrolled by 104 members of the Ornithological Society of New Zealand and 6273 dead seabirds were found. Two wrecks contributed to this record total of birds. During July and August large numbers of Blue Penguin *(Eudyptula minor)*, and a few other species, came ashore on both sides of Northland. This wreck was apparently caused by starvation. During September and October high numbers of species which normally frequent seas to the south and west of New Zealand were found on the south and west coasts. These birds were probably forced towards New Zealand by bad weather. New records for New Zealand are Antarctic Petrel *(Thalassoica antarctica)* and White-tailed Tropic Bird *(Phaethon lepturus)*. A new record for beach patrolling is Fulmar Prion *(Pachyptila crassirostris)*. Third and fourth records of Gould's Petrel *(Pterodroma leucoptera leucoptera)* were obtained.

INTRODUCTION

This paper records the results of the Beach Patrol Scheme of the Ornithological Society of New Zealand for 1973. The coastline of New Zealand is divided into 15 sections of coast. During the year all sections of coast were patrolled, and an additional section OI for " Outlying Islands " has been included. This year OI includes only patrols from the Chatham Islands but in future could include other outlying islands in the New Zealand region. 447 beach patrol cards and 31 specimen record cards were filed.

Nomenclature follows the *Annotated Checklist,* OSNZ 1970, except that to save space some trinomials have not been used in the tables. However, species marked * in the text and Tables 2, 3 and 4 all have more than one subspecies which may be found on New Zealand beaches. In most cases it is not reasonable to identify these subspecies from beach wrecked specimens.

Readers are asked to remember, while reading the following results, that data for 1965, 66, 67, 70 and 71 were not available to me for comparative purposes.

RESULTS AND DISCUSSION

The numbers of birds found and miles of beach travelled and covered per month and per coast is recorded in Table 1. The miles travelled in each area is a fair indication of the numbers of people

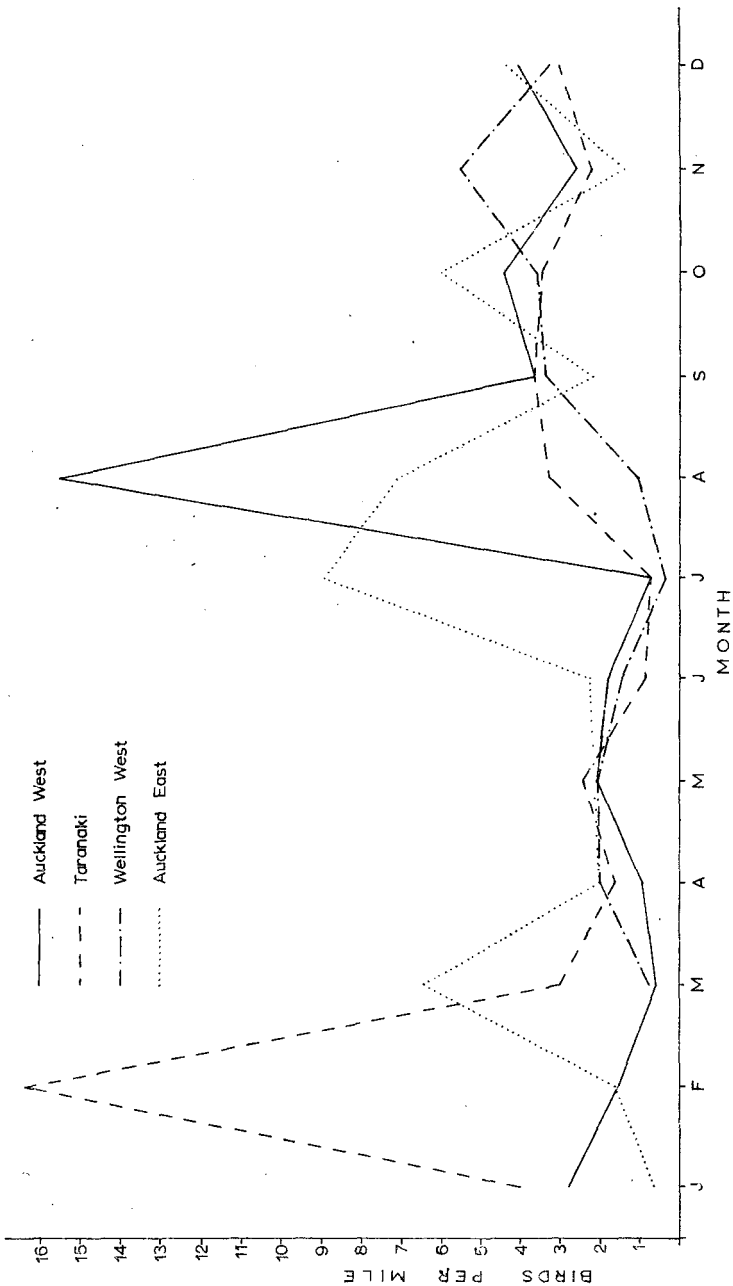

FIGURE 1 — Birds per mile per month for four regularly patrolled coasts in 1973.

patrolling. Auckland West and East, Wellington West and Taranaki received the most attention, while fewer persons did equally good work in other areas. The total miles travelled (1701) is similar to the highest previously recorded, and the number of birds found (6273) is a record. The average number of birds found per mile travelled (3.7) is higher than usual (1960, 1.8; 1961, 3.7; 1962, 1.9; 1963, 1.8; 1964, 1.2; 1969, 1.5; 1972, 2.0), with the exception of 1968 (4.0) when two extensive wrecks occurred. Miles travelled are the total distances patrolled; miles covered (see Table 1) are the lengths of coast inspected monthly. Thus if a mile of beach is patrolled three times in one month, 3 miles have been travelled, but only one mile covered. Although it is known that many patrols on one beach in one month will increase the number of birds found, it is considered that one patrol per month finds the majority of dead birds and hence, for comparative purposes, the figure of miles covered per month is used.

The basic monthly mortality pattern, as shown by birds per mile covered per month in Table 1, is a typical one of lowest mortality in late summer and autumn, but is confused by two major wrecks which occurred from July to October and minor wrecks in some areas as are discussed later.

Details of the rarer specimens found are shown in Table 2, and the monthly and coastal distribution of more common species in Tables 3 and 4. The numbers found on some coasts appears to be particularly large, but when related to miles patrolled the true relationship is shown. Data for birds found per mile covered per month are shown in Figure 1 for four regularly patrolled coasts.

The major wreck of the year, numerically, occurred around the northern half of the North Island beginning in late July and continuing well into August. There is usually a high mortality of Prions (*Pachyptila* spp.) at this time of the year. In 1973 there were more Grey-faced Petrels *(Pterodroma macroptera gouldi)* and White-headed Petrels *(P. lessoni)*, high numbers of Allied Shearwaters *(Puffinus assimilis*)*, Fluttering Shearwater *(P. gavia gavia)* and Diving Petrels *(Pelecanoides urinatrix*)*, and extremely high numbers of Blue Penguins *(Eudyptula minor*)*. The high numbers recorded may be partly due to increased patrolling in Auckland East where one would expect to find species which breed on the nearby islands and winter in New Zealand waters. A number of Blue Penguin from this wreck were clinically examined and appeared to have died from starvation. They were also examined for the presence of pollutants including lead, cadium, mercury, organochlorines, and polychlorinated biphenols but insignificant amounts were recorded (H. Black, Ministry of Agriculture and Fisheries, pers. comm.).

The second wreck occurred in September and October along the south and west coasts, and consisted of birds which normally frequent oceans to the south and west of the country. Notable among these were Kerguelen Petrel *(Pterodroma brevirostris)*, Blue Petrel

TABLE 1 — Numbers of dead seabirds recorded and miles patrolled on each coast in 1973.

COAST	CODE		MONTH											TOTALS	BIRDS/MILE	
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MILES	BIRDS	/COAST
Auckland West	AW	Miles	29	30	22	28	28	52	30	138	90	31	34	86	598		
		Birds	65	46	13	26	58	92	21	2131	332	134	90	347		3355	5.61
Taranaki	T	Miles	1	3	10	12	13	8	12	8	10	14	4	2	97		
		Birds	4	49	30	20	31	7	9	26	37	48	9	6		276	2.85
Wellington West	WW	Miles	-	-	15	19	62	27	28	35	96	48	25	4	359		
		Birds	-	-	11	38	127	41	11	36	325	174	139	13		915	2.55
Westland	WD	Miles	6	-	-	-	-	-	-	-	-	-	-	-	6		
		Birds	0	-	-	-	-	-	-	-	-	-	-	-		0	0
Fiordland	F	Miles	-	-	-	-	-	-	2	-	-	-	-	-	2		
		Birds	-	-	-	-	-	-	0	-	-	-	-	-		0	0
Auckland East	AE	Miles	6	6	15	2	-	8	43	28	6	2	8	40	164		
		Birds	4	10	96	4	-	18	383	199	13	12	11	175		925	5.64
Bay of Plenty	BP	Miles	10	3	8	3	-	4	3	-	5	4	-	1	41		
		Birds	34	20	46	0	-	13	2	-	6	1	-	0		122	2.98
East Coast North Island	EC	Miles	2	-	-	2	-	-	1	-	3	-	6	-	14		
		Birds	3	-	-	2	-	-	1	-	2	-	11	-		19	1.36
Wairarapa	W	Miles	-	-	-	-	-	2	-	-	-	-	1	-	3		
		Birds	-	-	-	-	-	3	-	-	-	-	0	-		3	1.00
Canterbury North	CN	Miles	4	8	7	5	13	4	6	4	1	-	-	4	56		
		Birds	9	10	17	4	16	0	29	0	0	-	-	12		97	1.73
Canterbury South	CS	Miles	5	-	4	3	-	-	3	4	3	3	4	4	33		
		Birds	18	-	3	1	-	-	1	38	3	10	8	5		87	2.64
Otago	O	Miles	1	2	11	15	7	3	12	11	13	1	3	1	65		
		Birds	41	2	34	2	4	9	6	3	5	23	4	12		145	2.23
Southland	S	Miles	-	3	-	4	2	-	-	-	4	4	4	7	28		
		Birds	-	10	-	7	137	-	-	-	4	46	12	10		226	8.07
Wellington South	WS	Miles	-	-	-	13	10	-	11	11	12	2	3	6	66		
		Birds	-	-	-	21	14	-	12	14	4	4	3	8		80	1.21
North Coast South Island	NS	Miles	-	4	-	4	-	-	1	-	2	-	5	-	16		
		Birds	-	4	-	6	-	-	0	-	1	-	3	-		14	0.87
Outlying Islands	OI	Miles	-	-	-	-	-	-	-	-	-	4	-	-	4		
		Birds	-	-	-	-	-	-	-	-	-	9	-	-		9	2.25
Total Miles Travelled (not listed above)			64	63	99	115	146	111	133	255	288	137	122	167	1701		
Total Miles Covered			64	59	92	110	135	108	121	234	240	113	97	153	1526		
Total Birds Recorded			178	151	250	131	387	183	475	2447	732	461	230	588		6273	
Birds/Mile Covered/Month			2.78	2.56	2.72	1.19	2.87	1.69	3.93	10.46	3.05	4.08	2.37	3.84			4.11

TABLE 2 — Seabirds of which 1 to 5 specimens were found dead in 1973. Coast and month of discovery given.

SPECIES OR SUBSPECIES	NUMBER FOUND	COAST(S)	MONTH(S)
Megadyptes antipodes	3	O	1, 3, 3
Diomedea epomophora	3	T, WW, WS	8, 8, 11
melanophris	5	AW(3), T, WW	6, 8, 8, 9, 10
bulleri	5	AW(2), O, S, (2)	4, 5, 9, 9, 10
cauta subspp/	5	AW(2), WW(2), CN	5, 6, 9, 10, 12
cauta salvini	2	AW, WW	9, 12
Thalassoica antarctica	2	AW, S	9, 10
Pterodroma spp/	3	AW(2), WW	5, 8, 12
leucoptera	1	AW	5
hypoleuca nigripennis	2	AW(2)	4, 9
Pachyptila crassirostris	2	CN(2)	7, 7
Procellaria cinerea	2	AW(2)	9, 12
parkinsoni	1	AW	6
westlandica	1	WW	5
aequinoctialis	5	AW(4), CN	1, 11, 11, 11, 12
Oceanites oceanicus	1	EC	4
Pelagodroma spp/	1	AW	8
Phaethon lepturus	1	BP	1
Phalacrocorax spp/	1	AW	6
sulcirostris	3	AW, AE, BP	9, 9, 9
Leucocarbo carunculatus chalconotus	4	O(3), S	5, 5, 9, 12
carunculatus onslowi	1	O1	10
Stercorarius spp/	1	AW	12
skua lonnbergi	5	AW(4), WW	4, 5, 6, 6, 9
parasiticus	1	AE	2
Larus spp/	4	AW, AE, WS(2)	7, 8, 9, 10
TOTAL	65		

/ Species or subspecies could not be identified by patroller.

TABLE 3 — Coastal distribution of the more common seabirds found dead in 1973.

SPECIES OR SUBSPECIES	COAST AW	T	NW	AE	BP	EC	W	CN	CS	O	S	WS	NS	OI	TOTAL BIRDS
Eudyptula minor	1715	31	26	305	10	1	-	-	3	14	1	5	2	2	2115
albosignata	-	-	-	-	-	-	-	5	3	1	-	-	-	-	9
Diomedea spp./	5	3	11	-	-	-	1	-	-	-	3	-	-	-	23
exulans	7	2	1	-	3	-	-	-	2	-	1	1	-	-	17
chrysostoma	12	1	-	-	-	-	-	-	-	-	-	-	-	-	13
cauta cauta	8	3	18	-	-	-	-	-	-	3	-	-	-	-	32
Pheobetria palpebrata	7	-	-	-	-	-	-	-	1	-	1	-	1	-	10
Macronectes giganteus*	28	5	4	4	-	-	1	1	2	1	1	3	-	-	50
Fulmarus glacialoides	66	13	45	-	-	-	-	-	-	-	9	-	1	-	134
Daption capensis*	47	4	16	4	1	-	-	-	2	-	2	5	-	-	81
Pterodroma macroptera	32	-	-	13	6	-	-	1	-	-	-	-	-	-	52
gouldi	39	2	5	-	-	-	-	-	15	-	-	-	-	-	61
inexpectata	10	-	-	-	-	-	-	-	-	-	-	-	-	-	10
brevirostris	104	8	30	-	-	-	-	-	-	-	1	-	1	-	144
cooki	3	-	-	10	1	-	-	-	-	-	-	-	-	-	14
Halobaena caerulea	23	1	11	6	-	-	-	-	1	-	-	-	-	-	42
Pachyptila spp./	139	16	305	30	-	3	-	2	6	-	5	1	-	-	507
vittata	6	1	8	22	-	1	-	6	4	-	11	-	1	-	60
salvini	76	1	19	4	-	-	-	2	-	-	-	-	-	-	102
desolata*	52	3	4	39	-	-	-	1	-	-	2	-	-	-	101
belcheri	41	-	6	4	-	-	-	2	7	2	-	1	-	-	63
turtur	153	14	153	43	2	2	-	18	8	2	5	7	-	-	407
Puffinus spp./	19	1	6	2	-	-	-	-	-	-	-	-	-	-	28
carneipes	10	1	-	38	7	-	-	-	-	-	-	-	-	-	56
bulleri	42	1	13	35	6	-	-	4	-	-	-	1	-	-	102
griseus	216	14	55	14	9	2	-	7	1	3	145	-	1	-	467
tenuirostris	33	8	31	9	7	-	-	-	-	1	3	-	-	-	92
gavia	112	17	23	75	13	-	-	1	-	-	-	-	-	-	241
huttoni	3	1	5	-	-	-	-	2	1	-	-	-	-	-	12
assimilis*	11	-	-	127	-	-	-	-	-	-	-	-	-	-	138
Pelagodroma marina*	-	-	-	3	4	1	-	-	-	-	-	-	-	-	8
Pelecanoides urinatrix*	106	10	19	73	8	2	-	-	-	-	14	2	-	-	234
Sula bassana	82	5	-	22	5	-	-	3	-	1	-	-	-	-	118
Phalacrocorax carbo	1	4	1	-	-	-	-	2	1	-	-	-	-	-	9
varius	6	-	-	3	2	-	-	2	-	-	-	-	-	-	13
melanoleucos	1	1	-	-	2	-	-	-	-	5	-	1	-	-	10
Stictocarbo punctatus*	4	1	-	-	-	-	-	13	12	35	4	-	-	-	69
Larus dominicanus	85	42	78	17	4	5	-	12	10	28	9	34	4	5	333
novaehollandiae	6	56	4	18	27	-	1	5	5	40	-	16	3	1	182
bulleri	-	-	4	-	-	1	-	-	3	-	4	-	-	-	12
Hydroprogne caspia	2	-	3	-	-	-	-	-	-	1	-	-	-	-	6
Sterna striata	13	4	3	2	3	-	-	4	-	1	1	-	-	-	31
TOTALS	3325	274	907	922	120	18	3	93	87	138	222	77	14	8	6208

/ Species could not be identified by patroller.

* See text.

TABLE 4 — Monthly distribution of the more common seabirds found dead in 1973.

SPECIES OR SUBSPECIES	MONTH JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL BIRDS
Eudyptula minor*	26	19	39	12	21	10	90	1724	73	26	13	62	2115
albosignata	3	2	1	-	1	-	-	-	-	-	-	2	9
Diomedea spp/	-	1	1	-	3	2	2	4	7	3	-	-	23
exulans*	4	-	-	1	3	1	-	3	1	4	-	-	17
chrysostoma	-	-	-	-	-	1	-	4	4	4	-	-	13
cauta cauta	-	-	3	-	9	7	1	2	2	6	2	-	32
Phoebetria palpebrata	1	-	-	-	1	1	-	1	2	-	3	1	10
Macronectes giganteus*	-	-	3	-	3	7	1	26	5	2	1	2	50
Fulmarus glacialoides	-	-	-	-	-	1	-	-	51	60	13	9	134
Daption capensis*	-	3	-	-	-	2	5	20	24	11	9	7	81
Pterodroma macroptera	4	-	4	-	1	5	10	7	14	2	1	4	52
lessoni	1	-	-	1	3	3	2	21	9	10	5	6	61
inexpectata	1	-	-	-	-	1	-	-	-	-	1	7	10
brevirostris	-	-	-	-	-	-	1	-	123	19	-	1	144
cooki	1	-	2	1	-	-	-	-	-	-	1	9	14
Halobaena caerulea	-	-	-	-	-	-	6	4	27	5	-	-	42
Pachyptila spp/	6	-	1	-	13	10	30	114	172	99	54	8	507
vittata	9	2	-	-	2	1	22	4	2	11	2	5	60
salvini	1	1	-	-	4	3	7	60	22	4	-	-	102
desolata*	-	-	1	1	4	1	38	43	8	4	-	1	101
belcheri	-	-	-	-	-	3	8	44	5	2	-	1	63
turtur	4	12	3	14	19	5	40	86	55	56	59	54	407
Puffinus spp/	-	-	1	-	-	17	-	4	2	1	-	3	28
carneipes	2	9	29	1	-	-	-	-	-	-	7	8	56
bulleri	8	6	14	6	7	5	-	-	6	6	10	34	102
griseus	13	20	7	7	171	18	4	5	13	13	49	147	467
tenuirostris	9	9	5	-	36	9	-	2	1	3	3	15	92
gavia	5	9	28	11	8	10	13	73	14	8	7	55	241
huttoni	1	-	1	-	1	-	-	1	2	6	-	-	12
assimilis*	-	-	-	-	-	-	119	11	-	-	2	6	138
Pelagodroma marina*	4	-	1	-	-	-	-	-	1	-	-	2	8
Pelecanoides urinatrix*	12	9	7	8	8	4	23	103	10	15	3	32	234
Sula bassana	6	13	3	8	3	7	8	22	11	6	3	28	118
Phalacrocorax carbo	-	1	1	-	3	1	-	1	-	1	1	1	9
varius	1	3	-	-	1	1	1	2	2	-	-	3	13
melanoleucos	2	-	1	-	1	-	1	2	1	-	1	2	10
Stictocarbo punctatus*	9	3	11	4	1	3	6	5	1	20	1	5	69
Larus dominicanus	13	10	37	31	39	21	20	32	34	31	21	44	333
novaehollandiae	26	11	39	15	9	13	11	11	11	10	10	16	182
bulleri	-	2	-	-	2	1	-	-	-	3	4	-	12
Hydroprogne caspia	-	-	1	-	-	2	1	-	2	-	-	-	6
Sterna striata	3	5	4	6	3	1	1	1	1	4	-	1	31
TOTALS	175	150	248	127	379	177	472	2440	718	455	286	581	6208

/ Species could not be identified by patroller.

* See text.

(Halobaena caerulea) and Antarctic Fulmar *(Fulmarus glacialoides)*. Information supplied by the New Zealand Meteorological Service indicates that there were gales along the Antarctic coast followed by strong southerly winds from 7 to 9 September which may have brought these birds northward. There was no noticeable increase in numbers of more common species found during this period except in some localised areas which are discussed later.

With this influx from the south came three specimens of Antarctic Petrel *(Thalassoica antarctica)*. Two of these, from Auckland West (Crockett 1975, *Notornis* 22 (3): 249) and Southland (Barlow 1974, *Notornis* 21: 183-4) in September and October respectively, are recorded in this scheme and both specimens are now in the National Museum. The third was reported from the Cape Kidnappers area in December (F. C. Kinsky pers. comm.). These are the first confirmed records of this species in New Zealand coastal waters. It has previously been recorded as rarely ranging north of 60°S (*Annotated Checklist,* OSNZ 1970: 121).

There were other unusual finds apparently not related to these wrecks. Most notable was the White-tailed Tropic Bird *(Phaethon lepturus)* found near Whakatane in January 1973. This was a new record for New Zealand (Brown 1973, *Notornis* 20: 380-1). The two specimens of Fulmar Prion *(Pachyptila crassirostris*)* found on Canterbury North beaches in July are new records for beach patrolling. The Gould's Petrel *(Pterodroma leucoptera leucoptera)* found in May and another taken live to the Wellington R.S.P.C.A. in the same month are the third and fourth records of this species in New Zealand (*Annotated Checklist, OSNZ* 1970: 23).

A study of Tables 1, 2 and 3 and Figure 1 show a number of minor localised wrecks around the New Zealand coast. In Otago during January, October and December local gales and patrols on beaches near breeding colonies contributed to higher than usual numbers of Blue Penguins, Spotted Shags *(Stictocarbo punctatus*)*, and Red-billed Gulls *(Larus novaehollandiae)*. Also some beaches on the Otago Peninsula appear to have an ability to collect sea borne flotsam. The high return for Taranaki in February, which consisted of a normal variety of species, appears to be entirely due to frequent patrolling of one good beach. Also in February northerly winds brought a relatively high number of birds to the Bay of Plenty among which were three Short-tailed Shearwaters *(Puffinus tenuirostris)*. Easterly winds and an increase in the amount of patrolling on previously unvisited beaches resulted in a high number of birds per mile to Auckland East in March and October. The high number of birds recorded for Southland in May is due to one person who patrolled 2 miles of Masons Bay on the west coast of Stewart Island and found 134 Sooty Shearwaters *(Puffinus griseus)*. Auckland West in December received 115 Sooty Shearwaters for no obvious reason, and there was a minor wreck of Fairy Prions *(Pachyptila turtur)* on Wellington West beaches in

November. There was also an unexplained large increase in the number of gulls *(Larus dominicanus* and *L. novaehollandiae)* found throughout the year. Other high figures of birds per mile per month can frequently be attributed to diligent searching of new areas as cards from such areas record many old specimens; and sometimes to frequent patrols of a good beach.

There have also been a few unusual records filed of seabirds found inland. These were:— 4 Fairy Prions in Nelson City, a Black-browed Mollymawk *(Diomedea melanophris*)* and an Antarctic Fulmar at Appleby, Nelson, and an immature Bullers Mollymawk *(Diomedea bulleri)* near Alexandra in Central Otago.

Miscellaneous birds recorded but not considered to be seabirds totalled 127. These were 19 Magpie (both subspecies), 18 Blackbird, 16 Rock Pigeon, 13 Mallard Duck, 11 Grey Duck, 5 each of Pied Stilt, South Island Pied Oystercatcher, Harrier and Pukeko, 4 Black Swan, 3 each of Starling, Bar-tailed Godwit, and Chaffinch, 2 each of Song Thrush, Myna, Goldfinch, Yellow Hammer and Pheasant, and one each of House Sparrow, Knot, California Quail, New Zealand Dotterel, Eastern Rosella, unidentified Oystercatcher and unidentified Passerine.

Among the 31 specimen record cards filed for 1973 were 18 for Kerguelen Petrels. To this I have added data from 6 specimen record cards filed between 1954 and 1972, 10 specimens in the National Museum, and 2 in the Auckland Museum. A summary of measurements is given in Table 5.

TABLE 5 — Summary of measurements (in mm) of Kerguelen Petrel *(Pterodroma brevirostris)*

	BILL Length	BILL Depth	BILL Width	Mid Toe & Claw	Tarsus	Wing	Tail	Total Length	Span	Weight
Number of Specimens	36	20	23	33	36	36	36	15	4	11
Mean	26.63	12.20	9.95	49.29	37.48	260.2	106.1	335.2	834.0	272.9
Range	25.2 29.7	10.5 13.0	9.4 11.9	46.0 53.0	32.7 41.7	241 275	92 120	315 345	790 876	240 340

ACKNOWLEDGEMENTS

During the year 104 members and friends took part in beach patrols. All credit is due to them for the results obtained. Those whose names I have were:— R. N. Alexander, M. Astill, The Auckland Team, Mrs M. L. Barlow, J. A. Bartle, Mr & Mrs R. J. Bellamy, Dr & Mrs A. Beu, A. Blair, F. M. Boyce, S. R. Brown, Dr P. C. Bull, W. J. Campbell, J. F. Castle, C. Challies, S. Chamberlain, C. D. Clunie, R. N. Cotter, S. Cotter, R. S. Cowan, D. E. Crockett, P. Crombie, G. Cunliffe, J. Davis, S. J. Donaldson, M. Eadie, J. P. Edgington, H. Elder, L. Esler, M. L. Falconer, Sir Robert Falla, G. Foreman, Dr J. A. Fowler, P. Gaze, C. J. Gibson, P. Gross, T. Habraken,

V. Hadlow, Mrs J. B. Hamel, P. C. Harper, T. R. Harty, H. F. Heinekamp, N. R. Hellyer, B. Hibbert, N. Hyde, M. J. Imber, T. Ireland, R. Jackson, E. B. Jones, Kapiti Junats, Mr & Mrs R. Kearns, B. Keeley, J. L. Kendrick, F. Kinsky, Mrs M. Lane, R. W. March, D. G. Medway, P. J. Miller, M. Mitchell, M. Munro, Mrs R. Nicholls, M. F. O'Shea, C. D. Paulin, R. Pierce, Mr & Mrs A. J. Poulton, Mr & Mrs Morrison, S. E. Quin, Mrs S. Reed, P. E. & H. A. Roberts, A. Robertson, D. Robertson, H. A. Robertson, M. Robertson, B. Rogers, E. K. Saul, B. Scahill, P. Scott, R. S. Slack, D. Smith, G. Stilwell, R. R. Sutton, T. C. L. & E. M. Symmes, R. Thomas, K. Upson, C. R. Veitch, C. Vooren, G. Watola, R. W. & S. I. Wheeler, D. M. Whyte, N. Wigram, Mr & Mrs T. Worthy and A. Wright.

My personal thanks also to Messrs A. Blackburn and P. Roberts for critically reading this manuscript.

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We are very sad to have to announce the passing of Mrs Hetty McKenzie, a much loved and valued member of the Society. An appreciation will appear in the next issue.

NEWLY PUBLISHED

Gardening with New Zealand Plants, Shrubs and Trees by Muriel E. Fisher, E. Satchell and Janet M. Watkins has been established for a number of years as an indispensable reference book for New Zealand gardeners, especially those concerned with the native flora and its relationship to abundant bird life. Many members of the OSNZ know and value the first edition of this book which, although now issued as the third printing, is virtually a new book since in the main sections Muriel Fisher has given full information on 37 new plants, as well as additional information on 16 plants already in the book. Janet Watkins has added step-by-step advice on how to start planning a garden, a piece on Home Units, and four new garden plans. Two completely new sections have been included — on Orchids by Stephen King, and on Water Gardening by Janet Watkins. Both Glossary and Index have been revised and enlarged; there are 23 new colour plates; and a new feature has 11 wash drawings by L. Ward, with three black and white photographs.

The publishers are Collins and the price is $12.50. It can be thoroughly recommended as the first printings have proved.

SHORT NOTES

SIGHT RECORD OF A DUNLIN IN NEW ZEALAND

On 24 February 1974, a party of South Auckland members, J. A. Brown, E. D. Metherell, Pamela Walter, D. M. Walter and the writer (BB), visited Tapora, Kaipara Harbour. On the large sand island we found a wader unknown to us resting on dry light-coloured sand with a loose flock of New Zealand Dotterels *(Charadrius obscurus)*. Scattered sedge clumps made it necessary to approach in spread-out formation, but each person was within a few metres of the next. Observations were made from 30m, using binoculars variously sized from 7x35 to 20x50 during about ten minutes at approximately 1300 hours. The weather was fine and the position a sheltered one.

First impressions, occurring independently to BB and DMW, were of a snipe-like bird in a squatting position. The heavy-billed head hung forward and down in an attitude totally different from that of any wader known to us. The bird then stood, stretched slightly, walked slowly about 1m, showing a plumpish body and short legs and sat down again. At this stage one observer who was clear of the sedge and closest to the bird saw the dark marking on the belly clearly. During these movements the bird's curiously slouched posture was maintained. Shortly after this a sudden panic among Wrybills *(Anarhynchus frontalis)*, Knots *(Calidris canutus)*, Golden Plovers *(Pluvialis dominica)* and Red-necked Stints *(Calidris ruficollis)* which fed at the waters edge, 50m distant, put up all birds in the vicinity. The stranger hesitated and then flew without attaching itself to any of the several small flocks which crossed to the mainland. Good views of the upper surfaces were obtained as it flew back and forth over the beach in front of us at varying heights. It crossed to the beach on the mainland, returned and repeated the back and forth flights giving the appearance of being strange to the area. It finally re-crossed to the mainland and went down at a considerable distance from us. Many scattered birds fed here and we were unable to find it again. The description which follows was compiled from field notes.

Size: Closely approximating that of a Curlew Sandpiper *(Calidris ferruginea)*.

Bill: Moderately long, black, broad at the base, with a decurved tip, in length slightly shorter than that of *C. ferruginea.*
Crown and upper surfaces: Greyish, with dark scaly pattern and some rufous chestnut apparently just showing through.
Face: Greyish.
Eye: Dark.
Superciliary: White, not strongly marked.
Neck: Shorter and thicker than that of *C. ferruginea.*

Upper breast: Dusky grey right across, overlaid with some darker vertical streaking and with at each side, a buffish tinge on the grey.
Lower breast and belly: White at the sides, with a disconnected central patch of greyish-black heavy mottling.
Remaining undersurfaces: White.
Rump and tail: Sides of rump white, in the centre a well-marked dark strip running up the back from a dark terminal band.
Alar-bar: White, of moderate width.
Legs: Short, very dark.
Voice: No calls heard.
Stance: Hunched and dumpy, short of neck and leg, head held forward with the heavy bill drooped downward.

All observers present agreed that: The bird was about *C. ferruginea* size, but lacked the fully white rump of that species, was of plumper build, had shorter legs, had a moderately long heavy black bill slightly decurved at the tip, had a white alar-bar, had the general appearance of a bird assuming breeding plumage, acted as if strange to the area and had a stance unlike that of any wader previously seen by us; and further that it was too large to be either a Western Sandpiper *(Calidris mauri)* which is about Red-necked Stint size, or a Broad-billed Sandpiper *(Limicola falcinellis)*, lacking the noticeable striped patterning on the back and y-shaped white stripe above the eyes of the latter species and both of which we have studied in the Firth of Thames (BB, JAB); that it had a white-sided dark-centred rump and tail (BB, DMW, PW); and had an almost black heavily mottled patch placed centrally on the lower breast and belly (JAB).

Visibility was such that details of breeding plumage of a splendid Golden Plover which stood 20m beyond the bird, were clearly seen and commented upon.

Two previous possible sightings of a Dunlin *(Calidris alpina)* are mentioned by McKenzie (1971, *Notornis* 18: 58), commenting on the number of vagrant arctic waders seen in the summer of 1969-1970. Referring to the Karaka bird, McKenzie does not consider that he saw enough of it to be sure of its identity (pers. comm.).

The other was that of J. P. Croxall at Puketutu, Manukau Harbour, on 19 November 1969. Unfortunately Dr Croxall was alone at the time. He has kindly made his notes available, which read as follows:

" Size of Curlew Sandpiper, smaller than Knot; stands lower and squatter than former, not reaching up like C.S., and looks much plumper as a result.

Bill dark and slightly downcurved (shorter than C.S. ?). Supercilium present but indistinct. Upperparts show scalloped darkish pattern much as C.S. Wing tips and tail darker than back, white patch at

side of tail seen when tail and wings 'settled.' Face darkest round eye and nearly as dark as crown. Rest of face and throat white; upper breast quite heavily streaked and lower breast with greyish flush. Rest of underparts white save for 6-7 dark tips to belly feathers. Legs dark, shorter upper joint than C.S. In flight shows white wing bar clearly at least as far as wing bend, white sides to dark centered tail conspicuous.

Watched for nearly 10 minutes at 50 yards at magnifications up to x50. Curlew Sandpipers and Knots available for comparison."

Dr Croxall was from England where he was thoroughly familiar with Dunlin.

The *Handbook of British Birds, Vol.* 4 (Witherby *et al.* 1940: 239), discussing resting of the Dunlin, mentions "where surface is dry, settling down belly to ground." When first seen the bird was in just this situation, settled belly to ground alongside New Zealand Dotterels *(C. obscurus)*.

The Southern Dunlin *(C. alpina schinzii)*, according to Witherby has a length of 6¾ inches, while the Northern race *C. a. alpina* is up to 7½ inches in length. *C. a. sakhalina* occurs in north-eastern Siberia and northern North America.

Peterson's *Field Guide to the Birds (Eastern Land and Water Birds)*, second edition (1963: 97), under the names Red-backed Sandpiper *(Erolia a. pacifica)*, gives its length as 8-9 inches and states — "The only Sandpiper with a black belly." Godfrey's *Birds of Canada* (1966: 155) says that it is "likely to be confused with only the Rock Sandpiper *Erolia ptilocnemis* of the West Coast which has vague black blotches on the lower breast, not on the abdomen . . . . and its legs are yellowish not black."

Our estimate of size as about that of *C. ferruginea*, stated by Falla *et al.* in the *Field Guide to the Birds of New Zealand* (1966: 142) to be about 8½ inches, would indicate that the bird may have been of the American race which according to Peterson "Breeds from n. Alaska (Pt. Barrow) south along coast to Hooper Bay, Nunivak; also n. Mackenzie." It winters south to the Gulf of Mexico. Slater (1970: 306), in the *Field Guide to Australian Birds, Vol* 1, says that the only records of Dunlin south of the equator are of vagrants near Hobart in Tasmania, at Melbourne, Victoria, and at Cape York.

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FINE BIRD BOOKS

A new catalogue entitled "*Fine Bird Books for the Connoisseur and Collector*" has been received from David Evans, The White Cottage, Pitt, Winchester, Hampshire, U.K. Anyone wishing to be placed on Mr Evans' mailing list is invited to communicate with him.

SIGHTING OF GRASS WHISTLE-DUCKS

A note has been received of the sighting of a flock of 12 unusual ducks in January 1975, at Little Wanganui, about 16 km south of Karamea, Northwest Nelson. This was referred to the Rare Birds Committee, which has confirmed the sighting as a record of the Grass Whistle-Duck or Plumed Whistling Duck *(Dendrocygna eytoni)*.

Linda-Jane Stopforth of Karamea, reported that the ducks were present for about 10 days, feeding on grass seedheads and fossicking about on the ground; they roosted in two gum trees. She described them as having long necks and long pink legs with webbed feet. "Their feathers were grey with black tips, breast feathers seemed slightly striped. They had large side feathers cream in colour and very unusual, black bills and orange-pink eyes."

This is the fourth record of the species in New Zealand, but the first for nearly 80 years. Previous occurrences were Thames (1871), Kaitangata (14 birds, 1871), Ashburton (3 birds, 1894-6). (*Annotated Checklist of the Birds of New Zealand, OSNZ* 1970: 36). Their arrival here is no surprise considering the distribution given by Slater (*Field Guide to Australian Birds — Non-Passerines,* 1971: 227): "Tropical Australia but isolated breeding colonies also occur inland as far south as the Murray River, and nomadic flocks can be seen at times almost anywhere in south-eastern Australia." It appears that one of these nomadic flocks crossed the Tasman in January; it may still be somewhere in New Zealand.

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BLACK-FRONTED DOTTEREL IN THE MANAWATU

The 1974 Labour Day Weekend Field Study Course in the Manawatu was organised primarily to study the spread of the Black-fronted Dotterel in the Manawatu, and secondarily to survey local swamps for Spotless Crake and Marsh Crake.

The course extended from 8.00 p.m. Friday 25 October to noon on Monday 28 October, most meetings being held in the Teachers' College Science Department to organise field work and report back. On Saturday evening Sylvia Reed gave an illustrated talk on the Galapagos Islands, and on Sunday evening a buffet tea was enjoyed at the home of two of our local members.

The field work was highly successful. The Black-fronted Dotterel survey was conducted on the Manawatu, Oroua and Rangitikei Rivers (see table for details). Several Black-backed Gull colonies were found on the rivers. Using tape-recorded calls to lure the birds, Spotless Crakes were heard or seen at four localities and Marsh Crake

at one (Lake Koputara). Lake Pukepuke was not included in the survey, but both species are known to be present there. A highlight of the visit to Lake Koputara was a Little Shag colony with 70 nests. Visits to the Rangitikei Estuary revealed: Spurwing Plover (2), Golden Plover (3), Banded Dotterel (9), Wrybill (2), Bartailed Godwit (21), Turnstone (1), Knot (38) and Red-necked Stint (4).

The Black-fronted Dotterel was first recorded in the Manawatu in 1955 (*Notornis* 6: 185) but was not again reported west of the Manawatu Gorge until 1971-72, when a nest was found near Longburn by J. Andrews, and birds were reported near Palmerston North and Tiakitahuna (12 seen by K. Cook). In July 1972, twelve were seen at Himatangi Beach on a sand-basin behind the foredunes (B. McConkey). Several surveys during 1968-70 had failed to locate any Black-fronted Dotterel west of the Manawatu Gorge.

The Manawatu population of Black-fronted Dotterels is presumably an overflow from Hawkes Bay. In October 1967, 16 were counted on the Manawatu River, all between Dannevirke and Hopelands Bridge. In November/December 1972, 32 were counted on this 13 mile section: 9 from Hopelands Bridge to Ngawapurua Bridge (6 miles), 12 from Ngawapurua Bridge to Ballance Bridge (8 miles) and 20 from Ashhurst to Fitzherbert Bridge (12 miles). One was seen on the Mangahao River and 2 near Longburn. The lower Manawatu and other rivers west of the Gorge were not surveyed systematically.

The 1974 Labour Day Weekend results are shown in Table 1.

TABLE 1 — Numbers of birds counted 26-27/10/74, except Feilding-Kopane which was November/December 1974. Figures in brackets are for November/December 1972. If a section of river was incompletely surveyed this is indicated by a + after the number of birds seen.

River	Section	Miles	Black-fronted Dotterel	Banded Dotterel	Pied Stilt
Rangitikei	Kakariki - Bulls	7	3	55	33
	Bulls- midway	6	7	27	32
	Midway - estuary	7	7	24	34
Oroua	Apiti Bridge - Barrow Rd	15	0	0	2
	Feilding - Kopane	8	9 +	12 +	100 +
Manawatu	Ashhurst - Fitzherbert Bridge	12	17 (20)	55 (59)	47 (127)
	Fitzherbert Bridge - Hamiltons Line	9	24 (2+)	42 (20+)	7 (106+)

The rivers were all running high during much of 1974 and by 26 October they had only just dropped to normal levels. They were up again on Monday (28th). The 1974 census figures may, therefore, be somewhat low, as birds may not have settled on the river.

The 1972 figures for late November-December are higher for all three species on the Ashhurst-Palmerston North section, but most markedly for Pied Stilt, many of which were seen on the paddocks(some with half-grown chicks) at the time of the 1974 census. One Black-fronted Dotterel was observed on a paddock on 28 October.

The 1974 census did not cover all the suitable habitats in the Manawatu and it was perhaps too early in the season for an accurate comparison with the 1972 figures, but it did serve to indicate the extent of the spread of the Black-fronted Dotterel since their presumed penetration of the Manawatu Gorge about 3 years previously. Breeding on the Oroua River was proved by R. Wasley who photographed nesting birds in November 1974.

Out of the breeding season, Black-fronted Dotterel have appeared in flocks at a variety of places e.g., Centennial Lagoon, Palmerston North (15 in March 1973), Hamilton's Lagoon (25 in August 1974), L. Pukepuke (8 in April 1974). Censusing would appear to be more satisfactory during the breeding season when the birds are largely confined to the river beds.

Our thanks are due to all members who co-operated in the census work, and all who helped to make the 1974 Labour Day Weekend such a success.

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SEASONAL VARIATION IN ESTUARY USE BY BROWN TEAL *(Anas castanea chlorotis)* ON GREAT BARRIER ISLAND

My earlier observations on feeding behaviour of Brown Teal *(Anas castanea chlorotis)* on Great Barrier Island (Weller 1974: *Notornis* 21: 25-35) provided some data on the distribution of teal according to habitat. Estuaries were not only used intensively but feeding was rhythmic in response to tides. A major portion of this post-breeding population was so tied to estuarine life that I wanted to gather additional data on their behaviour in another season. Three days were spent (27-29 Aug. 1974) on Great Barrier Island in search of Brown Teal, and my observations were so at variance with earlier notes that they seem worth recording.

Habitat Selection and Numbers:

In February of 1973 (7-14 Feb.), about 34 Brown Teal regularly used estuaries of the Port Fitzroy area. In August of 1974, I searched the estuaries in the Fitzroy area for teal but not one bird was seen during mornings, evenings, or after dark in spite of favourable low tides. Local residents had noted the absence of teal but had no knowledge of the timing of the seasonal variation.

Also in August of 1974, I visited the Mabey Farm where over 100 birds had been seen in February of 1973. A total of 35 birds was seen in the freshwater stream that meanders between the farm buildings. These birds were loafing and bathing during the early afternoon hours when I was there, but there was no active feeding in the uplands. Mrs Mabey noted that teal were normally present all year.

These brief observations, supported by local residents, suggest a different pattern of habitat use, and reduced population size in the late winter compared with the post-breeding period in late summer. Several possible reasons may exist and further information on this pattern could be valuable in preserving habitat for this rare duck.

First, there may be dramatic seasonal variation in production of estuarine invertebrates in winter due to shorter day length and colder waters. Invertebrates certainly were not conspicuous as they had been during summer. Secondly, rainfall patterns may produce more freshwater areas where teal may disperse, especially in the prebreeding period. And finally, surplus populations may leave the island and disperse to suitable areas on the mainland. Data on seasonal variations of Brown Teal appearing at ponds and sewage lagoons near Auckland or on the Coromandel Peninsula should be correlated with populations on Great Barrier.

Plumages and Behaviour:

Seasonal variation in plumages was very evident in comparing plumages of birds during the pre-breeding season in August and the post-breeding period in February. Whereas sexes were virtually indistinguishable in February, and all birds were drab brown with no evidence of breeding plumage, most males were approaching full breeding plumage in August. Hens still were essentially plain brown but, in comparison, drakes had darker greenish-black scapulars with a contrasting light linear line. Males also had a reddish chest, whitish sides of the tail, blackish undertail, a more prominent bronze and green irridescence in the crown, vermiculated sides, a more bluish-edged black bill, and a longer tail. None had a white ring around the neck but several had light areas there. None was as bright as figured by Scott in Delacour (1956, *The Waterfowl of the World, Vol II.* London).

Hens were paired or had males in close company. There were no active displays by males but hens incited and aggressiveness was conspicuous. There were only 8 females to 27 males in the flock at the Mabey farm.

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THRUSHES FEEDING ON MARINE SNAILS

It is well known that Song Thrushes feed on garden snails but less well known that they may feed on other types of snail. In a paper entitled "Song thrushes feeding on mud snails" (Nye 1971, *Notornis* 18: 211-214), I brought together three independent observations of thrushes feeding on the mud snail *Amphibola crenata* Martyn. Kinsky (1970, *Notornis* 17: 77) was the first to publish such a report when he saw thrushes feeding on mud snails at Rough Island, Nelson, in October 1969, and Mr A. Wright and myself saw the same behaviour at two locations on Otago Peninsula during 1970 and 1971. I have since found smashed shells of *A. crenata* at Papanui Inlet, Otago Peninsula, during the summer of 1973/4 and 1974/5 and a student, Mr G. Shirley, told me that thrushes also fed on mud snails at Purakanui Inlet, about 6 km north of Otago Peninsula, between 1972 and 1974.

In my earlier report, I asked for further records of thrushes feeding on mud snails in different parts of New Zealand as I wanted to consider whether the habit had spread from a single, pioneer bird or had been developed at different times or places by different birds. Since then I have received several reports which are summarised here with some other relevant data. Mr Archie Blackburn wrote from Gisborne to say that he had found broken *A. crenata* shells on his lawn by the Waimata River during October 1969, but not during the whole of the following summer or early summer of 1971, when he wrote. He thought that the later absence of shells was because mud snails had become scarce near his lawn, although thrushes were common in the area. Mr Bruce Campbell wrote to say that between 1920 and 1925 he saw thrushes feeding on the Invercargill estuary and carrying shells, resembling those in my article ,to a concrete embankment where the thrushes smashed these open.

Two further records were sent to me from the Nelson area. Mr G. T. Candy noticed thrushes feeding on mud snails at Clifton Inlet near the mouth of the Motupipi River which is about 100 km from Rough Island, where thrushes were first reported feeding on mud snails by Kinsky. Mr Candy saw a halo of broken mud snail shells around some large stones many times between 1961 and 1973 and thrushes were sometimes seen or heard breaking open the snails. Mr Candy says " . . . from the number of shells present, and the length of time I have observed them, I would say that this represents the work of more than one individual, and more than one generation." The other record from the Nelson area is most illuminating, especially when taken together with a report by a general practitioner in England, writing in the *British Medical Journal* on 18 March 1972 (Radford 1972, *Br. Med. J.* 1: 744). Mr H. F. Heinekamp saw thrushes feeding on the dark or black top shell, *Melagraphia aethiops* Gmelin, at Adele Island, Nelson, during October 1974, and Dr P. Radford, the general practitioner, said " One very cold January I saw a song thrush hammer-

ing periwinkles on a rock on the seashore and, having broken the shells, eating the flesh. Meanwhile, no doubt, other song thrushes inland were searching in vain for snails — their normal diet — under hard-frozen snow." The periwinkles to which Dr Radford refers are almost certainly the common or edible periwinkle, *Littorina littorea* Linnaeus, which looks very similar to *M. aethiops.* These two species are both prosobranch molluscs and not closely related to the two pulmonates *Amphibola crenata* and *Helix aspera,* the garden snail.

Although these reports are more meagre than I had hoped for, the evidence which spans a long time and widely separated places, suggests that individual thrushes may try various snail-like objects for food when they are available and thrushes living by the coast will have ample opportunity to explore the shore and sample marine snails. Presumably, if the thrush succeeds in opening a snail and the flesh is good then the habit may be repeated and copied by other thrushes which observe the local pioneers. On three occasions I found intact shells of the scavenger whelk, *Cominella glandiformis* Reeve, besides thrushes' anvils at Papanui Inlet, which further supports the idea that thrushes will attempt to exploit a variety of snails, a behaviour which will certainly help them to survive when their usual food is in short supply.

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FIRST RECORD OF THE ANTARCTIC PETREL IN NEW ZEALAND

During a beach patrol of the Dargaville West Coast on 22 September 1973 by Northland members of the Ornithological Society of New Zealand, one specimen of Antarctic Petrel *(Thalassoica antarctica)* was recovered.

I recognised the specimen from amongst an assemblage of Procellariiformes which included a strong southern element, consisting of Cape Pigeon *(Daption capensis),* Antarctic Fulmar *(Fulmarus glacialoides),* Kerguelen Petrel *(Pterodroma brevirostris),* White-headed Petrel *(Pterodroma lessoni),* Blue Petrel *(Halobaena caerulea),* Antarctic Prion *(Pachyptila desolata),* Grey Petrel *(Procellaria cinerea),* and Southern Skua *(Stercorarius skua lonnbergi).* The partially decayed specimen was found on the section between Maunganui Bluff and Baylys Beach by Alan Poulton and Pen Smith, both of Whangarei.

The *Annotated Checklist* (OSNZ 1970: 21) states that the Antarctic Petrel is found breeding on the Antarctic Coast and outlying islands, probably also further inland. Common in the Ross Sea, although breeding has not yet been proved in the Ross Dependency, this species moves north with the pack ice in winter; but rarely ranging

north of 60°S. The *Field Guide to Australian Birds* (Slater 1970: 151-2) records the Antarctic Petrel as far north as Macquarie Island in 1965.

Its occurrence at Dargaville and Oreti Beach, Southland, on 13 October 1973 (Barlow 1974, *Notornis* 21: 183-4) is unusual, especially the Dargaville example which came ashore in relatively settled weather. Normally the "wrecking" of petrels is associated with prolonged strong south to west winds.

When collected, the specimen was in an advanced state of decay. However, when forwarded to Mr F. C. Kinsky at the National Museum, Wellington, for confirmation of identification, one outstretched wing and a skeleton were prepared from the remains.

The Dargaville specimen agreed perfectly with the description given in the *Handbook of Australian Sea-birds* (Serventy *et al.*, 1971: 88-9) and the measurements (Culmen 38.5 mm, Tarsus 47 mm, Mid-toe and claw 57.2 mm, Wing 314 mm, Tail 113 mm) fall within the range listed.

My thanks to Mr F. C. Kinsky for his confirmation of identification and measurements.

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BLACKBIRD'S NEST USED THREE TIMES

About mid-September 1974, a Blackbird *(Turdus merula)* was observed building a nest in a secluded part of our garden in Havelock North. The nest was about one and a half metres above ground level on a eucalyptus stump from which a vigorous growth of young branches had sprouted. Within a few days three eggs had been laid and incubation commenced. Two of the eggs hatched, and eventually the two fledglings left the nest about 17 October and were observed perching in nearby trees with both parents in attendance.

One week later, it was noticed that the nest was again occupied, presumably by the same mother bird. This time four eggs were laid. In due course two of the eggs hatched, the young birds were diligently cared for by both parents and left the nest on 21 November. Again they were observed being fed in nearby trees.

Exactly a week later the same nest, now becoming rather threadbare, was observed to be again in use, and again presumably by the same pair. A small amount of restoration work seemed to have been done around the outside of the nest. On this occasion four eggs were laid, three were hatched, and all three left the nest on 26 December. On that day all three were seen in nearby trees with both parents in close attendance.

The essence of this report is that three clutches of Blackbirds were raised in one nest in one season. It is almost certain that all

three clutches were offspring of the same parents, a supposition which is strengthened by the consistency in their appearance and behaviour and their increasing tolerance of interested humans. After the third hatching the parent birds would feed the young without any sign of nervousness while two observers had tea in deck chairs at a distance of 4 - 5 m.

After its third use, the nest was still sound but it had become rather shallow and the grass lining was practically worn away from the mud-plaster walls.

JOHN & MARY McFADZIEN

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★

SOUTHERN BLACK-BACKED GULL *(Larus dominicanus)* AT CAPE HALLETT, ANTARCTICA

The Southern Black-backed Gull *(Larus dominicanus)* has been reported at only four localities on the continent of Antarctica, excluding the Palmer Peninsula (Ingham 1962, *Emu* 62: 126-8; Watson *et al.* 1971, Birds of the Antarctic and Subantarctic, Am. Geogr. Soc., Antarct. Map Folio Ser.). Watson *et al.* summarised the locations of all known breeding colonies and sightings of this species. No observations of the Southern Black-backed Gull have been reported for Cape Hallett (72°19'S., 170°13'E.) or the coast of Victoria Land. The southern record for this species is Ross Island (77°S.) (Watson *et al.* 1971).

On 4 November 1971 at 2030 G.M.T., I observed an adult Southern Black-backed Gull in flight over the north beach of the Cape Hallett Adelie Penguin rookery. The bird flew the length (450 m) of the penguin colonies on the beach ridge at a height of about 20 m before leaving to the northeast and the frozen Ross Sea. The duration of the observation was about five minutes.

The nearest known breeding colony of Southern Black-backed Gulls is Macquarie Island (54°S.) (Watson *et al.* 1971), about 1000 nautical miles from Cape Hallett. Two explanations for the presence of this species at Cape Hallett are: (1) that the individual was blown off course by a storm, or (2) that it was searching for food in the penguin colonies. I noted complete cloud cover and high winds (12-25 knots) at Cape Hallett on the day of observation. However, the weather for the preceding week was calm and clear in the Cape Hallett area. Although Southern Black-backed Gulls consume some birds and bird eggs as a part of their normal diet (Fordham 1964), this individual showed little interest in the incubating Adelie Penguins *(Pygoscelis adeliae)*. There are no reports of Southern Black-backed Gulls utilizing Adelie Penguin rookeries as a source of food, although they do take eggs and chicks of other Sphenisciformes (Bagshawe 1938, *Trans. Zool Soc. Lond.* 24: 185-306). Sladen (1958, *Scient. Rep. Falkld. Isl. Depend. Surv.* 17) found Southern Black-backed Gulls nesting within one-half mile of Adelie and Gentoo Penguin *(Pygoscelis papua)*

rookeries with no predation occurring. It is possible that this bird was searching for littoral invertebrates and fish, although the littoral zone at Cape Hallett was completely ice-covered. I saw no other Southern Black-backed Gulls at Cape Hallett during three austral summer seasons (1969-1971).

This observation was made while, sponsored by National Science Foundation Antarctic Research Program Grants (numbers GA13827 and GA23744) awarded to John R. Baker of Iowa State University, I was studying Adelie Penguin incubation behaviour. I thank George Llano, Program Manager for Antarctic research and the U.S. Navy for weather data.

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★

A WHITE HERON NORTH OF CHRISTCHURCH

I have been keeping a fairly consistent record for some time of the numbers of birds appearing on, or in the vicinity of, a new lagoon and area of swampland created as a result of the unusually wet winter of last year (1974). So far, thirteen different species have been observed. The location of this interesting lagoon is on the right hand side of the main north road from Christchurch, approximately 5 km from Saltwater Creek and 3 km from the Leithfield Beach turn-off. It is intersected by a rough causeway, one part being reed-fringed swampland and the other part a clear stretch of water.

On 19 February 1975, in the late afternoon, I was driving past the lagoon keeping a sharp look-out for birds, when my attention was drawn to a large white bird standing in the mud at the edge of the lagoon in the typical attitude of a heron, neck retracted. On closer investigation with the aid of binoculars, I identified the bird as a White Heron *(Egretta alba)*. Access to the causeway can be gained by entry through a farm gate and as I approached this, I noticed a White-faced Heron *(Ardea novaehollandiae)*, standing close to the White Heron; there appeared to be some interaction between the two. I was immediately impressed by the great size of the White Heron in relation to the White-faced but the latter flew off at my approach whereas the White Heron showed no sign of alarm apart from half flying out of the mud on to the causeway about 3 m ahead of me. I was in a superb position for photography and I took particular note of the yellow beak and long dark legs. I detected a slight tinge of buff colour on the breast of the bird but in retrospect this could have been discolouration caused by contact with slime as the heron waded in the water. As I moved still closer, the bird raised its wings into the wind and flew off, circling the swampy area once before alighting on the far bank.

I resolved to take advantage of this rare opportunity to study the White Heron further so I returned to the lagoon the following afternoon. Although I made a careful search, there was no sign of the bird but I found a set of clearly defined footprints in the mud close to the place where I had originally sighted it.

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★

DO MIGRATORY FLOCKS OF GODWITS AND KNOTS BRING OTHER WADERS TO NEW ZEALAND?

Shortly after reading the remarkable note "A pigeon among the shags" (Jenkins & Sibson 1975, *Notornis* 22: 76-77), I came across a discussion by Guy Mountford of other instances of birds being "caught up" in flocks of unrelated species (Mountford 1962, *Portrait of a River.* London: 86). The examples cited concern a Crane with Pelicans, Jackdaw with Lapwings, and Tawny Pipit with Pied Flycatchers, the latter being a flock on migration.

These several examples prompt me to formulate a question which recently came to mind while I was watching the very small numbers of certain waders on the Manukau Harbour, e.g. Golden Plover and Sharp-tailed Sandpiper, in the presence of the vast flocks of Godwit and Knot: is it possible that the shore birds which come to New Zealand as stragglers, or even as regular visitors in small numbers, do so as a result of being caught up in the massive migratory flocks of Godwit and Knot? Admittedly the waders in question are themselves migratory species, but is New Zealand their right destination or have these individuals perhaps "caught the wrong flight"?

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★

BROWN BOOBY IN WELLINGTON HARBOUR

On 24 April 1975, a Brown Booby *(Sula leucogaster plotus)* was sighted by Mr H. Secker perched on a rock 25 m off-shore between Ngauranga and Petone. I saw what was presumably the same bird on 11 May as it flew along the western end of Petone foreshore. The pale belly, uniformly dark plumage and gannet-like dives were observed before the bird and its escort of Black-backed Gulls moved away. For the next month the bird was frequently observed in this part of the harbour. Fortunately for photographers, an old pile some 30 m off-shore at high tide became a favourite perch (Fig. 1). This also provided an opportunity for such diagnostic features as the sharp line of demarcation on the breast and the bluish colour of the bill to be observed (Stein 1955, *Notornis* 6: 157-9).

Mr J. L. Kendrick sighted the bird as far east in the harbour as Mahina Bay on 30 May. The bird returned to Petone foreshore

where it was observed regularly by Mr M. L. Falconer and others until 13 June. The next day Mr B. D. Bell sighted what was probably the same bird off Seatoun, and a week later on 20 June it was discovered dead at Worser Bay by Mrs J. McCredie.

FIGURE 1 — Brown Booby, Petone Beach, Wellington Harbour, May 1975. Photo: B. D. Bell

The bird has been deposited in the National Museum where Mr F. C. Kinsky confirmed its identity and stated that it was a first year bird in full moult into second year plumage (Fig. 2). This is the fourth specimen from New Zealand, the first being shot in Napier Harbour in 1884 (Hamilton 1888, *Trans Proc. N.Z. Inst.* 21: 128-34) and the others found dead at Otaki Beach and Cape Reinga. Reports in *Notornis* indicate that Brown Boobies have occurred fairly regularly in the Hauraki Gulf since 1952, usually associating with gannets. The most southerly sighting is from near Timaru (Pierce 1969, *Notornis* 16: 125).

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FIGURE 2 — Brown Booby, Petone Beach, Wellington Harbour, May 1975. Note sharp line of demarcation on breast and moult condition. Photo: B. D. Bell

REVIEWS

New Zealand Albatrosses and Petrels — an identification guide, by Peter C. Harper and F. C. Kinsky. *Tuatara* 21 (1 & 2): 1-80, text-figs 17, pls 1-21, 1974. $2.50.

This latest of several identification guides to New Zealand petrels is the best and the most ambitious. It aims to provide " seafarers and interested ' landlubbers ' " with an " accurate, easy to use guide to the oceanic birds frequenting New Zealand waters." Actually, it deals only with Procellariiforms, but over a vast area — west to eastern Australia and Tasmania, north to New Caledonia, to 160°W in the Pacific and south to mainland Antarctica. In consequence, tropical gadfly petrels, some not on the New Zealand list, are included. Excluded are four of our rarer stragglers and the South Georgian Diving Petrel.

The contents are very well organised. An introduction gives outlines of typical petrels and their external features, lists " parameters " to look for when describing a petrel and what to do with banded or dead birds. There is a key based on categories reminiscent of those in Alexander's " Birds of the Ocean " which looks workable, but which this reviewer has not had the chance to test at sea. Then follow individual species' descriptions (35 to 330 words long) which include wing spans and body lengths (cm), field characters and modes of flight, distributions and breeding places. There are a number of good photographs, 21 pages of ink drawings, a short bibliography and an index to scientific names.

Much of the text is accurate, adequate for the purpose in hand, and some new information is included. There are very few typographical errors but among minor factual ones are occasional slips of the pen such as the statement that the nominate race of the Herald Petrel breeds in the Caribbean (confusion between Trinidad and South Trinidad Island ?).

Attention needs to be drawn, however, to some more important deficiencies. For example, to describe mollymawks as having black upperwings, backs and tails is misleading. They may appear so at a distance (though the usually grey tails tend to be lost against a dull sea, as mollymawk spotters in the North Atlantic have found) but at closer quarters, as when following ships, most mollymawks are seen to have sooty brown upperwings, grey mantles shading into darker grey or brownish grey on the back. Their tails are grey (Godman 60 years ago described them as " hoary grey ") but often acquire a brownish tinge, presumably with wear.

Harper and Kinsky follow the New Zealand " Checklist " in their nomenclature, hence the peculiar designation of the two giant petrels as subspecies despite sympatric breeding on at least three widely separated places. The statement that these birds cannot be identified at sea is not entirely correct, and the authors' descriptions are inaccurate.

Under good viewing conditions many adults can be identified using the characters set out by Bourne & Warham in 1966 (*Ardea* 54: 45 - 67) which have been substantiated by later work. Adult Northern Giant Petrels typically have dark grey or greyish-brown plumage, often with pale edges to the contour feathers, pale cheeks and foreheads and may be freckled whitish and grey on head, neck, throat and chest. Birds in this rather dark plumage with grey eyes are almost certainly *halli* because most, perhaps all, *giganteus* in similar plumage are dark eyed. Two of the birds in Figure 9 of the present booklet appear to be grey eyed and look like typical *halli* such as one sees in Cook Strait. The bill of *halli* is horn brown in colour, with a reddish or pinkish tinge along the ridge of the culmen and the upper nail and New Zealand birds often have dark marks on the inner aspects of both nails. Apart from white-phase examples, adult Southern Giant Petrels tend to be white headed and white necked, and *contra* Harper & Kinsky, often breed when brown eyed. Their bills are horn coloured with the culmen, and nails tinged greenish and lacking dark marks. These characters can often be picked out in adults although as yet it seems impossible to separate the dark-plumaged juveniles unless the bill tips are very clearly seen.

A major disappointment concerns the quality of some of the sketches. The outlines and " sit " of the birds are generally good, showing standardised upper and (often) lower views with tails closed and those of the gadfly petrels in particular are an improvement on sketches in previous guides. However, the shading is often crude: at the size of reproduction used, more precise detail and tonal gradation could have been shown. For example, Buller's Mollymawk on plate 5 appears to have a darker tail and back than wings whereas the reverse is true. The black trailing edge of the underwing is also too narrow and is much too narrow in the companion sketch of the Yellow-nosed Mollymawk, although the text states correctly that the underwings of these two birds are similar. In plate 6 the nigger-brown head of the Light-mantled Sooty Albatross is exaggerated, contrasting excessively with the back, and although the pale bill sulcus is shown, the broken eye-ring that forms an even more useful field character, is not. Few, if any *halli* giant petrels have white heads and faces as in sketch 11c. Again, the Grey Petrel appears to be black capped and although the dark undertail is shown and compares with the white undertail of the White-headed Petrel on the same page, this useful difference for separating the species even at a distance is not referred to in the text. Despite Peter Harper's expertise with this group, only three prions are figured: we might perhaps have expected sketches at least of the heads of the others, particularly as reference is made to a diagnostic white facial pattern in *Pachyptila belcheri.*

This, then, is not yet the definitive field guide to our petrels, but it does represent a distinct step forward and should certainly be in the library of all Australasian sea-bird enthusiasts.

J. W.

Scenic Reserves of Canterbury. By L. W. McCaskill for the Department of Lands and Survey. 36 pp., illus. Wellington: Government Printer, 1974. $1.35.

In 1972, the Lands & Survey produced the first of a series of reports made by Mr Geoff. Kelly ennumerating and describing the flora and fauna of the reserve lands of New Zealand, done as part of the New Zealand contribution to the International Biological Programme, a biological survey of reserves organised by the Botany Division of the DSIR. The volume on Canterbury runs to 390 pages of text with maps and containing much new information. What a fine basis this work seemed to provide for detailed ornithological studies on restricted habitats! Unfortunately, only 90 copies of this report were produced; their distribution was, accordingly, restricted and their very existence is little known. It has always seemed to me that if such an important job is worth doing, it is worth doing well; in other words, let it be known to those who would make good use of it.

Happily, my feelings are mollified by the appearance of Mr Lance McCaskill's excellently-written and copiously-illustrated booklet on the reserves of Canterbury, a district important and of very great interest ornithologically. The great tradition of T. H. Potts, W. W. Smith, E. F. Stead and others less prolific in their writings, has not been carried on in recent years. It was, for example, disappointing to have the bird sections of *The Natural History of Canterbury,* edited by Prof. G. A. Knox in 1969, written by relative newcomers to the Canterbury scene and not by those with the deep background that might have been more revealing in comparisons of times past and times present. A plethora of bird papers now issues from the Zoology Department of the University of Canterbury but these do not paint the picture of the variety and significance of the birds and the habitats in the Canterbury Land District. The appearance of this useful booklet might well serve to re-orientate ornithological studies towards habitats as such.

Mr McCaskill, prominent in the OSNZ at its foundation, has been deeply involved in conservation and the environment from long before these words achieved the prominence they do in to-day's literature. A tribute in the Christchurch *Press* of 27 December 1974 (p. 8) says of him: " It seems that since he retired in 1965 Mr L. W. McCaskill has done as much work as many people do in a life time, and that in spite of the fact that early in 1971 he was smitten by a stroke. He has carried into his retirement the same dynamic qualities and energy which characterised his work as an agricultural instructor, agricultural teacher, training college lecturer, lecturer at Lincoln College — he ended as associate professor and head of the rural education department — and then as the first director of the Tussock Grasslands and Mountain Lands Institute." Those who know Mr McCaskill or who have read his book on Molesworth Station and that on the history of soil conservation in New Zealand, *Hold This Land* (a delightfully modest account of much of his own drive and achievements in this field), need to be told no more. Those who want to know further of the accomplishments of this remarkable man should read the article in *The Press* in their public library. Mr McCaskill,

at any rate, knows his Canterbury and his birds and the booklet reflects this experience and life-long interest.

The Canterbury booklet is the first of a series of 12 covering the scenic reserves of the whole of New Zealand. Copy for the last of them went to the printer in August 1974 so those of us who have interests elsewhere will not have too long to wait.

Mr McCaskill's major task since his retirement in 1965 was to carry out a survey of all the reserves from Cape Reinga to Stewart Island. Between 1965 and 1971, accompanied by officers from the Lands & Survey and from the Forest Service, he visited 691 of the 960 reserves and reported on them. In 1972, the then Minister of Lands, Mr Duncan MacIntyre, asked him to produce his results in book form for public use, and this is the result.

The booklet begins with a discussion of scenic reserves in general, their purpose and their classification, introduces the scenic reserves of Canterbury and then describes 56 different reserves, ranging in nature from " Scenic A " (" Reserves with scenic values in a panoramic sense, viewed in the main from the outside, and not used actively by the public ") through categories " B," " Conservation " to the rather limited number of " Scientific " reserves " where preservation for scientific study of plant and animal communities, soil types, and geological features, is the primary concern " in addition to several " Reserves for the Preservation of Flora and Fauna " for entry to which a permit is required from the Commissioner of Crown Lands. Under each reserve is given its area, date of reservation, classification, geographical and ecological description and notes on birds and plants of special interest.

Although only 0.4% (15,268 in 3,620,138 hectares) of the Canterbury Land District consists of reserves, the far-sighted policy of the Lands & Survey Department in reserving and protecting these areas of scenic and scientific value has been rewarding. In addition, the 210,680 ha of State indigenous forest and 40,462 ha of State exotic forest brings up the total area of " reserved " land to just over 11% of the land district.

It should be noted, however, as Mr McCaskill says — " Apart from the Lewis Pass reserves and Peel Forest, most of the individual areas of bush in scenic reserves are extremely small and consequently very susceptible to damage by fire, stock, noxious animals, or over-use by people. As some of the lowland podocarp remnants in particular can be looked on as museum pieces, to be jealously guarded, it may be necessary before very long to consider restrictions on their use for recreation."

The message is clear. While, undoubtedly, we should have concern for our West Coast beech forests and view the introduction of exotics with scientifically (and perhaps also aesthetically) appropriate caution, we should accept Mr McCaskill's first booklet (and the other 11 in due course) as a challenge to look closely at what is on our own backdoor step, record what is there and consider its future before progress, neglect, lack of interest or over-use, any of the many ecological hazards, removes it from us. Mr McCaskill, as on many occasions during his distinguished career, has pointed the way.

E. W. D.

Coastal Ecology and Land Use at Aramoana. By G. E. Hamel & G. A. M. Barr. Published by Ecology Action (Otago). Pp. x + 1-46, 26 figs, 13 tables. 1974. Copies available from Mrs G. E. Hamel, Dept of Anthropology, University of Otago, P.O. Box 56, Dunedin, or from Mr G. A. M. Barr, Biology Dept, Bayfield High School, Shore St, Dunedin.

Ecological literature is now so replete with reports of one kind and another that, to adapt a delightful phrase taught me by Mr R. B. Sibson, it is becoming increasingly difficult to tell the red meat from the skilly. Appearance can be deceptive. Dingy, mimeographed sheets stapled together and produced without regard for anything but the present, can be found to tell of work more soundly based, less presumptuous and far more enlightening than that in many of the glossy-covered, elaborately-bound and immaculately-typed consultants' reports often costing thousands of dollars which seem designed to satisfy the ad hoc requirements of local authorities and ministerial inquiry. Some of these are profoundly shallow (a not improbable description) and one wonders who is doing the wool-pulling over whose eyes. It is a pleasure, therefore, to stumble over a not-too-conspicuously produced report compiled, in part, by one of our well-known Otago members of the OSNZ. I say " stumbled " because this is what I did. An introductory note on the second page states: " This report is intended for a general audience. Most of the information is directed towards a concerned public but we hope sufficient detail has been included to satisfy other ecologists." How does one come to know of such reports ? Dissemination of knowledge is a primary concern of all science. This report is worth a dozen of the superficial consultants' efforts which I have seen, but will it be read by the " other ecologists " and that " general audience " who will profit from its conclusions and the lessons of wide application which it demonstrates ? A copy sent for review to a journal read by a goodly number of the " concerned public " would have helped but my stumble makes up for it.

The authors tell us that this " survey was initiated by a concern for the possible loss of a rare and valuable resource, the intertidal flats at Aramoana, Otago Harbour, if a proposed aluminium smelter and deep water wharf were constructed on the adjacent dunes." They continue — " It was not possible to carry out the complete ecological survey which such a situation requires and a full Environmental Impact Report for any industrial development in the area will be needed. This pilot study should indicate the high biological productivity and diversity of the area and provide a baseline for future comparative studies." The authors will be found to be quite modest in rating their own achievements.

The present report describes in detail the physical environment, the invertebrate fauna, the plant species with special attention to zonation and species diversity and associations between species. Bird-life is well dealt with by Mrs Hamel outlining the daily routine of the major species, feeding habits and seasonal cycles. Gill Hamel and Gordon Barr have made a more thorough evaluation of the tidal flats at the entrance to Otago Harbour during one year, 1973, than one might believe possible in so short a time. True, 15 years of bird observations by Otago members of the OSNZ have been incorporated

but this is how it should be. Published work and bottom drawers should be searched and used.

In particular, these intertidal flats are discussed in relation to other habitats. The discussion and summary are well worth reading and pondering upon. The recommendations for further study could well be taken as guide lines for the investigation of any threatened or vulnerable area along the New Zealand coastline. The section of the " abstract " dealing with the ecology of the 31 species of birds is worth repeating here:

" The high tide bird roosts on the sand bars and salt-marsh of the eastern area are the major safe roosts for all the wader species in the harbour, particularly during spring high tides. Though the Aramoana flats constitute only about 10% of the intertidal flats between Waitati Bay and Hoopers Inlet, they carry 1-30% of the Pied stilt flocks, 25% of the Pied oystercatcher flocks, about 40-50% of the Godwit flocks and 60-70% of the Banded dotterel flocks for these areas. Most of the rare Northern Hemisphere waders recorded in East Otago have been found at Aramoana, and it is the only area where one or more of the rarer species can be seen regularly. Along the east coast of the South Island, Aramoana and the neighbouring inlets provide the only large areas of wader habitat between Invercargill and Christchurch. There are no breeding colonies of sea birds on the flats, but small numbers of Pied stilts, Spur-winged plovers, ducks and pukekos breed in the flax and shrubland above high tide. The Aramoana flats provide food and safe roosting areas for large flocks of Pied oystercatchers and safe roosting for Black-backed gulls, both of which are predators of insect populations in inland areas during summer."

As Professor Alan Mark concludes in his Preface, " The authors use the information available to put the ecological features of Aramoana into a New Zealand perspective. They also discuss the much more difficult aspect of assessing possible losses in relation to likely profits from industrial development. Undoubtedly such a value judgement must be made at some stage with Aramoana. Hopefully no person will attempt such a judgement without understanding and appreciating the valuable information contained in this report."

I echo his sentiments and whole-heartedly commend this report to everyone concerned with the conflict of needs and multiple usage of our valuable coastline. Show it to your local body councillors, regional authority members or place it in the hands of whoever must make the ultimate decisions on our behalf. It is a fine example for all.

E. W. D.

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The World of an Estuary. By Heather Angel. Faber & Faber, London. U.K. £1.95.

Bird-watchers have been on the prowl in estuaries ever since ornithology proper began; a fact which is acknowledged by the authoress when she asserts that these " coastal habitats have been ignored by most naturalists — with the exception of bird-watchers." Now under heavy pressure from pollution, industrialisation and the claims of human recreation, estuaries are very much in the news. It was fitting that the value of estuaries as habitats for birds, both resident

and migratory, was a topic for discussion at the first Summer School of Ornithology held near Nelson in January 1975; and when the N.Z. Ecological Society held its annual conference in August of this year, it is significant that one day was devoted to a joint symposium with the N.Z. Marine Sciences Society on the " Estuarine Environment."

Heather Angel sets out to explain in simple terms what an estuary is, the exciting and constantly changing zone where fresh and tidal water meet. Although she is concerned mainly with the estuaries of Britain, with an understandable bias towards her own special stamping ground, the great Severn estuary with its sweeping tidal bore, her text is highly relevant to New Zealand and is calculated to make the local estuary-watcher realise how little is known and how much there is to learn about what goes on below the surface of land and water where rivers flow out to the sea.

Logically and naturally the eight chapters examine different aspects of estuarine biology, e.g. the problems of survival and adaptation, the fascinating flora of salt marshes, marine invertebrates, fish, birds, man. The chapter on birds, of course, can only touch the fringe of a vast subject; but it is worth noting that the British counterpart of our South Island Pied Oystercatcher " eats approximately its own weight each day in mussel or cockle flesh."

This is a thoroughly workmanlike book, admirably produced and set in an attractive type. Furthermore, it is aptly illustrated with photographs, elegant sketches and imaginative diagrams, which ought to stimulate many young zoologists to further study. The long New Zealand coast is blessed with a wealth of estuaries. Like Cleopatra, they have infinite variety which custom cannot stale. Perhaps the time of their scientific neglect is coming to an end. It is tempting to paraphrase Pliny and say hopefully, " *Ex aestuario semper aliquid novi.*"

R. B. S.

ABOUT OUR AUTHORS

GEOFFREY R. F. HICKS was introduced to readers in the March 1974 issue of *Notornis.*

H. PAULINE McCOLL came to New Zealand in 1969 after obtaining a Masters degree from the University of Wales to take up a position as a soil zoologist at Soil Bureau, DSIR, Taita. Her principle research interests are the taxonomy of osoriine staphylinid beetles, and the invertebrate fauna of forest floors, particularly *Nothofagus* forests. She has recently returned from an extensive collecting trip to Africa.

MICHAEL J. MEADS was educated in Australia and came to New Zealand in 1954. He was involved in a stud stock-breeding programme in the Marton area before joining Ecology Division, DSIR, where he is at present working on opossum defoliation of northern rata, seasonal variation and relative abundance of Lepidoptera, and on the fauna of differing forest litter types. His hobby interests are directed towards natural sciences, principally entomology and herpetology.

GRAHAM S. HARDY is a lecturer in Vertebrate Zoology at Victoria University. His research interests for several years have been in herpetology and he is currently completing a Ph.D. thesis on skink systematics with particular emphasis on blood protein electrophoresis. He has had considerable collecting experience on many of the offshore islands of the Hauraki Gulf and Cook Strait.

ROSEMARY J. ROSER has now been at Victoria University for 4 years and last year gained a B.Sc.(Hons.) degree which included research into the feeding habits of the introduced ferret at Pukepuke Lagoon on the North Island West Coast. She is considering starting a Ph.D. later this year on aspects of the biology of the stoat.

CHRISTOPH IMBODEN has had ornithology as a hobby from schooldays. He graduated from the University of Basel, Switzerland, with a Ph.D. thesis on the migration, dispersal, and breeding period of the European Lapwing, *Vanellus vanellus L.* This was the first analysis of banding recoveries based on the new Euring system and carried out with a computer. He spent two years in New Zealand for further studies in ecology with a fellowship from the Swiss government, the first year with Ecology Division, DSIR, and the second year with the Wildlife Service. Now back in Switzerland with the Swiss League for Conservation of Nature, he is working on wetland habitats. His main interests are management and conservation of nature and population ecology.

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