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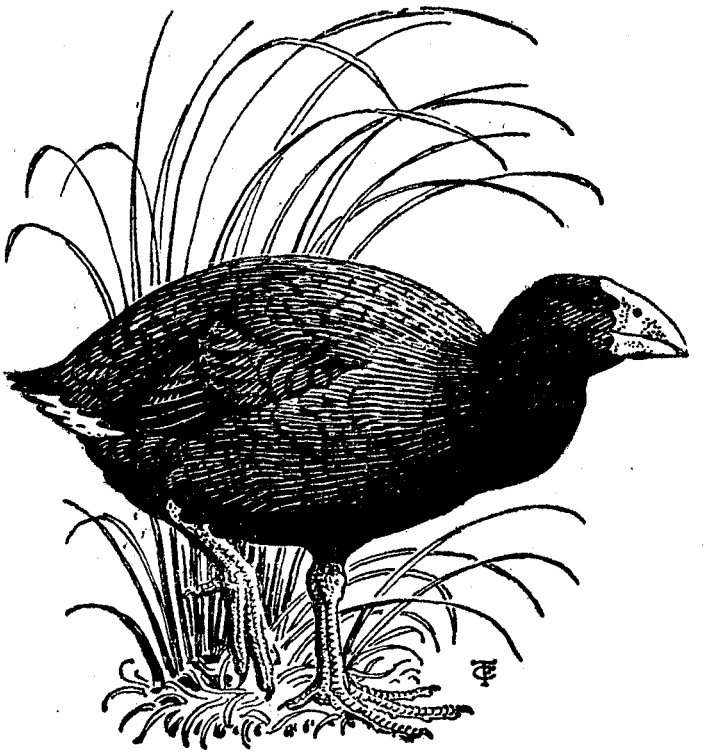
Journal of the Ornithological Society of New Zealand



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VOLUME 27 PART 4 DECEMBER, 1980

HABITATS AND FEEDING OF THE AUCKLAND ISLAND BANDED DOTTEREL (*Charadrius bicinctus exilis* Falla 1978) IN AUTUMN

By R. J. PIERCE

ABSTRACT

The feeding behaviour of the Auckland Island Banded Dotterel was studied at Enderby Island for 12 days in April 1980. Up to 155 dotterels were at Derry Castle Reef, foraging along the rocky shore, frequenting several habitats from the maritime zone to the sublittoral fringe at low tide. The midlittoral zone was the source of the greatest biomass of food and may be even more important in the future as the maritime sward regenerates to taller denser vegetation. Only 15-20% of daylight time was spent foraging, with peaks at early morning, noon and evening. Amphipods up to 2 cm long were staple diet. They were obtained mainly by pecking in algae (seaweed) and in rock pools. The other prey was large also, comprising polychaetes, oligochaetes, isopods, crabs, insects and spiders. Probably most or all of the population winters at Derry Castle Reef.

INTRODUCTION

Charadrius bicinctus exilis is confined to the Auckland Islands, where it breeds only on the higher hills of Auckland, Adams and possibly Enderby Islands (Falla 1978). After breeding, most move to Enderby Island where they apparently winter mainly at Derry Castle Reef, a basaltic peninsula 300 x 300 m on the north coast of the island (Fig. 1). Compared to *C. b. bicinctus* on the New Zealand mainland, *C. b. exilis* is very plump, weighing much more than *C. b. bicinctus:* four males collected during previous expeditions (J. A. Bartle, pers. comm.) weighed 77.5-88.7 g (average 81.8 g) compared to 53-67 g

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(57.7 g) for six male *C. b. bicinctus* weighed in November (R. J. Pierce, unpub. data). Of the conventional body measurements, only the tarsus and toe are significantly longer in *C. b. exilis.*

Only fragmentary data have been available on the ecology of the subspecies. At the invitation of the New Zealand Wildlife Service, I studied the feeding of *C. b. exilis* on Enderby Island on 2-13 April 1980. The aims of my study were to establish (a) which habitats were being used by dotterels at that time of year, (b) what they were eating, and (c) the feeding methods being used.

METHODS

Most work was carried out at Derry Castle Reef where all dotterel activity appeared to centre. All habitats at the reef were described qualitatively, but those most frequented by dotterels were described quantitatively also by using a transect system. In each of these habitats eight 25-metre long transects were established at 5-metre intervals and at right angles to the shore. The linear proportions of each plant species, pools, exposed rock, and so on were measured along each transect. In each habitat four or eight 10 x 10 cm quadrats were selected as representative of the feeding stations most used by dotterels, and the invertebrates in each were collected by hand or, in pools, by a small hand net with 0.5 mm mesh. On five days I recorded the habitats being used by dotterels by walking round the reef at half-hour intervals and noting the site and activity of each bird when I first saw it. Between counts and on the other days I made notes on general behaviour of the dotterels and quantitative notes on foraging. Food was recorded by direct observation — suitable for larger prey only — and by faecal analysis, which recorded the presence only of those animals with indigestible hard parts. Peck rate and search rate (number of steps per unit time) were timed in 30-second periods using a stopwatch. All observations were made through 8 x 40 binoculars at ranges of 15-50 m. The weather was mainly fine during the study period.

RESULTS

During the study period dotterel numbers remained relatively constant at 148-155 birds, with two maximum counts of 155. Only five birds were seen away from Derry Castle Reef, two in the sward to the west and three at Sandy Bay on the south coast of Enderby Island. Unlike *C. b. bicinctus* at this time of year, plumages were relatively uniform and I was unable to distinguish adults from juveniles.

HABITATS AT DERRY CASTLE REEF

Sward: A tongue of closely cropped sward occupying over 18 000 m^2 protruding into the middle of the peninsula (Fig. 3) from the rolling hillocks to the south. The main plants were *Scirpus, Colobanthus, Tillaea* and *Plantago.*

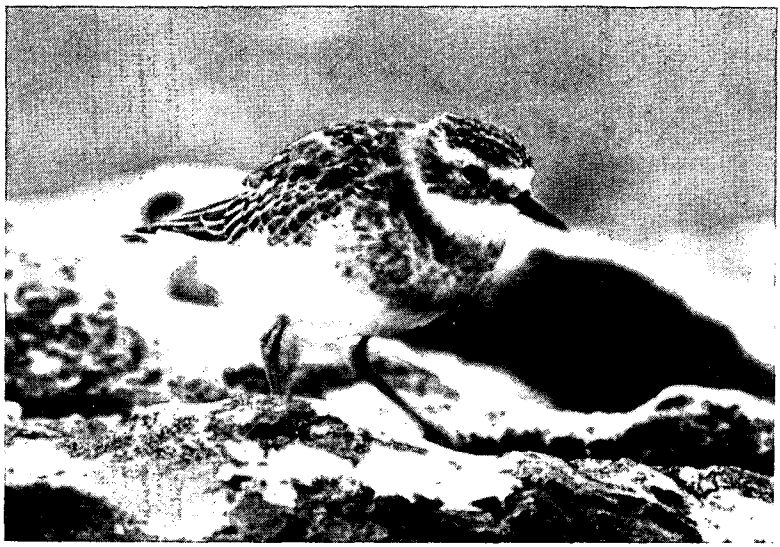

FIGURE 2 — Auckland Island Banded Dotterel.

Mean high water (MHW) kelp debris: A narrow belt of tidal debris (mainly *Durvillea*) covering less than 1000 m^2.

Littoral fringe shingle: An extensive area (11 000 m^2) of unsorted shingle and stones.

Littoral fringe boulders: A small area (1000 m^2) of large boulders between the littoral fringe shingle and littoral fringe shelf.

Littoral fringe shelf: The most extensive habitat (30 000 m^2) comprising elevated basaltic benches dotted with many saltwater pools. Vegetation was scarce and comprised mainly *Tillaea.*

Midlittoral stones: A small area (5000 m^2 at low tide) of stones in the south-east corner of the reef. The stones and pools were mainly covered with dense growths of *Xiphophora* and *Ulva* with fronds of *Durvillea* extending shorewards from the sublittoral fringe.

Midlittoral shelf: Flat basaltic benches covering 13 000 m^2 at low tide. Many small pools and extensive algal growths, especially of *Durvillea, Corallina, Gigartina* and *Porphyra.* The calm seas throughout the study period resulted in at least part of the two mid-littoral zones being continuously exposed, even at high tide (Fig. 4).

Sublittoral fringe kelp: A broad belt of *Durvillea* fringing the reef and covering about 11 000 m^2 at low tide.

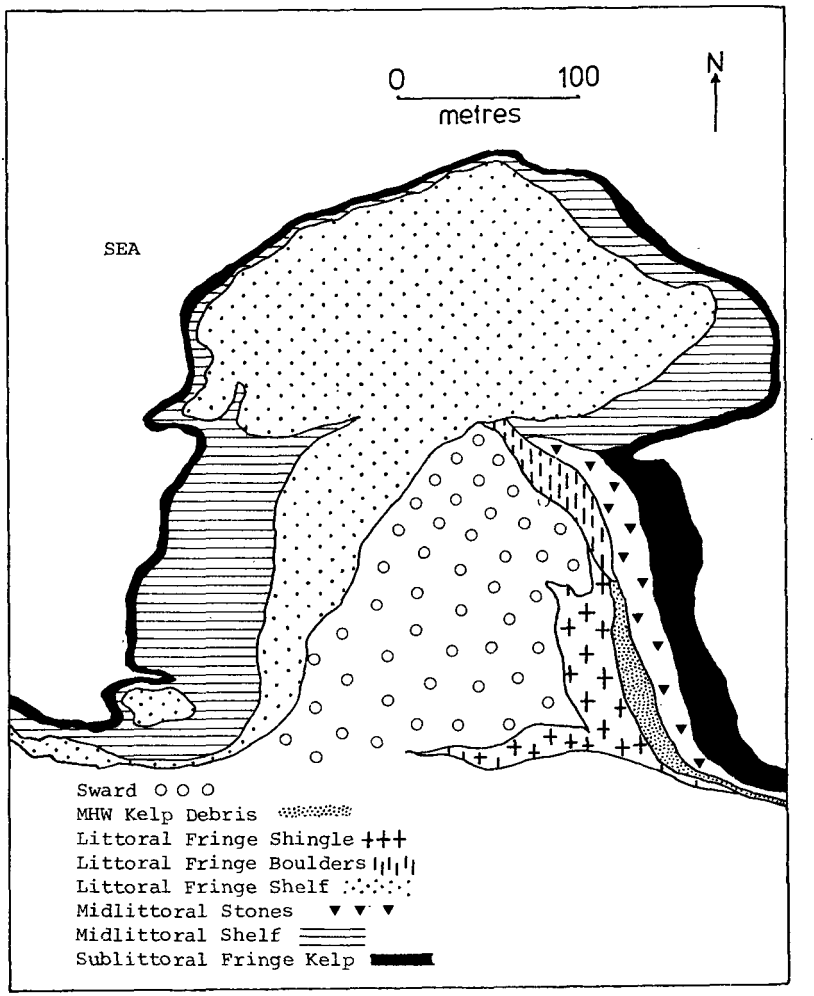

FIGURE 3 — Map of habitats at Derry Castle Reef.

INVERTEBRATE FAUNA

The invertebrate fauna of Derry Castle Reef was dominated by amphipods, which occurred in all eight habitats. The other invertebrate groups were, with preferred habitat in parentheses, polychaetes (both midlittoral habitats), oligochaetes (sward), copepods (littoral fringe shelf), isopods (both midlittoral habitats), decapods or crabs (both midlittoral habitats), insects (sward and all littoral fringe habitats),

arachnids or spiders (sward and littoral fringe shingle), molluscs (all midlittoral habitats) and echinoderms or starfish (midlittoral stones).

FEEDING BEHAVIOUR

Dotterel daily routine: From the half-hourly counts Banded Dotterels were calculated as spending 15-20% of daylight time foraging and the remaining time roosting or preening. Three peaks in foraging occurred — early morning, noon and evening (Fig. 5) with less than half the birds foraging at any one time. These peaks were regular, regardless of tidal changes during the 12 days.

Some dotterels continued feeding after dark, but the extent to which this occurred was not studied. Birds roosted in loose to moderately compact flocks in a small area of the littoral fringe shingle and to a lesser extent on the adjacent sward.

Habitats used: Banded Dotterels showed a marked preference for three habitats — midlittoral shelf, littoral fringe shelf and maritime sward, which together accounted for 83% of observations. Of these three preferred habitats, the midlittoral shelf was used all day, the littoral fringe shelf only in the early morning and evening, and the sward only in the early morning and, especially, around noon (Fig. 5). During the mid-morning and mid-afternoon almost all foraging that occurred was in the two midlittoral habitats. The changing tide level did not affect the use of these habitats.

FIGURE 4 — Part of the midlittoral shelf at flood tide.

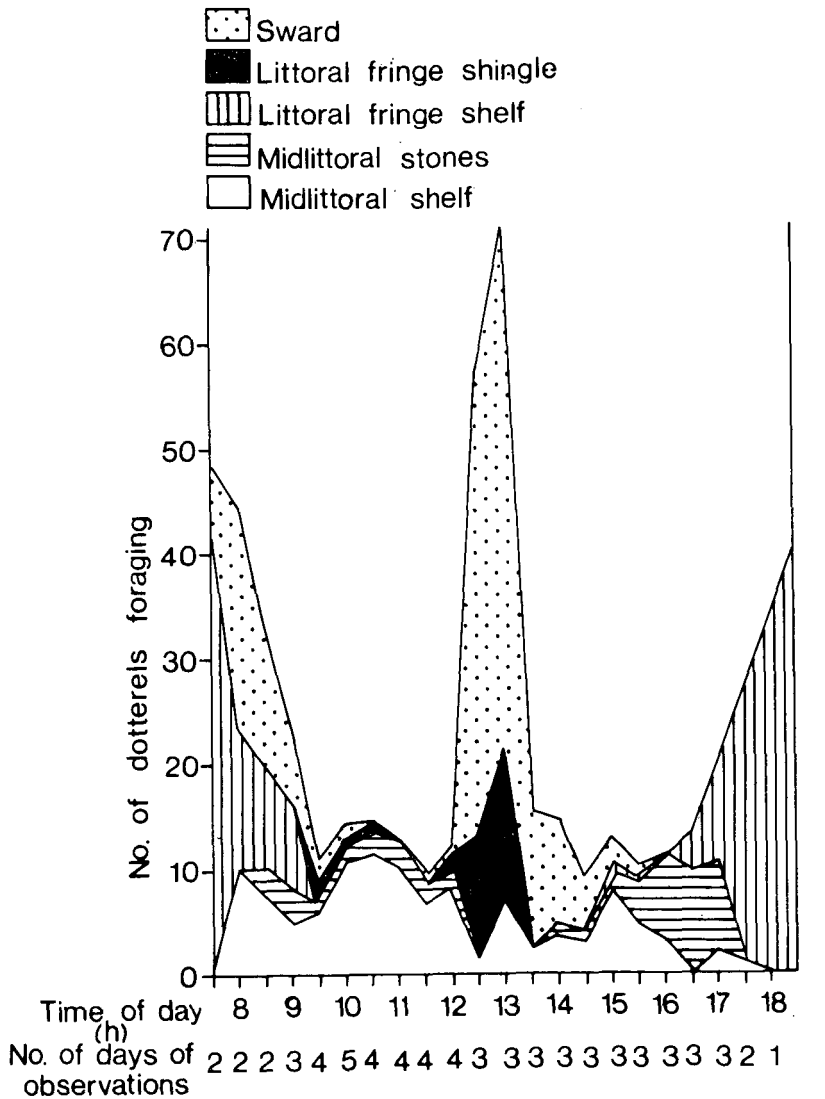

FIGURE 5 — Daily feeding routine of dotterels at Derry Castle Reef. The graph records average numbers feeding in each habitat.

TABLE 1 — Prey of Banded Dotterels at Derry Castle Reef, April 1980.

Prey	Method of Detection - seen eaten (e) - in faeces (f)	Estimate of Importance in Diet a) Numbers b) Energy value * = low-moderate ** = high	
Polychaeta	e	*	**
Oligochaeta	e	*	**
Isopoda (*Exosphaeroma*)	e	*	*
Amphipoda			
Talitridae	ef	**	**
Gammaridae	e	*	*
Oedicerotidae	f	**	**
Decapoda (*Halicarcinus*)	e	*	**
Insecta (Coelopidae)	e	*	*
Arachnida (Araneidae)	e	*	*

Food: A variety of invertebrates was preyed on by dotterels at the reef, but no vegetable matter. One bird picked up a berry of *Nertera depressa,* a common sward food of Auckland Island Pipits *(Anthus novaeseelandiae aucklandicus),* but it was soon dropped. However, a specimen collected by E. G. Turbott in 1944 contained many small seeds (J. A. Bartle, pers. comm.). Table 1 lists the invertebrates recorded as dotterel prey and their importance in the diet, estimated in two ways, by their numerical importance and by their energy value.

Amphipods were the staple diet of dotterels in midlittoral and littoral fringe habitats. Only in kelp debris and sward did other invertebrates such as kelpflies and earthworms become more important. Most amphipods taken were small oedicerotids 2-5 mm long, but the largest *Talorchestia* and gammarids (often over 20 mm) were regularly caught, some taking up to 15 seconds to be consumed. *Halicarcinus* and polychaetes were larger, than the amphipods and usually took 15-30 seconds to be consumed. The isopod *Exosphaeroma* was seen taken once. The few birds that foraged along the MHW kelp debris appeared to take mainly kelpflies.

Feeding stations: In the midlittoral shelf dotterels obtained most of their food from the *Corallina* turf (Fig. 6), even though the turf occupied only about 12% of the shelf (Table 2). At low and ebb tides about 75% of pecks and probes were directed at *Corallina* turf, undoubtedly because of the high density of amphipods and other accessible prey (Table 3). Only the *Durvillea* had a density of amphipods comparable to that of the *Corallina,* but there the animals

were hidden beneath large fronds. The *Durvillea* was also prone to sudden wave incursions, of which dotterels, unlike Turnstones *(Arenaria interpres)* were noticeably wary. As the tide came in, *Corallina* was still the preferred feeding station, but, presumably because of flooding of part of the *Corallina* beds, the proportion of feeding increased in algae on or in water and in pools without algal cover (Table 2).

In the midlittoral stony shore there was almost no *Corallina,* and so dotterels foraged in the *Ulva* and *Xiphophora* beds with a significant preference for *Ulva* ($X^2 = 255.7$, 1 d.f., $p < 0.001$); 48% of bill actions occurred in *Ulva* beds, which covered only 7% of the midlittoral stony habitat (Table 4). The invertebrate fauna of *Ulva* in this habitat was considerably richer than in *Ulva* in the midlittoral shelf.

The preferred feeding station in the littoral fringe shelf was pools, which accounted for 58% of pecks and probes in that habitat (Table 5). The selection of pools as a source of food may have been due to the absence of the algae that support most prey in midlittoral areas. Amphipods were common in the pools and were the main or only prey. Birds tended to seek prey by walking about the perimeter of pools or in very shallow water. Presumably this behaviour reduced ripples which may disturb prey and impair visibility. Once they saw prey, however, the dotterels would walk into the pools, sometimes up to belly depth, and with their long legs, they could feed well out

FIGURE 6 — The midlittoral shelf with pools (foreground), **Corallina** (pale algae), **Gigartina** (dark algae), and **Durvillea** (background).

TABLE 2 — Dotterel feeding stations in the midlittoral shelf.

Feeding Station	Linear % at low tide	% Use Low tide (n=291)	Ebb tide (n=111)	High tide (n=190)
Durvillea	36	0.3	-	-
Xiphophora	<1	0.3	-	-
Pachymenia	2	-	-	-
Gigartina	4	0.3	2.7	1.6
Corallina	12	75.3	74.8	42.0
Algae on water	2	8.6	10.8	31.1
Ulva	1	0.6	-	-
Codium	1	-	-	-
Porhyra	4	-	-	-
Rock	27	0.7	-	2.6
Shallow pools	2	13.9	11.7	22.7
Deep pools (> 5 cm deep)	9	-	-	-
Total	100	100	100	100

The % of the linear of transects occupied by each algal species, etc., is given in column 2. n is the number of observations of birds engaged in pecking or probing.

into the pools. Many prey were obtained from the water's edge and from crevices, especially moss-filled crevices.

In the littoral fringe shingle all pecks and probes (n=154) were directed at the shingle, whereas in the sward almost all (94.5% of 204 observations) were directed at the grass, and the other 5.5% at debris, lichen and the bases of stones.

Feeding methods: Banded Dotterels usually forage by a " run-stop-peck " or " walk-stop-peck " sequence covering moderate to large distances in a short time. Whenever a bird stops, prey is normally taken within 10-15 cm. Occasionally, the birds at Derry Castle Reef ran to larger more distant prey, such as crabs, which had obviously been seen before or early in the run. Search rates in the sward and shingle were very high, averaging 79 and 78 steps per 30 seconds respectively (n=51). In the midlittoral shelf and midlittoral stones search rates averaged only 44 and 41 steps per 30 seconds respectively (n=63), possibly reflecting the higher densities of prey there and/or a more methodical or intensive searching.

TABLE 3 — Invertebrates of various feeding stations in the midlittoral shelf. Average numbers per 100 cm².

Feeding Station	n	Amphipoda	Isopoda	*Halicarcinus*	Polychaeta
Durvillea	4	31 (27.7)	3	-	-
Gigartina	4	4	-	-	<1
Corallina	8	28 (12.5)	2	1	3
Ulva	4	8	1	<1	1
Rock	4	3	-	-	-
Pools	4	√	√	√	√

n is the number of quadrats examined per feeding station. Standard deviations are given in parentheses.

TABLE 4 — Dotterel feeding stations in the midlittoral stones.

Feeding Station	Linear % at low tide	% use at low/ebb tide n=274
Durvillea	35	1.1
Xiphophora	35	13.9
Red Algae	<1	1.1
Codium	2	3.3
Ulva	7	47.8
Algae on water	6	17.5
Rock	3	3.6
Shallow pools	11	11.7
Deep pools	1	-
Total	100	100

Pecking was the usual bill action in all habitats. Probing, the only other method used, figured prominently in only the sward and littoral fringe shelf, where it accounted for 38% and 19% of bill actions respectively. In the sward a few birds were seen foot-trembling for several minutes, apparently to disturb earthworms, many of which were caught during the process. This behaviour has been described for other New Zealand plovers (Heather 1977, Phillips 1977) but it probably occurs rarely in *C. b. bicinctus,* having been recorded once only (Dunn 1975).

Average peck rates ranged from 4.3 per 30 s in the sward and littoral fringe shelf to 5.8 per 30 s in the midlittoral stones. Peck rates in the midlittoral stones were significantly higher than in all other habitats ($p < 0.01$, Student's t-test), possibly because of a relatively high density and availability of prey. The difference was not a result of the birds taking only small and abundant prey because they regularly caught and consumed medium to large polychaetes, gammarids and *Halicarcinus.* A few birds when probing in crevices of the littoral fringe shelf had peck rates of up to 15 per 30 s.

Success rate was difficult to observe except at close quarters. The limited data collected suggested that about two out of three bill actions were successful in the shingle and midlittoral habitats, and about one out of two in the littoral fringe shelf and sward.

TABLE 5 — Dotterel feeding stations in the littoral fringe shelf.

Feeding Station	Linear %	% use n=221
Bare rock	65	5.9
Crevice	8	18.1
Tillaea	<1	0.9
Debris/stones	1	3.2
Water edge	7	14.0
Shallow pools		57.9
Deep pools	19	-
Total	100	100

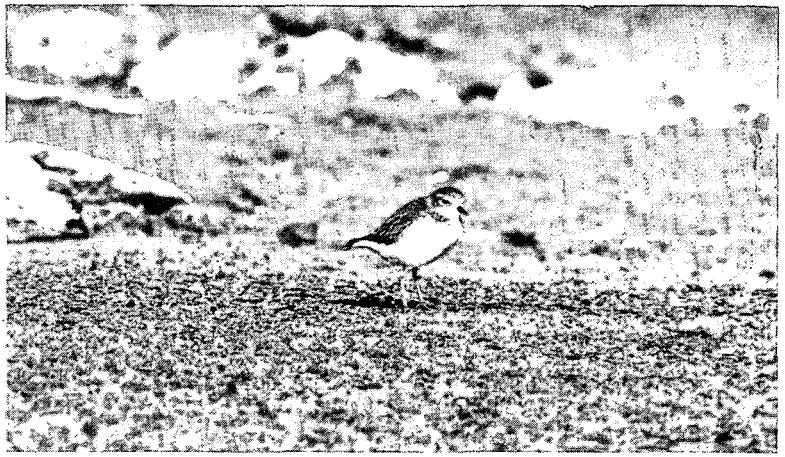

FIGURE 7 — Auckland Island Banded Dotterel foraging in sward.

INTERACTIONS WITH OTHER BIRDS

Although the Banded Dotterels were gregarious when roosting, they fed mainly alone and would often defend small areas for up to several hours. If few birds were foraging, defended areas were comparatively large (up to 2000 m^2), but if more birds arrived the defended areas became smaller. In the sward, dotterels usually foraged in very loose flocks, but individual distances were vigorously defended.

The reef was also frequented by up to 100 Turnstones, three Grey-tailed Tattlers *(Tringa brevipes)* and one *C. b. bicinctus.* The last two species roosted with the dotterels and foraged with them along the midlittoral zone, although the lone *C. b. bicinctus* also foraged in the shingle and sward. Turnstones roosted mainly in the littoral fringe, where they often foraged at high tide, but they foraged mostly in the midlittoral zone and did not visit the sward. Banded Dotterels avoided Turnstones, which on several occasions chased them away. The midlittoral and littoral fringe prey of both species overlapped, but the Turnstones flicked through the algae to disturb their prey rather than searching by visual means only, as the dotterels were doing.

Roosting flocks of dotterels, and less often foraging dotterels, were scared into flight by Southern Great Skuas *(Stercorarius skua lonnbergi)*, but I did not see skuas attack any waders. Adult and juvenile Black-backed Gulls *(Larus dominicanus)*, Red-billed Gulls *(L. novaehollandiae)* and Antarctic Terns *(Sterna vittata)* prompted a head-bowed/tail-in-air posture from foraging dotterels as they flew nearby. This posture has been recorded in the Shore Plover, *Thinornis novaeseelandiae* (Phillips 1977), the Black-fronted Dotterel, *Charadrius melanops* (B. D. Heather, pers. comm.), and Wrybill, *Anarhynchus frontalis* (pers. obs.), but not to my knowledge in *C. b. bicinctus.*

DISCUSSION

The 155 birds at Derry Castle Reef were probably close to the total population of *C. b. exilis* (see Falla 1978). Other members of the expedition saw no dotterels on visits to several coastal areas and islands in the Port Ross region (C. Meurck, Botany Dept, Otago University, pers. comm.). Rose Island was not visited.

On Enderby Island the dotterels were absent from other rock platforms probably because the greater area, diversity and quality of habitats at Derry Castle Reef were a major attraction. The south-east corner of the island may have been marginal dotterel habitat, as the midlittoral and littoral fringe habitats there were the most extensive of those away from the reef, and they were also backed by sward. They were used by up to 40 Turnstones. However, amphipods and polychaetes were much less common there than at the reef, which may explain why the dotterels stayed at the reef, a more profitable feeding ground.

If the dotterels were more numerous than they are, some birds would probably use the south-east corner and other parts of the Enderby Island shore. Falla (1978), in dismissing predation as a likely population control of the dotterels, commented that "... it is more likely that their low numbers reflect the limitations of a rugged terrain on which they are compelled to nest." I suggest that winter feeding also, like predation, may figure very little in population regulation. Foraging in midwinter is unlikely to differ greatly from that described here for April, except that the proportion of times spent foraging each day would be higher because of the shorter daylengths and because of increased food requirements to meet higher metabolic needs. Their large body size, together with the high energy content of their prey (Cummins & Wuycheck 1971), would still enable the dotterels to roost for most of each day during winter.

The two midlittoral habitats seemed to be the most important in terms of energy gain per unit time because here they took most of their large prey such as polychaetes, *Halicarcinus,* and large amphipods. On South East Island of the Chathams, the Shore Plover obtains most of its food from these habitats also, and particularly from wave-cut platforms, wider than those at Enderby Island (Phillips 1977). There, the Shore Plovers watched by Phillips in March were feeding on small and abundant prey, probably copepods, which were not taken by dotterels at Derry Castle Reef. The Shore Plovers could also catch fish at least 2-3 cm long. Most of the intertidal bullies present in the pools and under stones at Derry Castle Reef were large (over 10 cm long) and no dotterel was seen to eat any. Like *C. b. exilis,* the Shore Plover forages on sward (H. A. Best, pers. comm.), and the two species apparently forage at night as well as by day. I have found no records of *C. b. bicinctus* foraging along rocky shores, post-breeding flocks dispersing instead to tidal sandflats and mudflats around the New Zealand and Australian coasts (Hindwood & Hoskin

1954, Robertson & Dennison 1979, Pierce 1980). These habitats are missing from the Auckland Islands. The single *C. b. bicinctus* at Enderby Island was foraging mainly along the rocky shore, although it appeared to be taking small prey only.

The peck rate of *C. b. exilis* was consistently low, averaging less than ten pecks per minute. This contrasts with the widely fluctuating, but usually much higher peck rates of *C. b. bicinctus* (Bomford 1978) and the Wrybill (Pierce 1979), both of which prey mainly on small invertebrates. Low peck rates in *C. b. bicinctus* and the Wrybill are usually the result of temporary food shortages. In *C. b. exilis,* however, the low peck rate probably reflects the larger prey, which enables a more leisurely peck rate, and in some cases increased handling times. No data are available on *C. b. bicinctus* foraging intertidally, but at a coastal lagoon, Bomford (1978) found that between February and July the dotterels spent 63-96% of daylight foraging, compared with only 15-20% for *C. b. exilis* in April. Even with nocturnal foraging, it is unlikely that *C. b. exilis* spent as much time foraging over 24 hours as *C. b. bicinctus* did.

The sward used extensively by Banded Dotterels on Enderby Island has been induced by feral cattle and rabbits introduced last century (Taylor 1971). Cattle numbers have gradually declined owing to unfavourable grazing conditions and they will eventually die out. The situation then will probably be like that on neighbouring Rose Island. When cattle were removed from Rose Island in about 1920, *Poa littorosa* tussocks, no longer grazed by cattle, re-established on almost all the former sward despite the presence of rabbits (Taylor 1971). If tussocks re-established on the sward at Enderby Island, the dotterel wintering habitats would probably be limited to the midlittoral and littoral fringe — the original feeding areas before man-induced changes occurred.

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SHORT NOTE

BIRD AND STOAT ENCOUNTERS IN FIORDLAND

Stoats *(Mustela erminea)* are able to attack large birds.

On 24 January 1979, S. Field and J. Ayto (pers. comm.) heard a loud squawking behind the Martins Bay Hut, Hollyford Valley. Rushing outside they saw an adult Fiordland Crested Penguin *(Eudyptes pachyrhynchus)* walking with a stoat hanging from the back of its neck. The stoat had its teeth embedded and its front paws were clenching the bird's feathers. S. Field swung a stick at the stoat, which released its hold and ran off. The penguin rushed into the coastal scrub.

Occasionally birds get their own back.

In 1972, H. Nuttall (pers. comm.) saw two Western Wekas *(Gallirallus australis australis)* attack a stoat on the beach at Deas Cove, Thompson Sound. The stoat was crouched low on stones and the wekas were in frozen postures beside it. One weka hit the stoat a fast blow with its bill and the groggy stoat tried to move off. The birds continued to peck the stoat about the head until the animal was dead. Some of the stoat's guts were eaten by the birds.

In February 1973, R. Lavers (pers. comm.) found a freshly decapitated stoat, surrounded by a pile of Takahe *(Notornis mantelli)* droppings and feathers, in the Point Burn, Murchison Mountains. It appeared to the observer almost certain that a Takahe had killed the stoat.

Also in the early 1970s, A. Cragg and J. Cragg (pers. comm.) saw a New Zealand Falcon *(Falco novaeseelandiae)* flying with a freshly killed stoat at the Worsley River mouth, Lake Te Anau. The falcon flew low over the river with the stoat dangling in the water.

On 28 December 1979, J. Ayto (pers. comm.) saw a New Zealand Falcon swoop down and catch a stoat outside Dumpling Hut, Arthur Valley. Gripping the small stoat in its talons, the falcon flew back to its usual perch in a nearby dead beech and began to pluck its prey.

KIM MORRISON, *Fiordland National Park, P.O. Box 29, Te Anau.*

SOUTH GEORGIAN DIVING PETRELS (Pelecanoides georgicus) BREEDING ON CODFISH ISLAND

By M. J. IMBER and R. J. NILSSON

ABSTRACT

In September 1978 a colony of about 30-35 pairs of South Georgian Diving Petrels was identified breeding among the sand dunes at Sealers' Bay, Codfish Island, New Zealand (46°46'S 167°39'E). This may be the only surviving colony of this species in the Australasian region. It is of considerable interest, furthermore, in being the only colony situated on the Subtropical Convergence (all others are in colder waters) and in being the only one sympatric with *P. urinatrix chathamensis* (all others are sympatric with *P. u. exsul*).

INTRODUCTION

Codfish Island (46°46'S, 167°39'E) of 1480 ha is situated off the north-west coast of Stewart Island, oceanographically in a zone of mixed surface waters that links the Subtropical Convergence from west of to east of the South Island. It is a relatively unmodified island on which the only surviving vertebrates introduced by man are a rat (the kiore *Rattus exulans*), a marsupial (the possum *Trichosurus vulpecula*), and a flightless bird (the weka *Gallirallus australis*).

There is no mention of diving petrels (Pelecanoididae) in the reports by E. F. Stead and R. A. Wilson on the first exploration of Codfish Island by ornithologists (20 December 1934 to 7 January 1935). The next study of the fauna took place during eight days in early November 1948, R. K. Dell (1950) publishing the party's bird notes. These include the following: " *Pelecanoides urinatrix*. — Diving petrels were found in burrows at Sealers' Bay. The burrows were situated a few feet above high water mark in consolidated sand dunes and less commonly higher up on the dunes. The burrows were comparatively deep and the whole habit seems unusual. A single egg was present in the burrows investigated. . . ."

Sealers' Bay lies on the north-east side of the island and is the usual landing place, being sheltered from the westerly winds and sea swell. Fronting the main valley, it has the only sandy beach, which is about 1 km long between rocky, scrub-covered headlands.

Subsequent expeditions to Codfish Island took place in 1966, 1971, 1972 and 1973. These were preoccupied with the status of

Cook's Petrel *(Pterodroma cookii)* and diving petrels received little or no attention. However, during another expedition in December 1975, the authors rediscovered the burrows in the sand dunes that Dell (1950) had reported. In part these had probably passed unnoticed previously because most visits were late in the breeding season, when many burrows may have been obscured, even blocked, by moving sand. Although the burrows were in use during December 1975, we did not capture any of the diving petrels using them, being also preoccupied with Cook's Petrels.

Falla (Falla *et al.*, 1970) noted that the South Georgian Diving Petrel *(Pelecanoides georgicus)*, "occurring in New Zealand seas, as far as is known, only at the Auckland Islands, where it is now exceedingly rare," digs its burrows there in more sandy soil than that where the Subantarctic Diving Petrel *(P. urinatrix exsul)* nests. Burrows were found in consolidated sand dunes on Enderby Island by the *Erebus* and *Terror* Expedition in 1840, and also on Dundas Island by Falla in 1943 (Sir Robert Falla, pers. comm.). However, during the 1972-73 Auckland Islands Expedition, when both those localities were explored, "no trace was found of this species" (Bell 1975). It was because of this unique nesting habit of *P. georgicus* in the New Zealand region that we were particularly interested in identifying the birds of the Codfish Island sand dunes. Not having established their identity in 1975, we resolved to find out when the next opportunity arose in 1978.

FIGURE 1 — A South Georgian Diving Petrel on the beach at Codfish Island, September 1978. Photo: D. Garrick

RESULTS

A party comprising the authors, David Garrick, and David Crouchley visited Codfish Island from 22 September to 12 October 1978. On the first night we captured two diving petrels by spotlighting on the beach (Fig. 1). None of us had seen *P. georgicus* before or had recently handled any live diving petrels. With us we had some New Zealand reference works on seabirds (Oliver 1955, Falla *et al.* 1970, and others) but none enabled completely satisfactory identification. Later we found that Serventy *et al.* (1971) would have been more useful. At first glance the pale patch behind the ear and the white stripe in the scapulars drew attention. Details of the bill appeared to fit the description for *P. georgicus,* but we had no accurate illustration (the nostrils are not as shown in Falla *et al.* 1970). The considerable white areas in the inner webs of the outer three primaries and the white underwings also drew our attention. Suspecting that these were *P. georgicus* we collected both, preserving them in 70% alcohol and depositing them in the National Museum, Wellington, on our return. On subsequent nights we caught, examined, measured and released four more.

A few nights after our arrival, David Garrick and David Crouchley brought back to camp a diving petrel caught at the eastern end of the beach. This had dusky inner webs to its outer primaries, smudgy underwing coverts, a parallel-sided bill basally and nostrils with the septa clearly posterior: it was a Common Diving Petrel (Southern subspecies) and so we were now certain of the identity of the South Georgian Diving Petrels. Four more *P. urinatrix chathamensis* were caught during this trip, two being a pair of courting non-breeders taken from a burrow on a headland at the north-west end of Sealers' beach.

Of various characters that may be used to separate these two species, we found the colour of the inner webs of the outer three primaries to be the most useful by being consistent and easily observed. Bill characters came second because, though the nostril shape and position of the septa are quite reliable, birds we caught usually had sand in the nostrils and so the septa could not be seen. Bill shape is useful but probably too variable to be completely reliable as a single means of identification. Underwing colour also seems too variable in *urinatrix:* in *georgicus* it was always white, but in *urinatrix* it varied from heavily smudged brown-grey to being quite pale though never entirely white. There is a good discussion of identification criteria in Payne & Prince (1979). These criteria seem quite applicable to Codfish Island diving petrels, including the measurements of *georgicus,* which encompass ours.

We surveyed the distribution of burrows in Sealers' Bay. In late September it seemed that the breeding season had just begun, with burrows being scratched out and apparently some new burrows being attempted. In total we found and marked 45. They were placed

in the low foredune or in the main dune behind it, and 1-5 m above the high-tide line (base of the dunes). Sparse plant cover consisted of sedges — *Scirpus nodosus, Desmoschoenus spiralis;* introduced grasses — *Dactylis glomerata* (cocksfoot); and sand-hugging flowering plants — *Coprosma acerosa, C. propinqua.* Although most birds were caught when flying over the dunes rather than on the ground, it was soon apparent that *georgicus* were in the dunes part of the beach and that if we spotlighted at either end of the beach we would catch *chathamensis.* On 12 October 1978, when we left Codfish Island, 35 burrows were considered to be functional and in use, the remainder being incomplete holes or apparently disused but for unknown reasons. A survey by R. J. Nilsson between 11-15 December 1978, when incubation should have been in progress, indicated that about 30 burrows were active.

With such a small population in such an unstable environment it is undesirable and barely practical to study the nesting chambers directly. All seemed very deep in the sand: about 1 m or more. Thus inferences about occupation had to be drawn by observation at the burrow mouths.

The total population of *georgicus* thus seems to comprise about 100 birds: 60-70 breeding plus perhaps 30-60 non-breeders, mainly young birds.

No evidence of predation upon them was found, although wekas *(Gallirallus australis)* and kiore *(Rattus exulans)* frequent the area. However, kiore may attack unguarded eggs and chicks, and wekas may kill fledglings at departure. The status of this population needs to be watched closely, and this will now be more practical in view of the increasing frequency of visits by Wildlife Service staff to the island during the current operation to remove wekas.

Stomach contents of the two specimens collected were examined. Though very digested, there were identifiable remains of euphausiids, small fish (there were many small otoliths in one stomach but they were too worn to identify), and small squids (beaks of juveniles of *Argonauta* sp., *Histioteuthis atlantica, Teuthowenia* sp., and *Chiroteuthis* sp., were identified). These indicate that the birds had been feeding some distance from the island at the edge of the continental shelf. Common Diving Petrels are inshore feeders and we saw several that seemed to be this species whilst making trips in a small boat around Codfish Island.

Searches were made at either end of Sealers' beach for diving petrel burrows. At the south-east end about 6 were found high at the rear of the dunes where scrub begins, and at the north-west end, 11 were found on two of three low headlands that project into the bay. One burrow was kept under study using an observation hole covered by a stone, and eventually a pair of courting *chathamensis* was found in the chamber. Another burrow showed clear signs that incubation was in progress in early October. This subspecies probably lays

between mid-September and mid-October (Richdale 1943), whereas *georgicus* lays apparently in November on Codfish Island (Dell 1950) but in December further south (Payne & Prince 1979). Thus, as elsewhere (Payne & Prince 1979), *georgicus* burrows in unstable ground that generally lacks plant cover (scree, scoria, sand), whereas *urinatrix* burrows in stable soil or peat under vegetation.

DISCUSSION

The most northerly colonies of South Georgian Diving Petrels are in the Crozet Archipelago, on Hog and East Islands (Derenne & Mougin 1976, Despin *et al.* 1972), at 46°06'S and 46°25'S respectively. Although Codfish Island is about 30' further south, oceanographically it lies in much warmer water on the Subtropical Convergence, whereas the Crozets are well within subantarctic seas, about 5°-6° south of that convergence. This is perhaps the most interesting aspect of the Codfish Island colony.

There is a notable lack of the preferred nesting habitat of *P. georgicus* on the tussock-clad subantarctic islands south of New Zealand. Scoria cones and winter-snow-covered screes, much favoured at Prince Edward Islands, South Georgia and probably elsewhere, are quite absent from Antipodes, Auckland and Campbell Islands. Apparently screes are available on Macquarie Island, but lack of ornithological studies before the early arrival of various predators (Jones 1980) has left the original status of *Pelecanoides* species there in great uncertainty. Seemingly that island provides the only conventional nesting habitat for *georgicus* in the whole region. If it once bred there, it now seems to be extinct.

Undoubtedly, if it was to find nesting space in the region, this diving petrel had to adapt to a different terrain, and it did so by exploiting the terrain that physically most resembles scoria and scree — sand. Such soil types, characterised by instability, are avoided by nearly all other nesting petrels. However, even sand dunes are not common. There are none on Antipodes or Campbell Islands and only a few in the Aucklands (Enderby and Dundas Islands). It is worth considering that the rarity of *georgicus* in this region may have resulted merely from shortage of nesting habitat, with introduced vertebrates superimposed on this. Possibly, therefore, the extraordinary Codfish Island colony is a manifestation of this predicament.

CONSERVATION

Obviously this colony is worthy of receiving attention to its welfare. We have been unable to obtain any indication as to the number of burrows evident in 1948. Thus we have no idea of any trend in its numbers. An increase hardly seems likely.

The operation against wekas may be beneficial to this species as well as to Cook's Petrel. It may be necessary to investigate the effects of rats on breeding success. In the meantime annual checks

must be made on the number of burrows in use so that any population trend can be detected. Above all, however, it will be necessary to restrict people from walking over these dunes, particularly during the currently increased level of management activity.

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SHORT NOTE

MOLLYMAWK EATS DIVING PETREL

A Grey-headed Mollymawk *(Diomedea chrysostoma)* picked up on a Manawatu beach in 1978 by Hugh Robertson was some months later given to me for dissection. The crop contained several large squid beaks and the remains of a Diving Petrel *(Pelecanoides urinatrix)*. One wing of the diving petrel was intact and measurable for identification but the rest of the bird was thoroughly mutilated, including the crushed skull.

Serventy *et al.* (*Handbook of Australian Sea-birds* 1971: 75) commented that this mollymawk, from penguin feathers found in its castings, evidently takes birds captured at sea or swallows dead carcasses.

M. K. TARBURTON

BIRDS IN AN APPLE ORCHARD

By R. T. BAKER

ABSTRACT

Eleven bird species were recorded in an apple orchard at the Levin Horticultural Research Centre (HRC). Observations showed that only Blackbirds and Starlings damaged growing apples. Other species which fed on fallen or previously damaged fruit were Goldfinch, Greenfinch, House Sparrow and Silvereye. Birds inhabiting the orchard, but not feeding on apples, were Chaffinch, Fantail, Hedge Sparrow, Song Thrush and White-backed Magpie.

INTRODUCTION

Any fruit grower, whether on the commercial or home garden scale, is well aware of the damage which birds may cause to crops. Apples are no exception and considerable losses may occur in certain varieties, particularly if they are left to " tree-ripen " (Jensen 1974, Baker 1980).

Two studies of birds in orchards in New Zealand have been reported during the last decade. From a questionnaire submitted to fruitgrowers Dawson & Bull (1970) noted that seven species caused damage to apples. These were Myna *(Acridotheres tristis)*, Eastern Rosella *(Platycircus eximius)*, Blackbird *(Turdus merula)*, Song Thrush *(Turdus philomelos)*, House Sparrow *(Passer domesticus)*, Silvereye *(Zosterops lateralis)* and Starling *(Sturnus vulgaris)*. In an Auckland orchard, only Blackbirds and House Sparrows were seen to damage apples and only Blackbirds caused initial damage (Jensen 1974). Other species noted by Jensen were Starling, Myna, Chaffinch, Silvereye, Song Thrush and Goldfinch.

There is, therefore, conflicting evidence concerning the species causing damage to apples. Because of this, observations were made in an orchard at Levin, particularly to ascertain the bird species making the initial attacks on growing fruit.

METHODS

The research orchard at Levin HRC is well suited for study of bird behaviour because it is bounded on two sides by thick phebalium hedges, offering good, if uncomfortable, concealment for an observer. Apple cultivars in the study area, grown in blocks with 5 or 6 rows of trees per block, were Oratia Beauty (48 trees), Cox's Orange Pippin (162 trees), Golden Delicious (42 trees), Red Delicious (90 trees), Sturmer (162 trees) and Scarlet Pimpernel (5 trees). Observations through 10 x 50 binoculars were made of the birds in each block, for periods of approximately 30 minutes, generally between 6 and 9 a.m.

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when human activity was low. Records of the birds' feeding habits were made. Studies were continued, two or three times weekly, through two seasons, January to April 1978 and December 1978 to April 1979. The total number of apples on each tree was recorded after thinning, but before bird damage was noticed. Numbers of damaged apples on the trees were recorded three times each week.

RESULTS AND DISCUSSION

Eleven bird species were seen in the orchard, all of them common and recorded on most days. Populations remained fairly constant throughout the apple growing season except for Starlings, which became more abundant as fruit ripened, and Silvereyes which were not often seen before March.

HEDGE SPARROW *Prunella modularis*

Often seen feeding around the base of tree trunks but never on fruit. Never more than two at any one time.

SONG THRUSH *Turdus philomelos*

One or two usually present in most blocks, on the ground, but never seen to feed on fruit. Highest number recorded together was five. Very easily disturbed, flying off close to the ground into the nearby hedges.

BLACKBIRD *Turdus merula*

Always present with up to 20 birds per block. Usually on the ground where they fed mainly on fruit. They tended to progress via the low-growing fruit into the trees where they caused enormous damage to ripening fruit. When disturbed they usually ran for cover of the hedges and returned to resume feeding within two minutes.

FANTAIL *Rhipidura fuliginosa*

Seen at irregular intervals feeding on small flies around the trees.

SILVEREYE *Zosterops lateralis*

More common later in the season, although small flocks were sometimes present in the unsprayed Cox's Orange trees feeding on the apple leafhopper *(Typhlocyba froggatti)* during January and February. Apples also formed an important part of the Silvereyes' diet, as reported by Moeed (1979), and they seemed particularly partial to Sturmers remaining on the ground in early winter. Silvereyes were never seen to make initial damage to growing fruit.

CHAFFINCH *Fringilla coelebs*

Less common than the other finches and usually seen singly. Chaffinches were seen to take moths while in flight and did not feed on apples.

GREENFINCH *Carduelis chloris*

Adults were often seen feeding their young on insects during the summer. Also partial to apples, particularly Scarlet Pimpernel and Golden Delicious, but they fed only on previously damaged fruit.

GOLDFINCH *Carduelis carduelis*

Their abundance and behaviour was very similar to the Greenfinch; they also fed on weed and grass seeds.

HOUSE SPARROW *Passer domesticus*

Not as common as the Greenfinch or Goldfinch, although occasionally up to 12 birds were seen at one time. Fed mainly on moths but also on some previously damaged apples.

STARLING *Sturnus vulgaris*

Numbers increased as the season progressed, with few present before the first apples ripened. Flocks of up to 100 came in from roosts to the south-west and usually alighted directly in the apple trees. Unlike the Blackbirds, they fed mainly on apples in the trees and when disturbed flew upwards into a row of poplars bordering the orchard. From there they usually resumed feeding within five minutes.

WHITE-BACKED MAGPIE *Gymnorhina tibicen hypoleuca*

Always a few present, particularly in early morning, when they foraged about in the sward between the trees, but were never seen to eat fruit.

Bird activity in the orchard began soon after dawn, although magpies often began calling at least half an hour earlier. Birds flying into the orchard always approached from a south or south-westerly direction, but this had little effect on the distribution of apple damage in the orchard. Two of the 24 rows of trees suffered less damage than others, one being adjacent to, and on the east side of, a phebalium hedge and the other being on the east side of a plastic wind break. Birds seemed to be deterred from feeding on the east side of the plastic wind break, but fed readily on the west side.

As recorded in more detail elsewhere (Baker 1980), Golden Delicious apples were heavily damaged with 23% of fruit lost, compared with Oratia Beauty (15%), Red Delicious (7%), Cox's Orange (5%), and Sturmer (5%), during the 1978-79 season. In the previous season, however, when the rainfall was extremely low from January to March, losses were much higher with 20% of the Red Delicious and 15% of the Cox's Orange crop being taken. This suggests that apple eating by birds may be related to the amount of moisture available.

Feeding on apples by Blackbirds and Starlings continued throughout the day. Detailed observations on four Scarlet Pimpernel trees (which produce an early maturing bright-red apple much favoured by birds) showed that significantly more feeding occurred in late afternoon

than at other times (Table 1). Jensen (1974) observed that feeding was greatest between dawn and 10 a.m., a disagreement which might simply reflect differences in human activity in the orchards concerned.

TABLE 1 — Apple loss from four Scarlet Pimpernel trees during a single day (26/1/79).

Time	No. of apples damaged by birds				
	Tree 1	Tree 2	Tree 3	Tree 4	Mean per tree
6.00-9.00	11	2	4	1	4.50
9.00-12.00	8	5	7	6	6.50
12.00-15.00	8	6	4	7	6.25
15.00-18.00	12	12	10	7	10.25*
18.00-21.00	5	4	3	4	4.00
TOTAL FRUIT LOST	44	29	28	25	31.50
TOTAL FRUIT YIELD	572	400	431	368	443
% of crop lost	7.7	7.3	6.5	6.8	7.1

* Statistically different from the other mean values at the 5% level of significance.

CONCLUSIONS

From the observations made during two seasons at Levin it seems clear that only Blackbirds and Starlings can be regarded as harmful as they are the only species which actually puncture unblemished growing fruit. Silvereyes, Greenfinches, Goldfinches and House Sparrows will eat apple but only after the fruit has already been damaged. All birds seen in the orchard were beneficial in varying degrees as predators of harmful insects and other pests.

ACKNOWLEDGEMENT

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BIRD COUNTS IN LOWLAND FORESTS IN THE WESTERN PAPAROAS

By D. J. ONLEY

Birds were counted in four forest areas and an area of cutover forest in early summer. Marked differences in species composition and numbers counted were found. The role of soil fertility and vegetation in determining differences is discussed. Some observations on seasonal movements are given and a comparison is made with counts made at Reefton. The implications of these findings for reserves in Westland forests is discussed.

INTRODUCTION

This study was devised to identify the breeding habitat preferences of native forest birds in lowland forests so as to assist reserve design.

Topographic maps show that lowland forest (below c. 170 m a.s.l.) forms about a tenth of the remaining forested area in the South Island. Many biologists stress the value of these forests for biological conservation. The greatest pressures from logging and exotic conversion are on these lowland forests, and so the greatest urgency to identify reserves is in them.

METHODS

The area studied lies inland from Punakaiki, between Greymouth and Westport on the West Coast of the South Island. The lowland forest is situated in a synclinal formation on the western side of the Paparoa Range between the Punakaiki River and Bullock Creek (Fig. 1). Logging near Bullock Creek allowed bird counts in modified and unmodified forest areas to be directly compared. Three distinct vegetation types within the syncline, and a coastal vegetation type, were also compared.

Five-minute bird counts according to the method described by Dawson & Bull (1975) were carried out in November and December 1977 and in January 1978.

Uncontrolled variables usually limit comparison between bird counts in forests (Dawson *et al.* 1978). The following standard features of this study enabled the birds' preference for different vegetation types to be compared with a high degree of confidence.

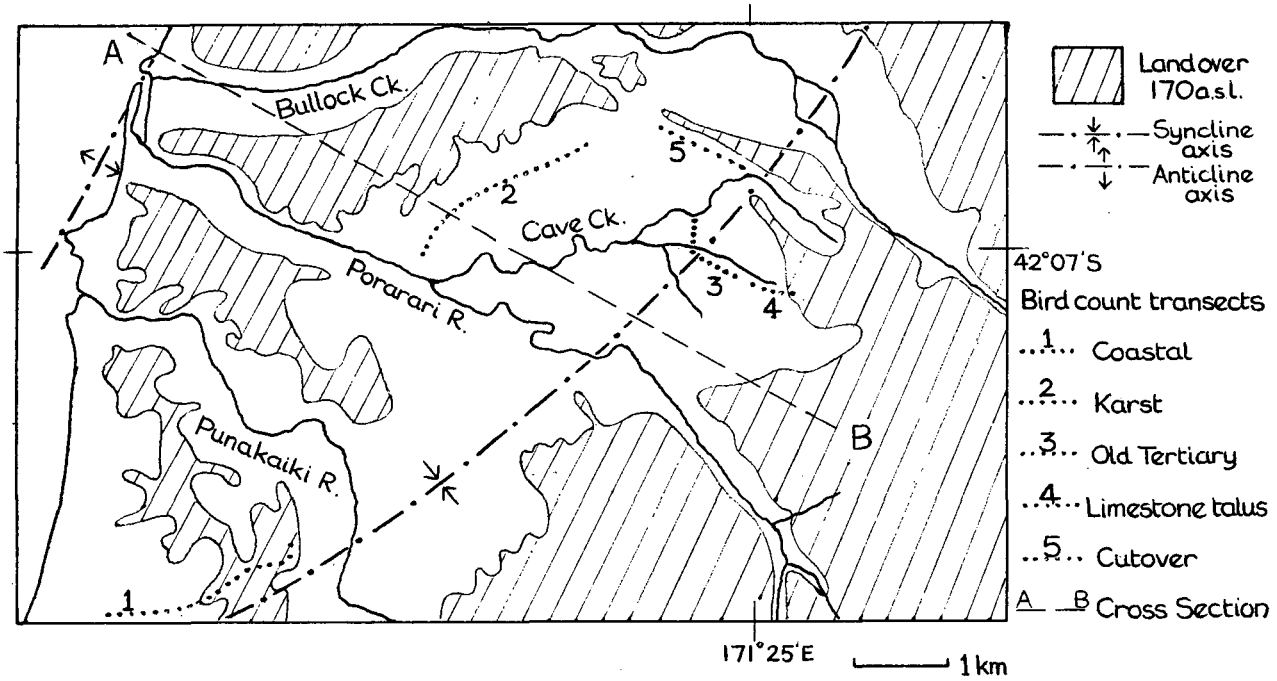

FIGURE 1 — The study area.

1. Selected weather — fine days with little wind or cloud.
2. Time of day — counts were done between 0900 and 1900 hours NZST, omitting the hotter part of the afternoon when song was at a minimum.
3. Breeding season — conspicuousness varies with the stage of breeding, moult, flocking, etc., but most forest birds are easier to count during the breeding season when they are more evenly distributed throughout the forest and males are singing well.
4. Good definition of vegetation types.
5. One observer.

The discussion is supplemented by six years of observations in the area, which often confirmed the generality of a statistically insignificant result.

Caughley (1965) showed that the number of species recorded increased with the number of counts. Figure 2 shows the number of species recorded for a given number of counts for 60 counts taken at random from the vegetation types in this study. Cutover forest near the road was omitted as the species composition was markedly different.

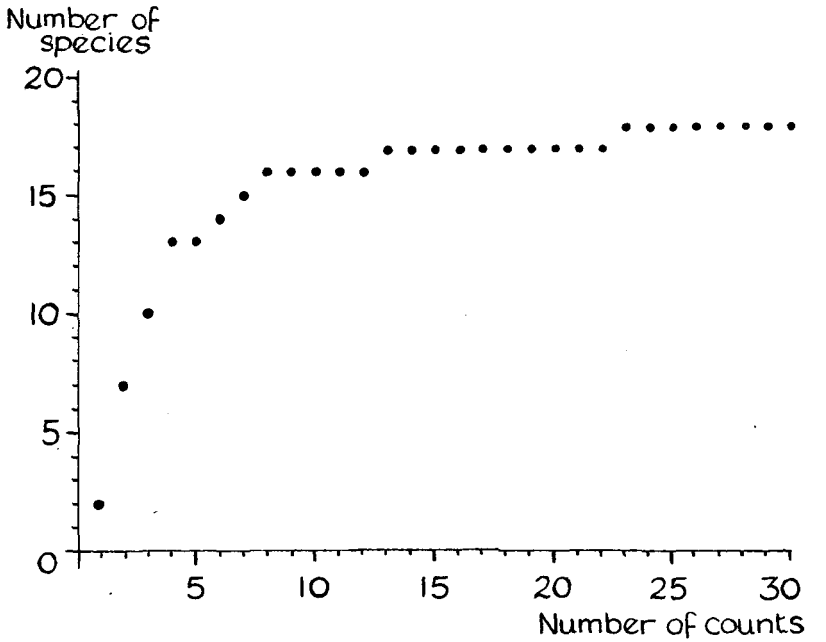

FIGURE 2 — The number of species recorded for a given number of 5-minute counts. 18 species recorded from count 23 to 60.

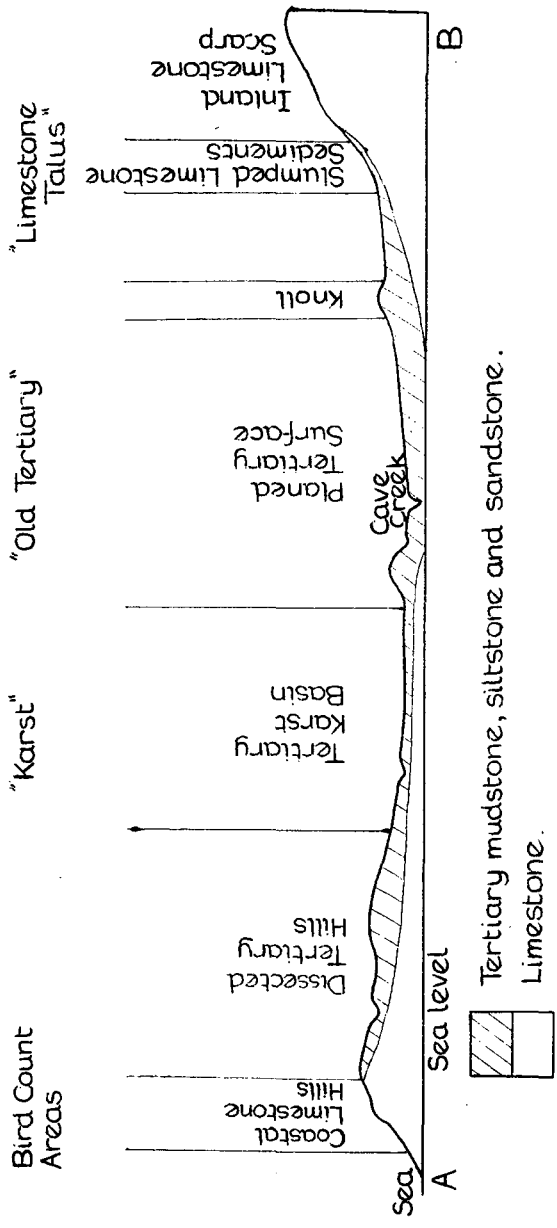

FIGURE 3 — Cross section of the geology, landform and bird count areas.

The graph shows that the number of species recorded increased rapidly until 8 counts were made and then levelled off. The commoner species were recorded early in the counts, whereas the two other species, recorded after 13 and 23 counts, were each noted only once in all 60 counts.

This suggests that for a study of this kind, where observer, seasonal, weather and vegetation variations in counts are kept to a minimum, 8 counts are satisfactory to record the majority of species present, though more are desirable.

VEGETATION TYPES

This study was devised to identify the breeding habitat preferences of birds and detailed preliminary geological and biological work was necessary to separate the forest into consistent, large vegetation types. The work was also useful in explaining the differences in bird counts in vegetation types. The detailed descriptions of the landform and vegetation are given in Appendices I and II, but I would stress their importance for this paper.

The coastal forest occurred on steeply dissected Tertiary hills, while the other lowland forests and cutover areas lay within a syncline of soft mudstone, siltstone and sandstone of Miocene age, overlying harder limestones of Oligocene age (Bowen 1964 and Figure 3). Six

TABLE 1 — A Vegetation Summary.

Vegetative layer		Cutover	Old Tertiary	Coastal	Karst	Limestone Talus
Emergents	Cover	5%	under 50%	few	few	under 10%
	Height	17 m	30 m	40 m	40-45 m	40-45 m
Canopy	Cover	broken	open	moderate/	closed	closed
	Height	10 m	20-25 m	closed 25 m	25-30 m	30-35 m
Subcanopy	Cover	absent	open	sparse	moderate	closed
	Height		15 m	5-20 m	15-20 m	20-25 m
Upper understorey	Cover				moderate	sparse
	Height				3-15 m	10-15 m
Lower understorey	Cover				open	dense
	Height					5-8 m
Shrub	Cover	dense	moderate	dense	open	dense
	Height	3.5 m		2 m		1.5-4 m
Ground	Cover	very dense	open	open	open	very dense
Epiphytes	Cover	few	absent	abundant	some	abundant

vegetation types were chosen for bird counts because of their wide variation in landform, soil fertility, coastal influence and modification by man.

Below, each vegetation type is briefly described and related to landform. Table 1 summarises the vegetation characteristics.

Old Tertiary

Rimu (kahikatea) / hard beech-silver beech forest with some areas of mountain beech and yellow silver pine. Emergents and canopy low and relatively sparse. With the other layers poorly developed, no epiphytes and an open ground cover, the forest appears poor and open. The soils are infertile on the planed Tertiary surface.

Karst

Red beech/silver beech forest with a small amount of emergent rimu. The canopy is red beech dominated, moderately high and relatively closed. There is a good development of subcanopy and upper understorey layers, with the lower layers and the ground relatively open and few epiphytes. The soils are fertile in Karst basins and wider valleys, while on the less fertile ridges a hard beech and rimu element becomes more prominent.

Limestone Talus

Rimu-kahikatea/red beech/silver beech forest. Tall emergent rimu and kahikatea over a high, closed canopy of red beech. Good development of all layers with a dense ground cover and abundant epiphytes. The soils are relatively fertile on slumped limestone sediments.

Coastal

Rimu (northern rata) / (hinau) / kamahi forest. Large emergent rimu and northern rata over a predominantly closed low canopy, mainly of kamahi. There are many representatives of warm forest species. Epiphytes are abundant and shrubs often dense, while the other layers are poorly represented and the ground cover open. This forest occurs on the steeply dissected Tertiary hills, near the coast, south of Punakaiki.

Cutover forest

Remnant rimu and beeches. A forest once mainly of the *Old Tertiary* type, but on discontinuous Pleistocene gravels overlying the Miocene deposits. Soils are infertile and often waterlogged. Low, infrequent rimu and beeches emergent over a low broken canopy, mainly of silver beech. Epiphytes few. Only the shrub and ground layers are well represented, both being very dense. Near logging roads there are more bare areas, small pools and introduced weeds and this was counted under a separate vegetation type: *Cutover near road.*

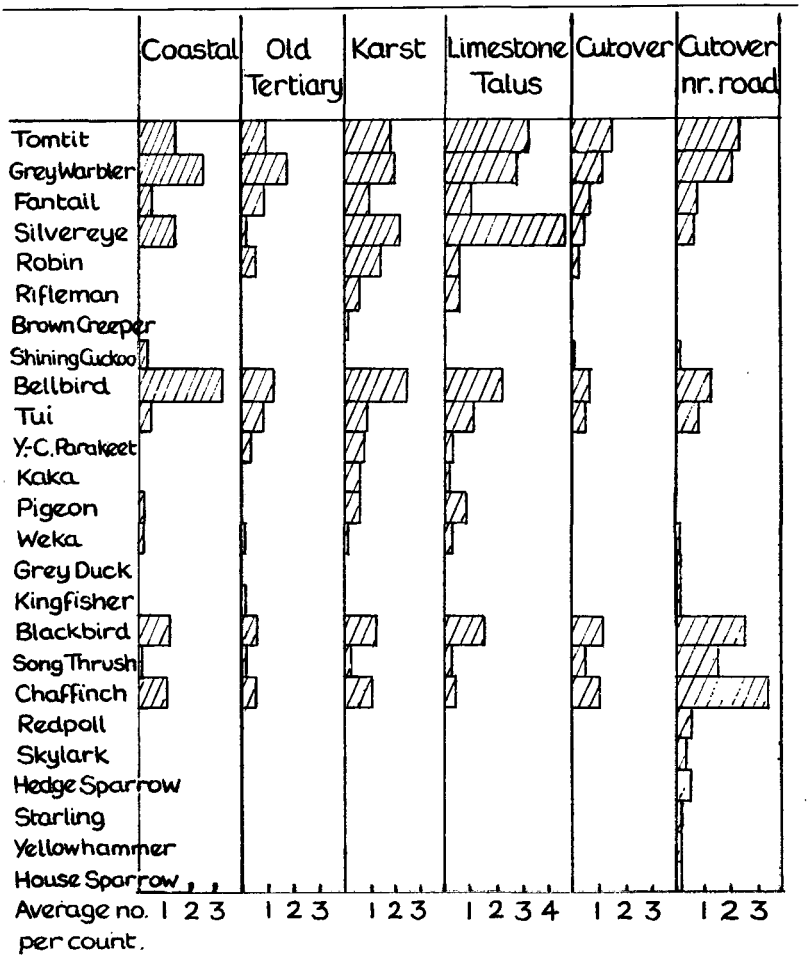

FIGURE 4 — Average number of birds per 5-minute count in each area.

TABLE 2 — Average number of birds counted per five minutes.

	PORARARI AREA						REEFTON		
Species	Coastal	Old Tertiary	Karst	Limestone Talus	Cutover	Cutover near road	Fletcher's Creek	Te Wharau	Reefton Saddle
Tomtit	1.3	0.95	1.8	3.1	1.5	2.3	1.68	1.56	0.79
Grey Warbler	2.5	1.7	2.0	2.8	1.1	2.0	0.93	0.88	0.95
Fantail	0.57	0.79	0.86	1.0	0.62	0.66	1.71	1.02	0.68
Bellbird	3.2	1.2	2.4	2.1	0.75	1.3	3.05	3.52	4.2
Silvereye	1.4	0.21	2.1	4.8	0.38	0.58	2.06	2.95	4.5
Tui	0.41	0.79	0.86	1.1	0.62	0.83	0.54	0.16	0.51
Robin	-	0.63	1.4	0.59	0.25	-	0.55	0.02	0.01
parakeet*	-	0.26	0.69	0.24	-	-	0.09	0.14	0.02
Kaka	-	-	0.50	0.12	-	-	0.09	0.12	0.25
Weka	0.14	0.05	0.07	0.29	-	0.08	0.02	0.01	0.02
Shining Cuckoo	0.33	-	-	-	0.12	0.08	0.09	0.24	0.25
Rifleman	-	-	0.43	0.53	-	-	-	0.29	-
N.Z. Pigeon	0.16	-	0.43	0.94	-	-	0.06	0.01	0.01
Brown Creeper	-	-	0.07	-	-	-	-	-	-
Grey Duck	-	-	-	-	-	0.08	-	-	-
Kingfisher	-	0.05	-	-	-	0.08	0.10	0.02	-
All native species	10.0	6.6	13.6	17.5	5.4	8.1	10.9	12.2	11.0
Number of native species	9	10	13	12	8	10	13	14	12

TABLE 2 — Continued

Blackbird	1.2	0.5	1.1	1.5	1.2	2.6	1.35	0.73	0.50
Chaffinch	1.1	0.5	1.0	0.3	1.0	3.5	0.60	0.68	0.60
Song Thrush	0.1	0.1	0.2	0.2	0.4	1.6	0.75	0.17	0.11
Redpoll	-	-	-	-	-	0.4	0.03	0.11	0.01
Skylark	-	-	-	-	-	0.3	-	-	-
Hedgesparrow	-	-	-	-	-	0.5	0.01	-	-
Starling	-	-	-	-	-	0.1	-	-	-
Yellowhammer	-	-	-	-	-	0.1	-	-	-
House Sparrow	-	-	-	-	-	0.1	-	-	-
All introduced species	2.4	1.1	2.4	2.1	2.6	9.2	2.74	1.69	1.22
Number introduced species	3	3	3	3	3	9	5	4	4
All species	12.4	7.7	16.0	19.6	8.1	17.3	13.6	13.9	12.2
Number of counts	47	19	14	17	8	12	80	80	80

* All the parakeets identified to species were Yellow-crowned.

RESULTS

Table 2 shows the average number of birds counted in five minutes in each area. Figure 4 shows the same in diagrammatic form.

Comparison between Forested Areas

Species composition

Eighteen species were counted in the forested areas and all but three were native. All three introduced species but only seven of the 15 native species occurred in all vegetation types. The *coastal forest* had the fewest species; it lacked Robin, parakeet, Kaka, Rifleman, Brown Creeper and Kingfisher, the *old Tertiary* next so; lacking Kaka, pigeon, Rifleman and Brown Creeper. The fullest representation was found in the *limestone talus* and *karst* areas.

Number counted

Limestone talus appeared to be preferred by many species (Table 3), *karst* and *coastal* next and least *old Tertiary*. Not all of these differences were statistically significant but the trends were confirmed by general observations in the area.

TABLE 3 — The unmodified habitat in which each species reached maximum abundance. The significant test results are given in Appendix III.

Habitat	Limestone Talus	Karst	Coastal	Old Tertiary
	Silvereye***	Robin***	Bellbird**	Kingfisher
	Tomtit**	parakeet*	Chaffinch**	
	Rifleman**	Kaka	Shining Cuckoo	
	N.Z. Pigeon**	Brown Creeper		
	Grey Warbler*	Song Thrush		
	Tui*			
	Blackbird*			
	Fantail			
	Weka			
Number of species	9	5	3	1

*** significantly higher than all other areas ($p < 0.05$),
** significantly higher than two other areas,
* significantly higher than 1 other area
not significantly higher

The *old Tertiary* habitat was preferred by only one species and had the lowest counts of all areas for Tomtit, Grey Warbler, Bellbird, Silvereye, Weka, Blackbird, Chaffinch and Song Thrush. Robin and parakeet were present however.

The coastal area was preferred only by the Bellbird, Chaffinch and Shining Cuckoo and the lowest counts of Fantail and Tui were recorded there.

Although the *karst area* was preferred habitat for only five species, four native species were counted there in the highest numbers (Kaka, parakeet, Robin and Brown Creeper). The high number of Robins was especially notable. Counts of all other species were higher than both *coastal* and *old Tertiary,* with the exception of the Weka.

The *limestone talus* area was the preferred habitat of most species. Exceptionally high counts were recorded for Tomtit, Silvereye and NZ Pigeon.

If the data of Table 2 are used to rank the areas for each species 4 to 1 in order of preference by birds, the following averages result.

Limestone talus	3.1
Karst	3.1
Coastal	2.2
Old Tertiary	1.8

The *karst area* thus proved a more favoured bird habitat than would appear from the previous discussion.

Cutover Areas

Native species found in the cutover areas were Tomtit, Grey Warbler, Fantail, Bellbird, Silvereye, Tui and Shining Cuckoo. Weka, Grey Duck and Kingfisher occurred near the road, while Robins occurred in small numbers only in an area of mature manuka with an open understorey. Blackbird, Chaffinch and Song Thrush were present in both cutover areas, but near the road six other introduced species were recorded in low numbers.

Counts of all species, except Robin and Shining Cuckoo, were higher near the road. Tomtit, Grey Warbler, Bellbird, Blackbird, Chaffinch and Song Thrush counts were especially high near the road. The road forms but a small element in the total cutover area and comparisons between cutover and forested areas should avoid giving undue weight to exceptionally modified areas near logging roads.

Comparison between Cutover and Forested Areas

Comparison is made between *cutover, old Tertiary* and *karst.* Much of the *cutover* once had vegetation similar to *old Tertiary,* but there were some pieces similar to *karst.*

Species composition

Cutover had the lowest number of native species (8), compared with 10 in *old Tertiary* and 13 in *karst.* Although the number of counts was satisfactory, a higher number in *cutover* would make comparison of species numbers more dependable (see Fig. 2). Parakeet, Kaka, Rifleman, NZ Pigeon, Brown Creeper and Weka were not recorded in the *cutover* area and these absences were confirmed by general observations. Robins occurred only in mature manuka. The introduced Blackbird, Chaffinch and Song Thrush occurred in all three areas.

Numbers counted

No native species gave the highest counts in *cutover* (Table 2).

A comparison with the least favoured forested area, *old Tertiary* (Table 4), shows that all but three native species preferred the forested area. The *cutover* area had a poor representation of species, low counts and few species preferring the area.

TABLE 4 — Native species which gave higher counts in **Old Tertiary** and **cutover** forest.

	Old Tertiary	Cutover
	parakeet*	Tomtit
	Grey Warbler	Silvereye
	Fantail	Shining Cuckoo
	Bellbird	
	Tui	
	Robin	
	Weka	
	Kingfisher	
Number of native species	8	3

* Significantly higher.

FACTORS ASSOCIATED WITH THE VARIATION IN BIRD NUMBERS

FORESTED AREAS

The general trend for native species was an increase in counts from *old Tertiary* to *coastal* to *karst* to *limestone talus.* The vegetation summary in Table 1 shows from *cutover* through old *Tertiary, coastal, karst* to *limestone talus:*

1. An increase in emergent and canopy heights,
2. An increase in canopy cover, and
3. An increasing representation of vegetative layers.

Apart from in *cutover,* these factors all reflect an increase in soil fertility in the same sequence.

Table 5 shows that insectivorous species showed a marked and consistent preference for the higher fertility sites within the synclinal basin. The high vegetation volume on fertile sites probably supports a large number of insects.

The dominant species of tree changed markedly in the counted areas. Table 6 is a summary of those trees forming the bulk of the vegetation in the canopy, subcanopy and upper understoreys. Red beech is prominent as a large canopy tree in both the areas most favoured by birds (*karst* and *limestone talus*) and is absent, replaced by a rimu canopy, in the least favoured forested area (*old Tertiary*). Hard beech, often indicative of less fertile sites on ridge tops and terrace edges, is present in all but the most favourable bird habitat in the syncline.

A transect conducted on a single day mainly through *karst* and dissected *Tertiary hill country* supported the view that the best bird habitat is the tall closed-canopy red beech forest and the least

TABLE 5 — Counts of insectivorous species in increasingly fertile sites. (Average number per 5-minute count.)

	Old Tertiary	Karst	Limestone Talus
	increasing		fertility
Tomtit	0.95	1.8	3.1
Grey Warbler	1.7	2.0	2.8
Fantail	0.79	0.86	1.0
Silvereye	0.21	2.1	4.8
Rifleman	0	0.43	0.53

TABLE 6 — Dominant tree species.

Cutover	Old Tertiary	Coastal	Karst	Limestone Talus
rimu	rimu	northern rata	red beech	red beech
hard beech	silver beech	rimu	silver beech	silver beech
silver beech	hard beech	kamahi	hard beech	
	kamahi		kamahi	
	quintinia			

favourable is the relatively low open rimu forest. The results are given in Table 7.

In coastal forests, the relatively low counts of birds agree to some extent with this effect of the structure of the vegetation. The canopy is quite low, though moderately closed and the vegetative layers are not fully represented. The tree species are markedly different (Table 7) and the absence of beech could account for the absence of parakeet, Kaka and Rifleman.

Most of the native species and the Blackbird show some conformity with the pattern of increasing numbers with increased vegetation volume and a larger proportion of red beech. The following species, however, showed some departure from this pattern.

Robin

Robins prefer *karst,* occur in moderate numbers in *old Tertiary* and *limestone talus* and are absent from the *coastal* vegetation apart from an occasional singing male in spring. My observations elsewhere show the distribution of robins in the south-west Paparoas to be patchy. Maximum numbers occur in the lowland forest in the syncline and on the low terraces of the major rivers. Small numbers are thinly distributed over the hill country to the east of the syncline, often associated with saddles or high terraces. Very few have been recorded above 800 m in silver beech forest on greywacke, but small numbers occur in montane forest on granite. A common factor is their preference for gentler topography.

For a predominantly ground-invertebrate feeder an association with a thick litter layer might be expected. Steep slopes and ridge tops are less conducive to litter accumulation than gentler topography. In the *coastal* vegetation ridges are sharp and slopes steep. Possible valley sites for robins have been cleared for agricultural use.

Bellbird

Bellbirds preferred the *coastal* forest, gave lowest counts in *old Tertiary,* and slightly lower counts in *limestone talus* than *karst.* Gravatt (1970) found that on Little Barrier Island, Bellbirds were taking nectar 50.7% of the feeding time and insects 44.4%. An explanation for the coastal preferences would be the abundance of nectar-bearing plants. Northern rata, *Metrosideros fulgens, M. diffusa, M. perforata,* kamahi, kowhai, fuschia, flax, clematis and hinau are all common in or near coastal forest. Only *Metrosideros fulgens* and kamahi are present in the other vegetation types in significant amounts. But Dawson *et al.* (1978) found Bellbird counts as high or significantly higher in areas at Reefton (Table 2) where none of these coastal nectar-

TABLE 7 — A transect through Karst and dissected Tertiary Hill Country The same ten count sites are classified according to first canopy height, then red beech in the canopy, and finally rimu in the canopy. One site was not readily assessed for canopy height and is omitted.

Canopy height	10 m	13 m	17 m	20 m	23 m
Average count	6.5	6	13	14	18.5
Number of species	6	5	9	10	13
Number of counts	2	1	2	2	2

Estimated percentage of red beech in canopy	0	10	15	20	40	60	70	90
Average count	6.5	10	6	15	14	13	12	18.5
Number of species	6	6	5	8	7	8	6	13
Number of counts	2	1	1	1	1	1	1	2

Estimated percentage of rimu in canopy	0	<5	25	30+
Average count	18.5	12.8	6.5	6
Number of species	13	14	6	5
Number of counts	2	5	2	1

bearing trees occur. Honeydew fungus is present at Reefton but is not a common feature in the forests of the Porarari area.

Tui

The Tui might be expected to show the same preference for coastal forest as the Bellbird, especially as Gravatt (1970) found that nectar feeding comprised 81.1% of all observations. But the lowest average counts in this study were from *coastal* forest. This may have been a seasonal anomaly, for Tuis are very mobile throughout the Punakaiki-Porarari area. In October before the counts began Tuis were present in large numbers feeding on nectar in the coastal forest. Gravatt (1970) showed that 96.4% of spring (August to October) observations were of nectar feeding whereas insect feeding increases to 23.4% in summer (November to January). This suggests that Tuis move to areas of maximum insect abundance (? non-coastal forests) to breed.

Other species

The small counts of Kaka and parakeet indicate a preference for *karst,* but the differences were not significant. Continuing casual observations suggest that both species are conservative in their choice of summer (breeding) territories and the differences in counts seem to be real. Their absence in the *coastal* forest could be due to the lack of beech.

Chaffinches show a preference for *coastal* and *karst* over *old Tertiary* and *limestone talus.* Their preference for *coastal* forest could be due to the proximity of cutover and agricultural land, especially as they gave such high counts in the modified *cutover near the road.*

Kaka, parakeet, Bellbird and Chaffinch were seen taking a variety of food: nectar, fruit, buds, insects and seeds. Their habitat preferences seem to be more complex than those of the purely insectivorous species.

CUTOVER AREAS

The low counts in cutover forest fit in well with the general trend to lower numbers in low, open-canopy, poorly layered forest with an absence of red beech. A summary of these vegetation factors is given in Tables 1 and 6, indicating that *cutover* is least favourable.

Those species occurring in *cutover* are common in much of New Zealand and have shown themselves adaptable to isolated patches of native forest, to exotic forest and, in the case of Fantail, Grey Warbler and Silvereye, to farmland and gardens.

Open-country species are present in the most modified area near the road — Grey Duck, Kingfisher, Redpoll, Skylark, Hedge-sparrow, Starling, Yellowhammer and House Sparrow. Blackbird, Chaffinch and Song Thrush also favour the more open areas with bare ground and introduced grasses and seeding herbaceous plants.

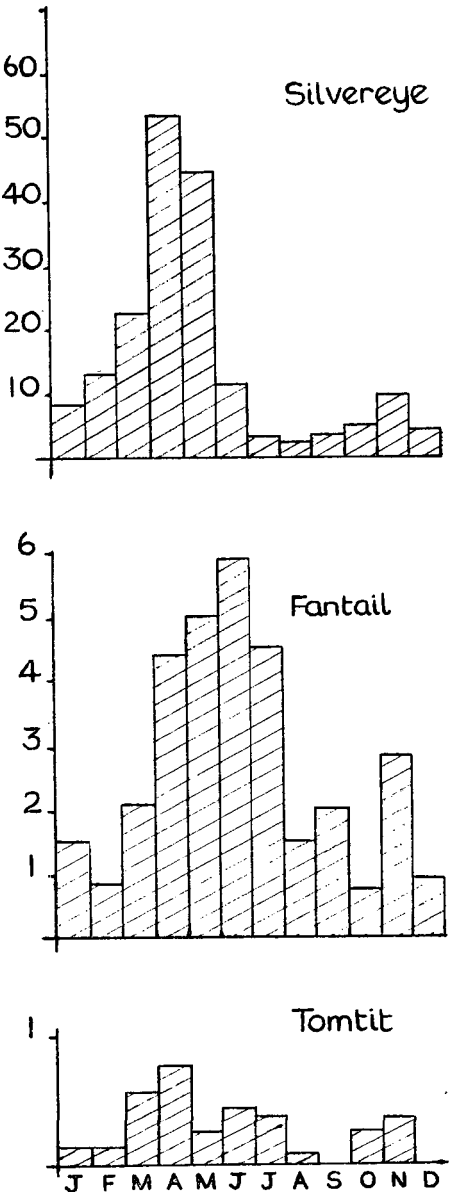

FIGURE 5 — Monthly counts in "Coastal" forest over a 2.8 km transect expressed as birds/km. June 1976 to May 1978. Number of counts, 72.

Relatively high counts of Tomtits occurred in both cutover areas. The flycatching method of feeding by pouncing at prey some distance away from an observation post could benefit from a relatively open parkland-type situation. Tomtits, however, are not successful in nearby farmland; they adapt only partly to modified habitats.

The moderate counts of Tuis and Bellbirds were of birds associated with nearby forested areas feeding on flowering flax near the road. Robins occurred in small numbers in the cutover in an area of mature manuka with an open understorey, uncharacteristic of the area as a whole. As this species does not occur in large expanses of manuka habitat in the Charleston area (20 km to the north), it is probably an overflow population from the nearby *karst*.

SEASONAL DIFFERENCES

Casual observations suggest that there is a partial redistribution of birds in the forest types in autumn, winter and spring.

Figure 5 shows the increase of Fantails, Silvereyes and Tomtits in *coastal* forest in autumn and winter. Fantails and Tomtits are presumably feeding on the more abundant insect life in the warmer, frost-free coastal zone. Silvereyes feed on the abundant small fruits of kahikatea and *Coprosma propinqua, australis, robusta* and *lucida* in March, April and May. Pigeon numbers increase in autumn and winter in *coastal* forest, feeding on hinau, miro and pigeonwood, and in spring on kowhai. Tuis increase in numbers in spring. Brown Creeper records in the *coastal* forest occur after infrequent heavy snowfalls in their favoured habitat of silver beech forest in adjacent hill country.

Within the forests of the syncline, Fantails move to rivers and warmer scarp edges. In some years, small flocks of parakeets occupy the *old Tertiary* forest in winter, feeding on the growing tips of podocarps and seeding grasses. In the winter of 1979, however, many pairs remained in their breeding territories. Introduced finches — Goldfinches, Redpolls and, to a lesser extent, Greenfinches, occur in large numbers in *old Tertiary* forest in autumn and winter. The large numbers of Silvereyes in summer in *limestone talus* forest start to disperse at the end of February at a time when breeding has ended and fruit becomes more important in their diet.

Similar patterns of movement were suggested by Dawson *et al.* (1978) in Reefton forests for Silvereyes, Tomtits, Tuis, NZ Pigeons and parakeets. They found no evidence of Fantail movement but recorded seasonal differences for Grey Warbler and Kingfisher. Most Silvereyes probably leave the Reefton forests in winter for areas similar to the *coastal* vegetation where I found them to increase. Tuis were found to disperse into hill country forest in October, and I noted a similar movement from *coastal* to inland forests in November in the Porarari area. NZ Pigeons were rarely seen in Reefton forests in late winter and spring, when they are numerous in *coastal* forest.

Thus the *coastal* forest and to a lesser extent the *old Tertiary* forests are important for birds in winter.

COMPARISON WITH OTHER AREAS

The only comparable data come from work by Dawson *et al.* (1978) near Reefton, on the eastern side of the Paparoa Range. The Reefton December counts are given in Table 2 for comparison with the forests at Fletcher's Creek, Te Wharau and Reefton Saddle. Interpretation of the contrast should be careful as differences in the observer, year, times and weather conditions would account for some difference.

Species composition

The number of species present in all three Reefton areas was similar to that of the *karst* and *limestone talus* forests of the Porarari. The Reefton areas show better species representation than *old Tertiary* and *coastal* forests. As a species list increases with an increasing number of counts as rarer birds are encountered (Fig. 2), so the Reefton areas are not as rich as a simple comparison would suggest because many more counts were made at Reefton than at Porarari.

TABLE 8 — Preferred habitats.

Porarari area				Reefton area		
Old Tertiary	Coastal	Karst	Limestone Talus	Fletcher's Creek	Te Wharau	Reefton Saddle
	Shining Cuckoo	Robin*	Grey Warbler*	Fantail		
		Para-keet*	Tomtit*	Kingfisher		Bellbird*
		Kaka	Tui*			
		Brown Creeper	Weka*			
			Pigeon*			
			Rifleman			
			Silvereye			
No. of species: 0	1	4	7	2	0	1

* significantly higher than counts on the other side of the Paparoa range.

Numbers counted

Table 8 lists those species preferring one habitat above all others. It again indicates that *limestone talus* is an important area for the commoner native species and *karst* for the species of higher conservation interest, even in this wider context. Grey Warblers are especially numerous on the western side of the range with counts indicating about twice as many birds in all areas as in the east. High numbers of

Robin and parakeet in the *karst* and Tomtit and N.Z. Pigeon in the *limestone talus* are especially notable. Only the Bellbird counts are consistently high in the Reefton areas.

Old Tertiary vegetation had lower counts than all Reefton areas for Bellbird, Silvereye, Blackbird and Chaffinch but higher counts for Grey Warbler, Tui, Robin, parakeet and Weka. It therefore seems regionally important for the native species, Robin and parakeet.

Coastal forest has a lower count than all the Reefton areas for Fantail and Silvereye, and higher counts for Grey Warbler, Weka, Shining Cuckoo, NZ Pigeon and Chaffinch.

Discussion

Limestone talus and *karst* look better bird habitats than those counted at Reefton, and *old Tertiary* and *coastal* forest compare favourably in some respects.

Although temperature records are not available for the Porarari area, the moderating influence of the sea, the lack of cold air drainage, the relatively low incidence of silver beech in the canopy, and the occurrence of certain shrubs (e.g. pigeonwood and *Coprosma australis*) in favoured pockets, suggest that the climate is warmer and subject to fewer extremes than the Reefton forest's.

At Reefton, lower night-time temperatures and especially frosts may depress insect abundance. The insectivorous species, however, do not show a simple preference for the warmer Porarari forests. Tomtit, Fantail, Silvereye, Blackbird and Song Thrush all gave higher counts in some of the Reefton forests than in some of the Porarari forests, as did the partly insectivorous Bellbird and Chaffinch.

An examination of the vegetation descriptions for the Reefton area suggests that low fertility sites were included in all count transects. Red beech forms less than 25% of canopy cover in all areas. Hard beech forms 25% of the canopy at Reefton Saddle and 50% at Te Wharau, while yellow silver pine and southern rata, both indicative of low fertility sites, occur at Te Wharau.

The pattern of bird abundance at Reefton probably agrees with the pattern of low bird numbers in infertile sites as found in the Porarari area. The definition of vegetation types in the Reefton study was not clear enough, however, to show this unambiguously.

CONCLUSION

Reserve Considerations

The comparison between cutover and forested areas shows that intact native forest reserves are necessary for the conservation of a full representation of native bird species in high numbers.

Species that must be given special consideration in reserves are those that do not adapt to modified habitats: Robin, parakeet, Kaka, NZ Pigeon, and to a lesser extent Tui, Bellbird, Brown Creeper, and

Rifleman. Optimal habitat in this district for Brown Creeper and Rifleman is outside the study area in montane silver beech forest (pers. obs.) and is mainly Protection Forest.

High-density areas of the commoner species — Tomtit, Grey Warbler, Fantail, Silvereye, Bellbird, Tui and Weka are also necessary as population reservoirs against times of lowered densities due to weather, disease, etc.

In selecting habitats to reserve, an assessment of the best areas for native birds in the breeding season could be made as follows:

(i) *Limestone talus.* Good species representation with the common species in high numbers and all the special native species in moderate numbers. Preferred habitat for the majority of species.

(ii) *Karst basins.* Good species representation with moderate to high numbers of the common species. The preferred habitat for the special native species Kaka, Robin and parakeet.

(iii) *Coastal.* Poorest species representation. Robin, parakeet and Kaka absent. Moderate counts for most common species. Preferred habitat only for Bellbirds, which, in any case, are common in all other habitats.

(iv) *Old Tertiary.* Moderate species representation with Kaka the only special species absent. Low counts for most species.

The comparison with Reefton forests shows that *karst* and *limestone talus* areas are regionally important bird habitats.

The counts in this study show habitat preferences of breeding birds, but reserves must also take into account birds' requirements throughout the year. Observations on seasonal movements suggest that *coastal* and, to a lesser extent, *old Tertiary* habitats are more important in autumn, winter and spring.

New Zealand already has a remnant bird population with a great decline in abundance of many forest birds and the complete disappearance of others. Locally, Phillips (1948) wrote of prolific quantities of Kaka, parakeet and NZ Pigeon, and the presence late last century of Saddleback, Red-crowned Parakeet, Piopio and Bush Wren. Penniket (1955) adds Kakapo in the 1930s.

In the Paparoa district the Protection Forest does not provide adequately for all the bird species because only Rifleman, Brown Creeper and Bellbird occur in it in high numbers. The remnant lowland forest contains high numbers of birds and has good species representation. This study shows that within lowland forest there are favoured and less favoured bird habitats. Great care must be taken to include these favoured habitats in any reserve proposals, if healthy populations of all native species of birds are to be maintained.

ACKNOWLEDGEMENTS

Geoff Park supplied most of the vegetation and geological information. Sandy Bartle assisted at all stages of the study, Euan Dunn worked out a lot of statistics without a calculator, and Dave Dawson advised on statistical matters and checked the calculations with a calculator.

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APPENDIX I. LANDFORM

The non-coastal lowland forest is contained within a syncline of soft mudstones, siltstones and sandstones of Miocene age overlying harder limestones of Oligicene age (Bowen 1964 and Fig. 3).

The major geomorphic processes historically affecting the forests are

1. A marine planation that left a rather flat expanse of soft mudstones, siltstones and sandstones. There is little lateral dissection with Cave Creek South meandering in a steep-sided gorge. Consequently, there is little soil renewal and much leaching to a rather infertile soil. Marked as *Planed Tertiary Surface* on Fig. 3.

2. A gentle ridge system that has developed on thin soft Tertiary deposits overlying limestone, where the limestone drainage pattern is dominant. Leaching is less prominent and soil renewal through lateral erosion greater. Therefore, fertility is generally high and especially so in the inland drainage basin. Marked as *Tertiary Karst Basin* on Fig. 3.

3. A steeper ridge system that has developed where the soft Tertiary deposits are thicker and the limestone drainage pattern is less dominant. Soil fertility is variable; least fertile on the sharp ridge-tops and more fertile in the wider valleys. Marked as *Dissected Tertiary Hills* on Fig. 3.

4. The massive slumping of Miocene and limestone sediments at the base of the inland limestone scarp, over-running the marine planed surface. These sediments are more fertile than the planed surface. Marked as *Slumped Limestone Sediments* on Fig. 3.

5. Deposits of Pleistocene gravels of varying thickness overlying the soft mudstones, siltstones and sandstones to the north of the area, near Bullock Creek. Leaching is considerable on these porous flat gravels and the soil is relatively infertile.

APPENDIX II. VEGETATION

The following information is based on a survey by G. N. Park, Botany Division, DSIR. A full account and detailed map appear in Park & Bartle (1978).

OLD TERTIARY

Rimu (kahikatea)/hard beech-silver beech forest

Rimu trees reaching a height of 30 m are visually dominant, although their canopy cover is usually less than 50%. On well-drained sites hard beech increases. Hall's totara occasionally occurs in the 20-25 m hard beech-silver beech lower canopy. The subcanopy is mainly kamahi and quintinia with a few miro. Important understorey species are quintinia, mountain toatoa, toro, lancewood, *Cyathea smithii* and *Dracophyllum townsoni*. There is little rimu regeneration. Common ground species are *Blechnum discolor, Gleichenia cunninghamii* and *Dianella intermedia.*

On ridge crests, remnant gravels and more poorly drained sites, small areas of the following type were intermixed irregularly with the above.

Rimu (kahikatea)/hard beech-mountain beech-yellow silver pine forest

More poorly drained soils than those with a major hard beech element support mountain beech and yellow silver pine, with a few silver pine, cedar, southern rata and Hall's totara. Hard beech is less important than above and silver beech is rare. Few rimu are greater than 70 cm diameter at breast height (Dbh) and there is little rimu regeneration relative to that of hard beech and mountain beech. The sparse subcanopy of kamahi, together with the very uneven canopy, gives the vegetation a characteristic open structure. Mountain toatoa, manuka, quintinia, broadleaf, *Dracophyllum townsoni, D. longifolium, Coprosma* cf. *parviflora* and *Myrsine divaricata* dominate over an uneven ground layer of *Gahnia procera, Phormium cookianum, Blechnum capense* and an extensive cover of bryophytes.

KARST

Red beech/silver beech forest

This occurs throughout the karst basins west of Cave Creek. It is distinctive because of the virtual absence of rimu. Huge buttressed trees of red beech 25-30 m tall dominate the multitiered forest and contribute about 70% of the crown cover. The other 30% is a 15-20 m subcanopy layer of silver beech, with some kamahi. Kamahi dominates the upper understorey. *Cyathea smithii,* toro and horopito are major elements in the lower layer. An open lower understorey consists of horopito, toro, *Coprosma* cf. *parviflora, Dicksonia squarrosa,* putaputaweta *Neomyrtus pedunculata, Blechnum discolor, Leptopteris*

superba, Microlaena avenacea and *Uncinia* spp. Filmy ferns, *Astelia solandri* and *Phymatosorus diversifolius* are the only epiphytes.

(Rimu)/red beech/silver beech forest

The valley floors in the more dissected low hill country adjoining the karst basins support forest that is very similar except for the addition of rimu and a more open canopy.

(Rimu)/hard beech-red beech-silver beech forest

Much of the lightly dissected hill country supports an open forest where hard, red and silver beech are co-dominant over a wide area. The forest is not otherwise distinctive. The upper and lower understoreys are dominated by kamahi and *Cyathea smithii* respectively over a dense ground layer largely of *Blechnum discolor.*

LIMESTONE TALUS

Rimu-kahikatea/red beech/silver beech forest

At the edge of the debris flow a tall multitiered forest adjoins the *old Tertiary* type.

The dominant tree is rimu, but it contributes as little as 10% to the crown cover . Together with kahikatea, rimu forms an emergent layer 40-45 m tall over the main canopy layer 30-35 m tall formed by very large diameter red beech. Most of the red beech in this very impressive forest are 1.8-2.0 Dbh with a few trees up to 2.5 Dbh. The rimu and kahikatea are largely 0.8-1.0 m Dbh.

Silver beech forms an important subcanopy and upper understorey element in the form of heavy-boled trees 25-30 m tall. The other understorey layers are

10-15 m — sparse kamahi with pole rimu and silver beech;
5-8 m — dense *Cyathea smithii* with toro, quintinia and lancewood; and
1.5-4 m — dense horopito, with toro and *Cyathea smithii.*

There is a very dense ground layer of *Blechnum discolor, Microlaena avenacea* and *Uncinia* spp. Filmy ferns are abundant as trunk epiphytes. *Phymatosorus diversifolius* and *Astelia solandri* occur on the larger trees.

COASTAL FOREST

Rimu (northern rata)/(hinau)/kamahi forest

Large areas of the steeper hill country above the coastal scarp north and south from Punakaiki support a complex forest from which beech is absent. The composition and structure of these forests are variable. As well as rimu, northern rata, hinau and kamahi, miro, matai, quintinia, putaputaweta and pigeonwood can be important. Mahoe, *Coprosma australis,* toro, supplejack and kiekie are the predominant understorey species. The emergent northern rata and rimu are usually large spreading trees with abundant epiphytes — kiekie, supplejack, *Metrosideros fulgens* and *M. diffusa. M. diffusa* often forms a ground cover. Nikau is present in the gully heads.

CUTOVER FOREST

Most of the cutover forest was originally *rimu (kahikatea)/hard beech-mountain beech-yellow silver pine forest* (see *old Tertiary* vegetation description). Exact dates of cutting are not available, but logging appears to have taken place in at least two phases between 2 and 20 years ago. Two distinct types of cutover have been recognised:

(a) *Cutover near the logging road.* The structure of the vegetation is very open with one 10 m tree every 30 m or so and a shrub layer up to 3 m high. The ground tends to be bare or waterlogged. Rimu predominates, with some kahikatea, miro, and the odd yellow silver pine. Manuka, lancewood, *Dracophyllum,* mountain toatoa, kamahi, and *Coprosma* n.sp. aff. *parviflora* are abundant in the shrub layer.

(b) *Cutover away from the road.* The structure of the vegetation is less open, with scattered rimu, miro, red beech and hard beech, emergent over a broken canopy of silver beech. Manuka, mountain toatoa, kamahi, lancewood, rimu, kahikatea and *Coprosma propinqua* are common over a dense layer of flax, cutty grass and *Coprosma* n.sp. aff. *parviflora,* although the density of the ground layer is inversely proportional to the amount of manuka. In places, manuka forms a dense canopy at 5 m with areas of *Gleichenia* or open ground beneath. This type of cutover is simply called *cutover* in the text.

The main difference between these two types of cutover vegetation is in the ground cover. Away from the road the presence of large amounts of dead wood with little subsequent disturbance has led to the development of a thick ground layer (about 1 m tall) of cutty grass, bush lawyer, *Gleichenia* and *Blechnum.* There is very little open ground and no litter layer accessible to birds.

Subsequent disturbance in the form of burning, seeding, and grazing near the road has resulted in an open ground layer with sedges and grasses interspersed with bare gravels and temporary muddy pools. Many introduced species (thistles, ragwort, Compositae) have colonised along the road.

APPENDIX III — MEAN NUMBERS OF SOME SELECTED SPECIES PER STATION AND SIGNIFICANCE TESTS (chi-squared tests) ON SPECIES TOTALS. Significant differences are indicated by breaks in what would otherwise be a continuous line. Vegetation types linked by an unbroken line did not show significant differences in numbers.

Yellow-breasted tit		Silvereye		Kaka	
Limestone talus	3.1	Limestone talus	4.8	Karst	0.5
Cutover near road	2.3	Karst	2.1	Limestone talus	0.1
Karst	1.8	Coastal	1.4	Old Tertiary	0
Cutover	1.5	Cutover near road	0.6	Coastal	0
Coastal	1.3	Cutover	0.4	Cutover near road	0
Old Tertiary	1.0	Old Tertiary	0.2	Cutover	0

Grey Warbler		Tui		Weka	
Limestone talus	2.8	Limestone talus	1.1	Limestone talus	0.3
Coastal	2.5	Karst	0.9	Karst	0.1
Karst	2.0	Old Tertiary	0.8	Coastal	0.1
Cutover near road	2.0	Cutover near road	0.8	Old Tertiary	0.1
Old Tertiary	1.7	Cutover	0.6	Cutover near road	0.1
Cutover	1.1	Coastal	0.4	Cutover	0

Fantail		Robin		Rifleman	
Limestone talus	1.0	Karst	1.4	Limestone talus	0.5
Karst	0.9	Old Tertiary	0.6	Karst	0.4
Old Tertiary	0.8	Limestone talus	0.6	Old Tertiary	0
Cutover near road	0.7	Cutover	0.2	Coastal	0
Coastal	0.6	Cutover near road	0	Cutover near road	0
Cutover	0.6	Coastal	0	Cutover	0

Bellbird		Yellow-crowned Parakeet		N.Z. Pigeon	
Coastal	3.2	Karst	0.7	Limestone talus	0.9
Karst	2.4	Old Tertiary	0.3	Karst	0.4
Limestone talus	2.1	Limestone talus	0.2	Coastal	0.2
Cutover near road	1.3	Coastal	0	Old Tertiary	0
Old Tertiary	1.2	Cutover	0	Cutover	0
Cutover	0.7	Cutover near road	0	Cutover near road	0

Chaffinch		Blackbird		Song Thrush	
Cutover near road	3.5	Cutover near road	2.6	Cutover near road	1.6
Coast	1.1	Limestone talus	1.5	Cutover	0.4
Karst	1.0	Cutover	1.2	Karst	0.2
Cutover	1.0	Coastal	1.2	Limestone talus	0.2
Old Tertiary	0.5	Karst	1.1	Old Tertiary	0.1
Limestone talus	0.3	Old Tertiary	0.5	Coastal	0.1

APPENDIX IV — GLOSSARY OF BIRD NAMES

Grey Duck	*Anas superciliosa*	Grey Warbler	*Gerygone igata*
Weka	*Gallirallus australis*	Fantail	*Rhipidura fuliginosa*
N Z Pigeon	*Hemiphaga novaeseelandiae*	Yellow-breasted tit	*Petroica m. macrocephala*
Kakapo	*Strigops habroptilus*	Robin	*Petroica* (miro) *australis*
Kaka	*Nestor meridionalis*	Song Thrush	*Turdus philomelos*
		Blackbird	*Turdus merula*
Red-crowned Parakeet	*Cyanoramphus novaezelandiae*	Silvereye	*Zosterops lateralis*
Yellow-crowned Parakeet	*Cyanoramphus auriceps*	Bellbird	*Anthornis melanura*
Shining Cuckoo	*Chrysococcyx lucidus*	Tui	*Prosthemadera novaeseelandiae*
Kingfisher	*Halcyon sancta*	Yellowhammer	*Emberiza citrinella*
Rifleman	*Acanthisitta chloris*	Chaffinch	*Fringilla coelebs*
Bush Wren	*Xenicus longipes*	Redpoll	*Carduelis flammea*
Skylark	*Alauda arvensis*	House sparrow	*Passer domesticus*
Hedgesparrow	*Prunella modularis*	Starling	*Sturnus vulgaris*
		Saddleback	*Philesturnus carunculatus*
Brown Creeper	*Finschia novaeseelandiae*	Piopio	*Turnagra capensis*

APPENDIX V — GLOSSARY OF PLANT NAMES

umbrella fern	*Leptopteris superba*
	Gleichenia cunninghamii
	Dicksonia squarrosa
	Cyathea smithii
	Phymatosorus diversifolius
	Blechnum capense
	Blechnum discolor
cedar	*Libocedrus bidwillii*
Hall's totara	*Podocarpus hallii*
miro	*Podocarpus ferrugineus*
matai	*Podocarpus spicatus*
kahikatea	*Podocarpus dacrydioides*
rimu	*Dacrydium cupressinum*
yellow silver pine	*Dacrydium intermedium*
silver pine	*Dacrydium colensoi*
mountain toatoa	*Phyllocladus alpinus*
horopito	*Pseudowintera axillaris*
pigeonwood	*Hedycarya arborea*
mahoe	*Melicytus ramiflorus*
manuka	*Leptospermum scoparium*
southern rata	*Metrosideros umbellata*
northern rata	*Metrosideros robusta*
	Metrosideros fulgens
	Metrosideros diffusa
	Metrosideros perforata
rohutu	*Neomyrtus pedunculata*
hinau	*Elaeocarpus dentatus*
kamahi	*Weinmannia racemosa*
putaputaweta	*Carpodetus serratus*
quintinia	*Quintinia acutifolia*
bush lawyer	*Rubus* sp.
mountain beech	*Nothofagus cliffortioides*
red beech	*Nothofagus fusca*
hard beech	*Nothofagus truncata*
silver beech	*Nothofagus menziesii*
lancewood	*Pseudopanax crassifolium*
broadleaf	*Griselinia littoralis*
inanga	*Dracophyllum longifolium*
	Dracophyllum townsonii
toro	*Myrsine salicina*
	Myrsine divaricata
kanono	*Coprosma australis*
karamu	*Coprosma lucida*
	Coprosma robusta
	Coprosma n.sp. aff. *parviflora*
	Coprosma propinqua
	Senecio jacobaea
	Astelia solandri
	Dianella intermedia
flax	*Phormium cookianum*
nikau	*Rhopalostylis sapida*
supplejack	*Rhipogonum scandens*
kiekie	*Freycinetia banksii*
	Gahnia procera
cutty grass	*Carex coriacea*
bush grass	*Microlaena avenacea*

D. J. ONLEY, *Madman's Farm, Little Totara River, Private Bag, Westport.*

THE TAXONOMIC STATUS OF EXTINCT NEW ZEALAND COOTS, *Fulica chathamensis* subspp. (Aves: Rallidae)

By P. R. MILLENER

Subfossil remains of a large flightless coot were first discovered on Chatham Island by H. O. Forbes (*Fulica chathamensis,* Forbes 1892) and subsequently in the South Island by A. Hamilton (*Fulica prisca,* Hamilton 1893).

Further discoveries have considerably enlarged the geographic range on the New Zealand mainland (Dawson 1962; Brodkorb & Dawson 1962; Trotter 1965; Millener, in press). However, general agreement on the number of forms admitted and their generic and specific status has yet to be reached.

Hamilton (1893), apparently solely for convenience, and Rothschild (1907), on the presumption (for which he gave no evidence) that the mainland form was volant, proposed specific separation for the mainland and Chatham forms. Scarlett (1955), followed by Oliver (1955), however, allowed no such distinction. Brodkorb & Dawson (1962), citing the evidence of Andrews (1896) that the New Zealand forms differed from both *Palæolimnas newtoni* Milne Edwards (the type species) and *Fulica,* proposed the new genus *Nesophalaris.* They treated the two forms as discrete taxonomic units " in the absence of a more critical comparison."

Olson (1973), on the basis that both forms exhibit characters of the pelvis and humerus typical of *Fulica,* returned them to that genus. Although Olson (1975) agreed with Scarlett that the two forms could not be clearly distinguished on the basis of size or on the shape of the crania, and therefore that specific separation was unwarranted, he did propose that morphological differences in the humeri were sufficient to validate subspecific distinction as *Fulica c. chathamensis* Forbes, 1892 and *Fulica c. prisca* Hamilton, 1893.

Examination of almost all the Extinct Coot bones available in New Zealand museums and private collections (Millener, in press), however, has shown the criteria selected by Olson to be insufficiently reliable to distinguish the two forms.

It is here proposed that certain characteristics of the sterna and tibiotarsi, described in detail below, provide a more consistent and less subjective means of discrimination.

Of the specimens illustrated, those designated Av 5280 are from a skeleton found by H. O. Forbes on Wharekauri, Chatham Islands

NOTORNIS 27: 363-367 (1980)

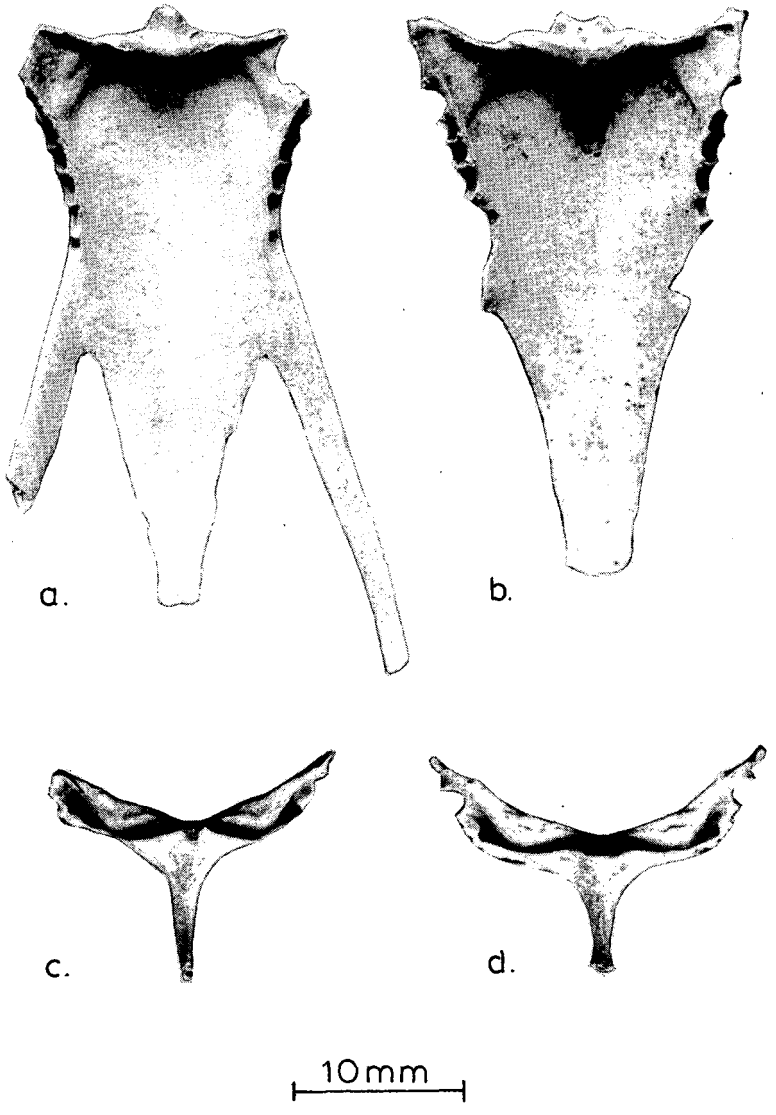

FIGURE 1 — Sterna of **Fulica chathamensis** subspp. in dorsal (a, b) and anterior (c, d) views.
a, c **Fulica c. chathamensis** (Av 5280)
b, d **Fulica c. prisca** (AU 6394)

c. 1892 and now held by the Canterbury Museum; and those designated AU 6394 are from a skeleton found by C. J. Templer in Mac's Quarry Cave, Waitomo in 1978 and now held by the Auckland University Geology Department.

Sternum (Figure 1 a-d)

Viewed in dorsal aspect, the ventral manubrial spine of *chathamensis* is distinctly rounded anteriorly (Fig. 1a). A distinct central zone of demarcation separates the coracoidal sulci. In *prisca* the spine is somewhat broader and anteriorly is flattened or, more usually, notched (Fig. 1b). It has on its ventral surface a small spike, which is usually

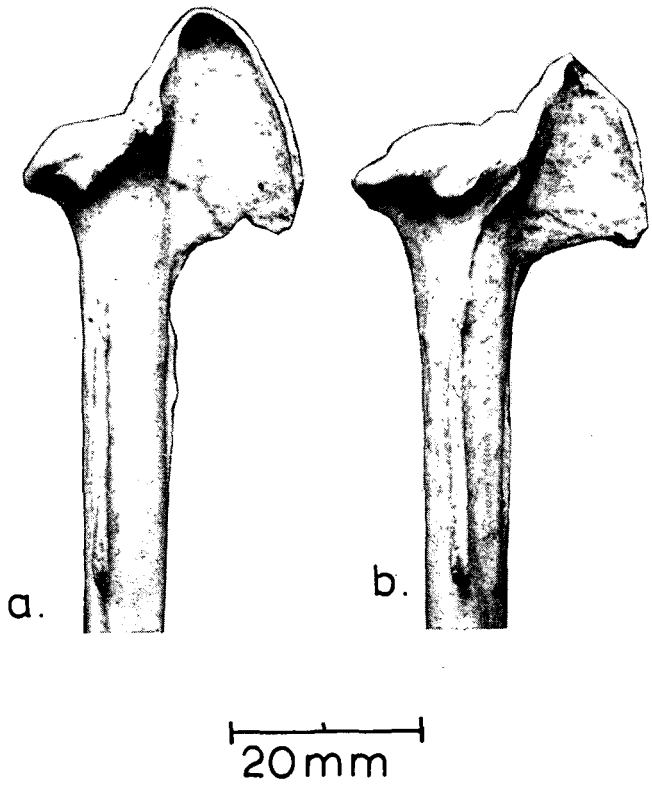

FIGURE 2 — **Fulica chathamensis** subspp.: proximal portions of right tibiotarsi in external lateral view.
a **Fulica c. chathamensis** (Av 5280)
b **Fulica c. prisca** (AU 6394)

absent in *chathamensis*. The coracoidal sulci merge centrally, exhibiting no noticeable zone of demarcation between them.

In anterior view, the coracoidal sulci of *chathamensis* take the shape of a very broad W (Fig. 1c) due to the upturning of the ventral manubrial spine. No such upturning is evident in *prisca*, and thus the sulci form a very shallow U (Fig. 1d).

Tibiotarsus (Figure 2 a-b)

In external lateral aspect, the proximal tibiotarsus of *chathamensis* exhibits a ridge which extends vertically upward from the fibular crest to the protruberance external to, and below, the lateral articular surface (Fig. 2a). In *prisca* a comparable ridge, proximo-anteriorly directed, connects the fibular crest and the outer cnemial crest (Fig 2b). Thus, whereas in *chathamensis* a markedly undercut rim connects the protruberance beneath the lateral articular surface with the outer cnemial crest, in *prisca* the two are separated by a distinctive groove.

In *chathamensis* too, the depression between the inner and outer cnemial crests is much deeper than that of *prisca*, while the inner cnemial crest itself is, proximally, noticeably more elongated.

Despite the available material consisting almost entirely of isolated bones from widely separated localities and of varied geologic age (certainly, in some cases, in the order of thousands of years), these selected characteristics allowed a remarkably consistent distinction to be made between the mainland and Chatham Island forms. Consequently, Olson's (1975) recommendation of subspecific status for the two forms is strongly supported.

Indeed, in many extant species (e.g. *Gallirallus australis, Nestor meridionalis, Callaeas cinerea*), subspecific status is given to forms which, osteologically, vary but little in size and are indistinguishable by shape or form. It would, therefore, not seem unreasonable to confer specific status on each of the two forms of Extinct Coot. Confirmation of a proposal such as this must, however, await the availability of larger sample sizes than exist at present.

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I am indebted to Ron Scarlett (Canterbury Museum) and Dr John Yaldwyn (National Museum) for making available to me specimens held by these institutions and for their contributions, by way of discussion and comment, to both the content and presentation of this paper.

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Robyn Thompson typed the manuscript.

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★

SHORT NOTE

RED-CAPPED DOTTEREL IN NORTH CANTERBURY

During the 1960s and 1970s, I spent much of my spare time wandering upstream of the mouths of the rivers and tributaries of northern Canterbury. During this time, I have been aware of a general presence of the Red-capped Dotterel *(Charadrius alexandrinus ruficapillus)*, although it has not been easy to find and seldom in the same place twice. I have encountered it, in singles or small groups, mainly on the Ashley and Waipara Rivers and once on the Leader River between early July at the earliest and late November at the latest. I have the impression that it arrives in late winter and prefers the shallower, more quietly flowing streams with plenty of cover nearby. However, my sightings on these quieter streams have not been at the same places from year to year, or even from month to month. If, then, they really prefer the major rivers, the reason that their population has not increased greatly may be that these rivers are subject to heavy flash floods from July to December. They do not seem to renest, and so with lost nests, they may depart early.

All my sightings have been within about 15 km of the river mouths. Since Shand's reports of a female Red-capped breeding with a male Banded Dotterel *(C. bicinctus)* in 1947 and 1950 (Oliver 1955, *New Zealand birds)*, the general attitude to any mention I have made about birds I have seen has been to assume that they too are hybrids. However, my descriptions seem to match that of adult Red-capped (B. D. Heather, pers. comm.), lacking any suggestion of the size, pattern, or general colouring of Banded Dotterels.

The first account in my notes is of a field weekend 25-28 October 1963 by the local OSNZ branch, which included a survey of the Ashley River from the Gorge bridge to the main road. A pair of Red-capped (called "hybrids" as usual) with two chicks was found. Probably because of a typing error, this was reported as five chicks in the report (*Notornis* 11 (1): 61-62, 1964). In my notes, the adult description

states rufous on top of head, no bands, slight side bars, and white underparts.

On 28 August 1966, among the breeding Banded Dotterels and Wrybills *(Anarhynchus frontalis)*, I saw eight dotterels that were smaller and greyer than the Banded Dotterels, with very white underparts, a broader white forehead, lores and side patch dark to black, and some with rufous on the head and continuing down behind the black face patch.

On 12 August 1967 and again on 9 September, I encountered four birds of the same description in my wanderings. At one point a bird showing complete bright white underneath appeared, flying low and daintily above a stream. I followed to where it landed and noted the following features: smaller and greyer above than Banded Dotterel and with a more erect stance; bill dark; a very broad white forehead band bordered above by a precise black band, and above that a chestnut or rufous crown; the rufous continued down the side of the head from the dark superciliary streak and the black lores to form almost a crescent on the upper side of the chest, the crescent ending sharply and black. One rather distant photograph shows what could be a hint of a brownish band where a Banded Dotterel's would begin, but I did not see this in the field.

This bird's call, a sweeter, lighter version of the Banded Dotterel's *pit pit pit*, drew forth its mate. She had no rufous crown or black above the broad white forehead, but she had some rufous on the side crescent, a paler black patch, and her legs were greyer than the male's black. I caught a small downy chick that ran from the area, half of whose face was black with sand under the skin, presumably forced through the eye socket during a tumble during the flash flood that had occurred two days before. After an hour's delay while I took the chick back to the car and removed the sand with a syringe, I could not find the adults. On playing the tape of their call that I had made when first seeing them, they soon appeared, approaching stealthily but calling repeatedly. The next day, I could not find them, and not until 11 November did I see an adult pair at this site.

Most of the birds I have seen in the later months have been singles, of rather indeterminate description, presumably either females or grown chicks. The adults seem to leave the rivers early.

On 5, 12, and 19 August 1978, I saw an adult pair of the usual description at the Ashley mouth. On 26 August, heavy rain locally and in the foothills washed out the whole estuary, leaving no riverside feeding places. Judging that the only refuge left would be the bank still holding between the lagoon and the sea, I reached this bank in heavy rain and found a large number of Banded Dotterel, Wrybill, Black-fronted Tern *(Sterna albostriata)*, and the pair of Red-capped Dotterels.

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SEABIRDS FOUND DEAD IN NEW ZEALAND IN 1970, 1971 AND 1972

By C. R. VEITCH

ABSTRACT

During 1970, 2152 kilometres of coast were patrolled by 82 persons. 4613 dead seabirds, including high numbers of Lesser Broad-billed Prions *(Pachyptila salvini)*, were found. During 1971, 2470 kilometres of beach were patrolled by 148 persons. 6244 dead seabirds, including high numbers of Fairy Prions *(P. turtur)*, were found. During 1972, 2748 kilometres of beach were patrolled by 117 persons. 4046 dead seabirds were found but there were no major wrecks. During the three years there were new beach patrol records of Soft-plumaged Petrel *(Pterodroma mollis)*, Fulmar Prion *(Pachyptila crassirostris)*, Brown Booby *(Sula leucogaster)*, Lesser Frigate Bird *(Fregata ariel)* and Antarctic Skua *(Stercorarius skua maccormicki)*. The single specimen of Manx Shearwater *(Puffinus puffinus)* is a new record for New Zealand.

INTRODUCTION

This paper records the results of the Ornithological Society of New Zealand's Beach Patrol Scheme for 1970, 1971 and 1972. The coastline of New Zealand is divided into 15 sections (Imber & Boeson 1969) with an additional grouping of " OI " for Outlying Islands, which includes patrols from the Chatham Islands during 1970.

Nomenclature follows the Annotated Checklist (OSNZ 1970), except that, to save space in the tables, some trinomials have not been used.

RESULTS AND DISCUSSION

The annual totals are summarised in Table 1 and totals of distances patrolled and birds found monthly on each coast are given in Tables 2, 6 and 10.

TABLE 1 — Summary of Annual Totals

	1970	1971	1972
Number of patrollers	82	148	117
Number of beach patrols	184	406	405
Number of specimen record cards	54	87	53
Total kilometres travelled	2717	3291	3247
Total kilometres covered	2152	2470	2748
Total seabirds found	4613	6244	4046
Birds per kilometre covered	2.14	2.52	1.47

Kilometres travelled are the total lengths of coast patrolled; kilometres covered are the lengths of coast covered monthly. Hence, if a kilometre of beach is patrolled 3 times in one month, 3 kilometres will have been travelled but only one kilometre covered per month.

Details of the more common seabirds found dead are given in Tables 3, 4, 7, 8, 11& 12 and of the less sommon species in Tables 5, 9 & 14.

WRECKS

1970

The high number of birds recorded for Auckland West beaches in January was due to a continuation of the early summer wreck of Sooty Shearwaters *(Puffinus griseus)* and high numbers of Blue Penguins *(Eudyptula minor)*. A rise in numbers of Blue Penguins found at this time of year is now considered normal.

On Auckland West beaches in late June, July and August and on Wellington West beaches in July, high numbers of Lesser Broad-billed Prions *(Pachyptila salvini)* were found. There is no reasonable explanation for this wreck which, at the time, was the highest ever recorded for this species. The average for all coasts in 1970 was 0.65 birds per kilometre covered. Higher numbers (1.8/km covered) were found during 1974 (Veitch 1976).

During October, following a long period of south-west winds, high numbers of Fairy Prions *(Pachyptila turtur)* were found on Auckland West and Wellington West beaches. Fewer birds than usual of this species were found earlier in the year, and so the total for the year was average.

In December there was the expected wreck of Sooty Shearwaters on Auckland West beaches.

1971

Data for January were significantly affected by a great increase in beach patrol activity on Auckland East beaches. Many new areas were covered and old remains of birds were found.

Also in January there were higher numbers than usual of Fluttering Shearwaters *(Puffinus gavia)*, Buller's Shearwaters *(P. bulleri)*, and Gannets *(Sula bassana)* found on Auckland West beaches. There is no obvious reason for this.

There also appears to be no single reason for the high numbers of Spotted Shags *(Stictocarbo punctatus)* found on Canterbury North beaches in July.

From September to November high numbers of Fairy Prions were found on Auckland West and Wellington West beaches and continued to be found on Auckland West beaches in December. During the early part of this period there were strong north-east winds, but after that fine weather prevailed west of New Zealand.

TABLE 2 — Numbers of dead seabirds recorded and kilometres patrolled on each coast in 1970.

COAST	CODE		MONTH JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS KM	BIRDS	BIRDS/KM /COAST
AUCKLAND WEST	AW	KM	50	48	55	61	30	69	68	68	55	150	51	60	815		
		BIRDS	142	62	16	41	45	133	597	357	42	369	80	393		2277	2.79
TARANAKI	TA	KM	–	6	6	24	24	16	23	6	29	11	6	6	156		
		BIRDS	–	4	6	12	5	17	18	4	11	8	6	12		103	0.66
WELLINGTON WEST	WW	KM	21	56	27	58	39	6	140	50	61	60	11	55	584		
		BIRDS	16	75	17	73	27	10	851	58	72	241	25	227		1692	2.90
WESTLAND	WD	KM	–	–	–	–	11	–	5	–	–	–	2	19	37		
		BIRDS	–	–	–	–	2	–	0	–	–	–	0	9		11	0.30
AUCKLAND EAST	AE	KM	–	–	–	–	–	–	–	–	43	–	11	13	67		
		BIRDS	–	–	–	–	–	–	–	–	58	–	28	16		102	1.52
BAY OF PLENTY	BP	KM	6	–	–	–	–	3	–	–	–	2	8	–	19		
		BIRDS	14	–	–	–	–	12	–	–	–	0	15	–		41	2.16
EAST COAST NORTH IS	EC	KM	–	–	–	–	–	–	–	–	–	–	5	–	5		
		BIRDS	–	–	–	–	–	–	–	–	–	–	3	–		3	0.60
WAIRARAPA	WA	KM	–	–	–	–	–	–	–	–	3	29	5	–	37		
		BIRDS	–	–	–	–	–	–	–	–	2	3	7	–		12	0.32
CANTERBURY NORTH	CN	KM	2	2	–	–	2	2	2	5	–	–	–	2	17		
		BIRDS	11	5	–	–	4	0	1	2	–	–	–	7		30	1.76
CANTERBURY SOUTH	CS	KM	27	5	21	5	21	5	8	14	14	6	13	8	147		
		BIRDS	32	2	6	2	12	1	0	5	7	3	7	4		81	0.55
OTAGO	OT	KM	2	–	2	11	–	5	8	3	14	8	2	2	57		
		BIRDS	4	–	1	7	–	0	2	0	5	5	1	8		33	0.58
WELLINGTON SOUTH	WS	KM	6	–	13	–	18	6	76	5	–	11	–	8	143		
		BIRDS	14	–	10	–	37	3	79	1	–	2	–	4		150	1.05
NORTH COAST SOUTH IS	NS	KM	–	16	–	2	–	–	–	–	11	2	–	–	31		
		BIRDS	–	16	–	6	–	–	–	–	31	1	–	–		54	1.74
OUTLYING ISLANDS	OI	KM	32	–	–	–	–	–	–	–	–	–	–	5	37		
		BIRDS	22	–	–	–	–	–	–	–	–	–	–	2		24	0.65
TOTAL KM TRAVELLED			179	188	148	185	235	185	393	198	290	303	193	220	2717		
TOTAL KM COVERED			146	133	123	161	195	112	330	151	230	279	114	178	2152		
TOTAL BIRDS RECORDED			255	164	56	141	132	176	1548	427	228	632	172	682		4613	
BIRDS/KM COVERED/MONTH			1.75	1.23	0.46	0.88	0.68	1.57	4.69	2.83	0.99	2.27	1.51	3.83			2.14

No patrols were reported from Southland or Fiordland.

TABLE 3 — Coastal distribution of the more common seabirds found dead in 1970.

SPECIES OR SUBSPECIES	COAST														TOTAL BIRDS
	AW	TA	WW	WD	AE	BP	EC	WA	CN	CS	OT	WS	NS	OI	
Eudyptula minor	127	10	39	–	11	6	–	–	–	2	3	5	12	4	219
albosignata	–	–	–	–	–	–	–	–	2	11	–	1	4	–	18
Diomedea spp*	3	–	12	–	–	–	–	–	–	2	–	1	–	1	19
exulans	24	–	–	–	–	–	–	–	–	–	–	1	–	–	25
melanophris	20	–	6	–	–	–	–	–	–	–	–	–	–	–	26
chrysostoma	22	–	8	–	1	–	–	–	–	–	–	–	–	–	31
cauta cauta	24	1	2	–	1	–	–	–	–	–	1	2	–	–	31
Phoebetria palpebrata	13	–	2	–	1	–	–	–	–	–	–	–	–	–	16
Macronectes giganteus	16	1	10	–	1	–	–	1	1	1	–	2	–	–	33
Fulmarus glacialoides	6	–	10	–	–	–	–	–	–	–	–	–	–	–	16
Daption capensis	37	1	13	–	–	–	–	2	1	5	–	1	–	–	60
Pterodroma macroptera	12	1	2	–	2	3	–	–	–	–	–	–	–	–	20
lessoni	81	2	15	–	–	–	–	–	–	–	–	–	1	–	99
Pachyptila spp*	149	1	503	–	2	–	–	–	2	–	–	2	–	3	662
vittata	22	–	37	–	–	–	–	–	–	3	–	–	–	2	64
salvini	805	21	477	–	–	–	–	–	–	–	–	4	–	–	1307
desolata	5	–	9	–	1	4	–	–	–	–	–	1	–	–	20
belcheri	9	–	17	–	–	–	–	–	–	–	–	–	–	–	26
turtur	189	7	219	–	24	1	1	–	–	–	–	3	31	3	478
Puffinus carneipes	78	–	5	–	1	–	–	–	–	–	–	–	–	–	84
bulleri	52	–	32	–	–	2	–	–	–	–	–	–	–	–	86
griseus	272	7	74	1	19	9	–	7	8	16	1	73	–	3	490
tenuirostris	23	–	10	1	1	1	–	–	–	2	–	–	–	1	39
gavia	89	3	30	2	5	5	1	–	–	–	–	–	–	–	135
huttoni	24	1	41	3	–	–	–	–	3	2	–	–	–	–	74
Pelecanoides urinatrix	46	3	31	–	23	9	–	–	–	–	–	2	–	–	114
Sula bassana	45	1	7	–	3	–	1	1	1	–	–	1	–	–	60
Stictocarbo punctatus	2	–	–	–	–	–	–	–	2	16	3	–	3	–	26
Larus dominicanus	23	21	54	1	–	–	–	–	5	6	9	34	1	2	156
novaehollandiae	5	16	5	–	2	1	–	–	3	5	12	10	2	2	63
Sterna striata	11	2	4	–	–	–	–	1	2	6	–	–	–	–	26
TOTALS	2234	99	1674	8	98	41	3	12	30	77	29	143	54	21	4523

* Denotes in all tables that the species or subspecies could not be identified by the patroller.

TABLE 4 — Monthly distribution of the more common seabirds found dead in 1970.

SPECIES OR SUBSPECIES	MONTH												TOTAL BIRDS
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Eudyptula minor	56	26	6	16	7	12	11	6	12	18	9	40	219
albosignata	4	–	2	4	–	–	1	1	–	1	1	4	18
Diomedea spp*	3	–	–	–	–	–	9	2	–	1	1	3	19
exulans	–	–	1	–	3	1	6	5	–	3	2	4	25
melanophris	–	–	–	3	1	1	4	–	4	1	–	12	26
chrysostoma	–	–	–	–	–	–	12	9	2	6	1	1	31
cauta cauta	1	1	1	3	3	2	2	2	1	5	2	8	31
Phoebetria palpebrata	–	–	–	1	–	–	3	1	3	8	–	–	16
Macronectes giganteus	2	1	–	–	2	–	13	6	7	1	1	–	33
Fulmarus glacialoides	–	–	–	–	–	–	–	1	5	10	–	–	16
Daption capensis	3	3	–	2	1	–	14	4	6	19	3	5	60
Pterodroma macroptera	2	1	1	–	–	–	1	–	2	9	2	2	20
lessoni	2	–	–	4	4	2	10	–	7	60	5	5	99
Pachyptila spp*	5	25	–	4	1	13	244	77	18	184	16	75	662
vittata	4	–	1	11	2	4	32	10	–	–	–	–	64
salvini	1	–	–	4	6	91	982	213	2	4	3	1	1307
desolata	–	–	–	2	1	5	8	2	1	1	–	–	20
belcheri	–	–	–	–	2	–	10	11	1	2	–	–	26
turtur	13	22	–	10	2	8	53	35	78	123	17	117	478
Puffinus carneipes	4	–	3	–	1	–	–	–	–	1	–	75	84
bulleri	7	6	3	3	–	–	1	–	1	23	2	40	36
griseus	56	14	2	8	59	8	44	2	5	32	57	203	490
tenuirostris	8	5	–	5	1	–	–	–	–	–	–	20	39
gavia	24	16	3	5	1	–	13	17	12	23	13	8	135
huttoni	2	7	4	2	–	–	–	–	2	48	2	7	74
Pelecanoides urinatrix	11	1	2	4	4	18	19	7	19	14	10	5	114
Sula bassana	3	9	6	6	2	1	3	–	6	8	9	7	60
Stictocarbo punctatus	6	3	1	1	4	–	–	1	3	3	2	2	26
Larus dominicanus	18	13	8	21	17	4	31	7	16	6	4	11	156
novaehollandiae	7	1	6	9	3	3	10	3	5	2	4	10	63
Sterna striata	3	4	–	6	2	1	1	–	2	1	1	5	26
TOTALS	245	158	50	134	129	174	1537	422	220	617	167	670	4523

TABLE 5 — Seabirds of which 1 to 9 specimens were found dead in 1970. Coast and month of discovery given.

SPECIES OR SUBSPECIES	NUMBER FOUND	COAST(S)	MONTH(S)
Megadyptes antipodes	3	CS,OT(2).	5,7,9.
Eudyptes pachyrhynchus	3	WW,WD(2).	2,12(2).
Diomedea bulleri	1	TA.	2.
epomophora	6	AW(4),WS(2).	3,4,7(2),10,12.
cauta subspp*	2	WW(2).	9(2).
salvini	4	AW(2),WW,WS.	3,8,12(2).
Pterodroma spp*	2	WS(2).	7(2).
inexpectata	9	AW(7),WW(2).	1,4(3),7,10(2),12(2).
leucoptera	1	AW.	1.
brevirostris	4	AW(3),AE.	8,9,10(2).
cooki	3	AW(3).	1,2,4.
h. nigripennis	1	AW.	5.
Halobaena caerulea	5	AW(2),TA,WW(2).	9,10(3),12.
Pachyptila crassirostris	3	AW(2),WW.	7,8(2).
Procellaria cinerea	6	AW(6).	10(3),12(3).
westlandica	2	AW,WS.	7,8.
aequinoctialis	1	WS.	3.
Puffinus gavia/huttoni	1	WW.	9.
assimilis	1	OI.	1.
Pelagodroma marina	4	AW,AE(2),CS.	1,9,10,11.
Phalacrocorax spp*	1	AW.	9.
carbo	4	AW,TA,WW(2).	7,11(2).
varius	6	AW(5),AE.	2,6(2),10(2),12.
sulcirostris	1	TA.	3.
melanoleucos	1	OT.	3.
Leucocarbo c. onslowi	2	OI(2).	1(2).
Stercorarius skua lonnbergi	1	WD.	5.
Larus bulleri	7	WW(4),CS(2),OT.	1,2(2),3,4(2),10.
Hydroprogne caspia	5	AW(3),WW(2).	1,7(2),11(2).
TOTAL	90		

During November and December there was the expected increase in the numbers of Sooty Shearwaters found. In December there was also an increase in numbers of Short-tailed Shearwaters *(Puffinus tenuirostris)* found on Auckland West beaches. The weather during these months was considered to be good.

1972

There were no large wrecks this year. During June, following a period of strong south to south-west winds, there was an increase in numbers of Spotted Shags on Otago beaches, Fluttering Shearwaters on Auckland West and Wellington West beaches, and Diving Petrels on Wellington West beaches, but these increases did not significantly affect the annual totals for these species.

These winds combined with the prevailing south-westerly sea currents also brought, mainly to Wellington West and Wellington South coasts, the highest numbers ever recorded of Yellow-eyed Penguins *(Megadyptes antipodes)*. The total for June was 35 and for the year 50. The next highest annual total is 14 in 1977.

TABLE 6 — Numbers of dead seabirds recorded and kilometres patrolled on each coast in 1971.

COAST	CODE		MONTH JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS KM	BIRDS	BIRDS/KM /COAST
AUCKLAND WEST	AW	KM	142	48	50	60	56	71	58	148	79	116	187	138	1153		
		BIRDS	429	114	42	18	63	14	41	84	156	301	373	967		2602	2.26
TARANAKI	TA	KM	18	3	8	5	19	–	10	8	5	10	11	3	100		
		BIRDS	32	2	3	1	16	–	10	19	0	16	12	8		119	1.19
WELLINGTON WEST	WW	KM	–	–	–	–	16	51	31	8	135	82	29	24	376		
		BIRDS	–	–	–	–	7	17	18	2	258	647	163	80		1192	3.17
WESTLAND	WD	KM	8	–	–	–	–	–	–	–	–	11	–	–	19		
		BIRDS	0	–	–	–	–	–	–	–	–	3	–	–		3	0.16
AUCKLAND EAST	AE	KM	151	14	6	24	16	–	11	18	–	14	42	74	370		
		BIRDS	413	15	1	25	14	–	8	56	–	13	221	350		1116	3.02
BAY OF PLENTY	BP	KM	13	–	3	–	2	–	–	21	10	2	24	6	81		
		BIRDS	29	–	6	–	2	–	–	38	3	2	110	12		202	2.49
EAST COAST NORTH IS	EC	KM	–	–	–	–	–	–	2	–	–	2	6	–	10		
		BIRDS	–	–	–	–	–	–	1	–	–	1	9	–		11	1.10
CANTERBURY NORTH	CN	KM	5	13	10	13	16	31	19	14	13	10	6	3	153		
		BIRDS	32	71	9	35	21	72	112	56	17	14	46	22		507	3.31
CANTERBURY SOUTH	CS	KM	3	–	6	3	–	–	6	6	5	–	–	–	29		
		BIRDS	4	–	11	3	–	–	21	6	13	–	–	–		58	2.00
OTAGO	OT	KM	16	6	3	–	2	3	–	–	3	–	45	–	78		
		BIRDS	17	5	6	–	1	1	–	–	1	–	188	–		219	2.81
SOUTHLAND	SD	KM	–	–	–	–	–	–	5	3	5	5	–	5	23		
		BIRDS	–	–	–	–	–	–	16	11	0	6	–	6		39	1.70
WELLINGTON SOUTH	WS	KM	–	–	–	–	8	–	11	6	–	–	6	–	31		
		BIRDS	–	–	–	–	10	–	20	5	–	–	110	–		145	4.68
NORTH COAST SOUTH IS	NS	KM	5	21	8	5	–	–	–	–	–	8	–	–	47		
		BIRDS	5	24	1	0	–	–	–	–	–	1	–	–		31	0.66
TOTAL KM TRAVELLED			423	183	159	142	138	232	280	293	340	399	412	290	3291		
TOTAL KM COVERED			361	105	94	110	135	156	153	232	255	260	356	253	2470		
TOTAL BIRDS RECORDED			961	231	79	82	134	104	247	277	448	1004	1232	1445		6244	
BIRDS/KM COVERED/MONTH			2.66	2.20	0.84	0.75	0.99	0.67	1.61	1.19	1.76	3.86	3.46	5.71			2.52

No patrols were reported from Wairarapa, Fiordland or Outlying Islands.

TABLE 7 — Coastal distribution of the more common seabirds found dead in 1971.

SPECIES OR SUBSPECIES	AW	TA	WW	WD	AE	BP	COAST EC	CN	CS	OT	SD	WS	NS	TOTAL BIRDS
Eudyptula minor	180	7	24	–	108	32	–	9	–	9	1	5	16	391
albosignata	–	–	–	–	–	–	–	21	13	5	–	–	–	39
Diomedea spp*	9	–	3	–	5	–	–	–	1	1	–	–	–	22
exulans	19	–	1	–	–	–	–	3	–	–	–	–	–	20
melanophris	8	–	1	–	1	–	–	–	–	–	–	–	–	10
chrysostoma	34	–	8	–	–	–	–	1	–	–	1	1	–	45
cauta subspp*	9	–	–	–	–	–	–	–	–	1	–	–	–	10
cauta	8	–	5	–	–	1	–	–	–	2	–	2	–	18
Phoebetria palpebrata	6	–	1	–	–	–	–	5	1	–	–	–	–	13
Macronectes giganteus	21	2	4	–	4	–	1	3	1	2	–	2	–	40
Daption capensis	30	–	18	–	2	–	–	3	–	1	–	2	–	56
Pterodroma macroptera	18	1	–	–	47	6	–	–	–	–	–	–	–	72
lessoni	33	–	4	–	1	3	–	–	–	–	–	–	–	41
inexpectata	8	–	–	–	1	1	–	1	–	1	–	–	–	12
cooki	8	–	–	–	16	–	–	–	–	–	–	–	–	24
Pachyptila spp*	96	3	101	–	2	–	–	3	–	1	–	1	4	211
vittata	11	–	63	–	–	1	–	4	–	–	–	–	1	80
salvini	27	–	8	1	1	–	–	1	–	1	–	–	–	39
desolata	7	–	2	–	2	–	–	–	–	–	–	1	–	12
turtur	425	14	647	–	41	3	–	34	1	13	–	2	1	1181
Procellaria cinerea	7	–	1	–	–	–	–	–	–	–	–	2	–	10
Puffinus spp*	12	–	–	–	1	2	–	3	–	–	–	–	1	19
carneipes	54	–	–	–	65	7	–	–	–	–	–	–	–	126
bulleri	56	–	10	–	99	14	–	–	–	–	–	1	–	180
griseus	781	7	119	–	304	96	6	55	5	130	26	98	–	1627
tenuirostris	171	1	14	–	31	1	–	15	3	–	2	1	–	239
gavia	230	13	50	–	80	3	1	16	–	–	–	1	–	394
huttoni	31	–	6	–	–	–	–	15	–	–	–	–	–	52
assimilis	9	–	–	–	9	–	–	–	–	–	–	–	–	18
Pelagodroma marina	6	–	–	–	7	3	–	–	–	–	–	–	–	16
Pelecanoides urinatrix	57	2	45	–	142	14	–	–	–	1	–	–	–	261
Sula bassana	101	6	10	–	81	5	2	6	–	1	–	–	2	216
Phalacrocorax varius	7	–	–	–	4	2	–	–	–	–	–	–	1	14
Stictocarbo punctatus	–	–	1	1	–	–	–	152	21	10	–	–	2	187
Larus dominicanus	49	22	26	1	10	–	1	63	3	17	8	17	–	217
novaehollandiae	12	32	8	–	31	1	–	59	2	14	–	5	1	165
bulleri	–	–	1	–	–	–	–	14	2	1	1	–	–	19
Sterna striata	19	5	–	–	4	5	–	19	1	–	–	1	–	54
TOTALS	2559	117	1181	3	1099	200	11	505	54	211	39	142	29	6150

TABLE 8 — *Monthly distribution of the more common seabirds found dead in 1971.*

SPECIES OR SUBSPECIES	MONTH												TOTAL BIRDS
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Eudyptula minor	124	47	15	14	13	1	16	78	9	16	17	41	391
albosignata	9	10	5	4	3	2	2	1	–	–	2	1	39
Diomedea spp*	6	2	1	1	–	–	2	–	2	–	4	4	22
exulans	16	–	–	–	–	–	–	–	2	1	–	1	20
melanophris	6	–	–	–	–	–	2	1	1	–	–	–	10
chrysostoma	6	1	–	–	2	–	11	2	8	8	5	2	45
cauta subspp*	1	–	–	–	–	–	–	–	1	–	2	6	10
cauta	3	1	–	–	1	2	2	1	–	1	5	2	18
Phoebetria palpebrata	–	–	–	–	–	–	6	1	5	–	–	1	13
Macronectes giganteus	2	–	–	–	–	4	14	6	6	3	4	1	40
Daption capensis	8	–	–	–	–	2	2	2	23	7	8	4	56
Pterodroma macroptera	50	2	–	–	2	–	–	1	1	–	5	11	72
lessoni	7	4	–	–	2	–	4	4	4	7	4	5	41
inexpectata	3	–	–	–	2	1	–	–	–	–	1	5	12
cooki	7	2	–	5	–	–	–	–	–	–	3	7	24
Pachyptila spp*	6	3	–	–	4	2	3	1	62	34	13	83	211
vittata	2	1	–	–	–	–	–	1	28	37	8	3	80
salvini	1	–	–	–	3	–	1	–	7	14	6	7	39
desolata	2	–	–	–	2	–	1	–	4	1	–	2	12
turtur	64	31	4	1	3	–	8	19	106	703	130	112	1161
Procellaria cinerea	4	–	–	–	–	–	–	–	1	1	2	2	10
Puffinus spp*	2	–	–	–	–	–	–	–	–	1	3	13	19
carneipes	54	11	–	2	3	–	–	–	–	2	21	33	126
bulleri	38	8	1	5	3	2	–	–	1	8	36	78	180
griseus	161	21	12	4	18	11	24	22	1	25	693	635	1627
tenuirostris	14	–	–	–	25	6	5	1	2	6	24	156	239
gavia	67	18	3	6	3	1	7	26	80	39	65	79	394
huttoni	7	6	–	–	–	–	–	–	1	9	24	5	52
assimilis	4	2	–	–	1	–	1	2	–	–	1	7	18
Pelagodroma marina	6	–	–	–	1	–	–	–	–	2	1	6	16
Pelecanoides urinatrix	85	1	1	3	4	–	2	37	33	27	22	46	261
Sula bassana	82	14	5	4	3	4	3	5	9	11	36	40	216
Phalacrocorax varius	7	1	2	–	–	1	–	1	–	–	1	1	14
Stictocarbo punctatus	7	7	7	15	8	37	52	23	10	2	15	4	187
Larus dominicanus	17	14	8	11	18	19	33	18	18	17	29	15	217
novaehollandiae	39	11	4	3	4	7	29	12	8	10	26	12	165
bulleri	2	6	2	–	1	1	4	3	–	–	–	–	19
Sterna striata	16	4	5	1	2	–	9	8	3	2	1	3	54
TOTALS	935	228	75	79	131	103	243	276	436	994	1214	1433	6150

TABLE 9 — Seabirds of which 1 to 9 specimens were found dead in 1971. Coast and month of discovery given.

SPECIES OR SUBSPECIES	NUMBER FOUND	COAST(S)	MONTH(S)
Megadyptes antipodes	3	OT(2),WS.	1,5,11.
Eudyptes pachyrhynchus	1	CS.	3.
Diomedea epomophora	3	AW,WW,OT.	1,12(2).
bulleri	7	AW(5),WW,CN.	1(3),6,7,8,11.
cauta salvini	9	AW(4),WW,AE,OT,WS(2).	9,11(3),12(5).
eremita	2	WW,BP.	9,12.
Fulmarus glacialoides	3	AW,CN,OT.	3,7,11.
Pterodroma spp*	4	TA,AE(2),NS.	1(2),5,7.
mollis	1	BP.	11.
brevirostris	2	AW,WW.	9(2).
pycrofti	5	AW(2),AE(3).	1(2),4(2),12.
leucoptera	2	AW,AE.	1,11.
h. nigripennis	1	AW.	1.
Halobaena caerulea	2	AW(2).	1,9.
Pachyptila belcheri	8	AW(5),WW(3).	9(3),10(3),11(2).
crassirostris	2	CS(2).	9(2).
Procellaria spp*	1	AW.	9.
westlandica	1	CN.	5.
aequinoctialis	3	AW(2),WW.	1(3).
Puffinus gavia/huttoni	1	WW.	10.
Oceanites oceanicus	1	AE.	12.
Sula leucogaster	1	AE.	1.
Phalacrocorax spp*	1	NS.	2.
carbo	4	AW(4).	10(3),11.
melanoleucos	5	AW,TA,AE(2),OT.	2(2),3,7,11.
Leucocarbo c. chalconotus	2	OT(2).	3,11.
Fregata ariel	1	AW.	1.
Stercorarius parasiticus	2	AW(2).	11,12.
Larus spp*	1	AE.	12.
Hydroprogne caspia	7	AW(5),AE(2).	1(3),4,10(2),11.
Sterna spp*	1	WW.	9.
fuscata	7	AW(4),WW,AE(2).	1(6),10.
TOTAL	94		

UNUSUAL FINDS

CHATHAM ISLAND MOLLYMAWK *Diomedea cauta eremita*

The two birds recorded from Himitangi Beach (WW) in September and Port Ohope (BP) in December 1971 are the second and third beach patrol records for this species. One specimen was found in August 1964.

SOFT-PLUMAGED PETREL *Pterodroma mollis*

The specimen found on Thornton Beach (BP) in November 1971 is a new record for beach patrolling (Hellyer *et al.* 1973) and the second time this species has been found in New Zealand. The previous record is of one specimen found alive in the Hutt Valley in May 1971 (Kinsky 1971). This species breeds on islands in the temperate zone of the South Atlantic and Indian Oceans. On Antipodes Island it has been seen flying in some numbers after nightfall but not on the ground (Warham & Bell 1979). Since 1971, the number of

sightings at sea near New Zealand has been increasing (Falla 1979). There are now subsequent beach patrolling records of one specimen found in December 1974 (Veitch 1976) and one in June 1978.

FULMAR PRION *Pachyptila crassirostris*

The three birds found in July and August 1970 are the first records of this bird in the Beach Patrol Scheme. There are now subsequent records of two birds found in September 1971, two in July 1973, one in September 1977, and eight in July, August and September 1978.

GREY PETREL *Procellaria cinerea*

The ten birds found in January and September-December 1971 is the greatest number of the species ever recorded. It has been found during most years at an average of 2.4 per year. The next highest number found was six in October and December 1970.

MANX SHEARWATER *Puffinus puffinus*

The specimen found near Pukerua Bay (WW) in June 1972 is a new record for New Zealand (Kinsky & Fowler 1973). This species breeds on islands in the eastern North Atlantic and winters in the south-west Atlantic.

BROWN BOOBY *Sula leucogaster*

The specimen found on Te Werahi Beach (AE) in January 1971 is a new record for beach patrolling. This species probably reaches our northern waters every summer (OSNZ 1970) and one has roosted with Gannets on Horuhoru Rock in the Hauraki Gulf (Sibson 1979).

LESSER FRIGATE BIRD *Fregata ariel*

The specimen found on Ninety Mile Beach (AW) in January 1971 is a new record for beach patrolling. This species straggles southward to New Zealand. There have been at least 13 previous records (OSNZ 1970), presumably of birds seen at sea.

ANTARCTIC SKUA *Stercorarius skua maccormicki*

The specimen found on Dargaville Beach (AW) in October 1972 is a new record for the Beach Patrol Scheme. During winter this species ranges to the north Pacific. There have been five previous records of this bird on the New Zealand mainland.

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E & O E

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TABLE 10 — Numbers of dead seabirds recorded and kilometres patrolled on each coast in 1972.

COAST	CODE		MONTH JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS KM	BIRDS	BIRDS/KM /COAST
AUCKLAND WEST	AW	KM	43	109	40	50	77	119	116	71	188	90	95	95	1093		
		BIRDS	176	148	57	37	109	142	149	95	233	134	114	111		1505	1.38
TARANAKI	TA	KM	10	10	5	3	2	2	8	19	–	2	2	5	66		
		BIRDS	16	11	10	0	1	0	2	11	–	0	3	4		58	0.88
WELLINGTON WEST	WW	KM	5	13	18	85	48	119	77	72	109	69	11	42	668		
		BIRDS	8	23	4	148	42	306	96	40	294	207	70	39		1277	1.91
WESTLAND	WD	KM	2	–	2	3	5	–	–	–	–	–	–	–	12		
		BIRDS	8	–	0	1	1	–	–	–	–	–	–	–		10	0.83
AUCKLAND EAST	AE	KM	31	47	16	5	47	6	39	114	10	14	16	18	363		
		BIRDS	45	74	17	1	16	2	27	183	5	35	15	23		443	1.22
BAY OF PLENTY	BP	KM	16	–	–	–	–	–	11	–	–	–	–	–	27		
		BIRDS	19	–	–	–	–	–	40	–	–	–	–	–		59	2.19
EAST COAST NORTH IS	EC	KM	–	5	–	3	–	5	–	–	3	–	–	–	16		
		BIRDS	–	3	–	1	–	0	–	–	0	–	–	–		4	0.25
CANTERBURY NORTH	CN	KM	8	14	10	16	34	14	6	6	–	6	–	–	114		
		BIRDS	29	54	29	17	58	6	1	1	–	1	–	–		196	1.72
CANTERBURY SOUTH	CS	KM	2	–	2	–	5	3	6	8	18	8	2	5	59		
		BIRDS	1	–	12	–	2	0	2	1	2	3	2	20		45	0.76
OTAGO	OT	KM	–	–	5	8	2	5	2	–	–	–	2	3	27		
		BIRDS	–	–	1	4	6	105	1	–	–	–	8	13		138	5.11
SOUTHLAND	SD	KM	5	8	8	6	2	6	6	–	6	6	13	6	72		
		BIRDS	4	15	4	4	11	7	4	–	14	32	11	28		134	1.86
WELLINGTON SOUTH	WS	KM	–	–	–	18	–	82	47	14	13	32	3	3	212		
		BIRDS	–	–	–	20	–	63	36	1	24	5	0	2		171	0.81
NORTH COAST SOUTH IS	NS	KM	–	6	5	–	–	–	–	6	–	2	–	–	19		
		BIRDS	–	3	2	–	–	–	–	0	–	1	–	–		6	0.32
TOTAL KM TRAVELLED			156	257	126	243	249	484	370	336	431	237	146	212	3247		
TOTAL KM COVERED			122	212	111	197	212	362	319	312	348	230	143	177	2748		
TOTAL BIRDS RECORDED			306	331	136	233	246	651	358	332	572	418	223	240		4046	
BIRDS/KM COVERED/MONTH			2.50	1.56	1.23	1.18	1.16	1.80	1.12	1.06	1.64	1.82	1.56	1.36			1.47

No patrols were reported from Wairarapa, Fiordland or Outlying Islands.

TABLE 11 — Coastal distribution of the more common seabirds found dead in 1972.

SPECIES OR SUBSPECIES	AW	TA	WW	WD	AE	BP	COAST EC	CW	CS	OT	SD	WS	NS	TOTAL BIRDS
Megadyptes antipodes	–	–	17	–	–	–	–	–	2	6	–	25	–	50
Eudyptula minor	197	2	38	–	83	–	1	6	–	4	11	5	3	350
albosignata	–	–	–	–	–	–	–	18	1	–	–	2	–	21
Diomedea spp*	5	–	10	–	1	–	–	1	–	–	1	1	–	19
melanophris	8	–	1	–	–	–	–	–	–	–	–	1	–	10
cauta subspp*	5	–	3	–	2	–	–	–	–	–	–	–	–	10
cauta	11	–	4	–	–	–	–	1	–	1	1	2	–	20
Phoebetria palpebrata	3	–	–	–	7	–	–	–	–	–	–	–	–	10
Macronectes giganteus	31	2	16	–	11	–	–	4	–	1	1	–	–	66
Daption capensis	18	–	16	1	4	–	–	–	–	–	3	6	–	48
Pterodroma macroptera	9	2	–	–	1	2	–	–	–	–	–	–	–	14
lessoni	30	–	5	2	2	–	–	–	–	–	–	–	–	39
inexpectata	11	–	–	–	–	–	–	–	–	–	1	–	–	12
Pachyptila spp*	150	3	214	–	24	36	–	–	–	–	1	–	–	428
vittata	12	1	17	–	–	–	–	1	14	1	14	2	–	62
salvini	11	–	11	–	4	–	–	–	–	–	–	–	–	26
desolata	12	–	8	–	3	1	–	–	–	–	–	–	–	24
belcheri	11	–	2	–	3	–	–	–	–	–	–	1	–	17
turtur	173	1	374	1	94	9	–	5	–	3	2	20	–	682
Puffinus spp*	1	–	3	–	1	–	–	4	2	–	–	–	–	11
carneipes	20	–	–	–	18	–	–	–	–	–	–	–	–	38
bulleri	46	–	7	–	17	–	–	2	1	–	–	1	–	74
griseus	230	7	62	3	20	–	1	35	1	3	27	9	–	398
tenuirostris	69	–	7	–	2	–	–	11	–	–	23	–	–	112
gavia	117	7	161	–	34	–	–	1	–	–	1	18	–	339
huttoni	10	–	12	–	–	–	–	5	–	–	–	–	–	27
Pelecanoides urinatrix	63	3	122	–	31	8	–	–	–	–	9	7	–	243
Sula bassana	110	1	13	–	25	1	1	1	1	–	–	3	1	157
Phalacrocorax varius	6	–	–	–	3	–	–	–	–	–	–	–	1	10
Leucocarbo c. chalconotus	–	–	–	–	–	–	–	–	–	10	8	–	–	18
Stictocarbo punctatus	4	–	13	1	1	–	–	52	13	99	4	2	–	189
Larus dominicanus	62	8	81	1	8	–	–	20	4	3	14	49	1	251
novaehollandiae	12	14	17	–	29	–	1	16	3	5	5	8	–	110
bulleri	–	–	8	–	–	–	–	4	1	–	3	–	–	16
Sterna striata	14	7	11	–	3	–	–	6	1	–	–	2	–	44
TOTALS	1461	58	1253	9	431	57	4	193	44	136	129	164	6	3945

TABLE 12 — Monthly distribution of the more common seabirds found dead in 1972.

SPECIES OR SUBSPECIES	MONTH												TOTAL BIRDS
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Megadyptes antipodes	–	–	–	–	1	35	7	–	–	–	1	6	50
Eudyptula minor	20	50	20	17	15	51	34	57	36	18	8	24	350
albosignata	6	3	4	1	4	1	–	–	1	1	–	–	21
Diomedea spp*	–	1	–	–	–	4	1	1	10	2	–	–	19
melanophris	–	–	–	1	3	1	2	1	1	–	1	–	10
cauta subspp*	–	–	–	–	1	2	3	2	1	1	–	–	10
cauta	–	–	1	2	3	4	2	2	1	2	3	–	20
Phoebetria palpebrata	–	–	–	–	–	–	–	8	1	1	–	–	10
Macronectes giganteus	–	2	–	2	4	9	8	11	18	5	5	2	66
Daption capensis	2	–	–	–	–	5	2	11	13	9	4	2	48
Pterodroma macroptera	2	3	2	–	1	1	4	–	–	1	–	–	14
lessoni	3	1	–	1	5	5	1	2	7	5	7	2	39
inexpectata	3	3	2	–	–	3	–	–	–	–	–	1	12
Pachyptila spp*	–	6	–	3	3	10	82	46	144	91	33	10	428
vittata	4	2	1	2	1	5	2	–	4	18	5	18	62
salvini	–	–	–	1	2	6	6	5	4	1	1	–	26
desolata	–	–	–	5	10	–	4	3	2	–	–	–	24
belcheri	–	1	–	–	–	4	4	4	2	1	–	1	17
turtur	22	16	2	58	10	26	65	101	198	130	33	21	682
Puffinus spp*	1	2	2	–	1	2	–	2	1	–	–	–	11
carneipes	5	16	4	4	–	–	–	–	–	1	2	6	38
bulleri	15	8	2	2	8	1	1	–	3	12	13	9	74
griseus	78	61	16	18	38	49	8	2	4	25	53	46	398
tenuirostris	34	17	2	–	13	–	1	–	–	16	11	18	112
gavia	16	37	15	19	10	129	27	26	27	12	10	11	339
huttoni	3	3	–	3	2	–	1	–	6	2	2	5	27
Pelecanoides urinatrix	37	16	–	22	7	31	18	11	16	16	7	12	243
Sula bassana	16	14	7	8	14	20	22	11	15	17	2	11	157
Phalacrocorax varius	–	5	1	–	2	–	–	1	–	–	1	–	10
Leucocarbo c. chalconotus	–	–	–	–	5	11	–	–	–	1	1	–	18
Stictocarbo punctatus	9	13	15	8	25	105	2	2	1	2	1	6	189
Larus dominicanus	6	22	16	37	32	41	29	8	30	11	5	14	251
novaehollandiae	11	19	10	5	15	14	15	8	3	4	3	3	110
bulleri	–	1	3	2	1	3	–	–	2	3	–	1	16
Sterna striata	8	4	7	7	5	7	2	2	–	–	1	1	44
TOTALS	301	326	132	228	241	635	353	327	551	408	213	230	3945

TABLE 13 — Miscellaneous birds recorded but not considered to be seabirds.

	1970	1971	1972
Ardea novaehollandiae	1	2	1
Egretta sacra	–	2	–
Anser spp*	3	–	–
Cygnus atratus	8	7	21
Tadorna variegata	–	–	1
Anas spp*	2	–	–
chlorotis	–	–	1
superciliosa	1	3	4
platyrhynchos	1	4	9
rhynchotis	2	1	1
Circus approximans	–	3	8
Synoicus ypsilophorus	–	1	–
Lophortyx californica	–	1	1
Phasianus colchicus	–	–	1
Porphyrio melanotus	2	1	4
Haematopus finschi	2	7	11
unicolor	2	1	2
Charadrius bicinctus	–	1	–
obscurus	–	1	–
Limosa lapponica	1	–	–
Calidris canutus	–	1	–
Himantopus leucocephalus	1	1	–
Hemiphaga novaeseelandiae	–	1	2
Columba livia	11	10	13
Ninox novaeseelandiae	2	1	2
Chaetura caudocuta	–	2	–
Halcyon sancta vagans	4	–	–
Alauda arvensis	–	1	1
Turdus philomelos	3	1	10
merula	7	4	17
Anthus novaeseelandiae	–	–	1
Prosthemadera novaeseelandiae	–	2	–
Zosterops lateralis	–	–	1
Chloris chloris	–	–	1
Carduelis carduelis	–	–	1
Fringilla coelebs	–	–	1
Emberiza citrinella	–	–	1
Passer domesticus	–	1	1
Sturnus vulgaris	–	3	4
Acridotheres tristis	–	2	–
Gymnorhina spp*	23	13	13
TOTALS	76	78	134

TABLE 14 — Seabirds of which 1 to 9 specimens were found dead in 1972. Coast and month of discovery given.

SPECIES OR SUBSPECIES	NUMBER FOUND	COAST(S)	MONTH(S)
Eudyptes pachyrhynchus	2	SD,WW.	3,4.
Diomedea exulans	6	AW(2),WW(2),AE,SD.	6(3),7,10,12.
epomophora	7	AW(3),WW(3),WS.	4,6(3),7,9,11.
chrysostoma	9	AW(4),WW(4),AE.	6,8,9(4),10(2),12.
bulleri	2	AW,SD.	6,11.
cauta salvini	8	AW(2),AE,CN,OT,WS(3).	3,4,7(2),9(2),10,11.
Fulmarus glacialoides	5	AW(2),WW(3).	10(4),11.
Pterodroma spp*	1	AW.	5.
brevirostris	6	AW(3),WW(3).	8(2),9(4).
cooki	5	AW(3),AE(2).	2,4,12(3).
Halobaena caerulea	8	AW(7),WW.	9(5),10,11(2).
Procellaria spp*	3	AW(2),AE.	8,9(2).
cinerea	1	BP.	1.
parkinsoni	2	AW(2).	9,12.
westlandica	2	AW,WD.	4,6.
aequinoctialis	3	AW(2),SD.	1,2,3.
Puffinus puffinus	1	WW.	6.
assimilis	4	AW(4).	1,3,11,12.
Pelagodroma marina	4	AE(3),BP.	1(2),2(2).
Phalacrocorax carbo	7	WW(3),CS,SD,WS(2).	2,5,6,7,9,12(2).
sulcirostris	2	AW,OT.	6(2).
melanoleucos	2	WW,AE.	6,11.
Stercorarius skua lonnbergi	1	AW.	12.
maccormicki	1	AW.	10.
Larus spp*	1	WS.	6.
Hydroprogne caspia	8	AW(2),WW(2),AE(2)CN(2).5(3),6,8,9,11(2).	
TOTAL	101		

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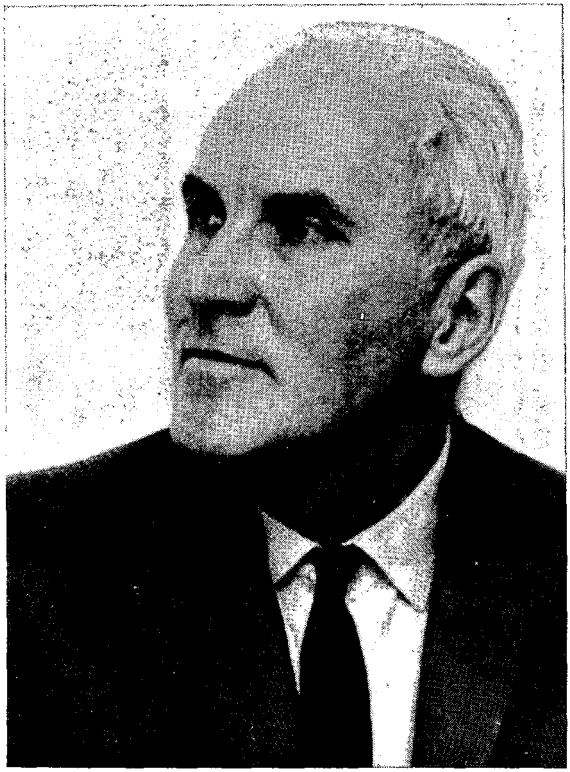
HONORARY LIFE MEMBERSHIP



At the 1980 annual general meeting, the Society unanimously elected Professor Brian John Marples as Honorary Life Member of the Society. Soon after he took up the Chair of Zoology at the University of Otago in 1937 he wrote to various ornithologists in New Zealand suggesting that an ornithological society should be formed here. This proposal initiated discussions which resulted in the founding of the Society in 1939. Professor Marples was its first secretary-treasurer and he was responsible for the initial organisation, as the following comment in the introduction to the first report shows. " Until the first annual meeting was held in May 1940, the organising secretary has had to do practically all the work and in some districts regional organisers had not even been appointed. Consequently there has been some delay in the task of collecting and collating the reports on birds submitted by members." From these reports the publishable

sections had to be extracted, sorted and finally typed. They occupied almost 16 typed foolscap pages of the 33-page cyclostyled first publication of the Society. So Professor Marples was also, in effect, the first editor.

He continued in this capacity with some assistance from Dr R. A. Falla until 1943 when Dr Falla went off on the Cape Expedition. Dr Falla joined him again in late 1944 and they continued to produce the by then printed *NZ Bird Notes.* In 1947 Professor Marples became president and gave up the journal editing and the position of secretary-treasurer. He was president for two years.

During this period he initiated and ran the first bird ringing scheme in New Zealand, the major outcome of which was the ' Report on trapping and ringing work on the White-eye *Zosterops lateralis* throughout the Dominion ' (*NZ Bird Notes* 1: 41-48, 1944). This was the first special study by the Ornithological Society of New Zealand. It is probably fair to say that the success of this project fostered the interest of members in ringing and the Society started its own ringing scheme from which has grown the present national banding scheme.

His unassuming council in the Society has had far-reaching effects. He was always accessible for discussion and advice, and both amateur and professional ornithologists sought them from him. His deep understanding of ornithology, especially in the field, has had a profound effect on many of his students, who in turn have made their impact on ornithology in New Zealand and overseas.

Professor Marples' initiative launched the Society. His effective hard work established a pattern for the publication of the classified summarised notes — one of the most important contributions to the knowledge of New Zealand birds. He served the Society well in its important formative years. The success of the Society owes much to his unassuming enthusiasm for ornithology and his ability to convey it to others.

It is fitting that the Society should recognise his contributions by making him an Honorary Life Member — the highest honour that the Society can bestow.

— L. GURR

SHORT NOTES

ORANGE-FRONTED PARAKEET: RECORD OF FLOCKING

Despite Harrison's (1970) review of what is known of *Cyanoramphus malherbi* Souance, the smallest and rarest of New Zealand parakeets, its status is still subject to discussion. At the NZ Ecological Society's annual conference in Wellington (August 1980), a poster display by Mr Allan J. Nixon, illustrating his research on *Cyanoramphus* parakeets, mentioned Holyoak's suggestion (1974) that *C. malherbi* (Orange-fronted Parakeet) may be a "morph" (i.e. an infra-subspecific form, mutation, phase or variation) of the Yellow-crowned Parakeet, *C. auriceps* (Kuhl). Its constancy, its apparent restriction to the South Island part of the range of *C. auriceps,* and its failure to turn up in a century's experience (more or less) of aviary breeding of *C. auriceps* may be cited as evidence for specific status, and there is additional evidence, not hitherto recorded, that Orange-fronted Parakeets occasionally associate in small flocks.

The late A. C. O'Connor, 1883-1951 (see Dell 1975), one of the last amateur collectors of New Zealand birds, was wool auctioneer for Wright Stephenson & Co. Ltd, stock and station agents, Wellington, and he regularly travelled to other New Zealand centres for the periodic wool sales. When I first knew him, his wife was an invalid, and they had separate rooms upstairs in his Grant Road house. He used the dressing room adjacent to his own room as a museum for his collection. He told me he liked to bring home a bird from his trips, so that he could prepare the skin in the evenings of the following week, within talking distance of his wife. So when in Nelson, Christchurch, or Invercargill, he would borrow the firm's car for the weekend to visit nearby bush or tidal estuaries, and in other centres he would meet up with ornithologist friends for an excursion. (On one occasion, for instance, I arranged to explore with him the shag colony on an island in Lake Waikare in the Waikato, which led to the first firm evidence that Little Black Shags bred there).

On 14 August 1928, O'Connor had driven from Nelson to the "Owen Junction" (Owen River of the *New Zealand Atlas*) and was strolling up a road or track in the bush when he heard parakeets chattering in the canopy above. Thinking they would be Yellow-crowned, he shot one, but was amazed to find, when he picked it up, that it was Orange-fronted. He raised his 410 shotgun and fired again and again and brought down four more Orange-fronted Parakeets. This was always a rare bird, and a new species to add to his collection, but to collect five specimens at one time was unprecedented, almost a miracle.

O'Connor's generation overlapped with that of H. H. Travers and other commercial collectors such as Bills and Dannefaerd, but he was not entirely devoid of conscience as a collector. After his un-

precedented luck in collecting five *C. malherbi* from one flock, he took steps to share the spoil with others. One specimen was handed directly to Dr W. R. B. Oliver (Dominion Museum), where it was mounted by the taxidermist, C. J. Lindsay. Another was given to the late Harry G. Drew of Wanganui, another collector friend who was a proficient taxidermist (taught, when a boy, as he told me in 1945, by Andreas Reischek when the latter came to Wanganui to mount birds for Harry's father, Samuel H. Drew, who founded Wanganui Museum). While O'Connor was competent in preparing study skins, he could not mount birds as well as Drew, and I believe Drew mounted two of O'Connor's *C. malherbi* (one for himself) while O'Connor made study skins of two more. O'Connor later gave (or exchanged) one of these skins to Edgar F. Stead and the other, probably some years later, to R. A. Falla for the Auckland War Memorial Museum, after he joined the staff in 1931. All five birds can still be traced.

O'Connor's manuscript catalogue (Canterbury Museum) has the following entries:

442 Owen Junction 14/8/28 ♂ (now Cant. Mus. Av. 63, ex E. F. Stead Coll.)
443 „ „ „ ♂ (marked "Falla, Auck.", now Auckland Museum, Av. 44.5)
444 „ „ „ ♂ (now Cant. Mus. Av. 2570, mounted, ex A. C. O'Connor Coll.)

National Museum, Wellington, has the following mounted specimens:

No. 446 Owen Junction ♂ 15/10/28

No. 1364 Owen R. Junction ♂ A. C. O'Connor, September 1928.

No. 446 is presumably the specimen given to Oliver by O'Connor and 1364 was acquired when the Drew Collection was purchased by National Museum about 1946.

I discount the dates associated with the two last specimens. O'Connor told me he got five birds together, giving one to Oliver and one to Drew, and that they were the only *C. malherbi* he ever collected. O'Connor had access to freezing chambers, and taxidermists sometimes put down on labels the dates they received or skinned the specimen. I do not recall O'Connor commenting on the five specimens all being males, and this should (if possible) be checked by measurements.

The three species of mainland parakeet are very similar and obviously closely related. The two larger species interbreed readily in captivity, occasionally in the field (Taylor 1975) and few would doubt that the two smaller species would also hybridise, given the right conditions. Moreover, although Taylor (1975) has recorded ecological differences between Red-crowned and Yellow-crowned, no one has yet been able to define precisely the differences in ecological niche between the three species, the suggestion that *C. malherbi* is

montane or subalpine being incompatible with its occurrence in lowland mixed flocks. This suggests that speciation was quite a recent event, no older than Quaternary in terms of the writer's model roughly correlating systematic differences with time of separation (Fleming 1961; see also Taylor 1975). *Cyanoramphus* is one of the few genera of New Zealand birds containing more than one species. I have elsewhere suggested (Fleming 1974) that the alternating high and low sea levels of the Pleistocene, by repeatedly isolating and linking the main islands, constitute a likely mechanism for initiating such speciation. During the phase of isolation, the southern isolates in each case became ecologically modified for life in southern (if not subalpine) conditions, sufficiently to permit them to live sympatrically with the northern stock when they mingled again after Cook Strait was bridged once more. This model seems most applicable to *Nestor* (Kaka and Kea) and *Xenicus* (Bush and Rock Wren), where the extra South Island species are obviously subalpine, but still seems tenable for the other groups, in which the South Island derivatives are forest species, like their more widespread presumptive ancestors (kiwis, Bush Canary-Creeper complex and parakeets). One difficulty with the model (for all cases) is to explain why the southern form, if evolved earlier in the Pleistocene, did not extend into the North Island across the Cook Strait land bridge in the Last Glaciation; this difficulty would be overcome if speciation dated from the last (i.e. post-glacial) flooding of the strait, but that seems far too recent a date for the degree of differentiation that has occurred. In both cases where three sympatric species have evolved (kiwis and parakeets), the species confined to the South Island *(Apteryx haastii* and *Cyanoramphus malherbi)* would be the result, under this hypothesis, of the latest episode of speciation in the South Island.

O'Connor's record of flocking is obviously relevant to the status of *C. malherbi;* additional data to throw light on parakeet speciation will come from Mr Nixon's studies. I am grateful to Mrs Sylvia Reed (Auckland Institute and Museum), Mr N. H. S. Hyde (National Museum, Wellington) and Mr Ron Scarlett (Canterbury Museum) for supplying data on specimens in the collections of these institutions, to Mr R. H. Taylor for encouraging me to write this note, which I alone could write at this time, and to Mr Nixon for the Holyoak reference.

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ADDITIONS AND CORRECTIONS TO THE BIBLIOGRAPHY OF R. A. FALLA

The following items amend the bibliography of R. A. Falla in *Notornis* 27 (2): 187-195 (1980).

Additions

Three items have been supplied by R. J. Scarlett.

1936: Birds at Cape Brett, New Zealand. Emu 36 (2). (Note referring to A. F. D'Ombrain, Notes on sea birds seen off Cape Brett, Bay of Islands, New Zealand. Emu 36 (1): 16-19.)

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Corrections

The last two items listed under 1949 (p. 190), " The Notornis has chicks " and " The egg came after the chick " were written and illustrated by Mr J. H. Sorensen for the *New Zealand Listener* and not by R. A. Falla. I apologise to Mr Sorensen for any embarrassment caused by the error.

C. A. FLEMING

★

GODWITS CHASING SKUA

On 31 March 1980 I was at the oxidation pond at the top of Nelson Haven, the weather was strong N.W. with heavy showers. I watched a skua, Pomarine or Arctic, dark phase, white at base of primaries very marked, smaller than Black-backed Gull *(Larus dominicanus)* but decidedly larger than a Red-billed Gull *(Larus scopulinus)* chase a Red-billed Gull in from the sea over the Boulder Bank. The Skua then swept back and forth over the oxidation pond causing complete disturbance among all the birds feeding and roosting in the area, including about 100 Red-billed Gulls, 50 Duck sp., about 50 White-fronted Terns *(Sterna striata)*, 150 South Island Pied Oystercatchers *(Haematopus finschi)*, 90 Pied Stilts *(Himantopus leucocephalus)* and 46 Godwits *(Limosa lapponica)*.

The Skua was chased by the flock of Godwits, one Godwit actually grabbing the Skua's wing in its bill and pulling the Skua off balance. The Skua then chased the Red-billed Gulls and was itself chased by a Black-backed Gull. Having completely upset the whole area it then flew away out to sea.

J. M. HAWKINS, *772 Atawhai Drive, Nelson.*

WHITE-EYED DUCK AT WESTERN SPRINGS

On 30 April 1980, at the northern end of Western Springs Lake in one of the western suburbs of Auckland, I saw a strange duck. It was feeding with Mallards *(Anas platyrhynchos)* in a patch of open water covered with *Azolla*. I watched the bird, in overcast conditions, at about 15 metres without binoculars for 5-10 minutes. I did not see it again until 3 May, when I found it on the western side of the lake. The light was excellent, and I was able to approach the bird up to 1 metre away and watch it for about 30 minutes. It was not seen to dive on the first occasion but did so on the second. It did not fly or call. Other duck species nearby were Mallard, Grey Duck *(A. superciliosa)*, Shoveler *(A. rhynchotis)* and New Zealand Scaup *(Aythya novaeseelandiae)*.

Size nearest to Shoveler.
Head, neck, breast, back and tail dark brown.
Sides and flanks brown.
Centre part of primaries and secondaries white, forming a conspicuous wing bar; rest of wing brown.
Undertail coverts white.
Rump and abdomen not seen.
Underwing (lifted while preening) white with narrow dark border.
Bill dark, iris brown, legs and feet dark.

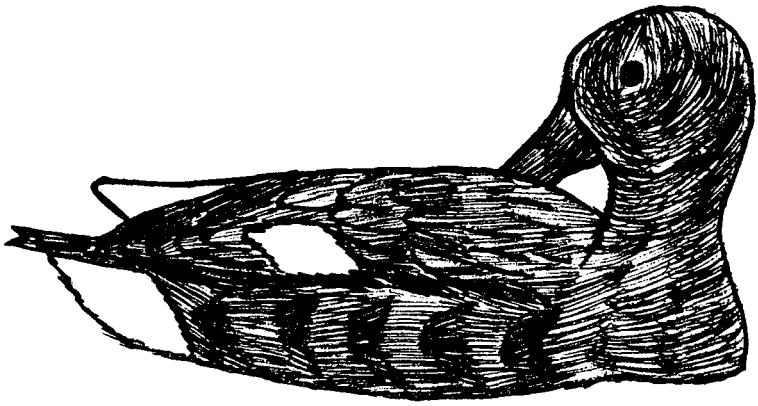

FIGURE 1 — Note white underwing with narrow dark border.

This bird has been identified as an Australian White-eyed Duck, or Hardhead *(Aythya australis)*, probably a female. There are several records of this species in New Zealand, the most recent being one shot in Hawkes Bay in 1973 (*Notornis* 20: 185) and a flock of eight at Runanga Lake, Hawkes Bay, in May 1973 (*Amendments and additions to the 1970 Checklist*, 1980: 14).

CHRIS JOWETT, *58/736 Great North Road, Western Springs, Auckland 2.*

YELLOW-NOSED MOLLYMAWKS IN THE BAY OF PLENTY

During a conversation with a Bay of Plenty fisherman I learned that an unusual kind of albatross had recently been seen between Mayor Island and Motiti Island; two of them on 12 July 1980 and five on 19 July 1980. As I knew this fisherman was well acquainted with Black-browed *(Diomedea melanophrys)*, White-capped *(D. cauta cauta)*, Salvin's *(D. cauta salvini)* and Buller's *(D. bulleri)* Mollymawks as well as the Wandering Albatross *(D. exulans)*, and as his description fitted the Yellow-nosed Mollymawk *(D. chlororhynchos)*, I asked to accompany him on his next weekend fishing trip.

At 6.30 a.m. on 27 July 1980, we sailed out to waters 8-10 km east of Mayor Island. It was fine with a 10 knot south-westerly breeze blowing. Very little bird life was seen until 2.45 p.m., when a fishing boat that had been working 1 km to the north of us came by on its way home and we caught sight of our first albatrosses. Two were following this boat, but as they came abreast of us they wheeled over and alighted beside us.

As the first one came planing in I began to note its salient features: white underwing with fairly straight narrow black edges, absence of grey about the head, and black bill with a yellow top and pinkish red tip (maxillary unguis). The yellow top to the bill was duller than the bright chrome-yellow of Buller's Mollymawk and did not cover such a large area of the culmen. Separating the base of the lower mandible from the gape feathering was a bright yellow line of tissue. Compared to other species of mollymawk this one had a smaller head, and as a result the bill looked disproportionately large. In size the bird resembled a slim slight Black-browed Mollymawk. Without doubt it was a Yellow-nosed Mollymawk.

The first two birds looked identical, but they were joined some 15 minutes later by a bird with a completely black bill, a subadult. Except for the different bill colouring this bird looked indistinguishable from the first two.

Although they had obviously been well fed from the previous boat, they quarrelled, "quarking" and braying wheezily over any scraps that we threw them. They were quite tame but I was unable to hand-feed them as I have done with Black-browed and White-capped Mollymawks.

When we left at about 5 p.m., they followed us for some time, catching up with us, then settling on the water again. They would let us get 500 metres or so ahead before repeating the performance, As there was very little wind they had to flap their wings a good deal to stay airborne.

It appears that occasional sightings of this species have been made during the winter months of the last two years by local fishermen. I was a regular visitor to Mayor Island waters in the winters of 1972,

1973, 1974 and 1975 but did not see any Yellow-nosed Mollymawks during that time. Perhaps this species is going to occur more regularly in the Bay of Plenty.

P. C. M. LATHAM, *c/o Papamoa Beach P.O., via Te Puke, Bay of Plenty.*

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UNUSUAL BEHAVIOUR OF ASIATIC WHIMBREL

For a number of seasons we have had opportunities to observe the behaviour of whimbrels, both Asiatic *(Numenius variegatus)* and American *(Numenius hudsonicus)*, in the Ashley River estuary, Canterbury. These birds are usually found attached to groups of Bar-tailed Godwits *(Limosa lapponica)* and are both alert and shy, often being the first birds to move off at the approach of intruders. When put up they frequently emit a single muted rippling call of six or seven notes but are normally silent when feeding or resting on high-tide roosts. Our records show that on several occasions whimbrels have arrived in August, right at winter's end and before the arrival of godwits. In the 1979-80 season, the only Asiatic Whimbrel to stay in the area was a large specimen, probably a female, not distinctly marked but with a definite brownish plumage and rather dark overall. Its behaviour was normal, that is, as described above. Our last sighting of this bird was in late December, and its place was taken by a smaller, greyer and more distinctly barred Asiatic Whimbrel with an unusually aggressive behaviour pattern and different dietary habits.

Although this whimbrel also roosts with godwits, we have noticed that as soon as the falling tide exposes its chosen feeding bank, it starts to strut about, chasing off any godwit approaching the area. Sometimes it flies in sustained pursuit of an intruding godwit, meanwhile calling persistently with series after series of harshly sounded sequences. On one occasion, when a godwit stood its ground and faced the whimbrel, the latter crouched almost cat-like with body flattened and wings outspread, head and bill raised and uttering a different set of calls quite unlike the ripple sequence and pitched more deeply. Again on another occasion, when the whimbrel was forced to concede ground several times at short intervals at the approach of a number of persons, it stalked around at a safe distance uttering its rippling call every few tens of seconds, then flew into the air screaming harshly and much more loudly than we have previously experienced. It flew north for about a mile, circled another site several times, then returned to stand on an elevated shingle bank overlooking its feeding territory. When this was clear, the whimbrel flew across and resumed feeding.

We have observed no interaction, apart from with godwits, between the whimbrel and any other species of bird encountered on its feeding territory, namely Pied Stilts *(Himantopus leucocephalus)*,

Red-billed Gulls *(Larus novaehollandiae)*, Black-billed Gulls *(L. bulleri)* Banded Dotterels *(Charadrius bicinctus)*.

Whimbrels have been observed feeding in dry areas, picking lightly at surface prey and in wet areas probing like godwits, but this is the first whimbrel we have seen consistently catching and eating crabs, which it removes from the immediate site of capture then proceeds to crush, in the course of which the crab may be dropped two or three times before being swallowed. The bird has frequently taken half a dozen crabs in as many minutes, also marine worms and other prey too small to be identified.

K. C. HARRISON, *50 Athol Terrace, Christchurch 4;* P. A. G. HOWELL, *36 Rollesby Street, Christchurch 2.*

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BROWN BOOBIES IN NEW ZEALAND

While doing a beach patrol on a stretch of Muriwai Beach on the Auckland west coast with Jane Wells and Kathie Parkinson on 6 April 1980, I found a Brown Booby *(Sula leucogaster)* which had been dead for about a week. Distinctive features when compared with an immature Australasian Gannet *(Sula bassana serrator)* were the smaller size, yellow feet, the smooth brown upper plumage, the underwing pattern of white with broad chocolate-brown margins, and the sharp line of demarcation between the brown breast and the brown-smudged white underparts. This colouring of the underparts showed the bird to be immature. Measurements were: culmen 103.2 mm, tarsus 52.5 mm, mid-toe and claw 92.3 mm, wing 440 mm.

Brown Boobies have been reported many times around New Zealand. One is known to have frequented the Hauraki Gulf for three consecutive seasons and to have roosted with Gannets on Horuhoru, and one visited Wellington Harbour in late summer 1975 (Sibson *et al., A New Guide to the Birds of New Zealand* 1979). The most southerly record is just south of Timaru (Pierce 1969, *Notornis* 16: 125).

The first specimen collected was shot in Napier Harbour in July 1884 (Hamilton 1888, *Trans. Proc. NZ Inst.* 21: 128-134). A further two specimens were found more recently and deposited in the National Museum. Details are: NMNZ 8775, an immature bird found by M. Bull, Otaki Beach, 18 May 1957; NMNZ 18704, an immature in moult found by H. J. McCredie, Worser Bay, Wellington, 20 June 1975 (J. A. Bartle, pers. comm.).

The first Brown Booby recorded in the OSNZ Beach Patrol scheme was found on Te Werahi Beach, near Cape Reinga, on 17 January 1971 (C. R. Veitch, *Notornis,* this issue) by T. R. Harty, and is now in the National Museum (NMNZ 16058). The bird we found is therefore the second recorded in the Beach Patrol Scheme and the fifth specimen obtained in New Zealand. It is now a skeleton in Auckland Museum (Av. 10).

COLIN MISKELLY, *3 Castleton Drive, Howick.*

GREY-BACKED STORM PETRELS AT DOUBTFUL SOUND

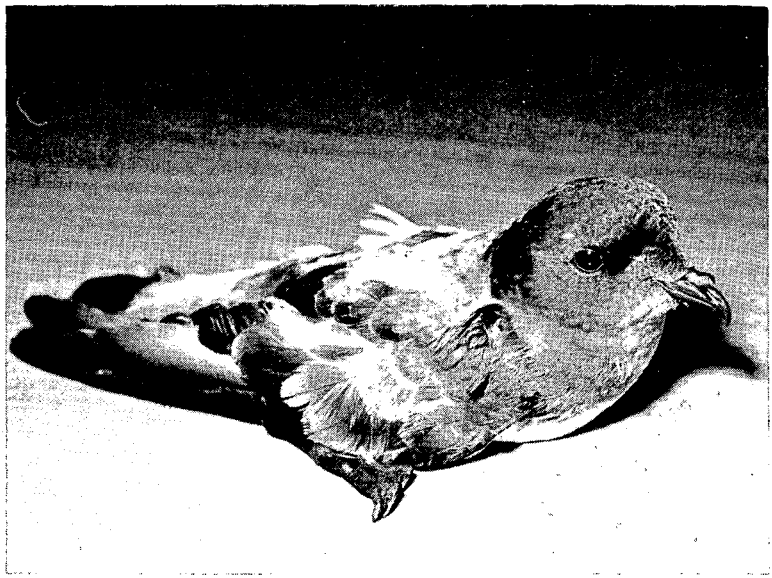

Photo: P. E. Gay

FIGURE 1 — Grey-backed Storm Petrel, Doubtful Sound.

While lifting and setting set lines with two others in very heavy rain at Deep Cove at the head of Doubtful Sound at about 2100 on 29 August 1980 I saw a small sea bird. It appeared to become completely disorientated by the light from our torches and very soon collided with a member of the party and fell into the dinghy. It was recovered in a very bedraggled condition and taken ashore for identification.

While removing wet gear before entering the Deep Cove Hostel, we saw another bird fly into the wall of the building. (All lights in the building were on at the time.) It also was recovered, but in excellent condition.

Both birds were readily identified from the "Field Guide" as being Grey-backed Storm Petrels *(Garrodia nereis)*. Figure 1 shows the second bird.

Both birds were held overnight and released the following morning, when both immediately flew strongly down the sound.

There had been almost no wind experienced at Deep Cove for at least 36 hours before the birds were recovered, although there had been very strong westerlies on the coast.

WYNSTON COOPER, *Box 1044, Invercargill.*

MOREPORK CALLING FREQUENCY IN NELSON

Moreporks *(Ninox novaeseelandiae novaeseelandiae)* are present around home gardens in suburban Nelson. Records of their nightly calling frequency were made from my Nelson home from 14 April to 31 August 1975 and 1 January to 31 December 1976 (17 months). I listened each night from 2100 to 2300 hours NZST for calling Moreporks. The maximum number calling at any one time during the two hour listening period was recorded.

My study area (c. 1 km^2) stretched across the mouth of the Maitai Valley and contained four Moreporks, apparently two pairs, one on each side of the valley. Farmland on the south side of the valley contained two large *Eucalyptus* groves, several *Pinus radiata* shelter belts and two areas of *Leptospermum scoparium* (manuka). The north side contained the Botanical Reserve, a remnant area of native hardwoods and podocarp mixed with mature introduced trees, such as *Quercus* (oak) and *Tilia* (lime).

Calling began at dusk and was recorded at all hours of the night until dawn. The *more-pork* call was heard throughout the year. The *cree* call was heard in August, September, November, December, February and April. Subadult calls were heard in July 1975 and June 1976 on the north side of the valley.

Calling frequency results are summarised in Figures 1 and 2. In 1975 calling was at a peak in April, was lowest in July, and another increase occurred in August. In 1976 calling again peaked in April, generally declined to its lowest in July and October and a smaller peak occurred in August. On nights when Moreporks were heard, the average number calling at one time varied from 1.0 to 2.5 birds (Figure 2).

An analysis of weather conditions (Table 1) shows that Moreporks called most frequently on clear and overcast nights. Birds called rarely on rainy and frosty nights.

Fleay (1968) described the calls and ecology of Moreporks in Australia. Some of his facts may aid in the interpretation of the data. He found that male calls were shorter and clearer than female calls, which were hoarse and in a lower key. Also, he described the *cree* call as a mate contact call given during the breeding season. He

TABLE 1 — Weather conditions and calling frequency.

Weather conditions	Total number of nights birds heard calling	Total number of nights birds not heard calling
Raining	7 (8.5%)	75 (91.5%)
Overcast	21 (50.0%)	21 (50.0%)
Clear	145 (43.3%)	190 (56.7%
Frost	8 (12.5%)	56 (87.5%)

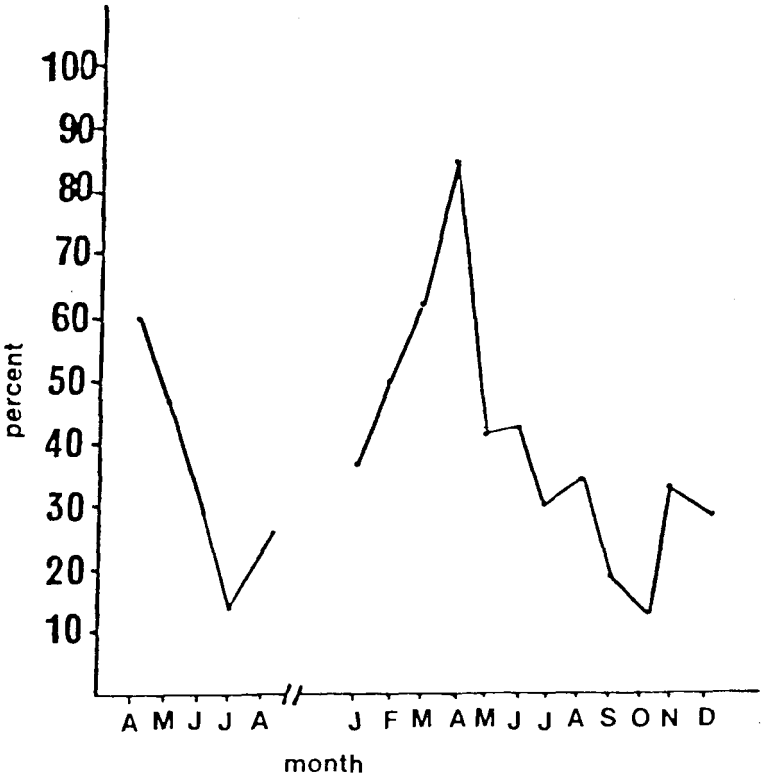

FIGURE 1 — Number of nights per month birds heard calling (percent).

found that pair bonds were formed in about August and that subadult calls were heard when young were 5-6 months old. He stated that Moreporks remain on their roosts in poor weather, and that during incubation, the female remains on the eggs almost constantly and probably only the male calls.

In this study, the highest calling frequency was during the time that young were still dependent but off the nest, and the lowest frequency during the incubation and nestling rearing stages of the breeding cycle. The nine months over which *cree* calls were heard may indicate that the pair bond was maintained from August to April.

The development of song in young birds, the August mating period, the increased mobility of birds and poor weather in winter, male territoriality, and female silence when breeding may all influence the annual calling pattern.

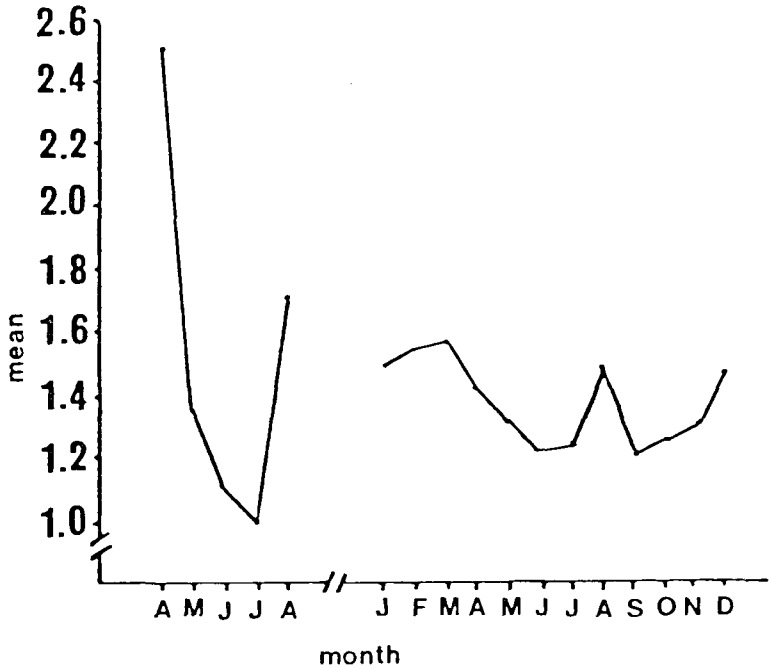

FIGURE 2 — Mean number of birds heard calling at one time per night, not including nights when no birds were recorded.

ACKNOWLEDGEMENTS

I thank Barrie Heather and Ralph Powlesland for their very useful comments on this manuscript.

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COLIN F. J. O'DONNELL, *198 Blenheim Road, Christchurch 4*

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THE FEEDING OF CAPTIVE NEW ZEALAND PIGEONS

On two occasions recently I have had a New Zealand Pigeon *Hemiphaga novaeseelandiae)* brought to me to look after. The first was an adult that had collided with power lines. It was a shy bird and would feed only in the darkness of a large closed carton, enjoying poor-quality grapes and the coprosma berries that were plentiful at the time. It recovered fully after almost 3 weeks of care.

The second bird, which was seen to land on the roadside but could not fly away, still had two downy filaments on most of its back

feathers and was very thin. No berries were available and I was at a loss what to give it. I took a quarter cup of frozen peas and poured hot water over them; they were accepted, in the daylight. I continued this diet, varying it with frozen vegetables, boiled rice and mashed potato, each time adding several drops of multi-vitamin syrup. After 3 days in a dimly lit corner, the bird started moving about, and so on the fifth day, I put it outside on an inconspicuous perch where I could still place food in its reach — three half-cups a day. After a week it joined two adult birds, returning regularly to feed and roost until I frightened it one night with a strong torch.

In my note on the foods of Tuis *(Prosthemadera novaeseelandiae)* in *Notornis* 26 (4): 356, 1979, I mistakenly wrote haekaro *(Pittosporum umbellatum)* instead of houpara *(Pseudopanax lessoni)* as the berry so eagerly taken in June.

C. W. DEVONSHIRE, *Tamaterau, RD 4, Whangarei.*

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POSSIBLE EARLY RECORD OF CATTLE EGRETS IN NEW ZEALAND

An apparent early record of Cattle Egrets *(Bubulcus ibis)* in New Zealand has come to my notice. Mr C. and Mrs M. Hamann of Thames told me of seeing a small flock of about five " white herons " with cattle, in the upper Moutere district near Nelson, in the early 1950s. The Hamanns travelled that way once or twice a year. Mrs Hamann later wrote to me saying " We stopped to watch them for a few minutes as they reminded us of the tick birds we had seen in South Africa; to the best of my recollection one at least was on a beast's back."

It was suggested that I should write to Mr R. Smeaton, a long term farmer and orchardist at Upper Moutere who has an interest in birdlife. His reply confirms the information saying " . . . we did have a visit by what I considered at the time were Egrets during 1956. I was sure they were not White Herons as we only see the 'odd' White Heron here and they are usually a bit larger. The birds we had stayed for a couple of months and then disappeared . . ." It has not been possible to fix a definite time of year for the birds' visit.

These recollections put back the possible time of arrival of Cattle Egrets in New Zealand to about seven years before the Belfast, North Canterbury, record of one on 28 September 1963 (Turbott, Brathwaite & Wilkin 10: 316).

BETH BROWN, 39 *Red Hill Road, Papakura.*

PROBABLE OCCURRENCE OF THE BLACK BITTERN, *Dupetor flavicollis* (Linnaeus), IN NEW ZEALAND

Lake Poukawa and its encircling swamp, adjacent to which are some archaeological sites, lies some 20 km south-west of Hastings, Hawkes Bay. Extensive systematic excavations by Mr T. R. Price on four of the sites have yielded a considerable number of avian bones from various stratigraphic levels (Price 1963). The soil of the drained peaty swamp contains a number of volcanic ash beds, the most distinctive being the Taupo Pumice (1849 ± 17 years BP) and the Waimihia Ash (3470 ± 70 years BP) (Pullar 1970). There has been some discussion as to whether the bones found below the Maori midden layers were natural deposits or were the results of early human hunting activity (Price 1965, Pullar 1970, McFadgen 1979).

Fifty-four species of bird, excluding the moas, have been identified from the four sites. During analysis of the bone material from site N141/12 (NZ Archaeological Association reference number) (Grid Ref. N141/140050), five bones referable to a small bittern were found. I considered it possible that they were of the Australian Little Bittern, *Ixobrychus minutus,* or its presumed extinct New Zealand counterpart, *Ixobrychus minutus novaezelandiae* (Falla 1964). There are only small quantities of bone material from these species in New Zealand museums, although several mounted skins are available.

Three of the bones were examined by Dr G. F. van Tets, CSIRO Division of Wildlife Research, Canberra. He found that they were definitely from a small bittern, but although agreeing in shape with *Ixobrychus,* were much too large to be of either *minutus* or *novaezelandiae.* They were also too large to be from the Yellow Bittern *(Ixobrychus sinensis).* Dr van Tets concluded that the bones were most probably those of the Black Bittern *(Dupetor flavicollis).* This is the first record of that species from New Zealand. The measurements of the five bones from Poukawa were similar to those obtained from X-ray photographs of nine skins of the Black Bittern held by the CSIRO Division of Wildlife Research. *Dupetor* has at times been placed in the genus *Ixobrychus,* but most authors prefer to keep them separate (Condon 1975).

The bones recovered at Poukawa were two right femora, one right and one left tibiotarsus, and a left tarsometatarsus (Fig. 1). One femur (from a submature bird) was excavated from a Maori midden deposit. The tarsometatarsus and left tibiotarsus were found together 3 cm below the Taupo Pumice band, and are probably from the same bird. The other tibiotarsus was situated 2 cm below the Taupo Pumice, and the remaining femur was 2 cm above the pumice band. All the bones were broken, with the proximal end missing in each case. Those measurements obtainable are listed in Table 1.

It would appear, therefore, that a minimum of three, but probably four, birds are represented at Poukawa. The most recent example, the

TABLE 1 — Measurements.

	D.	M.	
Tarsometatarsus*	—	0.29	
Tibiotarsus L.*	0.64	0.29	
Tibiotarsus R.	0.62+	—	(worn)
Femur*	0.63	0.31	
Femur	0.59+	0.29	(worn, submature)

(* = bones examined by Dr G. F. van Tets)

submature femur, would be between 150 and 300 years old, as this is the presumed period of Maori occupation, during which the midden was formed (McFadgen 1979). By measuring the vertical distance between layers of known age, the rate of soil build-up on the ridge slope of site N141/12, where the bones were found, has been calculated at approximately 1 cm every 100 years. Hence the estimated age of the femur found just above the Taupo Pumice is 1650 years, and the bones below the pumice band would be about 2150 and 2050 years old.

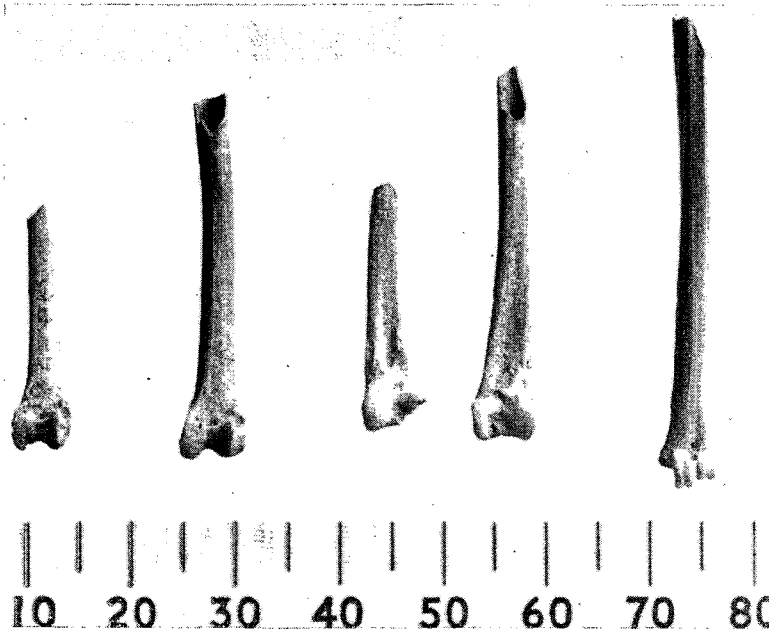

FIGURE 1 — Bittern bones from Poukawa, From left: R. femur, submature (posterior aspect), R. femur (posterior), R. tibiotarsus (anterior), L. tibiotarsus (anterior), L. tarsometatarsus (anterior).

While four birds do not represent a great abundance of the species, I consider it probable that the Black Bittern was a not infrequent visitor to Lake Poukawa. In terms of minimum numbers of species from site N141/12, it comprised 0.17% of the total avian population from the Maori occupation era (100-1000 years BP) and 0.15% from the Taupo era (1000-2500 years BP). The Paradise Shelduck and Southern Crested Grebe were found in proportions similar to the Black Bittern.

The presence of the submature femur also raises the possibility that this species was breeding in New Zealand. This would not be unlikely, in view of their estimated abundance.

Dupetor flavicollis is found in southern and south-eastern Asia, New Guinea, the Solomons and Australia. One of the five subspecies, *Dupetor flavicollis gouldi,* occus in Australia. Its recognised range is from the Moluccas to New Guinea, and coastal Australia, except for the southern regions (Condon 1975). It lives near fresh or salt water, in the timbered regions of streams, lakes and mangrove swamps.

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P. L. HORN, *Poukawa, R.D. 11, Hastings.*

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COLOUR-MARKED TURNSTONE IN MANUKAU HARBOUR

At this late date it seems worth recording that a Turnstone *(Arenaria interpres)* showing brilliant orange dye on its rump and tail was seen at Karaka shellbanks on 3/12/67, after the summer shorebird census. The writer, with S. Fogarty, T. Harty and S. Payne, had set out to walk the banks to check through the small birds when the Turnstone flew past us. H. R. McKenzie found through correspondence with the late Keith Hindwood in Australia, that the bird had been marked on the Pribilof Islands, off Alaska, shortly before the southern migration and that a similarly marked Turnstone had been seen in Australia at about the same time. Unfortunately no further details are available but banding of migratory waders now under way in New Zealand may be expected to produce interesting results.

BETH BROWN, *39 Red Hill Road, Papakura.*

AN OBSERVATION OF CARRION PREFERENCE BY THE AUSTRALASIAN HARRIER *(Circus approximans gouldi)*

Important constituents of the diet of Harriers in New Zealand are medium-sized mammals such as hare *(Lepus capensis)*, rabbit *(Oryctolagus cuniculus)*, and brush-tailed opossum *(Trichosurus vulpecula)*. Carcasses of these animals commonly become available to Harriers either as a result of pest control methods, or as road casualties. The diet of Harriers includes insects, small birds, small rodents, frogs as prey or carrion, and larger mammals as carrion. However, because of their size and relative abundance, hare, rabbit and opossum occurring as carrion must be a major food source. Baker-Gabb (1978) has reported that mammalian carrion is an important food during winter and early spring. Robertson (in press) has shown that Harriers show distinct food preference and, in a series of feeding experiments, he demonstrated that hen pullets *(Gallus domesticus)* and Norway rats *(Rattus norvegicus)* were chosen more often than rabbits, brush-tailed opossums or eels *(Anguilla australis)*.

During attempts to photograph Harriers at bait, carcasses were placed about 7 metres from a hide in the corner of a large paddock at Courtenay in Canterbury. On 11 May 1980, single carcasses of both hare and opossum were placed together. The following day it was noted that the hare was being eaten but not the opossum. Daily checks were made and it was noted that the opossum was not touched until two days later when the hare had been completely eaten.

Three first-year Harriers, at least, were known to be taking the bait, but only one bird fed at a time while the others waited nearby. The carcasses were placed no further apart than 50 cm and so one bird could easily dominate the bait. Further feeding experiments were conducted using different combinations of hare, rabbit and opossum for bait. These species were placed at random in each experiment to reduce any positional effect, e.g. influence of fences or the hide. Observations were made daily to record which species were being eaten, and bait was not replaced during the observation period.

TABLE 1 — Food Preference Tests for the Australasian Harrier.

	Experiment: (bait combination)	Date Started	No. of days of daily observation	Result
1.	hare v. opossum	11-5-80	4	Hare eaten completely before opossum eaten completely
2.	hare vs rabbit v. opossum	16-5-80	8	Hare eaten completely, then rabbit eaten completely before opossum plucked but not eaten
3.	rabbit (2 specimens) v. opossum (2 spec.)	24-5-80	6	Both rabbits eaten, opossums not touched
4.	hare v. rabbit	30-5-80	4	Hare eaten completely before rabbit eaten completely

Table 1 gives the results of these experiments.

These results, although consistent, are based on only four experiments at one locality and during a single month. However, hares seemed definitely to be preferred of the three foods offered. Rabbit was preferred to opossum. Whether this preference is based on meat quality or ease of skin penetration is not known, but Robertson *(idem)* noted that skinned rabbits were preferred to unskinned ones. Skin toughness may be a factor determining the choice of hare or rabbit in preference to the tougher-skinned opossum, but this needs verification.

I should like to acknowledge the help given by Colin McRae of the Plains Destruction Board in providing freshly killed animals for these tests.

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THE EFFECTS OF WEATHER ON A CASPIAN TERN COLONY

From 1975 to 1979, I have made 11 visits to the colony of Caspian Terns *(Hydroprogne caspia)* in Whangapoua Harbour on the east coast of the Coromandel Peninsula. The harbour, which covers about 1500 ha and is separated from the sea by the Omaro Spit, 4.5 km long and 800 m wide, has one narrow entrance. The terns breed on what is locally called Shell Island, which is about 800 m inside the harbour entrance and so is exposed to the full force of north-easterly gales. The nesting area occupies about 400 m^2 of the island on a ridge of white sand, on one side of which the nests are within 3 metres of the water at normal high tides.

At the colony, I counted at most 100 adults in 1975 and 140 in 1977. In those years, strong winds combined with high tides to wash eggs and chicks from the nests, but without unduly damaging the sand ridge itself. Each time the birds would relay, and so the 1975-77 period presumably shows the usual pattern of the terns' breeding, the colony apparently raising about 30 young in 1975/76 and 60 in 1977/78.

However, in July 1978 occurred the worst storm for many years, and on 28 November 1978 I found that the nesting ridge had gone, leaving only a flat area of sand well below the level of the former ridge and apparently swept by normal high tides when backed by wind. There were some 140 scrapes and nests but only 28 adults, and the 22 eggs remaining were broken. The following year, on 18 October, the sand ridge had partly built up again and there were 80 adults, 41 nests and 47 eggs. However, on 19 November, the birds had shifted their nesting area slightly and there were 124 scrapes and nests, and 30 eggs. By early December, the tide had washed them all away,

and on 18 December 1979, although 9 scrapes and a nest and egg were found spread well apart on the island, no birds were present and laying had been abandoned.

In spite of at least three attempts, therefore, no chicks were reared at the colony after the July 1978 storm, and the situation will probably not improve until the nesting ridge builds up again to the 1977 level.

I do not know when this colony site was first occupied, but it was certainly in use by 1956. The tidal waves that followed the 1960 Chilean earthquake created chaos in Whitianga Harbour further south with tides reaching a peak at least 2 metres above normal high-tide level. If the tern colony managed to recover from that event, it certainly should from the present lesser damage.

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GIANT PETREL RECORDS FROM FIJI

Since 1965 there have been four reports of the occurrence of giant petrels *Macronectes* sp. in Fiji. Morgan & Morgan (1965: 158) reported seeing an exhausted giant petrel wearing an Australian band near Suva, Viti Levu, on 22 August 1961. This bird had been banded (band number 130-25137) by the Australian National Antarctic Research Expeditions as a nestling on Macquarie Island on 8 January 1961. King (1967: 104) listed two records of giant petrels from Fiji. One was the banded giant petrel reported by the Morgans, but no information was provided about the other. Clunie (1980: 95) reported the occurrence of another two giant petrels in Fiji: one of these was found at Natadola Reef on the south-west coast of Viti Levu during the first week of July 1979; and the other was captured by villagers of Namara on Waya Sewa Island, north-west of Viti Levu on 11 August 1979. Jenkins (1980: 95) reported the sighting of a fifth giant petrel on 6 August 1976 at sea 40 km from the south-west corner of Viti Levu.

In addition to these reports of five giant petrels on or near Fiji, the recoveries of two other banded giant petrels on Fiji were reported by Hitchcock & Carrick (1960: 71, 72), but this report has not been referred to in papers published since 1965. Both had been banded as nestlings on Macquarie Island on 24 February 1959 by the Australian National Antarctic Research Expeditions. One (band number 130-15158) was found dead at the mouth of the Sigatoka River, Viti Levu, on 11 June 1959 and the other (band number 130-15212) was found dead near Bua, Vanua Levu, on 26 June 1959.

It is not possible, from the banding records, to identify to species level the three giant petrels that were banded on Macquarie Island and recovered on Fiji. They were banded on Macquarie Island as *M. giganteus* before the recognition by Bourne & Warham (1966) of

M. halli, which is sympatric with *M. giganteus* on Macquarie Island. Therefore, they can now be identified only as giant petrels *Macronectes* sp.

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REVIEWS

Children of Tane (VP 429); *Friends of Maui* (VP 444); *Birds of New Zealand* (VP 445). Also as cassettes.

The first of these three discs was released to coincide with Conservation Week 1979. It consists of 19 bird species heard on Radio New Zealand's early call programme with Robert Taylor, and songs in Maori by Sydney Melbourne about each species. For me, it's too much music and not enough bird song, and I don't like the blending of music into bird song. The birds take a definite third place to the music and to Robert Taylor's instructive comments. The second disc, released for Conservation Week 1980, has 19 seabird species and the Long-tailed Cuckoo, included because of its place in Maori mythology. It has 3 species not previously available on disc; the first one has 4 such species. The field recordings are by John Kendrick of Wildlife Service and are of high standard.

The third disc, released in August 1980, has all the birds of the other discs plus Taylor's comments. The playing time for each bird is greatly expanded, and so this is the choice for the ornithologist, unless you like Maori music and mythology for preference. All three make a great souvenir for tourists in New Zealand.

— LES McPHERSON

NEW RATITE FROM NEW CALEDONIA

Sylviornis neocaledoniae n.g., n.sp. (Aves, *Ratite eteint de la Nouvelle-Caledonie*, by Poplin, Francois 1980. C.R.Acad. Sc. Paris Vol. 290, Serie D, pp. 691-694.

A medium-sized lightly built ratite, like *Rhea, Casuarius* and *Dromaius* (the emu) but most like the last two, is described from a first phalange, the body of a left femur, two tibiotarsi and a tarso-metatarsus. They represent a bird resembling an emu, cassowary or rhea in general profile, of the size of a small emu (such as Black Emu).

Sylviornis confirms that the Rhatites are distributed on fragments of Gondwanaland, supporting the view of their common origin on that continent and dispersal without flying.

The bones come from Quaternary (probably Recent) brecciated coral reef and are older than the phase of brecciation which they themselves have suffered. The locality is an elevated barrier reef on the south of the Ile de Pins, Bay of Kanumera, a spot called Ure. The spongy ends of the bones have been lost and the diaphyses broken and dislocated. Geologists may be curious, as I was, about the cause of the brecciation.

The bones give substance to the local legend of the "Du," described as having on its head an ornament like a cassowary's. Archaeology in these regions has already shown that the oral tradition could apply to events several centuries ago. *Sylviornis* was able to persist into our own millennium, especially on the main island, more favourable for its survival. Undoubtedly, the author believes, it was exterminated by human beings who had been on New Caledonia for several millennia.

— C. A. FLEMING

Fossil Counterparts of Giant Penguins from the North Pacific, by Storrs L. Olson & Yoshikazu Hasegawa. 1979. Science 206, 9 November.

The extinct family Plotopteridae (Pelecaniformes) includes at least three genera of flightless penguin-like birds known as Oligocene and early Miocene fossils from Japan and Washington State. They most resemble Anhingidae in hindlimb and pelvic morphology but have paddle-like wings, convergent with those of penguins and flightless auks. The largest Japanese species probably exceeded 2 metres in length and may have been larger than the largest fossil penguin. Giant penguins and Plotopterids may have gone under to competition from seals and porpoises when they diversified to occupy similar pelagic niches, as first suggested by G. G. Simpson for the former.

— C. A. FLEMING