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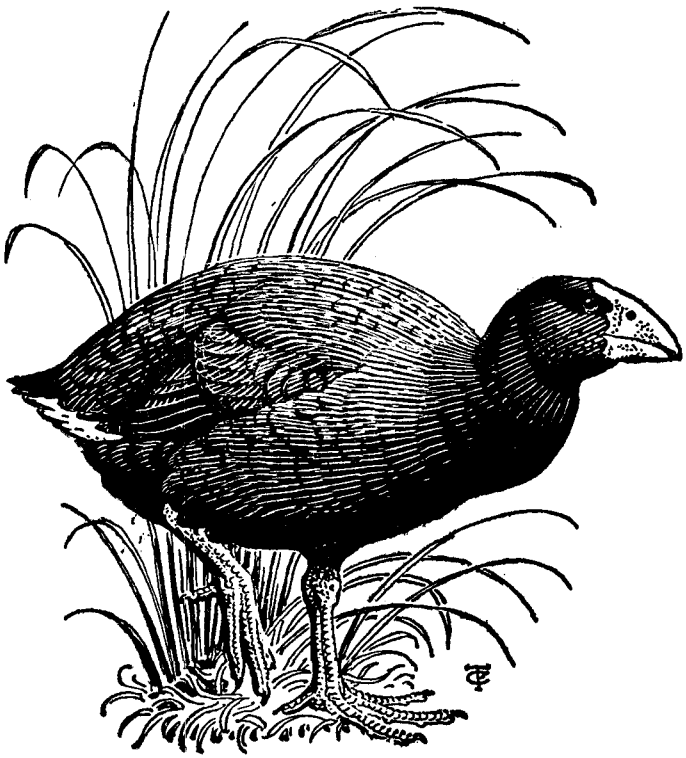
Journal of the Ornithological Society of New Zealand



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WADERS OF THE MANUKAU HARBOUR AND FIRTH OF THAMES

By C. R. VEITCH

ABSTRACT

The Manukau Harbour and Firth of Thames are considered to be among the richest wading bird (sub-order Charadrii) habitats in New Zealand. Annually large numbers of four species of New Zealand's endemic waders migrate to these, and other, northern harbours for the winter. Thousands of arctic breeding waders winter here during our summer. Small numbers of non-breeders of both these groups of waders remain here during their respective breeding seasons. There are also small numbers of two non-migratory species present. The results of twice yearly censuses of these birds during the period 1960-1975 are summarised, combined with other data where appropriate, and trends in the wader population shown. Although there has been an increase in the total number present, this has been caused by only some species, others remain stable. One species — the Wrybill *(Anarhynchus frontalis)* — has, on the Manukau Harbour only, fluctuated significantly due to changes to its chosen winter habitat. The general habitats are described and major modifications noted. Lists of waders recorded at times other than censuses are also given. There is a paucity of long-term data on most aspects of the ecology of these species.

INTRODUCTION

New Zealand has a number of harbours and estuarine areas which provide good habitat for waders (sub-order Charadrii). The Manukau Harbour and Firth of Thames are among the richest of these and due to the enthusiasm, particularly in the earlier years, of a few dedicated ornithologists, are also the best documented.

Annually a large number of four species of New Zealand's endemic breeding waders (South Island Pied Oystercatcher *(Haematopus ostralegus finschi)*, Banded Dotterel *(Charadrius bicinctus)*, Wrybill *(Anarhynchus frontalis)* and Pied Stilt *(Himantopus himantopus leucocephalus)*) migrate northward to winter on northern harbours. A portion of the Banded Dotterel population also migrates to Australia. Small numbers of these endemic birds remain behind and are joined by thousands of arctic breeding waders, wintering here during our summer. A small non-breeding portion of these arctic birds remains here during our winter (overwinter). Small numbers of resident wading birds (Variable Oystercatcher *(Haematopus unicolour)* and New Zealand Dotterel *(Charadrius obscurus)*) are present throughout the year.

This paper summarises the results of twice-yearly censuses undertaken by members of the Ornithological Society of New Zealand. Nomenclature follows the *Annotated Checklist of the Birds of New Zealand* (OSNZ 1970).

HABITAT DESCRIPTION

The Manukau Harbour, on the west coast of the Auckland isthmus, (Figs 1 & 2) at low water spring tide exposes approximately 18 000 hectares of intertidal area. The majority of this is presumed to be suitable for waders to feed on. However, a relatively small portion seems too sandy, an even smaller portion is rocky, and the upper reaches of most of the tidal arms have areas of mangroves *(Avicennia resinifera)*. Pollock Spit, Seagrove, Karaka Shellbanks, Wiroa Island (Airport), Puketutu and Onehunga (Fig. 1) are principal high tide roosts, other areas included in the censuses, also shown (Fig. 1) may sometimes have high numbers of birds. Land use around the harbour ranges from city and forest in the north to predominately mixed farming in the south.

Major modifications to the Manukau Harbour and its environs have been:—

1. Clearance from forest and scrub to farmland during the latter part of the 19th century. Since 1943 there has been an average annual increase of 10% in the rate of fertiliser application *(Agricultural Statistics)* with a presumed increase in nutrient runoff.
2. A continual increase of farm stocking rates. This has resulted in an increase of effluents from stock, stock sheds and silage pits.
3. Increasing urban development and associated runoff of pollutants into the harbour.
4. Direct discharge of sewage and industrial effluent from the greater Auckland area. Since 1960 this has been treated in a sewage treatment plant (Fig. 1) which covers some 400 hectares of former mudflat. From here some 300 million litres of treated effluent are discharged per day into the Manukau Harbour.

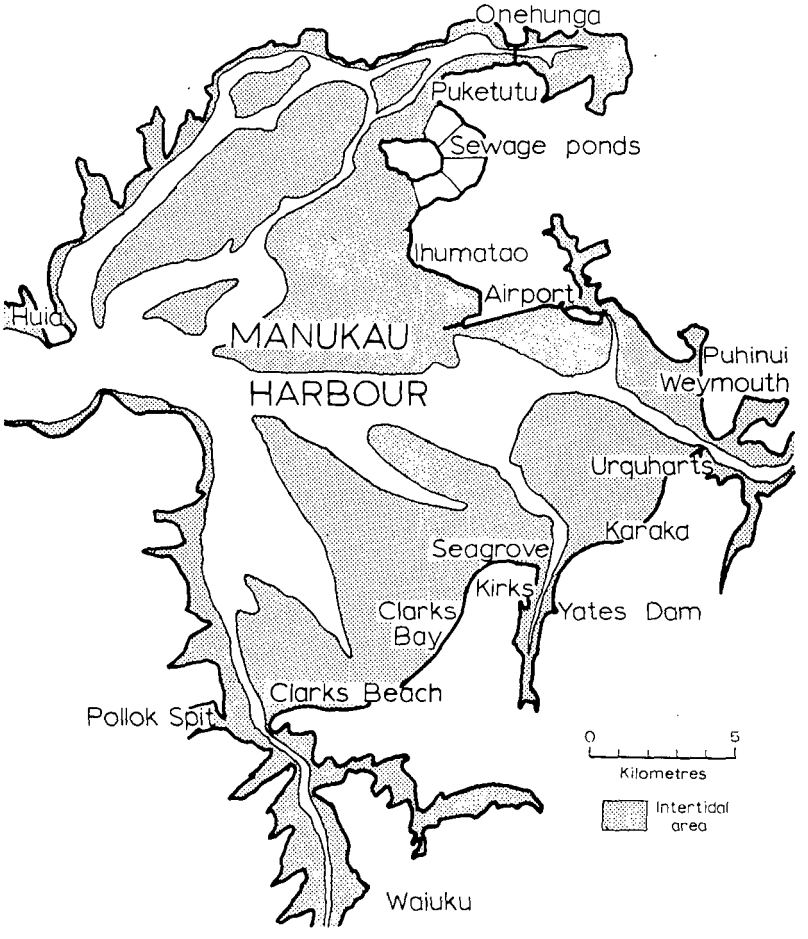

FIGURE 1 – WADER HABITAT IN THE MANUKAU HARBOUR

The places named are known roosts or census counting areas.

5. In the course of constructing Auckland International Airport some 100 hectares of mudflat were covered with solid fill. Here, the runway protrudes from the former shore in such a way that the natural movement of sediments, and/or changed water and wave action, has altered the intertidal area immediately to the south from soft mud to firm sand.
6. Large beds of the marine grasses *Zostera muelleri* and *Z. capricorni* have disappeared. This is presumed to be due to a fungal disease but the effect on waders is not known.
7. The grasses *Spartina alterniflora* and *S. townsendii,* which grow in the intertidal zone, have been introduced to the Manukau Harbour during the past fifteen years. This is spreading but at present occupies less than 3 hectares of mudflat.
8. There is a continually increasing level of human activity. Speed boats, some of which are capable of travelling in very shallow water, are common. At low tide people shellfishing and setting fish nets are common. Recently, small hovercraft have occasionally been travelling over the mudflats.

The Firth of Thames is east of Auckland and lies between the Hunua and Coromandel Ranges (Fig. 2). Mudflat areas extend along all of the south and south western sides. At low water spring tide there are approximately 8 500 hectares of exposed intertidal area, most of which appears suitable for waders to feed on, although more than 800 hectares are covered by mangroves. There are no tidal arms but two major rivers and other small streams, draining an area of approximately 360 000 hectares, flow into the Firth. The main high tide roosts are:—

Taramaire, Miranda, Piako, Karito and Waitakaruru. Other areas, included in the census (Fig. 2) sometimes have high numbers of birds. The land surrounding the mudflat area is all farmland.

Major modifications to the Firth of Thames and its environs have been:—

1. The clearing of forest and drainage of swamps within the Hauraki Catchment, which began in the early 19th century, is continuing today. A presumed consequence is a change of river flows and silt loads being carried into the Firth. Since 1940-45 there has been an increased rate of fertiliser application and a presumed increase in nutrient runoff from the land.
2. A continual increase of farm stocking rates. This has resulted in an increase of effluents from stock, stock sheds and silage pits.
3. Treated and untreated sewage is discharged into the Firth of Thames and its catchment.
4. The area of mangroves has increased from less than 50 hectares in 1952 to more than 800 ha in 1973 (Fig. 3).

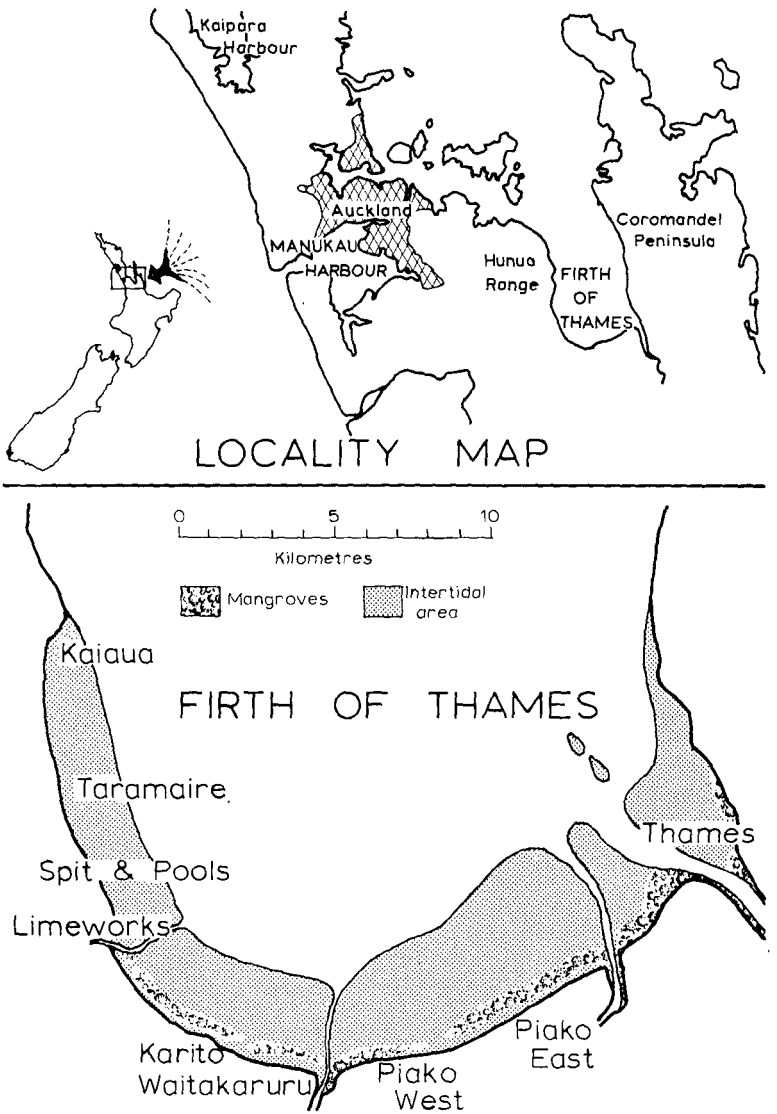

FIGURE 2- WADER HABITAT IN THE FIRTH OF THAMES

The places named are known roosts or census counting areas.

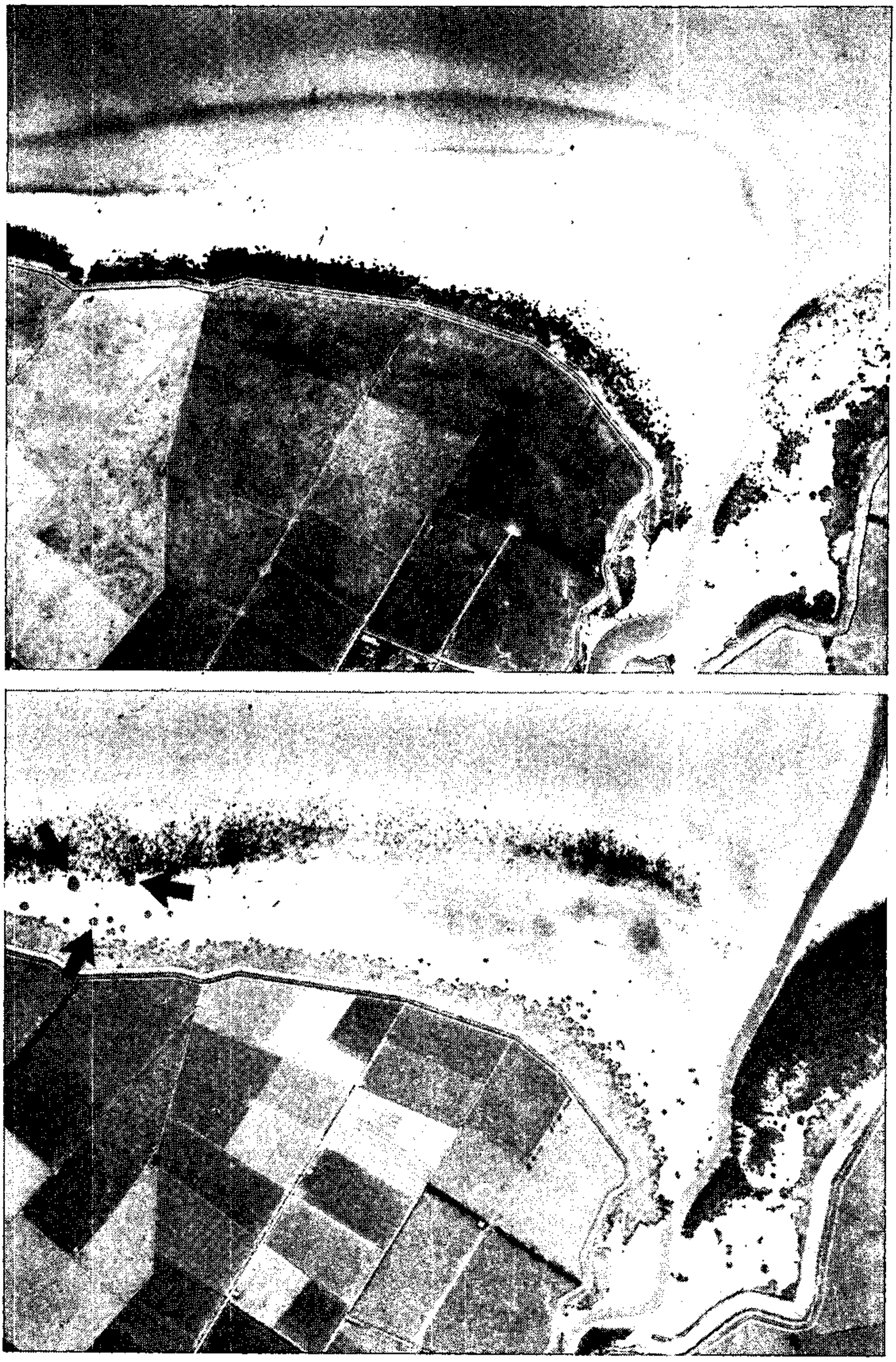

FIGURE 3 — The Firth of Thames Shoreline near Waitakaruru. Upper 1952. Lower 1973. Showing the increase of mangroves and introduction of *Spartina* (arrowed). Photographs printed with permission from Lands & Survey Department.

5. The grasses *Spartina alterniflora* and *S. townsendii,* which grow in the intertidal zone, have been introduced to the Firth of Thames during the past fifteen years. These now occupy less than two hectares of mudflat and are spreading.
6. Human activity is increasing but remains small compared with that in the Manukau Harbour.

CENSUS METHODS

The Manukau Harbour and Firth of Thames wader censuses are done twice yearly. The intent is to count the population when migration is at a minimum and numbers are stable, i.e., for summer censuses mid-November to mid-December and for winter censuses mid-May to mid-August. The system followed is to choose a day with a suitable spring tide. Observers watch each known high tide roost and patrol other areas where birds roost occasionally. The birds are counted at a predetermined time. However, as some census areas are long shallow stretches of water or beach which take a long time for an observer to cover and count, it is necessary for all observers to note arrival and departure of birds at the roosts for a period before and after census time, so that, if necessary, corrections can be made.

Censuses, principally as described, have been made on the Manukau Harbour and Firth of Thames since 1951. However, in the period between 1951 and 1959 counts were irregular and on some occasions not all species were counted or not all areas were covered. Data from 1960 to 1975 have been regular and complete and forms the basis of this paper.

RESULTS

The annual totals for summer and winter censuses in each harbour are shown in Figs 4, 7 & 9. The data show a general increase in the number of waders present.

Total numbers of waders in both harbours appear to fluctuate with more similarity in winter (Fig. 5) than in summer (Fig. 6). During both seasons the exceptions to this similarity are shared by the two harbours. The most notable exception is the winter of 1971 when there was a large increase of birds on the Manukau Harbour. A close study of the data for that year shows that there were many more S.I. Pied Oystercatchers and Knots *(Calidris canutus canutus)* and smaller extra numbers of Bar-tailed Godwits *(Limosa lapponica baueri)* and Pied Stilts present (Fig. 9). This is one occasion when a movement of birds from another harbour might be considered. However, as the increase in numbers of the major species (10 000 more S.I. Pied Oystercatchers and 4 000 more Knots) is more than are present on any other harbour, such a movement seems unlikely.

The relationship between winter and summer counts from year to year is irregular (Fig. 7) although both show a general trend of increasing numbers.

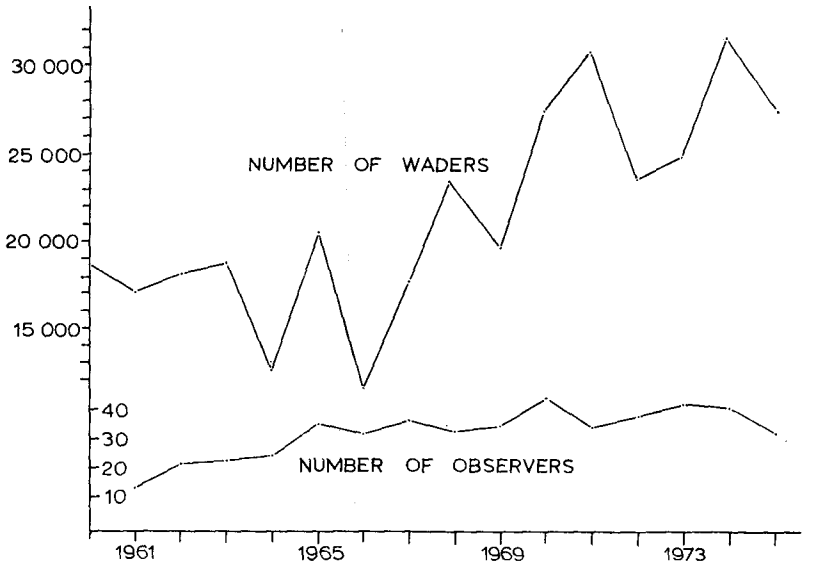

FIGURE 4 — MANUKAU HARBOUR SUMMER CENSUSES

The average number of waders in relation to exposed intertidal area is markedly different between the two harbours in both summer and winter (Table 1). However the difference between summer and

Table 1. AVERAGE NUMBER OF WADERS PER HECTARE OF INTERTIDAL AREA

	Summer	Winter
Firth of Thames	2.04	1.23
Manukau Harbour	1.19	0.95

winter is more marked in the Firth of Thames than the Manukau Harbour. There is a difference between the substrate types of these two harbours, the Manukau having more sand and the Firth of Thames more mud but there are no qualitative data available to suggest that this is a reason for the differences in bird numbers. The high tide roosts and, at least seasonally, the food supplies are known to be temporarily capable of catering for many more birds than are present at census time; for example, when high numbers are present immediately prior to the northward migration of arctic waders.

The distribution of different species between the two harbours is varied (Fig. 8). In summer, Knots show a marked preference for the Firth of Thames while Godwits are more numerous, but less dense,

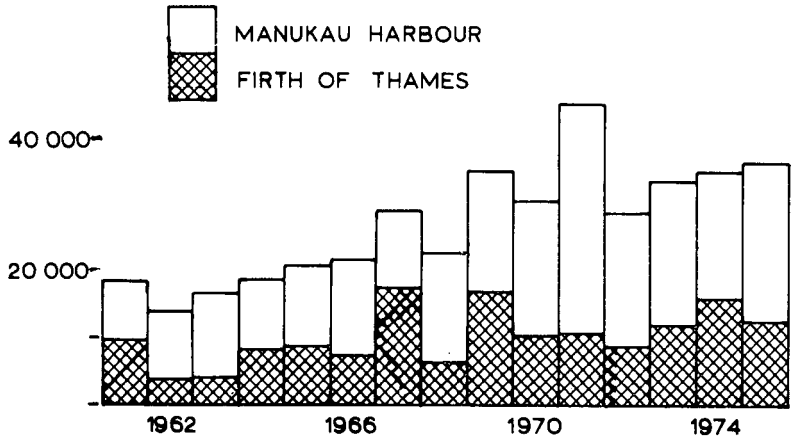

FIGURE 5 — WINTER CENSUSES

TOTAL NUMBER OF WADERS

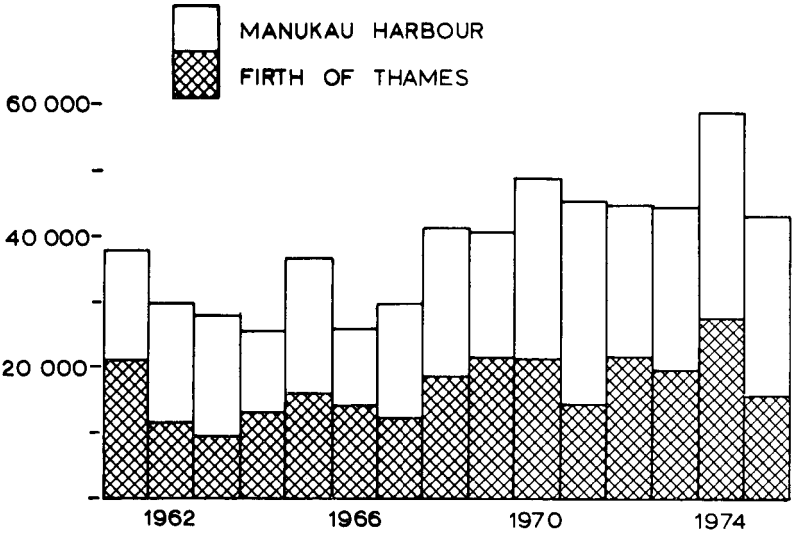

FIGURE 6 — SUMMER CENSUSES

TOTAL NUMBER OF WADERS

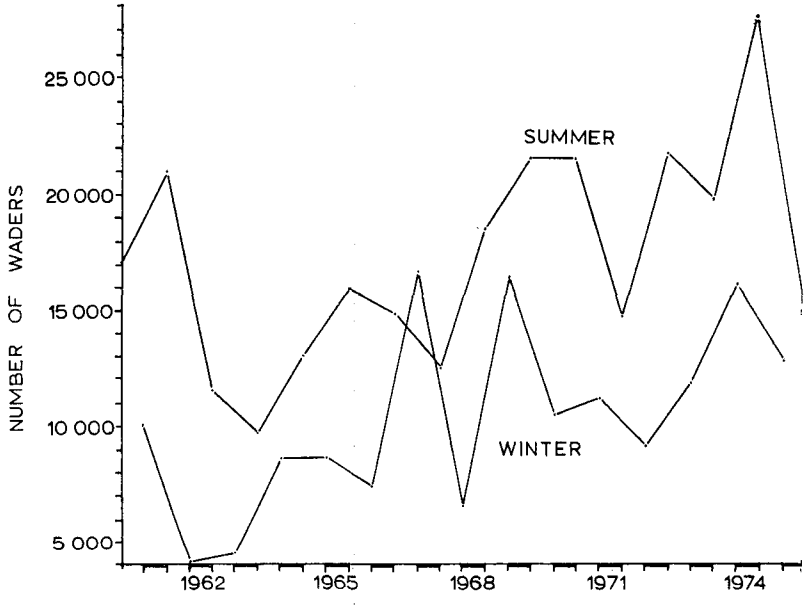

FIGURE 7—COMPARISON OF SEASONS
FIRTH OF THAMES

(Table 4) on the Manukau. However, in winter Knots are more evenly distributed while Godwits show a preference for the Manukau. There is no evidence to give reasons for these differences. The overall abundance of food appears to be good, as the birds appear to satisfy their needs easily and remain on the high tide roosts for some time after the tide has receded.

The numbers of each species on the Manukau Harbour in winter are shown in Figure 9 as an example of the complex fluctuations that make up the totals. I can find no specific data to explain these fluctuations. It is reasonable to expect that food supplies might vary to such an extent that a number of one species is forced to shift to another harbour. However, this does not appear to be so as numbers on one harbour do not rise and fall in sympathy with losses and gains on the other (Figs 5 & 6).

The number of young birds reared each year in arctic regions is known to vary greatly for species which have been studied (Frank A. Pitelka pers. comm.). Knots have been observed to increase about 500% in one part of Alaska during spring migration (M. E. Isleib pers. comm.). In recent years a general increase in numbers of the genera *Limosa* and *Arenaria* has been observed on the forest-steppe of

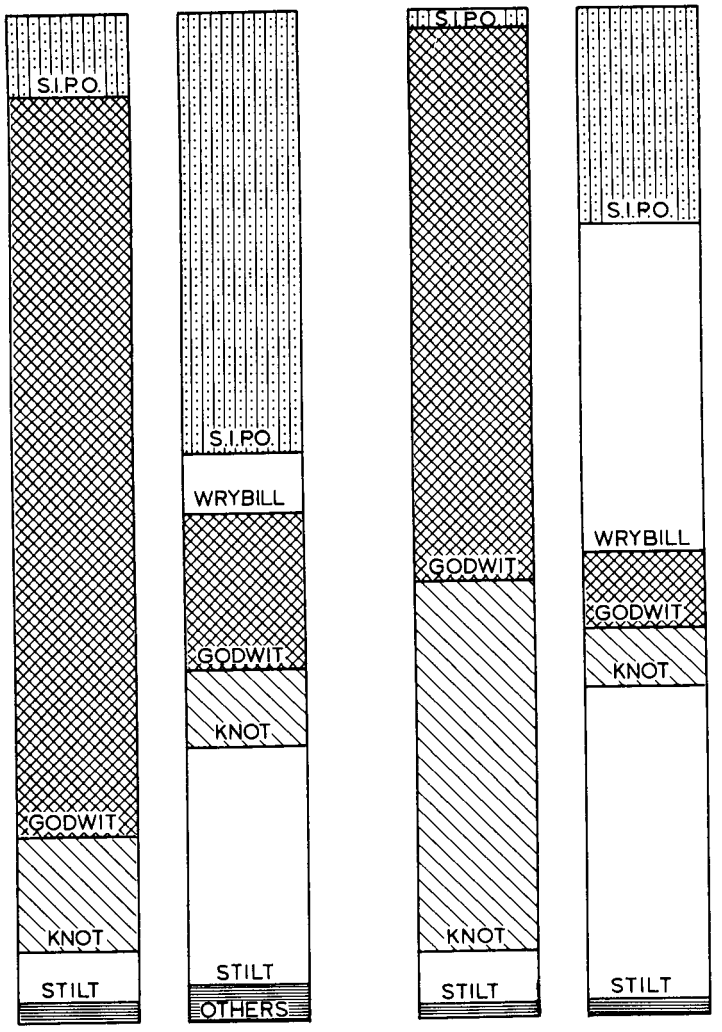

FIGURE 8 — RELATIVE ABUNDANCE OF WADERS 1960–1975

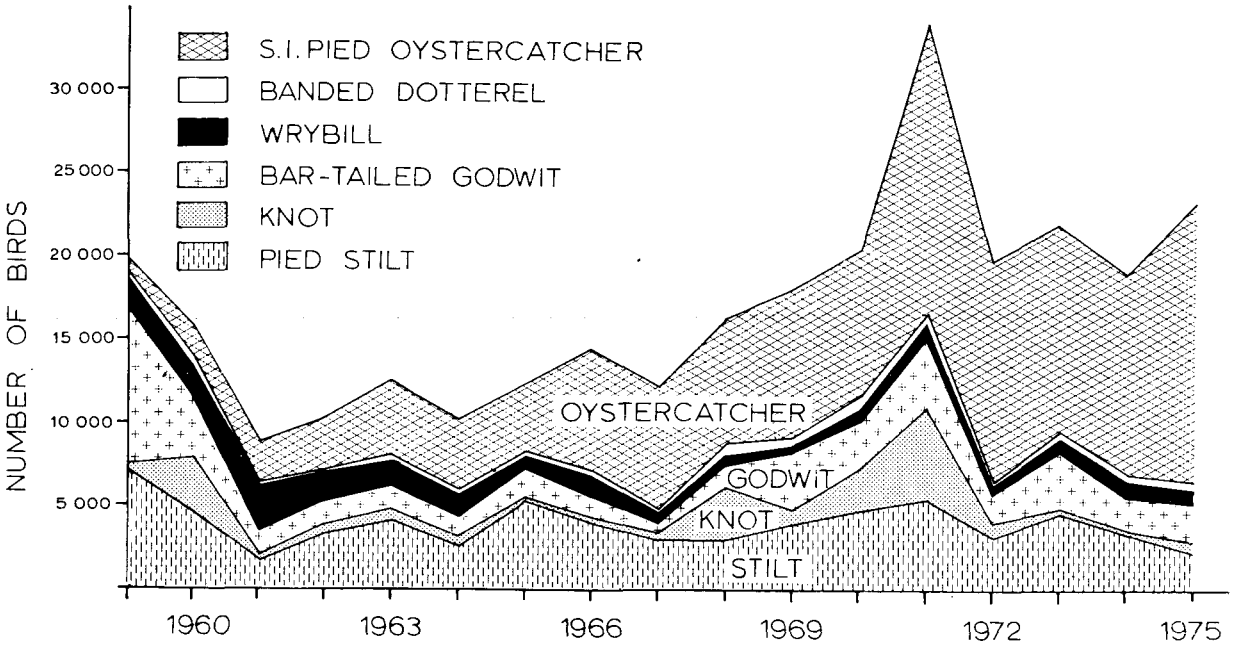

FIGURE 9—MANUKAU HARBOUR WADER POPULATION IN WINTER

West Siberia (K. T. Yurlov pers. comm.). Presumably the breeding success of other arctic species, and our endemic species, must also vary, and cause fluctuations in the number of wintering birds.

A number of casual readers of these census data have suggested that the number of observers present at each census could have a bearing in results obtained. I have therefore included the number of observers present on the Manukau Harbour during summer censuses in Figure 4.

MIGRANT ENDEMIC WADERS

SOUTH ISLAND PIED OYSTERCATCHER *(Haematopus ostralegus finschi)*

Soon after this species was protected by law in 1940 Sibson (1966) noted total winter numbers on the Manukau Harbour and Firth of Thames to be less than 300. He then recorded a subsequent steady increase in the numbers on both harbours between 1941 and 1965. This paper (Fig. 10) records a continuing increase for the period 1961 - 1975. The increase in numbers of this species is a major factor contributing to the overall increase of waders in winter on both harbours (Figs 7 & 9).

Baker (1973) calculated that in 1972 the total New Zealand population of this species was 59 000. During the winter of that year the Manukau and Firth of Thames total was 16 909 or 34.5%

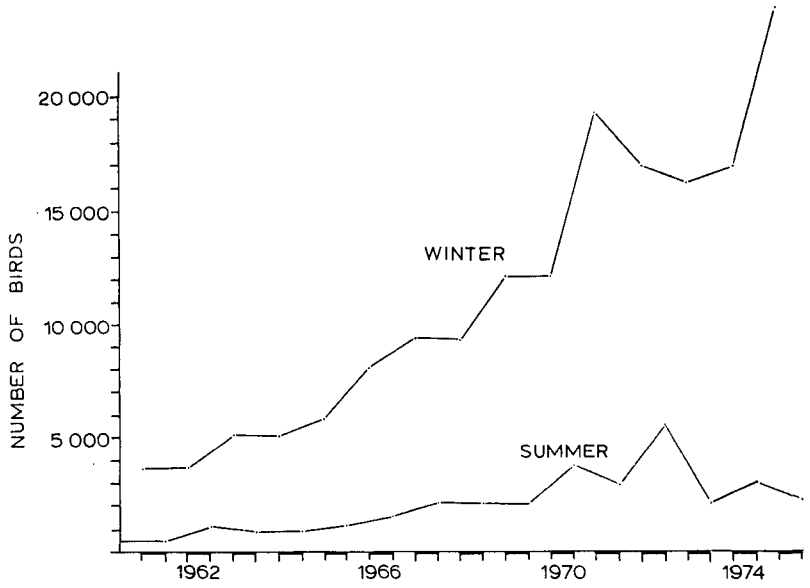

FIGURE 10– PIED OYSTERCATCHER TOTALS
FIRTH OF THAMES & MANUKAU HARBOUR COMBINED

of the total. During summer an average of 20% of the wintering population remain here though the proportional distribution of birds between the Manukau and Firth of Thames at 4.6:1 in summer is greater than during winter when it is 3.1:1 (Table 2). This is the only abundant species which occurs in greater density, in terms of birds per hectare, on the Manukau Harbour at all times of the year.

Table 2. DISTRIBUTION OF SOUTH ISLAND PIED OYSTERCATCHERS

	Summer		*Winter*	
	Average number of birds	Average birds per hectare	Average number of birds	Average birds per hectare
Manukau Harbour	1736	0.10	7821	0.43
Firth of Thames	377	0.04	2535	0.30

BANDED DOTTEREL *(Charadrius bicinctus)*

Census results indicate that Banded Dotterels have a marked preference for the Manukau Harbour in winter but are not entirely dependent on the estuarine habitat. Large numbers are frequently seen on fields some distance inland. H. R. McKenzie (pers. comm.) has recorded as many as 3 000 on a paddock near Waitakaruru. On both harbours and during both seasons counts record large fluctuations in numbers.

A portion of the Banded Dotterel population migrates during January-May to Australia, presumably returning to New Zealand for the next breeding season. *"The Bird Observer"* (1972) recorded that numbers in Australia are never high, with seldom more than 200 being seen in one place; however, they are widely distributed. At Karaka between 1963-1974 Banded Dotterels have maintained an average annual increase in mean numbers from about 200 in February to 400 during May in "good "years. (B. Brown pers. comm.).

WRYBILL *(Anarhynchus frontalis)*

Wrybills show a marked preference for the Firth of Thames where they have been steadily increasing (Fig. 11). Sibson (1963) noted that prior to 1940 the Wrybill population was very low but since then the prohibition of shooting of waders has allowed them, and other species, to live undisturbed. Sibson (1962) showed Wrybills increased during the years 1940 to 1960 on both the Manukau Harbour and Firth of Thames. The Puketutu area of the Manukau Harbour was a favoured feeding and roosting area. However, this area of

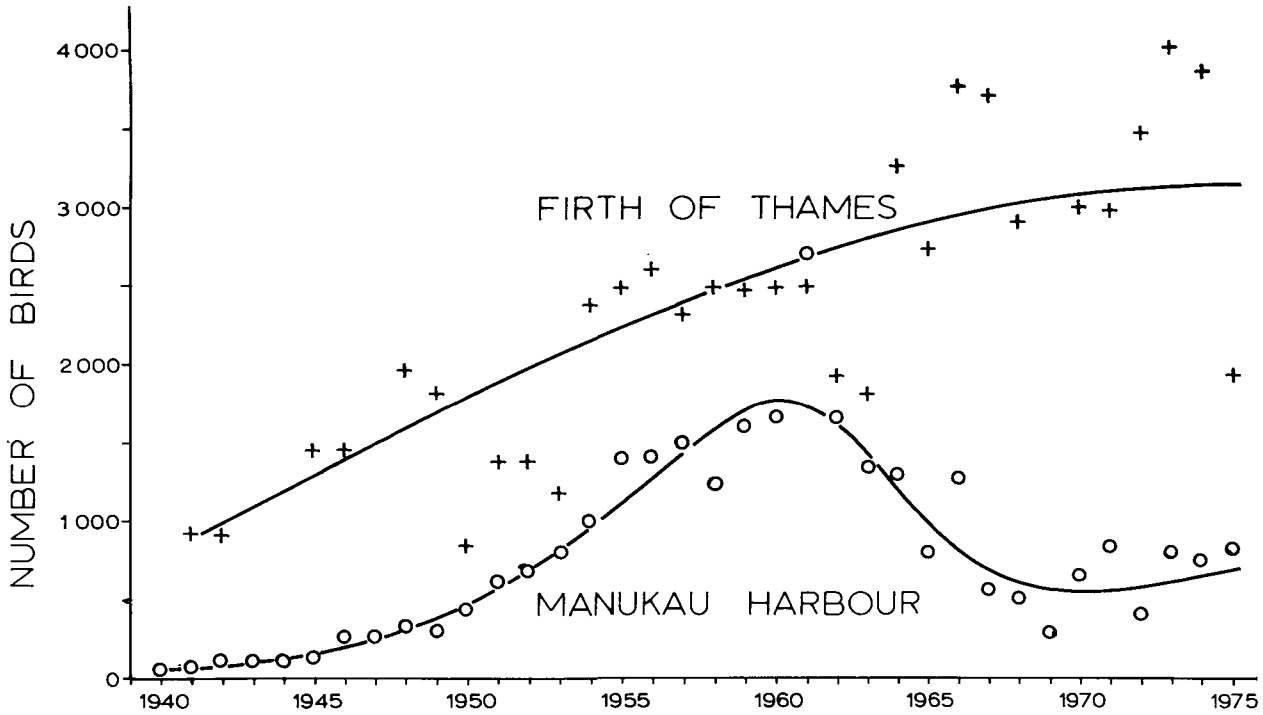

FIGURE 11—THE WRYBILL WINTER POPULATION

mudflat was inundated when the Auckland sewage treatment plant was constructed in 1960 and, presumably because of this loss of habitat, there has been a marked decline in numbers of Wrybills on the Manukau while they continued to increase on the Firth of Thames (Fig. 11). Less than four per cent of the winter population stays during summer, these non-breeding birds again favouring the Firth of Thames (Table 3).

Table 3. DISTRIBUTION OF WRYBILLS

	Summer		*Winter*	
	Average number of birds	Average birds per hectare	Average number of birds	Average birds per hectare
Manukau Harbour	19	0.001	1053	0.06
Firth of Thames	108	0.01	3281	0.39

Patterns of residency for Wrybills on the Manukau Harbour have been reconstructed from data recorded by Urquhart & Sibson (1952) and Sibson (1963) (Fig. 12). Because numbers have fluctuated widely, the maximum count for each year has been designated at 100% and other counts of each year a percentage of this. These data show the maximum population to be present during May-July.

PIED STILT *(Himantopus himantopus leucocephalus)*

Sibson (*in* Falla *et al.* 1970) noted that in the mid nineteenth century Pied Stilts seemed to have been relatively rare in northern New Zealand; now they are the most numerous of the larger waders which breed in New Zealand. During the period of this study numbers of Pied Stilts on both harbours have fluctuated greatly from year to year. However, there is no indication of any long term trend and these fluctuations are probaly a measure of their occurrence from time to time in other equally acceptable habitats.

BLACK STILT *(Himantopus novaezealandiae)*

Census data record Black Stilts only during the latter half of the census period. However, they have probably been present in low numbers for many years. It is only relatively recently that the "smudgy" stilt has been identified as the sub-adult plumage phase of this species (R. J. Nilsson pers. comm.).

COMMON MIGRANTS TO NEW ZEALAND FROM ARCTIC REGIONS

PACIFIC GOLDEN PLOVER *(Pluvialis dominica fulva)*

Pacific Golden Plovers occur in similar numbers on both harbours indicating, in terms of birds per hectare of mudflat, a marked preference for the Firth of Thames. Total numbers are small — ranging from

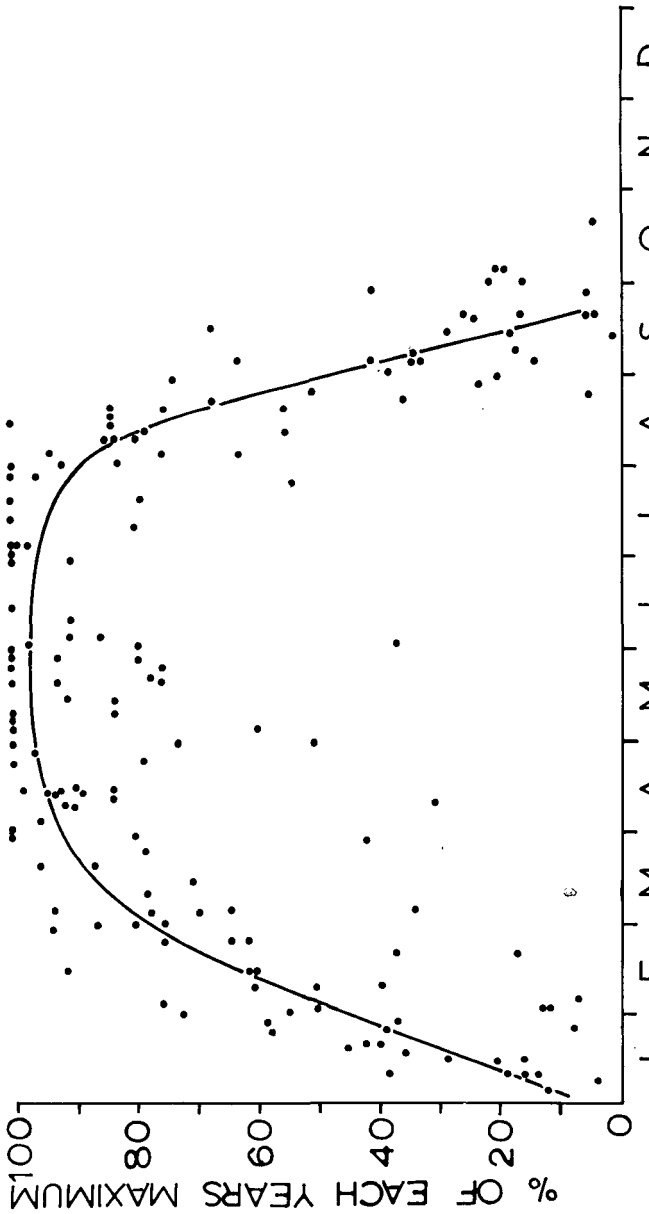

FIGURE 12-AVERAGE ANNUAL WRYBILL CYCLE MANUKAU HARBOUR 1940–1950

0 to 120, and are highly irregular. However, on the Manukau they have a habit of frequenting fields some distance from the harbour. Sibson (1946) recorded them on fields about 1 kilometre from the shore at Karaka when the tide was full. H. R. McKenzie (pers. comm.) has seen them flying away to the south of the Manukau Harbour, presumably to roost on fields. Golden Plovers in the Firth of Thames have not been recorded behaving similarly. Low counts during some censuses could be related to migration time. Sibson (1946) stated that Pacific Golden Plovers do not usually arrive in numbers in this region until late October or November. However, data given by McKenzie (1967 c) indicate an earlier arrival time of mid-September to mid-November.

A detailed search of the census records shows that this species, when present, usually frequents the same roosts: Waitakaruru in the Firth of Thames and Karaka in the Manukau. Puketutu causeway, now part of the Auckland sewage ponds, used to be a regularly used roost (R. B. Sibson pers. comm.).

The Golden Plover rarely over-winters; it has been recorded only during three Manukau winter censuses (1961, 1965 and 1973).

LONG-BILLED CURLEW *(Numenius madagascariensis)*

Although few in number the Long-billed Curlew has been a regular visitor to the Firth of Thames in summer. It has only once been recorded during summer censuses of the Manukau Harbour, when in 1975 four birds were found. Single birds have been seen there on at least three occasions during September and October (B. Brown pers. comm.). The census records show that some 22% of the summer population remains on the Firth of Thames during winter. They have been recorded on only three occasions during winter censuses of the Manukau (1962, 1974 and 1975). The apparent preference this species has for mangrove areas (Falla *et al.* 1970) may be a reason for their high use of the Firth of Thames.

EASTERN BAR-TAILED GODWIT *(Limosa lapponica baueri)*

The Eastern Bar-tailed Godwit is by far the most numerous arctic wader to visit New Zealand. Stidolph (1954) estimated the total summer population to be in the vicinity of 200 000. However, more recent estimates derived from more accurate data (Veitch 1977) suggest a figure closer to 100 000. Numbers recorded during censuses of the Firth of Thames and Manukau Harbour during summer range from 16 200 to 37 600 (a mean of 24 800). These counts may be misleading as those responsible for the larger total were made on 20 October and 17 November. At this time the southward migration may still be in progress and hence there could have been large numbers of birds in northern harbours prior to dispersal to the south.

The census figures show many fluctuations and a general increase in the number of birds present during the period covered by this paper

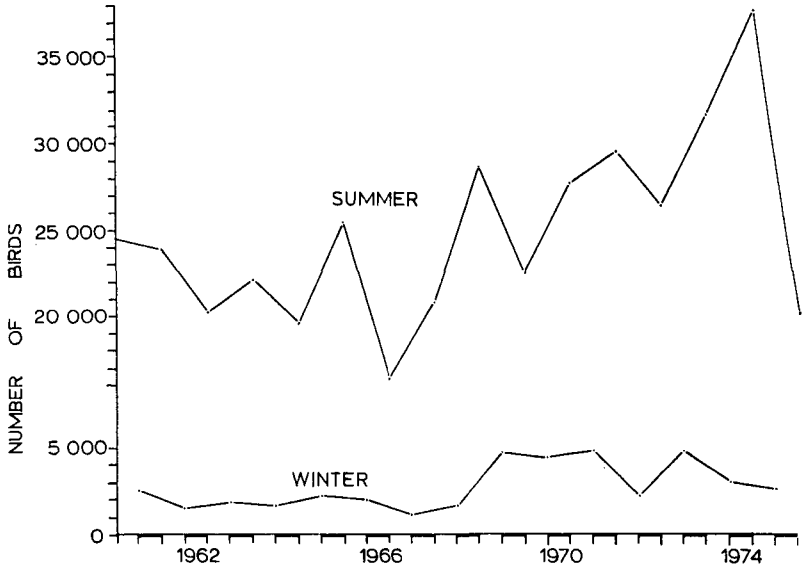

FIGURE 13– BAR-TAILED GODWIT TOTALS
FIRTH OF THAMES & MANUKAU HARBOUR COMBINED

(Fig. 13). Data presented by McKenzie (1967 a) for 1951-1966 indicate an even greater rate of increase during that period.

McKenzie (1967 a) recorded large Godwit flocks flying across country. All except one of his records relate to periods close to the northward migration time. On 1 March 1964 one flock of about 10 000 birds was seen to leave the Manukau Harbour, one and three quarter hours before high tide. They flew 20 kilometres to Whitford on the east side of the Auckland isthmus, where the tide is some three hours earlier, and rested on the sandy flats before flying back to the Manukau in time to feed after the outgoing tide. Sibson (pers. comm.) reports that large flocks of Godwit are commonly seen during March over Otahuhu (east of Puketutu/Ihumatao, Fig. 1) before and after high tide on the Manukau. Similar flights are also sometimes seen at the time of spring tides.

The pattern of distribution of Godwit between the Manukau and Firth of Thames is similar to that for most other species; that is, they are far more dense, in terms of birds per hectare, on the Firth of Thames (Table 4). Of note here is that, on average, more Godwit stay on the Manukau during winter (16% of the summer total). The total winter population has increased, but in recent years not in proportion to the increase in the summer population (Fig. 13).

Table 4. DISTRIBUTION OF BAR-TAILED GODWITS

	Summer		*Winter*	
	Average number of birds	Average birds per hectare	Average number of birds	Average birds per hectare
Manukau Harbour	15 472	0.86	2 563	0.14
Firth of Thames	9 310	1.10	751	0.09

Examination of seven birds killed during May showed five to be apparently sexually mature but thin, and therefore presumably not ready to migrate; the other two were not sexually mature. A portion of overwintering birds do appear to achieve sexual maturity, as indicated by their breeding plumage, but do not join the northward migration.

TURNSTONE *(Arenaria interpres interpres)*

Turnstones have been present on the Manukau Harbour from earlier than 1880, but were not recorded on the Firth of Thames until 1941 (McKenzie 1968). Since then the populations on both harbours have increased at similar rates. A noticeable gap in the census data is the nil record for the Manukau in the summer of 1964. H. R. McKenzie (pers. comm.) recorded 300 Turnstones at Karaka during November 1964 and January 1965. Probably an occurrence such as that described by Sibson (1964), when Turnstones were roosting at Karaka nearly a kilometre from the shore, took place at the time of the 1964 census.

The winter population is about 26% of the summer population and in general shows a similar distribution and increase in number. This is a high proportion of birds to stay during winter and may be related to a change of this species' distribution in New Zealand during winter or to some undetected aspect of its breeding biology.

KNOT *(Calidris canutus canutus)*

Census data for Knots show considerable fluctuations but there is no noticeable increase of average numbers present. Summer data may have been affected by counts which took place during the migratory period, as the two highest counts, both of more than 11 000 birds, were recorded in mid October. McKenzie (1967) noted that the arrival of this species continues from late September to early November.

Total winter populations show even larger fluctuations than those of summer — 268 in 1966 to 7 598 in 1971. The latter figure is significantly higher than usual, although obtained at a time of year when numbers should have been relatively stable. In this year (1971) other species were also recorded as being more numerous (Fig. 9). The nil record for this species on the Firth of Thames during the winter

census of 1968 could well be reliable. During that winter H. R. McKenzie (pers. comm.) on three other visits recorded 0, 1 and 30 Knots.

According to McKenzie (1967 b) — " The Firth of Thames and Manukau summer counts are, on the whole, very similar, but in spite of this the winter counts are very much in favour of the Manukau." The 1960-75 data (Table 5) extends this to show Knots to be far more numerous in the Firth of Thames during summer and in winter to be more numerous, although similar in terms of birds per hectare,

Table 5. DISTRIBUTION OF KNOTS

	Summer		*Winter*	
	Average number of birds	Average birds per hectare	Average number of birds	Average birds per hectare
Manukau Harbour	2 858	0.16	1 237	0.07
Firth of Thames	6 548	0.77	587	0.07

on the Manukau Harbour. About 19% of the total summer population is present during winter.

CURLEW SANDPIPER *(Calidris ferruginea)*

Although few in number Curlew Sandpipers have, during the census period, been a regular summer migrant, particularly to the Firth of Thames. Its status in New Zealand up to the summer of 1969-70 has been fully documented by Sibson (1971). These data show a steady increase in numbers, particularly on the Firth of Thames. Curlew Sandpipers, and many other small waders, show a marked preference for feeding and roosting with Wrybills and this may be a reason for the higher numbers of small waders found on the Firth of Thames which is the preferred wintering habitat of the Wrybill.

Curlew Sandpipers have not been found on the Manukau Harbour during winter censuses. H. R. McKenzie (pers. comm.) informed me that occasional sightings have been made on the Firtht of Thames in winter in years when it has not been recorded during censuses. The high figure of nine birds — all in breeding plumage (McKenzie pers. comm.) — during the census of 17 May 1964 indicates that this census may have included northward migrating birds.

RED-NECKED STINT *(Calidris ruficollis)*

Red-necked Stints are regular migrants to New Zealand even though numbers are small. Sibson (1968) recorded a marked increase in numbers on both the Firth of Thames and Manukau Harbour during the 1950s. During the census period numbers have fluctuated but there is no obvious trend. Winter numbers have been low except

in 1964 when the census may have been early enough to include some late migrants. This species likes to accompany Wrybills, but this affinity is not as marked as with some other species. This is shown by the more even distribution between the two harbours instead of more being in the Firth of Thames, the preferred Wrybill habitat.

NON-MIGRATORY NEW ZEALAND WADERS

VARIABLE OYSTERCATCHER *(Haematopus unicolor)*

This species is not known to nest within the census area. The few birds which have been irregularly recorded during censuses are probably typical of the small flocks which sometimes gather (Falla *et al.* 1970).

NEW ZEALAND DOTTEREL *(Charadrius obscurus)*

New Zealand Dotterels nest along the shores of both harbours and the summer census figures are, in all probability, an accurate assessment of the breeding population. The slightly higher winter numbers may be due to the presence of young of the year or flocking of birds which nest elsewhere.

BLACK-FRONTED DOTTEREL *(Charadrius melanops)*

A single bird was seen on the Manukau Harbour during the 1970 winter census and there are two other records of single birds there during the winters of 1971 (Sibson 1972) and 1972 (McKenzie pers. comm.).

OTHER MIGRANTS

There are 14 species of waders which reach New Zealand irregularly and have been included in census counts on the Manukau Harbour and Firth of Thames:

Red-capped Dotterel *(Charadrius alexandrinus ruficapillus)*
Mongolian Dotterel *(C. mongolus)*
Large Sand Dotterel *(C. leschenaulti)*
Asiatic Whimbrel *(Numenius phaeopus variegatus)*
American Whimbrel *(N. p. hudsonicus)*
Asiatic Black-tailed Godwit *(Limosa limosa melanuroides)*
American Black-tailed Godwit *(L. haemastica)*
Lesser Yellowlegs *(Tringa flavipes)*
Greenshank *(T. nebularia)*
Marsh Sandpiper *(T. stagnatilis)*
Terek Sandpiper *(Xenus cinereus)*
Sharp-tailed Sandpiper *(Calidris acuminata)*
Pectoral Sandpiper *(C. melanotos)*
Western Sandpiper *(C. mauri)*
Baird's Sandpiper *(C. bairdi)*
Broad-billed Sandpiper *(Limicola falcinellus sibirica)*

In quantity these birds account for 0.03% of the waders using

the Firth of Thames and Manukau Harbour throughout the year. In quality they have attracted a good deal of attention and notes about many have appeared in *Notornis*.

The Firth of Thames appears to be the place where these irregular migrants are seen more frequently. This may be due, in part, to the way these birds are attracted to the large flocks of Wrybills which are present there from January-February to August.

A further 9 species of waders have been recorded on the Manukau Harbour and Firth of Thames but have not been seen during censuses. These are:—

Grey Plover *(Pluvialis squatarola)*
Oriental Dotterel *(Charadrius veredus)*
Ringed Plover *(C. hiaticula)*
Little Whimbrel *(Numenius minutus)*
Upland Plover *(Bartramia longicauda)*
Siberian Tattler *(Tringa brevipes)*
Great Knot *(Calidris tenuirostris)*
Dunlin *(C. alpina)*
White-rumped Sandpiper *(C. fuscicollis)*
Sanderling *(C. alba)*
Ruff *(Philomachus pugnax)*. Probable sighting only.

To complete the list of waders the following species have been recorded in the New Zealand region but not on the Firth of Thames or Manukau Harbour:

Bristle-thighed Curlew *(Numenius tahitiensis)*
Wandering Tattler *(Tringa incana)*
Common Sandpiper *(T. hypoleucos)*
Least Sandpiper *(Calidris minutilla)* Probable sighting only.
Semipalmated Sandpiper *(C. subminuta)* Probable sighting only.
Australian Avocet *(Recurvirostra novaehollandiae)*
Grey Phalarope *(Phalaropus fulicarius)*
Red-necked Phalarope *(P. lobatus)*
Oriental Pratincole *(Glareola maldivarum)*

CONCLUSION

These censuses show some species to be increasing, some to be stable, and others to fluctuate. Except for rare occasions (e.g., Wrybills on the Manukau) there is no evidence to give reasons for these changes.

The breeding areas of some wader species are diverse and it is not known exactly which portion of these populations migrate to New Zealand. The breeding success of some wader species, but not those which migrate to New Zealand, have been studied and their numbers observed to fluctuate (Frank A. Pitelka pers. comm.).

Migration routes are not known accurately; therefore the effects of habitat changes on migrating birds cannot be deduced.

The food available to waders and the food taken by them in New Zealand is not known accurately, nor are the occurrence or effects of changed water salinity, temperature, nutrients, etc., and the variability of substrates is not recorded. All these factors are known to effect wader populations elsewhere (Wolff 1969, Perkins 1974).

Therefore, the data presented here stand on their own as a basis for further studies. It is hoped that censuses can be continued in their present form or even expanded to be more frequent and include other harbours. Regular New Zealand-wide censuses would help to clarify the wader distribution pattern.

ACKNOWLEDGEMENTS

The major credit for these censuses must go to Mr H. R. McKenzie who originated this work and organised it for many years. His foresight has made available a unique and increasingly significant record. This work is now organised by Mrs B. Brown, South Auckland Regional Representative for the Ornithological Society of New Zealand, with assistance from the Auckland Regional Representative and members of the OSNZ. Thanks are also due to the landowners who have allowed access over their properties.

My personal thanks is due, firstly, to Mr T. Caithness who made this paper into a readable document and, secondly, to the many people who have commented on and criticized my work and added valuable data to the existing records.

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THE REEF HERON (Egretta sacra) IN NEW ZEALAND

By A. T. EDGAR

ABSTRACT

This paper presents the results of 1975-76 Reef Heron enquiry in the form of a general account of the Reef Heron in New Zealand, summarised locality reports with two maps and a discussion of the present status of the species.

INTRODUCTION

The 1975-76 Reef Heron enquiry started as a Northland Regional project, initiated by Mrs K. Reynolds and designed to determine the present status of Reef Herons in the six northern counties of New Zealand and to collect information on nesting, behaviour, feeding habits, etc. The proposed working programme was submitted to OSNZ Field Investigation Committee for approval and guidance. Regional Representatives suggested that the scope of the enquiry should be widened to cover the whole of New Zealand, at least with regard to status and distribution.

Accordingly, records of Reef Herons taken from *Notornis,* other local publications and the OSNZ Recording Scheme were listed by regions and sent to Regional Representatives with a request for additional records and recent sightings. Nest Record cards were examined and details recorded. Further information was kindly provided by the National, Auckland and Canterbury Museums and by the N.Z. Wildlife Service.

An account of the Reef Heron in New Zealand includes notes on plumage, colour of soft parts, habitat, field characters and general habits, food, feeding habits and breeding. Summarised locality reports, compiled from information received, are supplemented by two maps. The results of the enquiry confirm that, at least in some areas, the Reef Heron population has shown a marked decline over recent years. Factors which may have contributed to this decline are discussed.

Names of contributors are listed, and identified in the text by initials. References to *Notornis* (including *N.Z. Bird Notes*) and its predecessor *Reports & Bulletins (1939-1942) of Ornithological Society of New Zealand* are given thus — (13/153) = *Notornis* Volume 13, page 153; RB15 = *Reports & Bulletins,* page 15.

It is evident that some observers find difficulty in distinguishing between the Reef Heron *(Egretta sacra)* and the White-faced Heron

(Ardea novaehollandiae). The plumage of both species is generally blue-grey. An old local name for the Reef Heron is " Blue Heron," and in Australia the White-faced Heron is sometimes loosely called " Blue Crane." The two species may be found together in harbours and estuaries but the Reef Heron is almost exclusively a coastal bird; the White-faced Heron also frequents inland waters, swamps, ponds and ditches and often congregates in paddocks. The White-faced Heron may nest in mangroves but generally prefers to nest high in tall trees; the Reef Heron nests along the coastline, usually in caves and crevices, sometimes in the shelter of overhanging pohutukawas or thick coastal vegetation. There are several easily observed field characters which, once appreciated, should eliminate confusion. The White-faced Heron has an upright stance, long legs, pale grey plumage with a wash of purplish-brown on the breast and an extensive white area on the face. The Reef Heron has a more crouching gait, shorter legs, a heavier bill, slaty grey plumage and no white on its face; a narrow white stripe on chin and throat is rarely visible in the field. In flight, the two-tone wing of the White-faced Heron (dark flight feathers contrasting with pale grey wing coverts) is distinctive. A flying Reef Heron appears to be all one colour.

The range of the Reef Heron extends from southern Asia to Australia, eastern Polynesia and New Zealand. The species is dimorphic, having a white and a dark phase. Both phases occur in the tropical parts of its range, in proportions which vary with the locality, but the white phase is not known to occur in New Zealand.

PLUMAGE

Adult, general colour slaty grey, darker above, tinged brown on the lower surface. A variable white patch or line on chin and throat, sometimes extending down the foreneck. Elongated feathers on the nape; narrow lanceolate bluish grey ornamental plumes, up to 180 mm long, on the back; similar feathers on the lower neck, overlapping the breast.

Immature, general plumage browner and duller, especially on the upper surface. No plumes.

Field observers frequently comment on the marked variation of plumage colour in different individuals. Partly this may be due to light conditions — on a dull day a bird may appear very dark, in strong light it may appear light bluish grey — but the general plumage of individuals can in fact vary from slaty grey to almost black and this is not always dependent on age, light or plumage condition. Birds in fresh plumage may have a " bloom " which, seen in strong light, gives the impression that the general colour of the bird is much lighter than it really is. Birds in worn plumage tend to become browner and

this probably also applies to museum specimens. GAT* examined eight study skins in the Canterbury Museum and commented on the brownish nature of their plumage. One specimen had no plumes and could have been a young bird but the other seven had plumes and were presumably adult. In the field, however, it is probably safe to assume that a bird is immature if it shows a strong brownish tinge on the upper surface and wing coverts.

The white throat patch is inconspicuous in the field, though it can be seen if the bird is observed from below and stretches its neck and is obvious when the bird points its bill upwards in the process of swallowing some large food item.

In some birds it reaches up to the chin, in others the actual chin is dark; in first year birds the patch may be short and not fully developed (FCK). Buller (1888), writing of a first year bird, stated " gular streak, instead of being narrow throughout, expanded in the middle." MJT recorded a throat patch c. 30 mm broad, on a bird observed at Warkworth. In Canterbury Museum specimens (GAT) the patches fitted into two fairly easily recognisable shapes, narrow and broad; lengths of patches were — one male, 70 mm; three females, 60, 87, 88 mm; three, unsexed but with plumes, 62, 65, 70 mm; one, unsexed, no visible plumes, 93 mm. Moon (1960) described a breeding pair in which the male throat patch was c. 90 mm and that of the female only c. 25 mm. There seems to be much individual variation, not necessarily connected with age or sex.

OTHER FEATURES

Iris

Generally recorded and described as yellow to golden yellow. Moon (1960) said — " varies from light orange to red," and described a mated pair he watched and photographed over a long period, the female of which had an orange red iris while that of the male was more yellow. JFS reported a bird at Huia on 8 July 1976: its iris, caught in sunlight, showed a glowing red.

Naked skin on lores

Generally described as greenish yellow. I have notes of a February bird which had greenish brown lores and of a June bird of which the lores were grey, with no green or yellow tinge. FCK commented " with immature birds the colour is grey, as it is with many adult birds during the non-breeding season. In the breeding season it varies between bluish green and yellowish green and is more yellow than green at the height of the season, i.e., before egg-laying."

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* For names of informants see under " List of Contributors . . ."

Bill

Adult, dark yellow, shaded with brown on culmen and sides, horn coloured at the tip. Immature, dark brown (Oliver 1955).

There is general agreement that bill colour of immature birds is brown, sometimes with a greyish or greenish tinge.

Field notes indicate that there is considerable variation in bill colour of adults during spring and summer. Descriptions recorded range from brown to brown tinged yellow, yellowish brown with yellow tip, dull yellow, yellow, very yellow, almost orange and ochreous yellow with a touch of tan. FCK considers that the amount and intensity of yellow colouring depends on age and the time of year; with adults in breeding season the bill can look very yellow but there is always some brown present; outside the breeding season the bills of adults and those of immatures are brown, with the lower mandible somewhat lighter than the culmen; or can be all greyish brown with only a lighter stripe along the cutting edges. Field notes for the February-June period give support to this; e.g., in a secluded bay in the Far North bill colour of two (presumably the same two) birds was recorded as dull brown in March, pale yellow in August. Bills recorded as grey (DJB, April), slate-grey, slightly tinged green (AJG, November) and olive (SQ, December) may have been those of young birds.

D. C. Watson (21/391) recorded Reef Herons with white bills at Warkworth and Raglan. Could this perhaps have been a trick of the light? Many observers have been plagued and puzzled by the way strong or reflected light can cause a false impression of the colour of bill, legs and even lower plumage of shore birds. PGS wrote of two Aurere herons in July 1976 — "beaks and legs at 50 yards distance, in sunlight, appeared to my eyes to be slaty grey with a yellowish tinge; when the birds finally flew, with the sun behind them, feet and beak were obviously yellow."

Feet

Adult, greenish yellow, claws horn; immature, yellow (Oliver 1955). The colour of the tarsus is variable in adults. In some birds it appears grey or greyish green, with or without a tinge of yellow; in others it is described as olive, olive yellow, yellowish olive-green, yellowish green or greenish yellow. The soles (i.e., toes from below, as seen when a bird flies away from the observer) are yellow. In some examples the upper surface of the toes is yellow and this yellow colour may extend to the lower part of the tarsus above its junction with the toes. These may perhaps be cases in which the yellow of young birds is fading to the greener shades of maturity. Most adults have the front of the tarsus patched or mottled with black to some degree and this mottling may extend on to the upper surface of the toes. FCK commented that this is caused by an individually varying amount

of black pigment in the scales, which is present in most birds, sometimes dense and regularly distributed, giving the front of the tarsus a very dark, almost blackish appearance, but often not present in every scale and therefore not so obvious, as it forms only irregular black patches. Usually the exposed portion of the leg is one general colour but sometimes the tibia and joint may be darker than the tarsus.

Measurements

Bill 80-92, Wing 285-295, Tail 100-108, Tarsus 76-90, Mid-toe 65-70 mm (Oliver 1955).

HABITAT

Normally the Reef Heron is a bird of coastal rocks and the tide line, preferring sheltered situations in bays and estuaries which provide good sites for crevice nesting and also suitable conditions for intertidal feeding. Inshore islands which satisfy these requirements are a favoured habitat; the more exposed offshore islands are not, probably because their coasts, though suitable for nesting, are generally unsuitable for feeding. Long sandy beaches are usually avoided except when their continuity is broken by sizeable rocky outcrops. Inside harbours and estuaries Reef Herons frequent sandy beaches and tidal mudflats as well as rocky shores and in northern harbours may be seen feeding under the mangroves. Sometimes they feed up tidal rivers, e.g., Hatea river, upstream from Port Whangarei; Clevedon river, 3½ km upstream from the mouth; and (MJT) Mahurangi river as far inland as Warkworth. Usually rather a shy bird, but individuals which have become attached to urban localities such as Warkworth, the upper reaches of Manukau harbour and the Wellington wharf area, or which frequent stretches of coastline bordered by main highways, seem to lose all fear of pedestrians and passing traffic.

Inland records are few and some of them doubtful. Smith (1889: 221) recorded the Reef Heron as common in the summer and autumn, when eels and grayling are plentiful, in the Arnold and Lake Brunner. As far as I know there have been no subsequent records from this area and this may be one of the early instances of confusion between *Egretta sacra* and *Ardea novaehollandiae*. Buller (1888) recorded a pair seen by Captain Mair on Lake Taupo in October 1875 and a personal sighting of one at Lake Rotoiti in October 1884. In July 1961 HRMcK and others (9/200) saw one, and later two Reef Herons on the shores of Lake Taupo, on the stones of the groynes or paddling along the sandy beach; one was seen to catch a fish, probably a "cockabully." In April 1974 RMW (21/355) saw one fishing for smelt at Twin Streams, Lake Rotoiti; when waves broke over its tarsal joint it rushed back to the beach, then dashed forward for another fish; a White-faced Heron was further along the beach. CHL saw a bird at Lake Rotoiti in May 1974. Two 1962 records from inland Waikato, one of a single bird in July at

Rukuhia, near Hamilton (LT) and one of two birds on floodwater at Hinuera, south of Matamata, in October (W. Renouf) were probably correct identifications. In November 1975 IAN reported a single bird on the river bank at Athenree gorge, Bay of Plenty. In ten years of observation at Lake Horowhenua, a few kilometres inland from Manawatu coast, EBJ has recorded single birds on four occasions.

FIELD CHARACTERS AND GENERAL HABITS

Like other herons, the Reef Heron flies with neck drawn back and legs extended under the tail. Flight appears slow, but is powerful, with regular leisurely downward wing beats; usually on a steady course only a metre or so above the water but sometimes at an altitude of 40-50 m when changing ground — e.g., three birds flying over the sea from Whatipu to a point some kilometres up the coast towards Piha, individuals flying round Manukau north head in the direction of some point well inside the harbour and (MJT) a bird at Waiwera, flying from the coast to some destination well upstream, which had reached an altitude of 50 m by the time it flew over the main highway bridge. Capable of sustained flight from mainland to offshore islands such as Little Barrier (c. 22km) and longer flights would have been necessary to reach some of the more distant islands where it has been recorded as a straggler. At Rangaunu Bay, on a falling tide, when birds were leaving the sandspit for their feeding grounds, I have seen Reef Herons fly up the harbour with the Godwit mobs, soon to be outdistanced by the faster flying waders.

Movement from pool to pool or from one rock perch to another by short flights is a somewhat laboured performance. Take-off is slow, with legs dangling and neck partly outstretched; hardly is the bird airborne, neck drawn back and legs outstretched, than it is time to re-adjust for landing. Longer flights often end with a short glide during which the feet are brought forward and lowered. The bird then generally stands erect for a moment in the alert position, head up, bill horizontal and long feathers smoothed down, before settling to its normal crouching stance.

Reef Herons feed mainly on fish, also on crustacea and molluscs. Small flat fish form a large proportion of food taken; at Onehunga BB watched adults taking flounders up to 125 mm. Larger fish (herrings, etc.) are sometimes taken.

R. Mander reported seeing Reef Herons at 180 m. a.s.l. on Stephens Island on several days in March 1961, apparently catching skinks and geckos. This is perhaps exceptional. Reef Herons do, however, sometimes feed on coastal paddocks. At Kerikeri, in January 1967, I watched one searching for and apparently finding food items on the edge of a paddock which bordered a mangrove swamp. At Paua, in March 1976, a number of Black-backed Gulls were feeding on a coastal paddock and among them, also actively feeding, was a Reef Heron. The following month one was seen in the same paddock,

about 60 m from the water's edge, but on this occasion it was not feeding and its presence in an unusual situation may have been due to strong wind, to which its normal high tide perch on a jetty was very exposed.

Feeding normally occurs from some time after till some time before full tide. Food is obtained from rock pools, shallow lagoons, water runnels or pools in the mudflats where fish are left by the receding tide, along the shoreline, at the mouths of freshwater streams and in riverbeds some distance upstream. High tide is usually the time for rest and preening but sometimes, perhaps when food supply is at a low level, birds may be seen working over pools on rock shelves and shellbanks when the tide is full.

Daily routine varies in different localities according to circumstances. Where a good feeding ground is adjacent to a rock roost the routine is simple. Many northern harbours have rocky shores around their entrance but widen out to mudflats with beaches of mud or sand. In Whangaroa harbour most of the herons find all they need at the northern end and only a few seem to feed on the flats further south. KR commented on how difficult it is to pick up a Reef Heron resting on the rocks, often almost invisible till a glint of sunlight on its bill betrays its presence. In Whangarei harbour CWD has diligently observed the movements of herons, generally up the harbour on a falling tide and down the harbour on a rising tide; some birds, however, seem to frequent the upper reaches of the harbour for much of the year, except probably in the breeding season, and the same applies to Parengarenga harbour and inlets in the Bay of Islands. Where rocky roosts are not readily available close to the feeding ground herons may loaf at high tide on sandbanks or perch on boats, jetties, bridge rails, posts of a sea fence, maimais, dead trees, trunks and lower branches of living trees along the coastline and, in Rangaunu Bay, on the tops of small growing mangroves; in built-up areas like Wellington waterfront, on wharves and sea walls.

The heron catches fish in its bill; small fish are swallowed without delay and fish up to about bill length (85 mm) may be dealt with in this way. A larger fish (over 100 mm), gripped about 40 mm from the end of its tail and flapping wildly, was held while the bird ran with it to the shore, where it was flipped round and swallowed head first. At Warkworth weir MJT saw a 100 mm fish similarly carried a few steps back from the water's edge before being swallowed; the heron then took three sips from a pool.

Feeding behaviour includes a range of tactics and techniques designed to suit different types and sizes of prey, condition under which they have to be hunted, state of water and degree of light. The " stand and wait " method characteristic of some species of heron whereby a solitary bird stands motionless at the edge of or in shallow water until its prey comes within striking distance is not, in my

experience, used by the Reef Heron. I have, however, seen herons waiting on the tideline when parties of Little Black Shags were herding shoals of small fish into the shallow water.

FHB described the behaviour of a heron on Pepin Island spit, the shoreline of which dips steeply into deep water; it patrolled about 100 m along the spit, flew back to its starting point and repeated the process twice, keeping its feet on the dry stones but successfully capturing some fish. PGS recorded a bird which moved quickly over rocks at Koutu Point with rapid stabs of the bill from time to time, then flew to a rocky point and fished off the side of the rock shelf. At Maraetai RC watched a bird working along the rocky outcrops, stopping at each for a few minutes and then flying on to the next outcrop; five minutes later it was followed by another bird which repeated the actions of the first. From Coromandel JG noted several instances of birds flying in to rocks, investigating them and then flying on. This restless method of hunting by repeated short flights seems to be related to the periods when the tide has recently started to ebb, or when it is rising towards the full. Birds so engaged may assume an erect posture on first landing, scan, and then settle down to a hunting position or may adopt a hunting position immediately after landing and stand erect only when about to fly.

Stance of a foraging heron may be a crouch with body held very low and neck much retracted, suitable for situations requiring stealthy movement; a low stalk with body horizontal and neck drawn back, head level with the body, movement slow and deliberate; or an upright stalk with body at a slight angle to the horizontal, neck curved but not retracted, head well above the level of the body and movement usually more rapid than in the low stalk. The upright stalk may be used in shallow water or in water up to the depth of the tarsal joint. Individual birds may change from one position to another in the course of their hunting and frequently stand erect between periods of stalking. Periods of slow deliberate movement may be interrupted by sudden bursts of activity with repeated quick stabs of the bill, as when a bird which has been working slowly along the edge of a tidal stream dashes out into midstream when a shoal of small fish passes by, and then returns to feed in the shallows (HMM), or when a bird hunting in deeper water makes periodic short runs.

In crouch and low stalk wings may be held close to the body, or slightly extended. The final pounce on a fish is often aided by a flip of the wings. Sudden wing movements, as if to restore balance, are often observed, in running water, in pools or in tidal water about 80 mm deep. Two birds at Kerikeri went through the erect-quick run-low stalk routine; one of them then fluffed its feathers, raising the breast plumes above the level of the body in the process, and raised first one wing and later the other before resuming its stalk. This may have been a comfort movement; shortly afterwards two quick

wing flaps caused a shoal of small fish to scatter fanwise. At Mill Bay I watched a party (two adults and two young birds). The adults stalked with their wings spread like a cloak, with periodic short runs, forward jumps and stabs with the bill. The young birds used the same run-jump-stab procedure but did not spread their wings. This spread-winged hunting has been recorded by various observers (PJ, HRMcK, MJT) and I have seen it on a number of occasions. It has been suggested that it may have two purposes, either to create a patch of shade which could attract fish or to help the bird's vision by cutting out reflection from the surface of the water.

Reef Herons seldom go into water deep enough to wet the feathers of the tibia, but birds fishing off the edge of a rock shelf may plunge after their prey so that the head and part of the body is immersed. In such a situation I saw one bird washed off the rock three times by small waves; each time it clambered back again, not without considerable scrambling and wing flapping.

In autumn and winter the Reef Heron is generally a solitary bird and if two are present in an area they tend to feed some distance apart. In early spring birds of a pair may still feed separately but within sight of each other. At this time of year it has been noticed that birds which could previously be closely approached tend to become restless, shy and nervous. Once nesting is underway, some feeding areas which have been regularly used during autumn and winter may be temporarily forsaken, presumably because the birds find sufficient food closer to the nest site. In late summer family parties of two adults and one to three young birds feed together. On mudflats south of Dargaville BSC watched a young bird approaching and chasing two adults, as if begging for food; the adults rejected its plea and danced out of its way with wings half spread. This went on for some time, but when disturbed by a passing dinghy the party broke up and the three birds dispersed over the mudflat and fed singly. In recent years post-breeding concentrations of 10-11 birds have been seen on high tide roosts at Parengarenga, Rangaunu, Bay of Islands and elsewhere. These congregations may occur in winter, e.g., eleven birds at Mill Bay, Manukau, in June (RBS).

Voice has been well described as a guttural croaking, often accompanied by bill snapping in the breeding season, and the alarm as a guttural "crraw." Outside the breeding season Reef Herons are generally silent, but a low croaking can sometimes be heard when one bird flies in to join another on rocks or tidelines, and the alarm note when a bird is suddenly startled by an intruder. Buller (1888) reported — "in the breeding season I have heard these birds mewing like kittens as they hovered overhead and were evidently concerned about their nests."

Patches of powder down on the breast and behind the thighs are characteristic of the plumage of herons. This soft friable disintegrating material gives off minute dusty particles. The bird plunges its bill into the powder down patches and the adherent dust assists in removal of fish slime and oil from the plumage. Herons spend much time preening. Moon (1960) described how the feathers were first puffed out and shaken, then each tail and wing feather meticulously combed down its full length with the bill; the whole process lasted more than twenty minutes. In winter 1976 PGS watched two birds preening for about fifteen minutes, an hour after high tide, on a beach at Doubtless Bay.

On its feeding ground the immediate reaction of a Reef Heron to any intruder is the alert display as already described. If the intruder is human the heron may fly away, or merely make a short flight over the water and land again further along the coastline. If a quartering Harrier flies over, a heron may point its bill upwards till the Harrier has passed. On arrival of the other bird of a pair it will usually raise the feathers of its crown and lower them again once recognition is completed. When a Little Egret frequented Kerikeri Inlet for several months in 1965 the local Reef Heron at first displayed some hostility, sometimes advancing on the egret with crest feathers raised, but as time went on this wore off and the two birds fed near each other without any sign of enmity. White-faced Herons generally seem to be tolerated; I have seen one displaced from a rock shelf which at that time was the favoured high tide roost of the Reef Heron. RC described an incident at Tapu (Coromandel) in September 1976 which was probably the result of a Reef Heron's defending its breeding territory. A White-faced Heron flew 20 metres above the shoreline, closely followed by a Reef Heron. As the birds passed the observer both swept up in a dramatic aerial movement; the Reef Heron wheeled back and flew low over the water for some 300 metres to land on a small rocky island; the White-faced Heron lost altitude and continued its flight along the tideline. Occasionally a heron chases oystercatchers which land near it; a kingfisher which perched on a stone on the mudflat close to a feeding heron was also chased away. Red-billed Gulls move aside when a heron approaches them. JJ saw two city pigeons chased off " dolphins " on Aotea quay. An uneasy relationship exists between Reef Herons and Black-backed Gulls. At Mission Bay MJT watched a heron feeding undisturbed through a flock of 50 roosting gulls. At Paua, a heron feeding on a coastal paddock adopted a crouching stance and advanced towards a flock of feeding gulls in a menacing manner; the gulls parted and moved aside. Two herons fishing on a Manukau sandspit were harried by gulls but did not give up their catch (BB); at Wellington Wodzicki (1/24) recorded a fight which ended with the gull getting the heron's fish. At Waiheke Blundell (7/77) reported flying young herons being constantly harried by gulls and S. Chamberlin saw two young herons at Whangaparaoa being attacked by nesting gulls. HRMcK noted that at Frenchman's

Gap and Koi Rock Reef Heron young were successfully reared only yards away from small but dense Black-backed Gull colonies. L. Wagener studied a heron nest in an open cave on a stack at Houhora heads; of two chicks, one died and the other survived till nearly ready to leave the nest, but was later found killed and partly eaten, almost certainly by a Black-backed Gull.

Moon (1960) described display between adult birds when one returned to the nesting territory. The birds approached one another with head, neck and back feathers erected, uttering raucous squawks which were accompanied by much bill snapping and stretching and lowering the neck. The crest feathers may be erected at any time of the year, during the process of recognition, while bathing, or (MJT) while feeding from rocks. Crest, neck and back plumes are raised in threat display; KR recalled the behaviour of three herons on the rocky shore at Parua Bay. As she swam underwater towards them the birds ran down to the water's edge with hackles raised, retreating when she surfaced; this performance was repeated several times.

Courtship flights involve swooping, banking and chasing movements very different from the normal sedate progress of a flying Reef Heron. At a point on Houhora harbour about 6 km from the nearest likely nesting area, two birds were so engaged, one of them carrying a stick in its bill. In spring and early summer when one bird is pursuing another in the air, the pursuing bird may fly for short distances with its neck extended, not drawn back. In the Bay of Islands I have seen this only occasionally with Reef Herons but it is commonly observed with the much more numerous White-faced Herons at this season of the year. On the flats a courting pair stalk around together, often with pronounced arching of the neck and plumes raised; CWD described the antics of a pair which indulged in a sort of courtship dance before taking flight. In spring I have twice, in different localities, noted three apparently adult birds together, two of them stalking round each other with neck extended or curved, one or both with dorsal plumes raised, and the third bird in what appeared to be a submissive crouching attitude.

BREEDING

The Reef Heron has an extended breeding season. A. R. Harris recorded a nest with two eggs at Portobello on 29 August 1953; Moon (1960) noted clutches as late as February but considered that these late nests are the result of earlier failures. A check of nest record cards and other material made available to me during this enquiry indicates that the main egg-laying period is from September to December with a few January records; peak laying seems to be in October.

Preferred nesting sites are caves, rock clefts, crevices between or behind rocks and boulders and rock shelves sheltered by overhang.

D. W. Hadden recorded a nest in a horizontal crevice which allowed only 200-250 mm of depth for the sitting bird. Nests in such situations may be from just over a metre up to eleven metres above high water mark. Cliff-side vegetation provides shelter for nests under clumps of flax or *Astelia banksii,* among the roots of pohutukawa trees and occasionally on their branches (RAF, MH, J. Lambert). Oliver (1955) recorded a nest two metres above water level on a horizontal branch of a matipo. On small islands in Hauraki Gulf and elsewhere DVM found a number of nests under canopies of taupata *(Coprosma repens)* or taupata and *Hymenanthera,* and two nests in open situations among rushes. Nests may be placed in rotting hulks; beams and stringers of wooden wharves and jetties, where these still exist, provide acceptable sites which are sometimes used, even if some distance from the sea, as at Kohukohu in Hokianga harbour. AP recorded a nest in an old maimai. Several pairs may nest on one small islet but it would probably be unusual to find occupied nests less than 6 metres apart.

The nest is a platform of sticks and twigs up to 600 mm in length, sometimes with a little dry seaweed. In some nests dry grass, flax leaves and rushes are also used. A. R. Harris described an Otago nest made of light sticks, seaweed, silver tussock, fragments of manuka and toitoi — all material which could have been washed up by the tide. At Pukerua Bay C. N. Challies recorded a nest of dried willow twigs and in the following season another nest, three metres from the site of the first, was made of the same material, which could only have been obtained as driftwood. A new nest is a shallow structure but if the same nest is used for several years the end result may be a bulky pile of sticks 460 mm deep.

Eggs, elliptical, pale greenish blue. Clutch, 2-3, occasionally 4. I have only one record of a 4-egg clutch (AP, Bay of Plenty, January). In records available to me the ratio of 3-egg to 2-egg clutches is as 4:3. The actual ratio in favour of 3-egg clutches is probably considerably higher, as many of the 2-egg nests were only inspected once and the clutch may have been incomplete at the time of recording. Eggs are laid at intervals of up to two days. Both sexes incubate. Incubation starts when the first egg is laid, so chicks may vary in size. Incubation period is recorded as 25-28 days. Chicks are sparsely covered with dark grey down. Many more nest record cards than the somewhat meagre number now available would be needed to give any acceptable figure for hatching and fledging success. For what it is worth, the records show 15 observations of 3 chicks, three 3-egg clutches which produced two chicks and one which produced one chick. Of ten two-egg clutches for which records are available, six produced two chicks and two produced one chick; two were deserted. There are also 15 records of two chicks and three of one chick, but with no information as to size of clutch. Two single eggs were found deserted;

one of these desertions was by a bird which had laid in a dark crevice behind a large rock and was obviously very scared when flushed off its egg on a previous visit.

According to Moon (1960), chicks are brooded by one of the parents for the first few days but left unattended for progressively longer periods as they develop. When the chicks are small the parents, after returning from the feeding ground, perch for up to half an hour near the nest, presumably to pre-digest the food. Once on the nest, the parent stands upright for about two minutes, with neck stretched upwards; the neck gradually thickens and swallowing movements develop; the parent then lowers its head, its bill is seized crosswise by the chick; the parent regurgitates the food, which appears to be guided into the chick's throat by the parent's tongue. In the early stages one or both parents remain near the nest, but when the chicks are about three weeks old the parents leave the vicinity after feeding is over, and Moon was able to approach the chicks which promptly disgorged their meal; he found that the usual meal per chick at that age was up to 18 fish, mostly flounder about 30 mm long; as soon as he returned to the hide the chicks retrieved their meal. As the chicks developed, the pre-feeding waiting period was reduced and eventually they were fed with whole undigested fish. WSS recorded a well grown chick as disgorging a mullet 100 mm long.

The chicks are fully fledged and ready to fly 5-6 weeks after hatching. From about the third week they are able to leave the nest and wander among the rocks around it. W. T. Parham found that 3-4 week old chicks, when disturbed, hid in rock crevices; older chicks did not trouble to hide but made threatening motions with their bills when approached. C. N. Challies watched chicks which were hatched in a nest 9 m a.s.l. on a large rock; at three weeks one chick left the nest when approached, the second stayed on the nest. At four weeks both had left the nest and were in a rock crevice 2½ m above the waterline, where they were found again on the next visit a week later. The following day the second chick was still in the crevice, the first had climbed to a rock shelf 7 m higher up; it was the stronger chick, and flew at six weeks, a day or two before the second.

Young birds just starting to fly are closely attended by the parents, but soon become capable of fending for themselves, feeding actively, jumping, playing, chasing and croaking. The family party stays together for a few weeks. A. R. Harris noted that two young birds which flew on November 7, though quite independent, were still closely associating with the parents on February 7.

SUMMARISED LOCALITY REPORTS

List of contributors to 1975-76 enquiry

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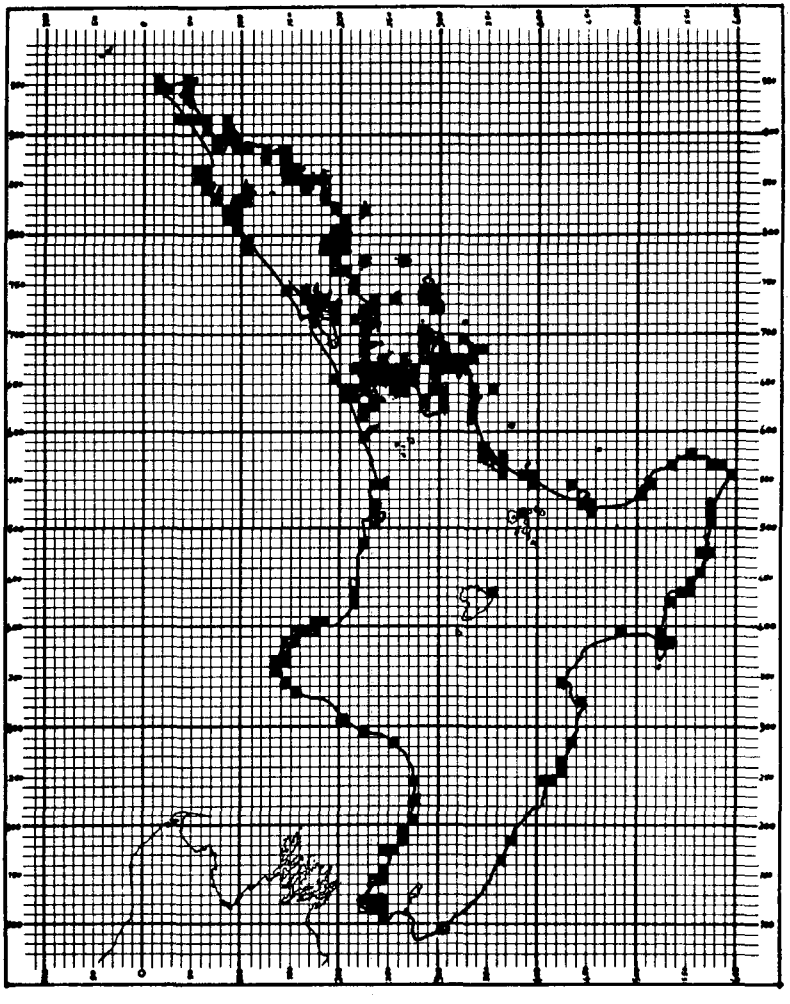
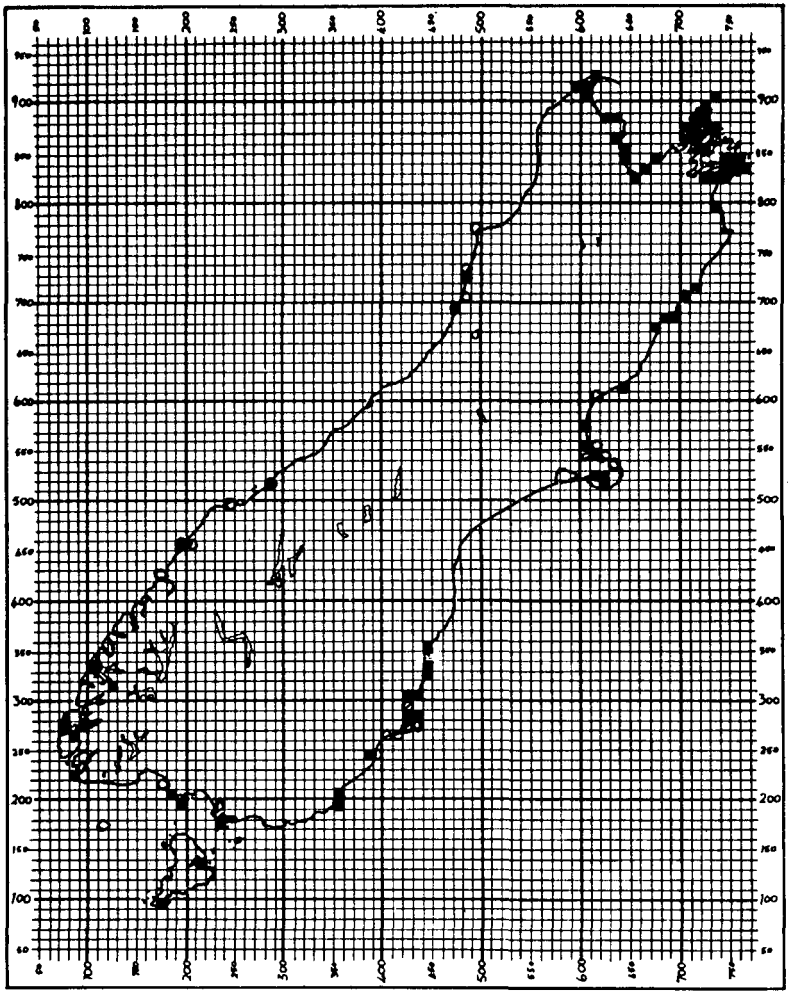


FIGURE 1 — Records of Reef Heron in New Zealand



K. Brash, B. Brown, J. A. Brown, P. C. Bull, B. J. Burch, D. E. Calvert, E. C. M. Calvert, T. R. Calvert, W. Campbell, W. F. Cash, C. N. Challies, S. Chamberlin, S. Chambers, P. Child, R. Child, G. Clifford, J. F. Cockrem, D. Cook, B. S. Cooksey, S. Cotter, R. S. Cowan, J. A. Cowie, D. E. Crockett, M. P. Daniel, A. F. Davis, C. W. Devonshire, A. T. Edgar, G. Eller, M. L. Falconer, Sir Robert A. Falla, Sir Charles A. Fleming, K. Fletcher, R. Floyd, P. Fooks, G. Foreman, R. Froggatt, J. Gaunt, A. J. Goodwin, A. Gordon, A. H. Gordon, E. Graham, K. Green, R. Guest, A. Habraken, H. Hagen, J. Hamel, J. M. Hamilton, E. H. Harlow, K. Harlow, P. C. Harper, M. N. Hawthorn, B. D. Heather, J. C. Henley, V. H. Hensley, F. Hollay, L. Howell, P. A. G. Howell, M. Hows, J. R. Jackson, R. W. Jackson, T. Jackson, J. Jenkins, P. Jenkins, I. W. Johnson, A. B. Jones, E. B. Jones, M. P. Kearns, J. L. Kendrick, J. C. S. Kennedy, F. C. Kinsky, R. E. Lambert, R. Larritt, S. Lauder, D. A. Lawrie, J. A. Lees, T. G. Lovegrove, R. Lowes, C. M. Lusk, N. B. Mackenzie, E. Madgwick, J. McCallum, G. K. McKenzie, H. R. McKenzie, R. V. McLintock, Mrs Marfurt, R. G. Marquand, W. Mawson, D. G. Medway, D. V. Merton, B. Miller, P. J. Miller, J. A. Mills, J. L. Moore, M. Moore, P. A. Moore, H. M. Morgan, A. M. Munro, G. Nicholson, I. A. Nicholson, R. J. Nilsson, C. F. J. O'Donnell, M. F. O'Shea, K. L. Owen, A. Palliser, R. J. Pierce, A. T. Poulton, N. Prickett, S. Quin, S. M. Reed, K. Reynolds, M. Ross, W. S. Sanderson, C. Schiska, H. L. Secker, J. H. Seddon, D. Shand, R. B. Sibson, J. F. Skinner, M. H. Smith, P. G. Smith, S. C. Sparrow, R. R. Sutton, M. J. Taylor, L. Templer, R. Thomas, J. S. Thomson, S. Thomson, K. V. Todd, G. A. Tunnicliffe, E. G. Turbott, M. K. Twyman, D. A. Urquhart, C. R. Veitch, D. M. Walter, R. M. Weston, R. W. Wheeler, D. M. Whyte, L. W. Whiteley, H. Willis, J. F. Wisnesky, A. Wright.
E & O E.

Mangonui County

One at Te Werahi, January 1977 (ATP). 1976, a single bird and a pair at Tapotupotu (HMM, FH, WM) and two birds at Spirits Bay (GE). One at Kerr Point 1971 (JCSK).

From 90 Mile Beach the only records are from the Bluff, where single birds were seen on various occasions 1962-70 and once a bird at Bluff Rocks and a second bird on the tideline about 6 km to the south (ATE). At the south end of the beach there are 1969 records from Ahipara, round the rocky coast of Tauroa and Reef Point and southwards to Hukatere stream (EM). Herekino harbour entrance, sightings in 1973 and 1976 (ATE, PGS).

On the east coast nests were found in rock clefts at Ohau (Coal) Point in 1968 and a bird was seen on a beach a few km further north (ATE). A. H. Watt (2/116) reported a gathering of 30 birds at Parengarenga harbour in winter 1946; as far as we know White-faced Herons had not arrived in the Far North in 1946 so there seems no reason to doubt the validity of this record. Subsequent counts from

Parengarenga refer to the Paua-Te Pua Point peninsula within the harbour, frequently visited because it is a well known wader roost; up to 11 Reef Herons were recorded in 1947-1969 by various observers and 10 were present in 1971 (ATE), but no more than 5 birds have been recorded on any one day 1972-1976.

In Parengarenga harbour maximum counts of White-faced Herons rose from 18 and 25 in 1968 and 1969 to 65 in March 1970, 70 in January-March 1972 and 80 in April 1975 and February 1976; numbers present fluctuate widely during the January-July period each year and a high count on one visit may be followed by much lower counts on subsequent visits; few birds (usually less than a dozen) have been recorded in the August-December period each year from 1968 to 1975.

Reef Herons sometimes use Kokota sandspit (South head, Parengarenga harbour entrance) as a high-tide loafing area. No records from the sandy sweep of Great Exhibition Bay, but a 1972 sighting further south at Rarawa beach (CS). L. J. Wagener (13/153) found evidence of two breeding pairs on Simmonds Islands and two nests in the cliffs near Farmer's Point, in 1965; in the same year a pair nested on a basalt stack at Houhora Heads. Inside Houhora harbour Reef Herons have been seen regularly 1962-1976 near Houhora Tavern and Pukenui whart (ATE); the population in the harbour and on the adjacent outer coast appears to be stable.

At Rangaunu Bay in August 1953 J. Prickett (5/218) reported 26 Reef Herons flying out of the harbour as the tide became full. Along the shore at Kaimaumau eleven were feeding in 1961, 6 in 1969 and lesser numbers 1971-1975 (ATE). There are unconfirmed reports of up to 11 birds seen in Rangaunu Bay and near Rangiputa in 1976 (VHH). Two birds have been noted on several occasions 1975-76 in Awanui channel, just north of Unahi (MH). White-faced Herons are plentiful in Rangaunu Harbour, seasonal maximum perhaps 200 birds.

Karikari Bay, sightings of 1-3 birds 1967-76 (ATE, GE). G. P. Adams (18/47) reported a 1968 sighting on Moturoa island, west of Cape Karikari.

Doubtless Bay, 1971 sightings at Whatuwhiwhi (rocky coastline at the north end of Tokerau Beach) and of four birds on Tokerau beach (ATE); 1976 and 1977, two birds at the mouth of Awapoko river, near Aurere (PGS, ATE). Frequent sightings of one to three birds at Taipa 1953-77 (various observers); breeding reported at Cable Bay 1953 (B. Ashby) and 1975 (ST). Regular in Mangonui harbour, 5 birds seen in 1961 (ATE), 4 in 1976 and 1977 (TRC, RWJ). Probably three breeding pairs along the coastline from north of Mangonui to Cooper's Beach (MNH).

Whangaroa County

Taupo Bay, a pair frequently reported by various observers, 1966-76.

KR investigated Whangaroa harbour by launch in January 1975 and January 1976 and recorded at least 15 birds in the northern third of the harbour (Pekapeka Bay to the Heads, Waihe-Peach Island-Kingfish Point-Owanga) where the shore line is generally rocky with some sandy beaches, and mangrove in the estuary of Wairakau stream. In the southern two-thirds of the harbour birds have been observed feeding on the flats near the mouth of Kaeo river (AHG), from the coast road and near the township (ATE *et al.*). White-faced Herons are present in the harbour but in small numbers, perhaps 20-30 birds.

Stephenson (Mahinepua) Island — D. E. Crockett found two pairs in 1974 and in 1975.

Cavalli Islands — R. B. Sibson (5/112) recorded a nest on Motukawanui and a bird on Motukawaiti (Step Island). In 1975 D. E. Crockett found a pair on each of these islands and AHG reported one bird flying from Kahangaroa islet, west of Step Island, to the south end of Matauri Bay on the mainland, where birds have been seen on various occasions 1966-75.

Takou Bay — sightings of one or two birds on various occasions 1962-69 (ATE).

Bay of Islands

Birds still breed at Black Rocks, on islets north of Moturoa (D. E. Calvert) and off Paihia (GC), probably on Urupukapuka, Waewaetorea (KR) and elsewhere in the bay. Sightings reported from most of the islands, along the southern shore at Rawhiti, from Parekura Bay round to Manawaora Bay and Tapeka Point; up Russell Inlet near Russell, Waitangi, Te Haumi and Opua; at Marriott Island in Waikare Inlet (KR). Recorded on the north coast at Rangihoua Bay and Te Pahi Islands, at Akeake Point at the entrance to Mangonui Inlet (KR), up Mangonui Inlet at Tangitu (BB); at Motupapa (Cocked Hat island) at the entrance to Kerikeri Inlet and at a number of points in Kerikeri Inlet as far up as the mouths of Kerikeri and Waipapa rivers. There are records from about 30 localities in the Bay and its inlets; total numbers are difficult to assess because of movement of individual birds from island to island, island to mainland, up and down the inlets. On two occasions in 1975 congregations of Reef Herons were observed, once 8 birds at Day Point, west of Moturoa (D. E. Calvert) and once 10 birds at Black Rocks, east of Moturoa (KR). These gatherings probably represented the population of the area around Moturoa and if we add, say, 3 pairs which are apparently resident in the three inlets and, say, 4 pairs from the main islands and southern coast to the 10 birds seen at Black Rocks, a conservative estimate of total population would be 24 birds.

White-faced Herons are seasonally abundant in the inlets, up to about 50 in each of Kerikeri and Mangonui inlets and up to 40 at Parekura Bay (WC); most of them breed on the adjacent mainland but one or two pairs breed on Moturoa (D. E. Calvert).

Hokianga County

Sightings at Whangape harbour, 1966 (RSC) and 1976 (PGS).

Hokianga harbour — a fair population in the lower reaches; in January 1976 at Omapere eight birds were seen, flying singly across the harbour to North Head, also two at South Head and two at Pakanae (EHH). There are 1976 records of two birds between Omapere and Opononi and a single bird at Koutu Point (PGS), where four were sighted in October 1975 (KB). On the western side KG recorded six birds in April 1976 between North Head and Rangi Point. Further up the harbour there are records from Motuti, Rawene in 1972 and 1973, and Kohukohu — two adults opposite the township and a very young bird on Mill Wharf, 1967 (ATE); one bird up Mangamuka river near Umawera in 1967 (JAL). A moderate population of White-faced Herons exists along the length of the harbour.

South of Hokianga Heads, two birds in 1971 north of Waimamaku rivermouth (R. Froggatt) and in 1968 two south of the river (ATE) where PGS saw a single bird in 1976. One at Kawerau in 1973 (D. E. Crockett).

Hobson County

The outer coastline consists of a long sandy beach from Waipoua to Kaipara North Head. The only Reef Heron records are from Maunganui Bluff and Aranga beach just to the south, and a bird at Pinaki (half way between Bayly's beach and Kaipara North Head) which may have flown across Poutu peninsula from the sheltered waters on its eastern side (W.C., D. E. Crockett, 1974). From this inner shoreline Reef Herons were reported from Poutu in 1963 (MR), Kelly's Bay in 1975 (MPK) and Tangitiki Bay in 1977 (BSC).

Whangarei County

In contrast to the scanty records from the long sandy stretches of Northland west coast there are numerous locality records from the more varied eastern coastline south of Cape Brett; Whangamumu, 1969 and subsequently (D. E. Calvert); Bland Bay, April 1976 (PJM, KH); Whangaruru harbour, one to three birds seen at intervals 1954-1976 (various observers); Oakura, 1976 (DMW); Mokau, 1973 (WC); Helena Bay, 1972 (HH); Tauranga Kawau, 1975 (WC); Whananaki, 1974-76 (WC, PJM, KH); Matapouri Bay, 1971, and between Matapouri and Tutakaka, 1976 (PGS). Ngunguru esuary and river, one or two birds 1969-76 (various observers); Ngunguru Bay between Horahora and Pataua, 1972 (PGS); Pataua, 1968 (BB),

1971 (PJM, AMM) and in 1975 numerous sightings throughout the year of one or two birds, feeding in pools, on the estuary and upstream from the footbridge; of three birds seen in January 1976 one was probably immature (DS). Ocean Beach, north of Bream Head, 1975 (AG) and 1977 (PJM); Peach Cove and Smuggler's Bay, west of Bream Head, 1975 (PJM).

In Whangarei harbour the traditional nesting place is Aubrey's (Passage) island off Reotahi. WSS reported 16 nests in 1943-44; 5 nests in October 1975 (KR) and in the same year birds were seen along the coastline at Urquhart's Bay, Taurikura and Munro Bay (KG). Parua Bay was a breeding place in 1948 and in March 1949 MH counted 10 birds on the beach and in pools; only two birds noted in 1975 (KG), one in April 1977 (PJM). Further west birds were observed in 1975-76 at Rangitahi and CWD reports birds which regularly feed on the Tamaterau and Waikaraka flats and fly up and down the harbour with the tides. Hatea river is a regular haunt; birds have been seen feeding or flying along the shore on the western side of Onerahi peninsula (MPK, EHH), at Awaroa river mouth, Port Whangarei and on the river bank near a boat yard on Port Road (EHH, TGL); regularly on the mud beach and among mangroves at Carrot Island (KR), sometimes at the city rubbish dump (JCSK), in a shallow tidal creek in the city commercial area (MPK) and once flying over Bank Street in the city (MKT). Single birds occur at Portland; a few formerly frequented the mudflats at Hewlett's but apparently not since about 1960 (AMM); Marsden Bay, 1977: one at Marsden Point 1968 (BB).

AJG reported seven Reef Herons at Ruakaka in 1955 (6/198) but only one or two birds have been recorded of recent years. Regular at Waipu around the river mouth, Spit and Johnson's Point 1961-1976 (many observers) but only 1-3 birds.

White-faced Herons are quite numerous along the coast of Whangarei county, flocks of 25 or more often seen on coastal paddocks, in season. Around the harbour they occur mostly around the mangrove areas and on the southern side, where up to 80 have been counted in the first half of the year.

North Auckland

The 1965 Kaipara harbour survey located 14 birds on the eastern side of the harbour and in its inlets; eight in Northern Wairoa estuary from Ruawai to Tinopai, two in Otamatea estuary, four in Tauhoa river (HRMcK, 12/75). Recent records from Tinopai, two birds in 1974 (D. E. Crockett); Batley, 1973 (PGS); Tapora (Okahukura peninsula) 1975 and 1976 (AH, LH); one up Oruawhero river at Port Albert, 1976 (AJG).

Muriwai beach, no record. Up to three birds at Bethells (Te Henga) 1951-61 and at Whatipu 1950-67 (ATE).

On the east coast single birds reported at Mangawhai, 1976 (DW), Te Arai (Mapping Scheme) and Pakiri, 1954 (AJG). Buddle (RB15) notes three pairs at Goat Island, Leigh in 1937; birds still breeding there 1976 (RT). Sightings at Ti Point, 1960 (ATE) and in Whangateau harbour near Omaha 1960 (ATE) and 1976 (LH). A Mapping Scheme record from Kawau Bay. On Kawau Island C. F. Parsonson (8/68) reported 8-10 birds in 1958; recent records of two in 1971 (BB) and one in 1976 (PAM).

A 1976 sighting at the entrance to Mahurangi harbour (CS); a long way up the river, at Warkworth, one near the boat ramp in 1947 (D. G. Dawson, 21/391) and in 1976 one downstream from the main road bridge, Elizabeth Street (MJT) and one behind the County office, Baxter Street (LH).

Wenderholm, one in 1976 (RC) and 1977 (MJT). Waiwera, reports of one to three birds 1961-1975 (various observers). Hatfield's Beach, recorded 1950, recent sightings 1974 and 1975 (BB, KR). Orewa, reported regular in 1943; seven seen in the creek in 1950 (N. Macdonald, 4/42), regular sightings 1975-1977 (DFB). Whangaparaoa peninsula, probably breeding at Frenchman's Gap. Matakatia Bay, 1975 (S. Chamberlin) and 1976 (LH).

Waitemata harbour, Tamaki river and strait, Firth of Thames

A 1975 sighting in the river at Albany (AJG). Recorded near the Western motorway, 1961 (ATE); a Mapping Scheme record from Te Atatu. Auckland waterfront, 1976-77 sightings at Westhaven, at Herne Bay (CS), Freeman's Bay (FH, WM), Hobson Bay, Mission Bay and along the rocky shore Kohimarama-St Heliers (MJT). Regular 1975-76 at Tahuna Torea reserve, Glen Innes; Purewa Creek, 1967-73; Farm Cove, Pakuranga, 1970 (SMR). RAF recorded a nest at Buckland's Beach in 1932.

Six birds recorded at Shelly Park, Howick, 1951; six at Turanga Creek, Whitford, 1952 (N. Macdonald, 4/180, 5/218); one to three birds recorded at a number of half-yearly counts in the area Howick-Whitford during 1965-74; frequent sightings at Whitford in 1976 (SMR). Omana Beach-Maraetai, singles 1964-67, 1973-74 (BB *et al.*) and two birds in 1976 (RC).

HRMcK wrote — " when we had 15-20 herons on Pakihi Island in 1940-43 there were always some of the mud and sand flats from Maraetai to Kawakawa Bay; very few now." A 1974 record from Duder's Beach (BB), a Mapping Scheme record from Wairoa river and a 1975 record from Mataitai (AJG). Kawakawa Bay, 1960-67, one to three; 1967-73, one or two; 1974-76, singles, one seen in 1975 apparently a bird of the year (BB, AJG, HRMcK).

A scarce bird on the western shore of Firth of Thames, but singles recorded 1961-71 at Whakitiwai, two at Wharekawa, north of

Whakitiwai, 1976 (SC) and singles 1960-1976 at Kaiaua (various observers). Miranda coast, records of one or two birds 1971-74 (BB, WFC) and three in March 1977 (R. Lowes) Thames estuary (Orongo-Parawai-Thames) three in 1965, singles 1970-75. Thames-Thornton Bay, 3 in 1967, one in 1975, and one at Whakatete Bay 1976 (AJG). Single birds at Te Puru, 1967 (BB) and 1970 (DAL), at Waiomu 1964 (ECMC), at Tapu 1976 (RC, AJG, R. Floyd) and at Te Mata 1967 (BB).

White-faced Heron counts in Firth of Thames 1965-69, average 61, maximum 141; 1970-76, average 116, maximum 208 in 1972.

Islands — North Auckland and Hauraki Gulf

Three Kings — no record.

Poor Knights — 1953, one on Aorangi (BDB). 1973, rarely seen on Tawhiti Rahi and Aorangi, two on Archway Island (CRV). 1975, up to six reported (PCH).

Hen and Chickens — 1948, one at Old Woman's Cove, Hen Island (RBS). 1962, a pair probably breeding on Hen, one bird at Big Chicken (Skegg, 11/71). 1971, one on Lady Alice Island, one on Manitaha Island (CRV).

Mokohinau — about 1889 Sandager (1890: 288) wrote — " one or two visit Mokohinau annually for several months at a time. There is one here now (August) which I have seen nearly every day since February." November 1973, one on Burgess Island, one on an islet north of Maori Bay Island (CRV).

Little Barrier — apparently a casual visitor. 1962, one offshore (ATE); one reported 1975 (JFW).

Great Barrier — recorded in 1868 at Port Fitzroy by Hutton (Oliver 1955). Further records from Port Fitzroy area 1960 (BDB), two in 1965 (AJG), two or three in 1972 (SMR). Whangaparapara, 1960 (BDB), 1965 (AJG), 1976 (GKMcK). Tryphena, two in 1960 (BDB). Mapping Scheme records from Tryphena and Whangapoua areas.

Cuvier — no record.

Rangitoto — in 1916-1936 they nested regularly on the stone stairway inside the tower of Rangitoto beacon, getting in and out through narrow ventilation slots (RAF). 1975, one at wharf, one at Islington Bay, where MJT reported a 1977 sighting.

Motutapu — two in April 1950 (N. Macdonald, 4/42).

Rakino — 1974-1976 sightings, one or two birds (SMR).

Motukorea = Brown's Island — 1976, two flying close inshore (MJT).

Motuihe — two pairs in 1941 (PCB, RB 47); one seen 1976 (JG).

Waiheke — records from the main island at Oneroa beach, 1962 (DFB), Thumb Point, 1963 and Te Matuku Bay, 1964 (AJG), Man o' War Bay, 1975 (HRMcK), Arran Bay (IAN) and Connell Bay (BB) in 1976.

Nests or evidence of nesting on at least five rocky islets off Waiheke in 1975 (RBS). Bred on Motukaha 1949 (RBS); on Crusoe Island 1964 and 1965 (DVM). Koi Rock in Rocky Bay is a traditional nesting site, 6 nests in 1947 (HRMcK), 3 in 1948 and 2 in 1949 (RBS), 4 in 1960, 3 in 1963, 2 in 1965 (DVM); birds still present in 1974 (BB). Three Sisters Rocks, 7 nests in 1947 (M. L. Johnson, 3/92), flying young in 1955 (M. J. Breen, 7/77), 4 birds seen in 1975 (AJG). Tarakihi, present 1961-62, breeding 1964 (DVM). Frenchman's Gap, nine birds, including two lots of flying young, in 1966 (HRMcK), sightings in 1975-76 (IAN).

Ponui — three nesting sites known in 1943 (T. M. Roberts, 1/24); sightings in 1967, two at Scully's reef in 1975 (BB, HRMcK), one at Ponui point in 1976 (JG).

Pakihi Island, off Kawakawa Bay, was a noted stronghold in 1940-43; up to 20 birds recorded in the area, once eleven on a barge, once eighteen on a single pohutukawa tree (HRMcK). Numbers have decreased. In 1976 JMcC reported frequent sightings of a pair and a single bird.

Manukau Harbour

On the northern shore, 4 birds at Huia 1960-61 (ATE), up to 3 birds 1974-76 (JFS). Cornwallis, 1951, seven on the wharf (N. Macdonald 4/180); 1971, one on the beach and 1973, one at Malcolm's Bay (JFS). Mill Bay, regular 1960-1963, up to 10 birds (ATE, RBS), present 1976 (FH, WM). Parau, single birds 1961-63 (ATE) and 1977 (CS).

Around Onehunga and below Mangere bridge frequent records by various observers, 1-3 birds in 1946-58, 1-2 birds 1967-75. At Puketutu and outside the sea wall at Mangere ponds 3-4 birds recorded 1955-66, singles in 1972 (BB, SMR). Records from Ihumatao 1958-59 and 1976 (CS), Puhinui Creek-Weymouth 1968, Papakura Inlet 1969 (BB).

On the southern shore recent records from Urquhart's 1973, Kidd's 1974, Kirk's 1971, Yates Dam 1970, Pollok Spit and Bottletop Bay 1975, Clarks Beach 1974.

Waiuku river, regular records of 1-2 birds 1964-1976 (IWJ, DAL). Te Toro 1968 and 1972 (BB, DAL). RBS found 2-3 birds on Awhitu beach in 1942 but none in 1976. Records from Graham's beach 1968 and 1972, Big Bay 1965-1967, Orua Bay 1968 (BB, DAL).

In 1974 HRMcK and DAU estimated the population of Wattle Bay and Big Bay at 6-7 birds. Recorded at Manukau South Head 1972 (MPD).

Half-yearly bird counts in Manukau Harbour show that in the period 1965-1968 the average winter count of White-faced Herons was 111 and the average summer count 268 birds. 1969 December count was surprisingly high at 689 but thereafter numbers apparently stabilised and for 1970-1975 winter counts averaged 352 and summer counts 348. Perhaps the unusually close agreement between winter and summer counts in this area may be due to presence of abundant nesting sites close to the harbour shores.

Coromandel Peninsula and offshore islands

In an October-November 1971 survey of islands off Coromandel Harbour CRV reported single birds at Matakariki group (south of Manaia Harbour) and at Rangipukea Island (off Te Kouma Harbour); a pair with one juvenile on Cow Island (automatic light), a pair and an old nest at Motukakarikitahi and a single bird at Motuokino. In January 1976 JG reported one bird at Te Kouma Point; at Coromandel swell entry, two pairs nesting on Rat Island and one bird on the rocks on the Whanganui side of the gap; one in a deep bay north of Whanganui Island and one which flew from Waimate Island and landed on the spit at Motukopake. One at Coromandel wharf, January 1975 (BDH). Long Bay, just north of Coromandel town, single birds in 1962 (JMH) and January 1976 (CS). May 1976, about one in each bay round Coromandel harbour, solitary at this season (RAF). Okahu Point, between Coromandel and Papaaroha, 1976, one (BB).

Motukawao Island Group — two nests on Moturua, 1963 (C. A. McCall). November 1971, a nest on the northernmost of three Ngamotukaraka stacks, sightings on the southermost stack and on Motukaramarama (CRV). January 1976, two birds on Happy Jack = Motukahaua (IAN).

North of Colville, at Waiaro, one in 1964 (BDB), one in 1974 (BB); 1961, three at Te Hope (JLK); Port Jackson, one in 1962 (JMH) and in 1964 (BDB).

On the east coast, singles at Kennedy's Bay 1962 (JMH) and at Wairiri beach 1964 (BDB). Whangapoua harbour, records of one or two birds 1962-1976 (various observers). Kuaotunu, one in 1967 (HRMcK), one in 1975 (PAM).

Mercury Bay, Devil's Point, April 1977 (JHS); regular at Buffalo Beach 1975-76, usually one bird, two in October 1975; Whitianga estuary 1975-76 (ABJ) and 1977 (JHS). Cook's Bay 1975 and 1977 (RWJ, SCS); singles in 1975 at Wharekaho beach and Tarapatiki stream (RWJ).

Tairua estuary, August 1975, two pairs (PF). Pauanui, one in 1964 (BDB). Storm Beach, January 1976, two (IAN). Wharekawa harbour, regularly reported at Opoutere 1964-1977; three in January 1974, a pair with two juveniles in January 1975, four near harbour mouth in November 1975 (BB); four regular in estuary, January 1976 (GN), 6 in February 1977 (JHS).

White-faced Herons — Whangapoua, January 1976, 28; Whitianga 1975, 20 on estuary, 30 on adjacent paddocks; Tairua, 200 in December 1975 (ABJ); Wharekawa harbour, reported population has increased since about 1972 and in 1975-76 was about 100 birds (BB, GN).

Whangamata, three in 1954 (R. Shanks, 6/91); 1963, found in both estuaries (J. Lambert); estuary rocks, 1976 (R. Floyd). Islands off Whangamata — August 1971, 4 on Hauturu (JAB); November 1972, one on Hauturu, a pair nesting on Whenuakura; two seen, also two old nests, on a stack between Hauturu and Whenuakura islands (CRV).

Mercury Islands — P. D. G. Skegg recorded in 1962 one or two pairs along the south coast of Great Mercury, plus a sighting at Coralie Bay (10/163) and in December 1965 one bird seen around Red Mercury on two successive days (19/365). Recorded around Korapuki Island, 1974 (G. R. F. Hicks *et al.*, 22/209).

Alderman Islands — November 1972, reported on Ruamahuanui island and Middle Chain (DVM): none seen January 1977 (JHS).

Bay of Plenty

Tauranga Harbour is sheltered by Matakana Island, which stretches from opposite Bowentown in the north to opposite Tauranga and Mount Maunganui in the south. Bowentown, 1974, one (JFC); Bowentown heads, seaward side, 1976, 3 birds (GA). One at Athenree 1968 (RWJ); one some distance up river in Athenree gorge, 1975 (IAN). Tanner's Point, 3 in 1973, 2 in 1975 (JFC). Katikati, one in 1962 (D. Jenner).

In the inner harbour, M. Hodgkins (2/41, 3/12) recorded pairs and parties of up to 8 birds in January-March period, 1945-49, feeding in the harbour and apparently flying to roost on Karewa Island; also birds fishing from rocks at Mt Maunganui and nesting on Rabbit Island (Motuotaua). Karewa lies about 6 km offshore from Matakana and is a wildlife sanctuary. In December 1952 B. Sladden counted 28 on the rocks and in August 1954, 17 (5/218, 6/198); 18 in November 1963 (DVM); on a short visit in November 1972 JCSK found 3 nests, six adults and at least one well-grown chick. Motuotaua is less than one km from Mt Maunganui beach and is a scenic reserve, KF described it as rocky, with many caves and a dense tree and scrub cover, a roosting place for great flocks of starlings and for large numbers of feral pigeons which feed around a flour mill in the dock area. B.

Sladden in 1952 recorded 22 nests, 18 adults and 12 feathered young; in October 1954 he found 3 nests with eggs, others building (5/218, 6/198). Several nests were found in 1972. The breeding population of both islands has decreased over the years but is still probably considerably higher than 1976 sightings of 5 birds at Karewa (GA) and 3 at Motuotaua (JHS) might indicate.

Inside the Tauranga end of the harbour RVMcL in 1962 recorded upwards of a dozen birds along the foreshore, in Welcome Bay, at Matapihi and at Rat Island (Motuopahi). In 1976 AP recorded 6 birds at Sulphur Point, and KF has noted birds at the above localities plus Maungatapu, Coronation Pier, Otumoetai rail bridge and flats; estimated the winter population of the eastern end of the harbour and town waterfront at 5 pairs, commented on the extreme scarcity of young birds, and suggested that herons may be deterred from nesting in otherwise suitable breakwater areas by the presence of large numbers of rats.

Kaituna cut, possibly breeding 1976 (KF). Maketu, several records of single birds or a pair 1974-1977 (DJB, AB, RWJ). Little Waihi, records of one or a pair, 1970-75, (RWJ, AP).

Whakatane, a nest at the heads in 1954 (C. D. Blomfield, 6/198); 1976 sightings at the harbour entrance and in the town area (AFD, KF), and one in April 77 (PJM). Ohope 1976 (RMW). Ohiwa harbour, 15 reported in 1949 (PCB); 11 in one inlet 1958 (W. T. Parham, 8/201); 7 at Kutarere in 1962 (H. D. London); regular in 1975, probably 3 pairs, up to 8 birds seen (AP), breeds on Ohakana island (RMW).

Mapping Scheme records from the vicinity of Motu river mouth, Te Kaha and Whangaparaoa Bay, south of Cape Runaway.

Buller (1888) recorded breeding on Rurima rocks and quoted Captain Mair's account of some 30 birds and a number of nests on Whale Island (Motuhora). JCSK saw two birds at Rurima rocks in November 1972. I have had no reports from Mayor Island, Motiti, Motunao, Motuhora or White Island.

Cape Runaway - Poverty Bay

Lottin Point, one in April 1976 (GF). Mapping Scheme records from Hicks Bay (where also recorded by HRMcK), from Horoera map square and from East Cape (where also recorded by AW in 1964); from Whareponga map square and from Waipiro Bay (where AB reported three pairs nesting and odd pairs along the coastline in 1963). Tokomaru Bay, two in April 1976 (GF). Tolaga Bay, four birds at Uawa estuary, April 1976 (GF); Pourewa Island, a 1955 nest reported by AB, and a Mapping Scheme record from the same map square. Pakarae river mouth, two in 1954 (AB). Whangara, December 1975 (JCH). Tatapouri, 1953 (J. D. Cochrane) and 1960

(J. W. Bain). Gisborne, in Waikanae Creek, 1953 (J. D. Cochrane); in the harbour, 1959 (J. W. Bain); in Taruheru stream and Waimata river 1971-75 (AB). Muriwai lagoon, one or a pair recorded at intervals 1955-1963 (AB).

Hawke's Bay - Wairarapa

Recorded from Mahia 1947-1955 (W. J. Phillips, D. H. Brathwaite). Opoutama beach, one in April 1976 (GF). Mapping Scheme records from the northern half of Mahia peninsula and from Pukenui beach map square just north of Mahia; also a record from Wairoa.

Reef Herons were noted at Napier (Westshore) in 1950 and 1954 (D. H. Brathwaite) and one in March 1977 (KVT). One recorded at Black Reef, Cape Kidnappers, in October 1976 (KVT). Kairakau beach, two birds noted in August 1974; on a day of strong wind and a wild sea, they were near a pool of surface water on a paddock behind the beach (KVT); in May and December 1975, single birds in the same area, near the mouth of Mangakuri stream (SQ). In May 1971 CAF recorded single birds at Pourerere and at Black Head. Porangahau, October 1975, four birds flew up the beach; previous sightings of single birds (LWW).

Wairarapa Mapping Scheme records from the area of Mataikona river mouth and from Castle Point. Castle Point is a breeding place of long standing, at least from 1934 to 1959; 5 nests in 1945 (J. M. Cunningham, 2/41), eight nests in 1959 (CNC, 8/201); sightings of one or two birds in 1974 and 1976 (SQ).

On 27 November 1975 CNC visited the site of the former nesting colony at Castle Rock. The seaward side of the rock was searched from its northern end for about three-quarters of its length; this included the area where Reef Herons nested in the past. No nests were found. One adult bird was seen flying past the rock on the seaward side; none were seen on the rocks above high tide mark as on previous visits. Several roosting areas were however seen, mainly under overhanging rocks well above high tide mark.

There is a December 1945 record of two birds at Te Awaiti (R. A. Daniell, 2/41).

Waikato

Waikato Heads and Port Waikato have been a good area for Reef Herons for many years and a total of seven birds was recorded in May 1975 (BB, BJB). In 1955 C. Peart (6/198) put the population of Raglan harbour at about 12 birds; 1969-77 records of pairs and single birds at a number of different localities within the harbour and at its entrance, and evidence of recent breeding activity at the known nesting area on the north side of the harbour in February 1977 (JHS).

For Aotea harbour HRMcK mentioned limestone stacks across from the end of Pakoka road as a favoured locality and there is a 1951 record (6/91) of 23 birds flying from the islets. No recent records from this harbour but a sighting at Toreparu beach in September 1971 (RGM) is in the same map square.

Kawhia harbour, regular; 9 birds reported in 1955 (6/198), sightings in 1963-73 (LT); 1976 and 1977 sightings along the shoreline at Kawhia township and on Totara Bank at the south-westerly end of the harbour (JHS).

There is a Mapping Scheme record from Marakopa; HRMcK mentioned Reef Herons at Awakino but I have no recent records.

Taranaki

Two birds at Mokau river in 1961 (JLK) but no recent reports. A 1968 record from Mohokatino river mouth (BDB); Tongaporutu area, a 1961 sighting (HRMcK) and a Mapping Scheme record.

A fair Reef Heron population is carried along 50 km of coastline from west of Waitara to Cape Egmont. Taranaki members (DJB, REL, Mrs Marfurt, DGM, NP, RWW) have reported recent sightings from about 15 localities. One or two birds have been seen at Epiha road, west of Waitara; at the mouths of Waitara, Waiongona and Waiwakaiho rivers, Bell Block beach, Kawaroa foreshore; breeding reported at Moturoa (Sugar Loaf Islands); sightings on the coast south of Schnapper Rock, at five localities in the Tataramaika - Okato area between Timaru road and Komene road; three birds Bayly road - Cape Egmont, single birds just south of Cape Egmont; a sighting in Opunake Bay.

M. G. Macdonald and M. Bysouth recorded a 1963 nest near Pihama, south of Opunake; HRMcK reported a 1961 sighting at Patea.

Wellington West Coast, Wellington Harbour

Waitotara estuary, singles reported 1948, 1960 and in 1967 (DGM). Wanganui, apparently uncommon; one at the estuary in 1948 (3/92); one in the river March 1966, the first seen in three years (EBJ); one at South Mole May 1970 (MFO'S); one at Castlecliff in December 1975 (DW).

Single birds at Rangitikei estuary in 1961 (IGA) and 1972 (JLM); at Manawatu estuary north head in 1963 (IGA) and flying over the sea wall in March 1976; occasional at Lake Horowhenua, where one seen in 1975 was the fourth sighting in 12 years of observation (EBJ).

Mapping Scheme records from the coast near Waikawa beach and Otaki. Waikanae, single birds recorded 1941-42 (K. A. Wodzicki, 1/15); formerly not uncommon, but recent records of single birds in April and June 1971 and two birds in February 1975 (CAF).

Kapiti Island, about four pairs nesting in 1941 (K. A. Wodzicki, RB91); the Wilkinsons (1952) noted that several pairs breed on the island each season. June 1976, sightings just north of Rangatira flats (MLF).

Pukerua Bay, breeding 1953-1960 (CNC); two birds in July 1974 (MLF). Mana Island, eggs in 1960 (B. Enting). A Mapping Scheme record from Titahi Bay area. Sightings in Porirua harbour 1955 (BDH) and 1974 (EBJ).

Ohariu Bay 1943 and 1946 (HLS). Makara beach and estuary 1975 (JRJ, MLF). Tongue Point 1947 (HLS). Island Bay, June 1975 (JRJ). Lyall Bay, 1946 (HLS).

The 1975-76 Wellington Harbour Survey organised by MLF and carried out by Wellington members has produced sightings at points all round the harbour. Monthly shoreline counts vary from one to nine birds, the highest count being in September 1975 when singles were seen at Palmer Head, Point Dorset, Ngauranga, Point Howard and Eastbourne and four birds at Day's Bay. Birds have been noted on other counts or by individual observers at Moa Point, at Karaka, Scorching, Evans and Oriental Bays; in the wharf area, at Aotea quay, the floating dock, Kaiwharawhara, Petone area, Lowry and Mahina Bays and towards Pencarrow. The population within harbour limits has been estimated at six pairs. Two pairs are known to have nested on Somes Island, other pairs probably on Leper Island, Ward Island and around Palmer Head; possibly also in the wharf area and near Pencarrow. Young birds banded on Somes Island were sighted at Petone wharf in March 1976 (S. Cotter).

Marlborough, Sounds and coastline

Stephens Island, two birds in March 1961 (R. Mander) and a Mapping Scheme record. D'Urville Island, 1969 sightings at Port Hardy, Greville harbour, and at three points between Ragged Point and the southern tip of the island; breeding (ATE); 1961 records from Ohaua Bay and from Tinui and Puangangi Islands in the Rangitoto group (BDB) and a 1957 record from French Pass (E. W. Dawson). Inner Chetwode, 1961 (BDB) and April 1972 (MHS). Port Ligar, April 1974 (SCS). Forsyth Island, breeding on Bird Island 1958 (DVM). Maud Island, April 1972 (MHS).

Queen Charlotte Sound, 1971, flying from Motuara to Long Island (JRJ). A Mapping Scheme record from Endeavour Inlet. Ruakaka Bay, 1976 (CFJO'D). An old record from Anakiwa (CAF) and a Mapping Scheme record from the same map square. Picton flats and Karaka Point, 1969 (KVT).

Tory Channel, 1949 records from Whekenui (E. W. Dawson) and Perano Head (ATE); Port Underwood, two birds in 1943 (J. R.

Eyles). Mapping Scheme records from Perano Head and Port Underwood map squares.

One at Wairau Bar, Blenheim, 1961 (ATE); 1976, one at Paparoa Point (15 miles north of Kaikoura) and 1975, one at Rakautara (JAC). Kaikoura Peninsula has been a Reef Heron haunt for many years; one or two birds recorded at Point Kean and South Bay on a number of occasions 1963-1976 and previously (JAC, JAM, RG, KLO). Further south they have bred at Riley's Rock (HRMcK); sightings at Goose Bay, 3 in 1969 (JAC), 4 in 1977 (ATP) and at Oaro 1965 and 1975 (HRMcK, EG, RG).

Nelson

Tasman Bay, records from Pepin Island sandspit, 1975 (FHB), Boulder Bank, two in 1974 (CRB); Tahunanui, 1967 (ATE); several 1975-76 records from Motueka and Moutere Inlet (FHB, PAGH, KLO); 1973-77 records from Marahau (CFJO'D, TJ, KLO, CS).

Golden Bay, recent records from Wainui Inlet (FHB), Tata lagoon (JST), Ligar Bay (KVT) and west of Tarakohe (BM); a Mapping Scheme record from Collingwood; Pakawau Inlet, 1976 (EG); Puponga, 1974-77 (SMR, ATE, KLO, ATP).

Whanganui (Westhaven) Inlet, 1966-67 sightings include one of three birds at North Head (IGA).

West Coast, Fiordland

A 1922 record from Cape Foulwind (R. S. Sutherland). Two at Fox River mouth, 1957 (L. Angus, 7/193); one at Punakaiki, 1963 (T. Hartley-Smith); Bullock Creek to 17 Mile Bluff, very small numbers, 1954 (J. G. Penniket, 6/171); one a mile south of Port Elizabeth, 1964 (R. W. Crack).

Haast lagoon, often seen up to 1964 (D. Greanay). Jackson Bay to Big Bay, four, 1947 (P. L. Moore, 3/20); occasional at Jackson Bay 1964 (D. Greanay). Martin's Bay, March 1976, two (ATP). One at Anita Bay, Milford Sound, 1952 (CAF, 5/89). Doubtful Sound 1963 (W. T. Poppelwell); a Mapping Scheme record from far up the Sound in the vicinity of Hall Arm. Dusky Sound, one at Anchor Island harbour, 1974 (CAF); Mapping Scheme records from this area, also from Heron Island and the vicinity of Long Island. A dead bird at Puysegur Point, October 1975 (AW).

Canterbury

Present distribution limited by location of suitable rocky shores — Banks Peninsula and north of Pegasus Bay (RG).

Motunau river mouth, a pair in 1975 (J. R. Eyles) and in 1954 (D. E. Crockett); one on the beach, 1974 (RG). The shore line of

Motunau Island appears suitable, but on twelve visits each of several days, 1969-77, none has been seen (CNC).

D. E. Crockett reported ten birds at Waipara mouth, April 1954, and six at Waimakariri estuary, May 1961, and confirmed that he considers his indentification was correct. These may have been post-breeding congregations. No recent records from either area.

Heathcote-Avon estuary, regular at least from 1946 till 1976; up to seven in 1954 (G. Guy, 6/91); two-three 1959-1964 (PAGH); numerous sightings in McCormack's Bay 1973-1976 (GAT, HW *et al.*). Sumner Head, 1958 and Amuri Bluff, 1965 (JRJ). Godley Head, one in September and October 1976, the only sightings in five years (CNC). Banks Peninsula, 1946-47, seen in small numbers during the year at various points from Heathcote estuary to Lake Forsyth; a nest found near Pigeon Bay (RAF, 2/159); an old Canterbury Museum specimen from Little Akaloa (GAT). Probably present in a number of bays around the peninsula, but no recent sightings (RG). Recorded on Akaroa harbour 1948, 1954 and in 1972 (PC, RG). A Mapping Scheme record from Lake Forsyth area. Not recorded from Lake Ellesmere (GAT).

Otago

Reported at Kakanui 1950, 1963, 1964; two at Aorere Point 1971 (MHS). Goat Island, Moeraki (HRMcK). Katiki beach 1975 (RJN). Shag Point, 1973 (RG). Waikouaiti, two in 1968 (JH). Merton-Karitane, eight reported in May 1949 (L. E. Walker, 3/205), only one-two birds noted 1955-71 (JH *et al.*). Blueskin Bay, 1947-50 records from Warrington and Waitati (G. Guy) and a 1964 sighting (J. Watt). Purakanui Bay, 1946-49 records of one-three birds (I. Tily) and in January 1949 one at Purakanui Bay and five north of Long Beach (I. McArthur, 3/205).

Aramoana, records of one-two birds 1957-67; 1973, one flying 30 m above the flats (RJP). Commonly seen around harbour and inlets 1939-40 (B. J. Marples, RB15); scattered records — Dowling Bay, Deborah Bay, West harbour — 1949-68 (various observers). Nesting at Te Anawaewae Point, Portobello, 1935; sightings of two-four birds, including a juvenile, 1953-55 (A. R. Harris, 6/91, 198). One flying over the sea near Wheeler's Rock, 1975 and 1976 (AW); two pairs near Taiaroa Heads 1971 (JH). Pipikaretu, 1968; one at Ryan's beach 1975 (RG). Papanui Inlet, 1946 and 1972. Anderson lagoon, three in September-November 1964 (J. Watt). One at St Clair, 1963 and one at Green Island lagoon 1962 (W. T. Poppelwell); Kaikorai stream, 1947 and 1951 (2/159, 5/89). Breeding on Taieri island 1941-43 (B. J. Marples, RB47, 1/75); one at Taieri mouth 1965 (W. T. Poppelwell) and a Mapping Scheme record from this map square. One on the tidal flats at Akatore, 1947 (I. Tily, 2/159).

Sandy Bay, south of Nugget Point, March 1977, two (TJ). Hayward's Point, Pounawea, 1954, five (6/91); present on Catlins coast 1970 (JH); False Island, March 1973 (DC).

Southland, Stewart Island, Solander Islands

Single birds recorded from around the Bluff (Stirling Point and Ocean Beach) 1967-70 (MLB, RRS) and in August 1976 (MHS). One at Pahia 1970 (MLB); two at Waihoaka, Toetoe Bay, 1949 (O. Sansom, 3/205). HMM lived on Centre Island, south of Colac Bay, from September 1973 till May 1975; only one Reef Heron was seen, in August 1974; it stood on a rock off the southern shore for 15-20 minutes and then flew towards the mainland.

Stewart Island, 1940-41, birds generally present as far south as Port Pegasus (CAF, RB57). D. E. Crockett reported a pair and a single bird at two localities in Paterson Inlet in 1957. Seldom recorded of recent years; there is a Mapping Scheme record from Port Pegasus area and PJM saw a single bird in Paterson Inlet, December 1976.

Solander Islands, a pair in December 1947, not seen in July 1948 (RAF, 3/55).

Chatham and Auckland Islands

Has been observed at Chatham Islands. Straggler to Auckland Islands (Oliver 1955). I have had no record from either locality.

DISTRIBUTION MAPS

The maps have been prepared from material listed in locality reports. Blacked-in map squares indicate 1960-1977 records; squares marked with a circle are those from which there are old records but no report for the period 1960-1977.

The maps show that Reef Herons are most abundant along that part of New Zealand coastline which is washed by south-going surface currents arising from the movement of sub-tropical water in the Trade Wind Drift. These are the West Auckland current as far as Waikato (where gaps in distribution correspond with presence of long sandy beaches), the East Auckland current (Auckland east coast, Coromandel and Bay of Plenty) and the East Cape current which meets the coast some miles south of East Cape but then deflects and lies offshore.

Further south, cooler surface currents flow northwards along the coast of both islands and eastwards into Cook Strait and through Foveaux Strait as far as Otago. It will be seen that Reef Herons are present in moderate numbers in Taranaki, Wellington area, Marlborough Sounds and Nelson, but scarce on the rest of South Island coast and on the east coast of North Island as far north as Mahia. Possibly

the distribution pattern on S.I. West Coast might be somewhat altered if more observers were available.

DISCUSSION

Locality reports make dull reading, but serve their purpose if they record available information on the present distribution and abundance of Reef Herons and some evidence of the decline in numbers which has occurred between 1940 and 1977, hence providing a yardstick by which local observers can measure future trends.

The Field Investigation Committee suggested that some effort should be made to record the number of White-faced Herons, if this species is suspected of affecting the Reef Heron. Figures for White-faced Herons are included in locality reports for northern harbours.

Because White-faced Herons have increased and Reef Herons have decreased over recent years it is tempting to assume that one species is displacing the other and causing its decline. I suggest that this is not so. In the early years of their establishment in New Zealand White-faced Herons were found mainly along the coast but Mapping Scheme records show that they are now well distributed over the whole country and reports indicate that they continue to colonise inland localities. On the intertidal flats of northern harbours and inlets they feed in fair numbers for part of the year but are usually comparatively scarce or absent during the breeding season; at all times of the year they find much of their food on grassland or around freshwater lakes, dams and streams. It is interesting to note that Wellington Harbour Survey recorded only one White-faced Heron on five monthly counts August-December 1975.

There is no competition for nest sites — the Reef Heron is a crevice-nester, the White-faced Heron a tree-nester. When individuals of both species are feeding on tidal flats there appears to be no antagonism, which would surely be observed if there was serious competition for food items.

We tend to think of the decline in Reef Heron population as having started about 1940, but Hutchison (1901: 217) wrote in 1900 — "the Blue Heron has disappeared from here. They were to be seen on Napier beach about 40 years ago but have moved now to the quieter refuge of the Kidnappers and Mahia."

New Zealand is the south-eastern limit of range of the Reef Heron, which is mainly a bird of the tropical and sub-tropical zone. It may be that conditions for survival in this peripheral area have, by natural causes, become less favourable than they used to be. It is certain that changes brought about by the activities of man have had an adverse effect on the species. Disappearance of wooden wharves,

reclamation of tidal land, deepening of channels, water pollution, proliferation of power-driven boats and consequent disturbance of nesting sites have all affected the Reef Heron's life style and reproductive capacity.

The Reef Heron is not yet a rare bird. In some areas there has been satisfactory adjustment to changed conditions. Numbers may continue to decline, or may stabilise by better breeding success at traditional sites or occupation of new ones in undisturbed localities. I hope that the results of this enquiry will encourage members who live in coastal areas to continue their observations and keep track of future developments. Records from additional localities and any other relevant information should be submitted for inclusion in Classified Summarised Notes.

ACKNOWLEDGEMENTS

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BREEDING OF ANTARCTIC TERNS AT THE SNARES ISLANDS, NEW ZEALAND

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ABSTRACT

The breeding and habits of the Antarctic Tern *(Sterna vittata)* were studied during a summer at the Snares Islands. Daily records were kept of ten nests situated on cliff ledges and rocks. Egg-laying occurred during two periods; late October/early November and late November. The usual clutch was one egg, but some two-egg clutches were laid. Re-laying probably occurred on one occasion when the first clutch was lost. Both parents incubated, and the incubation period averaged 24 days.

The chicks were guarded for two to three days after hatching and were fed by both parents. Chicks fledged between 27 and 32 days after hatching. Adverse weather severely restricted chick growth during the early stages of development and was a major factor in chick mortality.

INTRODUCTION

The Antarctic Tern is a circumpolar species breeding in coastal areas from about 47°S to 68°S (Watson 1975). In the New Zealand region it breeds on Campbell, Auckland, Snares, Antipodes, Bounty and South Cape Islands (Falla *et al.* 1970).

Despite its wide distribution, there are only a few general accounts of its biology, the most informative being those of Bailey & Sorenson (1962) who outlined breeding at Campbell Island (52°33'S, 169°08'E) and Parmelee & Maxson (1975) who studied breeding on Anvers Island (64°45'S, 64°05'W).

Antarctic Terns were recorded first at the Snares Islands (48°02'S, 166°36'E) by Buller (1896). Subsequently, brief mention of them has been made by Fleming (1948), Stead (1948), Richdale ("1948") and Warham (1967).

This paper outlines the breeding biology of the Antarctic Tern for the 1976-77 summer at the Snares Islands, New Zealand. This formed part of the study programme of the 1976-77 University of Canterbury Snares Islands Expedition, which was at the Snares from 9 November 1976 to 3 March 1977.

STUDY AREA AND METHODS

The Snares Islands consist of granite with a gneissic structure (Fleming 1953). The granite forms precipitous cliffs which rise to

* University of Canterbury Snares Islands Expeditions Paper No. 35.

about 200 m on the west coast of the main island. The study area was on the less precipitous and lower cliffs of the east coast of the main island (Figure 1A).

Daily checks of the study area (Figure 1B) were made from 12 November 1976 to 31 January 1977 to find Antarctic Tern nests. Most adult terns defending nest sites were caught using traps at the nest and colour-banded for individual recognition; however none was sexed. Behaviour of terns before egg-laying was recorded. Nest contents were recorded at about the same time each day, until the chick(s) fledged. Eggs were marked with red ink for individual recognition. Chicks were weighed and measured at each visit. Bill and tarsus lengths were measured to the nearest 0.1 mm using vernier calipers. Chicks were weighed in a bag of known weight on a spring balance, accurate to 2 g. Chicks were banded before fledging, and post-fledging sightings were recorded.

Observations of 4-5 hours duration were made at two nests when adults were feeding chicks. Food samples were obtained from a chick regurgitation and food remains collected around a nest site.

Counts were made of terns at a roost in Boat Harbour on most evenings. Additional observations at Antarctic Tern nests outside the study area were made and have been incorporated where relevant.

Place names mentioned in the text follow those of Warham (1967) and Horning & Horning (1974).

RESULTS

The nest site and nest.

In the study area, Antarctic Terns nested solitarily (Figure 1B), the closest nests (4 and 5) being 10 m apart. Nests were either on cliff ledges overlooking the sea or on the tops of rocks a short distance inland. All nests were exposed; however a screening of light vegetation gave slight protection from the weather to some nests. With the exception of nest 3, all were associated with groups of Red-billed Gulls *(Larus novaehollandiae)*. The gulls were nesting just inside the forest edge, often within 3 m of a tern nest. There was no competition for nest sites with Red-billed Gulls as the gulls chose the shelter of vegetation, whilst the terns nested in the open. This association benefits both species against predation by Southern Skuas *(Catharacta lonnbergi)*.

Outside the study area a further six nests were found. Four were within 10 m of one another at Mollymawk Bay while single nests were found on the north side of Punui Bay and the south side of Mollymawk Bay.

All nests were slight scrapes in shallow peat and vegetation. A thin layer of leaves, usually dead *Poa astonii* and *Hebe elliptica*, lined the bottom of scrapes.

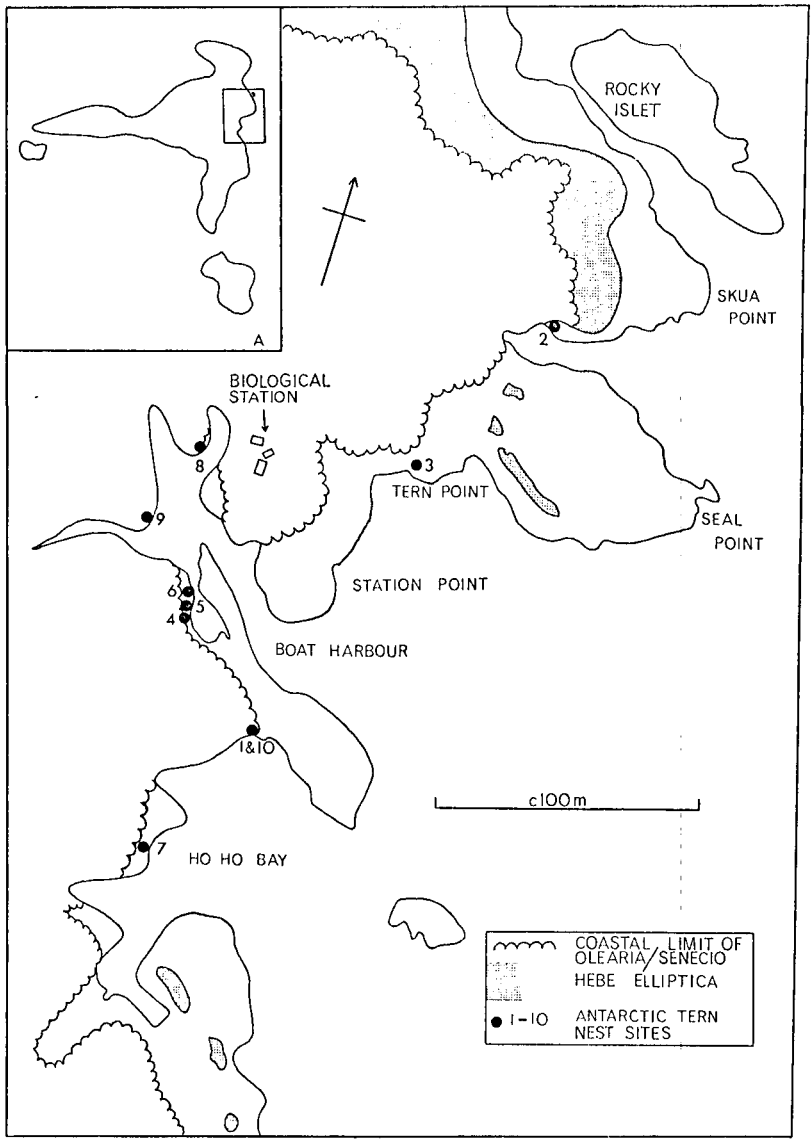

FIGURE 1 — A. The location of the study area on the main Snares Island.

B. The study area.

Pre-egg-laying behaviour.

Pairs were seen in courtship flight, with one bird carrying a small fish across its bill. They would land briefly at several places before settling. After the fish had been offered, received and eaten, both birds would appear to test several places on the light *Poa astonii* by pressing their breasts onto the ground while scraping with their feet. Eventually one site was selected and one bird would continue pressing and scraping while the other stood by.

Following nest-site selection both birds were seen to defend the immediate area of the scrape. Red-billed Gulls and other terns were driven off by fierce dives and bill clicking. Two nest sites were defended for 11 days and one nest site for 9 days before egg-laying.

Copulation was observed only once, at nest site 8, 6 days before egg-laying.

Egg-laying.

Complete clutches were found in nests 1-5 on 12 November. However, by back calculation from hatching dates, using incubation periods (determined later) the dates of first eggs were estimated (Table 1).

The egg from nest 1 disappeared between 1600 on 13 November and 0900 on 14 November. Another egg was laid in the same nest (nest 10) on 23 November. As neither of the birds from nest 1 were banded re-laying is not proven.

Stead (1948) noted that this tern has a prolonged breeding season at the Snares and suggested individual pairs may raise two broods a year. This is not supported by my observations, which suggest there is a double peak in egg laying activity, one in late October/early November and the other in late November; the second peak occurring about the time the first eggs hatch (Table 1).

Clutch and egg sizes.

Fourteen complete clutches were recorded; 10 were one-egg and 4 were two-egg clutches. However, no account can be made for eggs laid and lost before being recorded.

Fourteen eggs were measured and ranged from 41.2-49.2 x 30.5-33.2 mm with a mean of 46.2 ± 1.84 x 32.1 ± 0.70 mm. The mean weight of six fresh eggs was 24 g.

Incubation behaviour.

Nest relief was observed three times during incubation. On all occasions a bird flew in from the sea and gave a brief call before landing near the nest. The incubating bird then flew from the nest and out over the sea as its partner flew onto the nest .

Table 1: Breeding data for ten Antarctic Tern nests at the Snares Islands.

Nest No.	1	2	3	4	5	6	7	8	9	10
First egg laid	by 12.XI.76	by 12.XI.76	27.X.76*	2.XI.76	30.X.76*	25.XI.76	26.XI.76	27.XI.76	28.XI.76	23.XI.76
Second egg laid			30.X.76*			27.XI.76	28.XI.76			25.XI.76
First egg hatched	D	D	19.XI.76	26.XI.76	22.XI.76	19.XII.76	20.XII.76	20.XII.76	21.XII.76	D
Second egg hatched			22.XI.76			21.XII.76	22.XII.76			D
First young fledged			20.XII.76	23.XII.76	21.XII.76	20.I.77	D	D	D	
Second young fledged			24.XII.76			D	D			
Clutch size	1	1	2	1	1	2	2	1	1	2

* estimates from average known incubation period

D died or disappeared

Incubation period.

In two-egg clutches incubation began after the first egg was laid. The incubation period was taken as the time between the laying and hatching of the last egg in the clutch. The incubation periods of six eggs were 24, 24, 24, 24, 25 and 25 days.

Hatching.

In eight cases the interval between the first observed starring of an egg and its hatching ranged from 1-3 days. In two two-egg clutches the second egg hatched two and three days after the first. After hatching shells were removed from the nest.

Chick behaviour.

Chicks were brooded for two days before they abandoned the nest and sought shelter in nearby open vegetation. When adults were present the chicks readily stood in the open.

Chick growth and development.

The weights of four chicks are presented in Figure 2. The curves for chicks 3.1, 3.2 and 4 are typical of those obtained for other seabirds, with a steady rise to a maximum, followed by a fall before fledging. These chicks hatched from eggs laid in late October/early November. Chick 6.1 hatched from an egg laid in late November. Its growth curve was normal until six days after hatching. When this chick was 6-13 days old strong winds and cool, wet weather persisted and the chick's rate of weight increase was severely depressed. This was proably due more to metabolic problems of the chick than to feeding problems of adults as terns were seen feeding frequently during this period. Once favourable weather conditions returned the weight of the chick increased steadily.

Chick 4 was from a single egg clutch and increased in weight more rapidly than the two chicks from nest 3.

The average tarsus and bill length measurements of the four chicks are presented in Figure 3. The tarsus grew quickly to adult length while mean bill length was shorter at fledging than that of the average for adults.

Initially the chicks were down-clad. The first feathers to appear were the primaries, which burst their quills about 11 days after hatching. Chicks were down-free 1-2 days before fledging i.e. at about 25-30 days. At fledging the heavily barred dorsal plumage, which distinguishes Antarctic Tern juveniles from Arctic Tern *(Sterna paradisea)* juveniles and is typical of juvenile Southern Hemisphere *Sterna* (Murphy 1938), was obvious (Figure 4). The tarsus, feet and webs were dusky red while the bill was dark with a slight pink tinge.

Food and feeding.

Chicks were fed by both parents at irregular intervals. Typically, an adult flew towards the nest from the sea with a fish across its

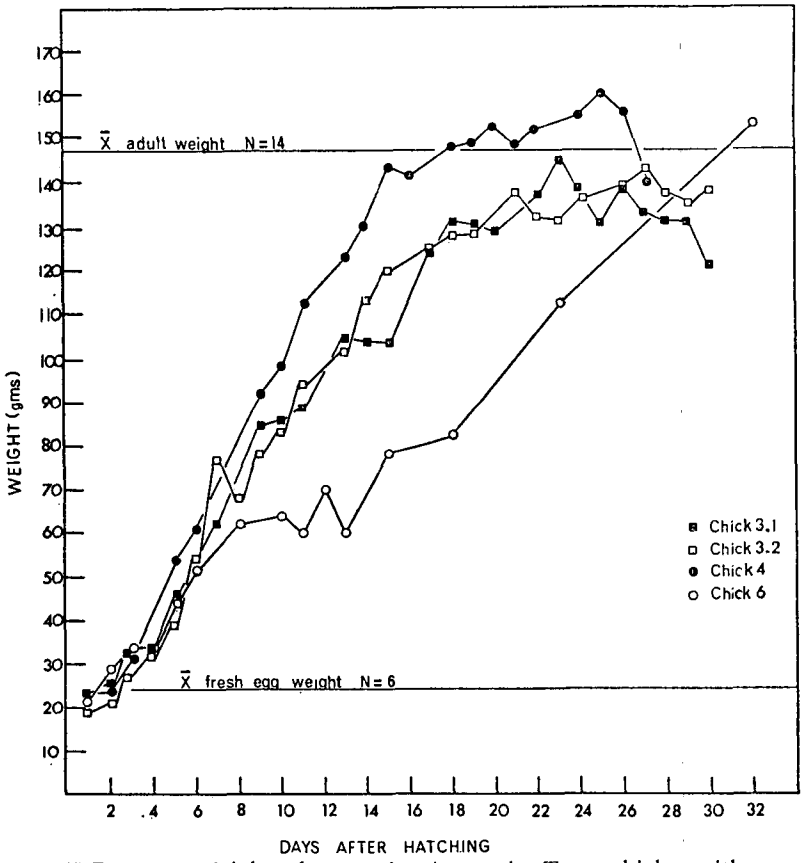

FIGURE 2 — Weight changes in Antarctic Tern chicks with age.

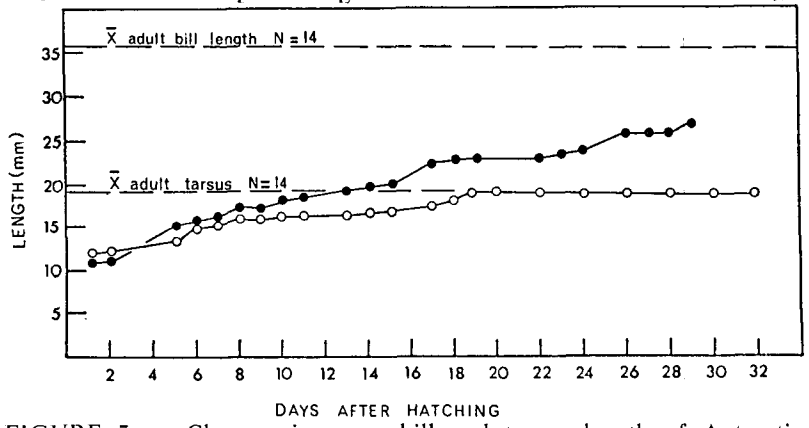

FIGURE 3 — Changes in mean bill and tarsus length of Antarctic Tern chicks with age.

FIGURE 4 — Recently fledged Antarctic Tern chick.

bill. When 10-20 m from the nest site the adult gave a short call and on landing the chick appeared, running out of the vegetation, begging. The fish was passed immediately to the chick which quickly swallowed it whole, head first. The adult then flew off and the chick retired into the vegetation.

When two chicks were present, the first to reach the parent was given the fish. After several feeds the first chick became less responsive to the call of a landing parent, allowing its sibling to be fed.

Antarctic Terns fed close inshore. They flew slowly over the sea, occasionally hovering, then dropping into the water briefly, almost totally submerging. Flocks of up to 49 were seen congregated to feed.

All identified food proved to be fish. The species identified were *Cheilodactylus macropterus* and *Notothenia microlepidota* (det. J. Moreland, National Museum, Wellington). Three whole fresh *C. macropterus* found by a nest measured 76, 80 and 90 mm. Presumably the chick either was too well fed or the fish were too large for it to swallow.

Fledging period.

Four chicks fledged from 27-32 days after hatching (Table 1). These seem to be the first data on fledging periods for Antarctic Terns recorded.

Chicks were fed by their parents for at least three days after fledging. After this time both parents and chicks left the breeding area. At nest 3, once the older chick had fledged it accompanied the parents when feeding and occasionally roosted on an exposed rock near the nest site. Both chicks were flying with the parents the day after the younger chick fledged.

Mortality.

Three clutches disappeared before hatching (Table 1). At nest 1 the terns probably re-laid (see above). However, at nest 2 the terns deserted the site.

Southern Skuas are the principal predators of Antarctic Terns (Parmelee & Maxson, 1975). These skuas breed within 50 m of Antarctic Terns at the Snares Islands. Terns were seen actively pursuing skuas. Whenever a skua flew into Boat Harbour all the terns and unoccupied Red-billed Gulls gave chase. The terns then returned quickly to their nests.

Red-billed Gulls were potential predators of tern eggs and chicks. I saw no sign of such predation but terns defended their nest sites against intrusion by gulls.

Five tern chicks died during the windy, cold wet weather mentioned previously. All were less than five days old and neither the surviving chick (chick 6.1) nor the dead chicks were being brooded.

Roost composition and numbers.

Both first-year and non-breeding adult terns usually roosted near nests 4, 5 and 6 in Boat Harbour during early and late summer. They were joined by up to five juveniles during February. Non-breeding terns were easily distinguishable from adult terns by their white foreheads, and dull red-black bills and tarsi.

The number of first year terns dropped sharply (from 11 to 1) in late November. Parmelee & Maxson (1975) recorded a similar pattern in first-year terns at Anvers Island. Emigration and/or moult are possible explanations for these declines. The numbers of adult terns remained steady (3-4) during November and December but rose sharply in January (19) and peaked in February (25). Juveniles first appeared at the roost on 2 February. These increased numbers were indicative of the end of the breeding season.

DISCUSSION

Colonial nesting of Antarctic Terns has been recorded from Heard Island (Downes *et al.* 1959), Gough Island (Swales 1965), Saint Paul and Amsterdam Islands (Segonzac 1972) and Anvers Island (Parmelee & Maxson 1975). On Tristan da Cunha, following the introduction of rats, Antarctic Terns abandoned nesting on sandy beaches for inaccessible ledges (Elliott 1957). At the Snares Islands, although mammalian predators are absent, the terns usually nest solitarily. Habitats suitable for colonial nesting do exist; however, their use by Fur Seals *(Arctocephalus forsteri)* and Hooker's Sea Lions *(Phocarctos hookeri)* as hauling out grounds and Southern Skuas for breeding denies terns the use of these areas.

The breeding cycle of Antarctic Terns varies significantly with locality. Egg dates from the Snares agree with those reported from Saint Paul and Amsterdam Islands by Segonzac (1972). Eggs were seen from late November to late January on Campbell Island by Bailey & Sorenson (1962) and from late January to early March on Gough Island (Swales 1965). Further south, on Crozet, Kerguelen and Heard Islands, laying begins in late December (Watson 1975). At Anvers Island egg laying occurred from about 11 November to 27 November (Parmelee & Maxson 1975). These data do not follow the trends shown by Warham (1972) for Rockhopper Penguins *(Eudyptes chrysocome)* and Young (1977) for Southern Skuas, where sea temperature and latitude affected the onset of breeding. The prolonged and varied breeding seasons indicate that Antarctic Terns have adapted to local conditions, the Anvers Island population being adapted to the short Antarctic summer.

Antarctic Tern clutch size increases with increasing latitude. Contrary to my findings, Stead (1948) reported one-egg clutches from the Snares, and Oliver (1955) reported one-egg clutches for New Zealand subantarctic islands. At Campbell Island the nests often

contained one egg, although the complete set was two (Bailey & Sorenson, 1962). Further south, at Anvers Island, the ratio of two-egg clutches to one-egg clutches was 27:2 (Parmelee & Maxson 1975). This trend contrasts with that of the Arctic Tern which displays a marked decrease (mean 2.4 in boreal, 2.1 in low-arctic and 1.5 in high-arctic) in clutch size with increasing latitude (Salomonsen 1972). One, or a combination of factors such as food availability, predation pressure and migratory habits may be responsible for these contrasting trends. However, until more detailed data on these species are available, the roles of such factors remain conjectural.

My value for the incubation period of 24-25 days supports that estimated by Parmelee & Maxson (1975). This period is similar to those stated for other *Sterna* species.

Dunn (1975) has shown that wind, rainfall and sea conditions had measurable effects on the weight increase of Common Tern *(S. hirundo)* chicks and that wind speed had a strongly linear depressive effect on the weights of Roseate Tern *(S. dougalli)* chicks. My observations support those of Dunn.

The fledging period of 27-32 days is similar to that given for the Common Tern, about 28 days (Witherby *et al.,* 1941) but is significantly longer than that given for the Arctic Tern, about 21 days.

CONCLUSIONS

The breeding biology of Antarctic Terns at the Snares Islands is typical of other *Sterna* species, especially with regard to clutch-size, incubation and fledging periods and mortality. Elsewhere this species has adapted to local conditions in breeding when conditions are most favourable.

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FLUCTUATIONS IN BIRDLIFE IN A SUBALPINE BASIN

By P. CHILD

ABSTRACT

Results are given of a monthly survey of birdlife in the subalpine Lake Harris basin, north-west Otago Alps. Fluctuations over a year, from May 1976 to April 1977, were tallied by species and by numbers of individuals. Comments are made on effects of climatic conditions and resources available to birds at such altitudes in the Southern Alps along the Main Divide. Arising from observations made so far, it is suggested that the Rock Wren *(Xenicus gilviventris)* may hibernate during harsh winter months.

INTRODUCTION

In order to study the changes in birdlife in a representative subalpine zone over a yearly cycle the author paid monthly visits (from May 1976 to May 1977) to the " Harris Basin " below Lake Harris in the Routeburn River headwaters of Mount Aspiring National Park.

This area was chosen because of its ease of accessibility from a road, and because suitable accommodation was available almost on the site (at the Routeburn Falls hut, owned and operated by the Park Board). Since the completion of the new vehicle bridge across the Dart River (18 km above Glenorchy at the head of Lake Wakatipu) it is now possible to motor to the roadend at the old Routeburn Lodge, from which an easy 2½ hours' tramp up the well-known " Routeburn Track " leads one to the Falls hut. (In summertime, by leaving Alexandra about 4 p.m. it is thus possible to reach the hut before dark).

The main drawback of this area for study is the fact that the subalpine scrub is not particularly tall and luxuriant compared with some other similar headwaters close to the Main Divide, and hence perhaps does not harbour the diversity of species within the scrub zone that one might expect, as will be discussed more fully later.

Nevertheless, the area is fairly typical of dozens of such basins near the heads of alpine streams above the beech treeline east of the Main Divide of the Southern Alps of New Zealand.

GENERAL DESCRIPTION

The " Harris basin " (Fig. 2) is a large montane cirque, about 3 km in diameter, scoured out by ancient iceflows, and now enclosed

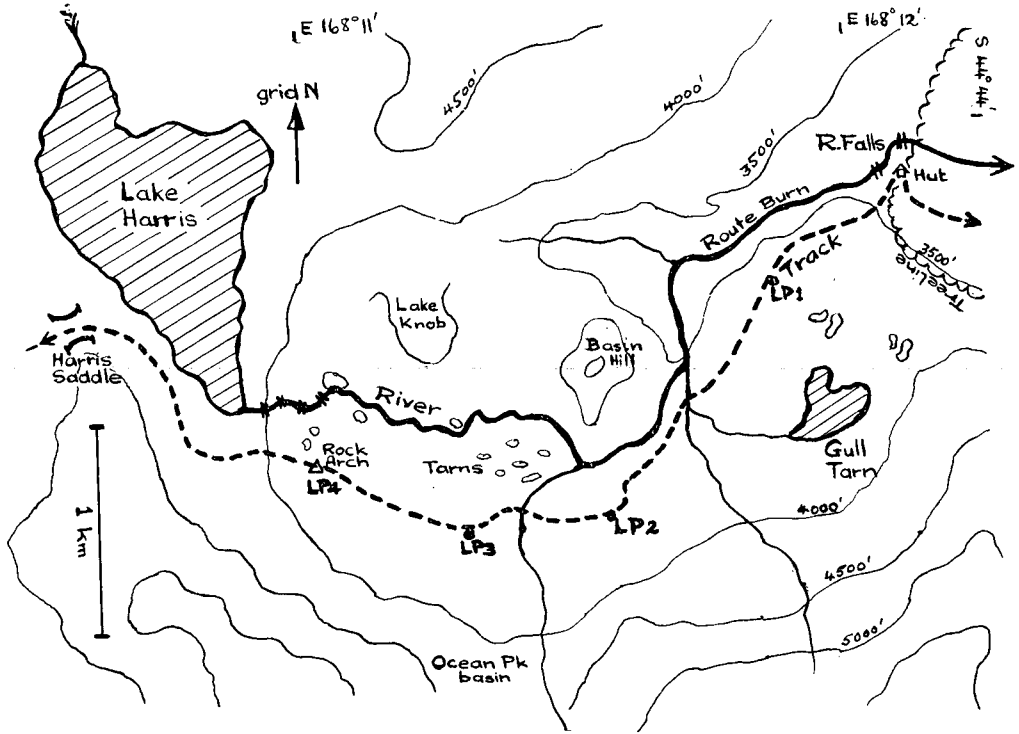

FIGURE 1 — Sketch map of the study area, with natural landmarks and listening post (LP). Adapted from NZMS1/S112, Hollyford.

in impressive bluffs and peaks (to 1912 m) of the Humboldt Range. It is a region well-known to trampers for the picturesque cascades and waterfalls below the lake outlet, as well as over its eastern lip, and for the deep dark lake just below the saddle at 1340 m (4400') on its western exit, this saddle giving various routes of access to the lower Hollyford valley.

The basin floor is above the beech forest at c. 1070 m (3500'), with most of its expanse lying open to the morning/early afternoon sun, except its steep northern slopes whcih are in shade most of the day and which are cold, snow-covered and usually well frozen during the winter (from about May to September).

For birds it provides several types of habitat:—

i. the lake itself, larger tarns and river backwaters suitable for waterfowl and gulls.
ii. the scrub zone for the small passerines.
iii. the high tussock knolls and ridges (with exposed mineral substrate) for Pipit.
iv. the scrubby bluffs, mountain cliffs and vegetated ledges favoured by Falcon and Kea.
v. the consolidated jumbles of huge boulders intermingled with scrub and herbfield which, with suitable bluffs above, furnish ideal terrain for the endemic Rock Wren.

Being on the Main Divide the area is subject to sudden changes in weather, severe storms, heavy annual precipitation (probably about 4700 mm), and frequent snowfalls, with deep snow lying most winters from about late May to early September. However, because of the enclosing mountains, the basin itself is relatively sheltered from high winds.

CHANGES IN WEATHER CONDITIONS

By chance, the night of the first visit (8 May 1976) coincided with the first heavy snowfall (to 150 mm) of the winter, and although the following day was clear and calm only the tips of the Hebes were showing through. The snow thawed slowly on sunny faces, and then was cleared almost completely by heavy north-west rains just before the mid-June visit. This was followed later in the month by heavy snowfalls and severe frosts, so that by mid-July the basin was completely plastered white with snow to 1 metre or more deep, ice and icicles festooning the bluffs and mountainsides, with hardly a patch of rock showing, and air temperatures very low. Two Keas were the only birds recorded. (Under slightly less severe conditions in mid-July 1974, one Kea was the only bird recorded, even though some bluffs and shrubby extremities were clear on that occasion.)

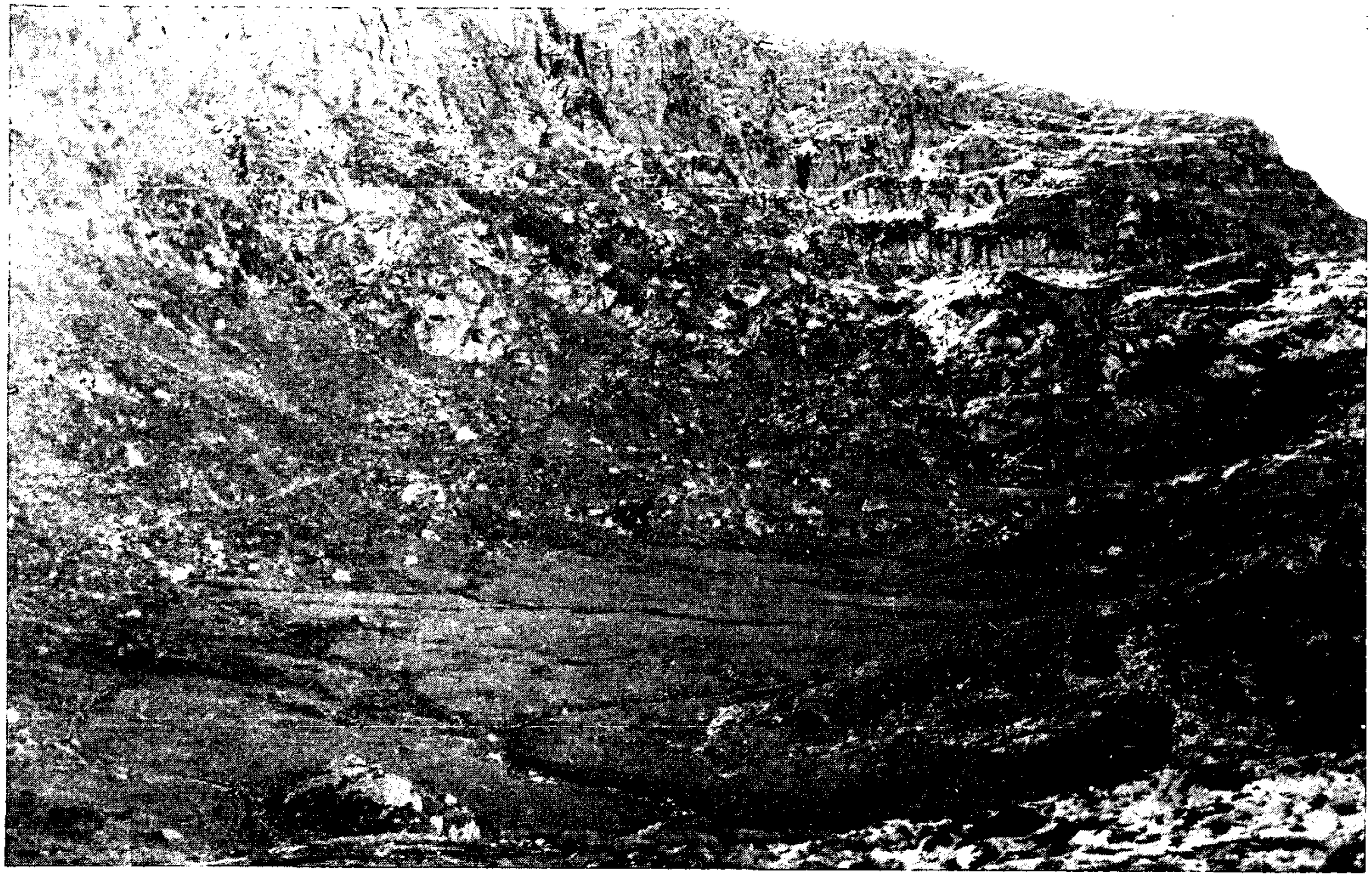

FIGURE 2 — A general view of the Harris Basin from below the 'Gull Tarn' looking west to the Harris Saddle (extreme right). A faint line leading upwards on the left through the scrub is the tramping track. Lake Harris is above the main snow patches below the bluffs on the right (from a colour negative, May 1977).

Photo: P. Child

By mid-August tips of shrubs, bluffs and boulder sides on sunny slopes were clear but the general snow-cover was still 0.5 m deep. A month later shrubs were more exposed on the sunny faces with frozen snow patches up to 300 mm deep in the shade. The tarns and lake were still snow and ice-covered, with ice 250 mm thick on the lake. After some windy, mild days in early October, the basin was clear of snow up to the level of the lake, the lake itself still being covered in snow and ice except for some melting at the shoreline on the warmer southern side and around the outlet. (The scrub was now becoming inhabited by Hedge Sparrow and Yellow Hammer.) By mid-November, however, there was a sudden reversal of conditions; a week of bitter southerly weather produced snow up to 600 mm deep with only the tips of shrubs, etc., showing through again, although it was thawing quickly on north-facing bluffs and ledges.

December, January and February had the usual changeable alpine summer weather, mainly mild days but frequent showers and heavy rainstorms.

Most of the autumn was mild and settled with occasional storms putting a fresh skiff of snow on the tops but the basin warm enough for it to remain clear until at least mid-May 1977.

THE VEGETATION

Sodden peat swamp, dotted with small muddy-bottomed tarns, characterises much of the basin floor, with a typical bog vegetation of short sedges and grasses, cushions of *Oreobolus, Donatia* and *Phyllachne* and a mixture of small herbs, including a sundew *(Drosera arcturi)*. Extending up the lower gentler slopes of the basin walls is a belt of subalpine scrub, about 100 m wide, not particularly dense except in a few patches, interspersed with tall snow-tussock *(Chionochloa flavescens)* and the large southern speargrass *(Aciphylla horrida)*. Below the shrub canopy is a rich variety of alpine herbs, prominent among which are the largest mountain daisy *(Celmisia coriacea)* and the great mountain buttercup *(Ranunculus lyallii)*. Of the scrub itself *Hebe odora* and *Olearia moschata* are generally co-dominant, with occasional conspicuous patches of snow totara *(Podocarpus nivalis)*, three species of turpentine scrub *(Dracophyllum uniflorum, D. menziesii,* and *D. longifolium)* and stunted ribbonwood *(Hoheria lyallii)*; Mountain flax *(Phormium cookianum)*, whipcord hebe *(Hebe hectori)*, at least two coprosmas and a few others are scattered throughout. Except for a few stands the scrub is rather rounded and stunted, mostly only about 1 - 1½ m tall (see Fig. 3).

Above the scrub is the usual tall snow-tussock, gradually giving way to shorter species, and the upper alpine herbfield.

There is no forest in the basin, the mountain beech *(Nothofagus solandri* var. *cliffortioides)* limit being at the hut level below the eastern rim at about 1040 m (3400').

FIGURE 3 — Mixed vegetation with scattered scrub in the Harris Basin: speargrass and tall tussock in the foreground; in the middle distance the co-domininat shrubs *Olearia moschata* (light) and *Hebe odora* (dark); on the rocky knoll in the background *Dracophyllum uniflorum* (dark) and some scattered mountain flax *(Phormium cookianum)* (from a colour negative, May 1977). Photo: P. Child

METHODS

Routeburn Falls hut was usually reached late in the evening and the following day spent in the basin. Most surveys occupied from about 8.30 a.m. to 3 p.m. All birdlife seen or heard was noted for numbers and species. A particular lookout was made in boulder areas known to have been frequented by Rock Wren. Several points en route, usually in the " lee " of a knoll or large boulder were utilised at " listening posts," where hearing was good because of the shelter afforded from the noise of wind or river. The lake itself, river pools and the large " Gull Tarn " (see Fig. 1) were examined for waterfowl or gulls. The southern half of the survey route lay more or less along the line of the tramping track, with appropriate side excursions, the return being across the lake outlet and back via knolls and scrubby slopes on the northern side of the basin to recross the river and rejoin the track near the eastern rim above the hut.

(For comparative purposes, in very different prevailing weather from that experienced a year earlier, a thirteenth visit was made in May 1977.)

RESULTS

Results of individual visits are shown in the table below (Table 1). The monthly total of numbers of individuals and of species is shown graphically (Fig. 4).

DISCUSSION

1. *Numbers and species:*

As one might expect in an area subject to rigorous seasonal climatic change the results show a general increase in both species and individuals from the winter to summer.

The greatest number of individuals (63) occurred in early summer (December) whereas the least (2) occurred in mid-winter (July).

The greatest number of species (9) was recorded in late autumn (April) whereas the least number (1) was recorded when heavy snow filled the basin in mid-winter (July).

Prevailing weather affects movements and hence tallies, the small passerines in particular tending to descend to the shelter of the treeline beeches during severe conditions and during temporary adversities (rain-showers, etc.) to seek cover in the scrub. This was amply exhibited by comparing results of 9 May 1976 (after the first heavy winter snowfall, up to 150 mm deep) when only 4 birds of 2 species were recorded, with a warm, calm, almost snowfree basin on 11 May 1977, when 19 birds of 5 species (including 16 passerines) were present.

	M	J	J	A	S	O	N	D	J	F	M	A	Totals: Indiv. Records	Totals: Months Recorded	Ave/Visit: Whole Year	Ave/Visit: Months Present Only
1. Falcon (Falco novaeseelandiae)	–	1	–	–	–	–	–	–	–	–	–	1	2	2	0.2	1.0
2. Harrier (Circus approximans)	–	–	–	–	–	–	–	–	–	1	–	–	1	1	0.1	1.0
3. Black-backed Gull (Larus dominicanus)	–	–	–	–	–	?	–	–	–	–	–	–	2	1	0.2	2.0
4. Paradise Duck (Tadorna variegata)	–	–	–	–	–	–	–	–	?	–	–	2	4	2	0.3	2.0
5. Grey Duck (Anas superciliosa)	–	–	–	–	–	1	–	1	–	–	–	2	4	3	0.3	1.3
6. Kea (Nestor notabilis)	3	8	2	3	1	2	2	9	3	16	1	3	55	12	4.6	4.6
7. Hedge Sparrow (Prunella modularis)	1	1	–	1	17	13+	12	31	15	15	11	9	126	11	10.5	11.5
8. Chaffinch (Fringilla coelebs)	–	–	–	2	–	1	1	4	1	–	11	8	28	7	2.3	4.0
9. Redpoll (Acanthis flammea)	–	–	–	–	–	–	–	10	6	15+	4	6	41	5	3.4	8.2
10. Yellow Hammer (Emberiza citrinella)	–	–	–	–	4	7	1	8	9	6	–	–	35	6	2.9	5.8
11. Silvereye (Zosterops lateralis)	–	–	–	–	–	–	–	–	–	–	–	7	7	1	0.6	7.0
12. Pipit (Anthus novaeseelandiae)	–	–	–	1	–	–	–	–	–	–	–	2	3	2	0.3	1.5
13. Rock Wren (Xenicus gilviventris)	–	–	–	–	–	2	–	–	4	2	1	–	9	4	0.8	2.3
Totals: Indiv/Species	4/2	10/3	2/1	7/4	22/3	28/7	16/4	63/6	42/7	55/8	29/5	40/9				

Table 1: Monthly records for tallies of each species.

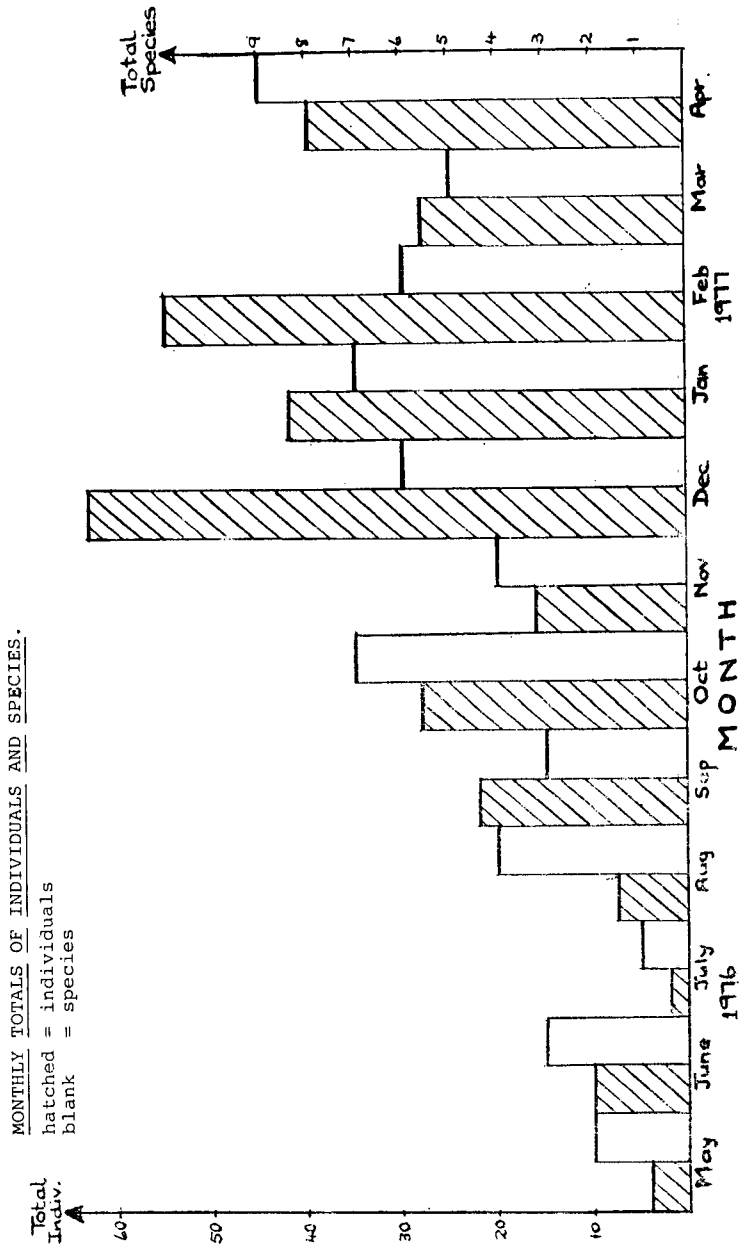

FIGURE 4 — Monthly totals of individuals and species.

Climatic conditions also affect reliability of recording, with snow, fog and rain hindering visibility, and hearing being affected by wind. On most visits during the present survey, however, recording conditions were remarkably good, with very little wind interference. The relatively low totals in January may have been due partly to poor visibility in cool, misty showers.

By contrast the clear, warm autumn day of 16 April provided a tally better than expected, and a record number (9) of species. Contributing to the latter result may have been

(a) presence of both Paradise and Grey Duck, possibly post-breeding dispersal from valley floors.

(b) the only (monthly) record of Silvereye — possibly an autumn behavioural characteristic in search of ripe fruit of subalpine shrubs.

(c) only the second records of Falcon and Pipit, the latter possibly at lower altitude following southerly storms which left a dusting of snow higher up.

As noted elsewhere (Child 1976) the subalpine scrub zone is dominated by aliens, especially Hedge Sparrows, Redpolls, Chaffinches and Yellow Hammers. In this basin there is a surprising absence of Blackbirds *(Turdus merula)*, usually typical of this zone, which is probably due to the relative lack of tall scrub. (Blackbirds are present in the forest and valley below.)

More difficult to explain is the absence of the native Grey Warbler *(Gerygone igata)* which is usually a not uncommon member of the avifauna of the shrub zone in other similar areas of the Park.

2. *Habitat Resources available:*

Within the habitats listed under the general description are the following resources:—

(a) *Nesting sites:*

Bluffs — Falcon.
Large boulder falls — Rock Wren, Kea.
Subalpine shrubs — Hedge Sparrow, Chaffinch, Redpoll, Yellow Hammer, Silvereye.
Overhanging tussocks, etc. — Paradise Duck, Grey Duck, Pipit.
" Open " knolls near water — Black-backed Gull.

(b) *Foods:*

Tussock and other small dry seeds — Yellow Hammer, Pipit, Redpoll.
Succulent fruits of Coprosma, Snow Totara, etc. — Kea, Silvereye, Chaffinch.
Insects and other small invertebrates — Rock Wren, Kea, Hedge Sparrow, Chaffinch, Silvereye, Pipit.
Grasshoppers — Black-backed Gull, Kea.

" Wetland " foods — Paradise Duck, Grey Duck.
Small birds — Falcon.
Carrion of birds and mammals — Harrier, Black-backed Gull.

The 1976-77 summer/autumn appears to have been a poor season foodwise for frugivorous and graminivorous birds, with relatively low production of succulent fruits on the subalpine coprosmas, totara, etc., and an almost complete absence of seeding of the snow tussocks in the basin.

3. *Some Comments on Individual Species:*
(1) *Falcon:* Only 2 sightings, each of one bird, probably the same one judging by size and colouring. Since the Falcon is fairly territorial all year round (Nick Fox, pers. comm.) the Harris basin probably formed only part of its domain — significantly it was seen disappearing over into the Hollyford side of the Humboldt Range on a third sighting in May 1977. During the April visit it was seen to eat a Silvereye — of interest because this was the only month Silvereyes were recorded.

(2) *Harrier:* Only 1 sighting (in February) of a singleton soaring in the basin at about 1220 m (4000'). Of interest because it is only the second record I have made of this species above treeline within the Park.

(3) *Black-backed Gull:* One might normally expect to find a pair at " Gull Tarn " and/or Lake Harris each summer. The pair sighted at Gull Tarn in October were apparently discouraged from nesting by an unseasonal heavy snowfall (up to 600 mm) in the basin in November, and left the area altogether. The common large alpine grasshopper *(Sigaus australis)* is an important food item for this gull, especially as part of the diet of its nestlings.

(4) *Kea:* Kea numbers seemed to be lower than normal over the survey period, with quite small numbers most of the year and a maximum of 16 in February. Four seasons previously there had been 27 at the hut alone. Keas eat a great variety of plant and animal foods, including subalpine shrub berries; roots, bulbs, leaves and stems of some soft herbs; shoots and buds of beech in the growth period (December to March); larger insects at any time available — grasshoppers, beetles and grubs; nectar of mountain flax; seeds of speargrass (Campbell 1976). As mentioned earlier the season was a poor one for shrub fruits and this could have affected numbers present during the survey. For instance, snow totara *(Podocarpus nivalis)* fruit is an important kea food, but fruiting is poor in wet seasons because the plant is wind-pollinated (Jackson 1960). The 1975-76 summer was drier than normal so that heavy fruiting was the rule, while the reverse was true in the 1976-77 season.

Competitors for some of the " Kea foods " in the basin include occasional red deer, chamois, hare, oppossum and the frugivorous birds such as Silvereye and Chaffinch.

(5) *Hedge Sparrow:* Next to the Kea, the diminutive Hedge Sparrow was the most tenacious of this habitat, being recorded in all months except one, with a singleton being recorded even in winter visits. Unlike the other small passerines it does not flock in winter, and occasional individuals are evidently able to sustain themselves on whatever small invertebrates they can find among the tips of shrubs protruding from the snow. For the rest of the year they easily form the bulk of this bird community, their short song and communication calls being distinctive on calm days.

(6) *Redpoll:* These were present (as singles, pairs or very small groups) only in summer and autumn when the small seeds of *Celmisia, Olearia moschata* and grasses are available.

(7) *Yellow Hammer:* Very small numbers (only in spring and summer) were recorded. Their relative scarcity and sudden disappearance after February is attributed to the almost total lack of seeding of the snow tussocks in this survey period.

(8) *Pipit:* Only 2 records. " Alpine " pipits seem to prefer the shorter tussocks, herbfield and exposed mineral matter of the higher ridges rather than the taller, denser vegetation of the lower basin. (There are no Skylark *(Alauda arvensis)* competing for resources at these altitudes in the western ranges of the Main Divide, as there are on the summits of the unforested ranges of Central Otago. (See Child 1975).

(9) *Rock Wren:* Recorded only from October to March (and, significantly, absent in November when heavy snow again filled the basin). Rock Wrens are usually first heard, and even then are sometimes difficult to locate, being concealed within shrubs or among large boulders. When finally sighted, invariably both members of a pair are fairly close together (within an area of a few square metres) and they can then be subsequently followed as they work their way about the territory searching for small invertebrates among the shrubs, or among lichens and bryophytes on the boulders and damp bluffs. On clear still days in winter when snow fills the basin (with only the tips of the shrubs emerging) they would be particularly conspicuous on top of such shrubs or exposed boulders. Although I have spent many such days in the Harris basin and elsewhere in alpine regions of the Park, Rock Wrens have never been so recorded by me (or any other observer as far as I can ascertain). Neither have they been reported from the protection of the beech timberline where the small exotic passerines shelter and where the related Rifleman *(Acanthisitta chloris)* is usually a common component. It seems, therefore, quite feasible that the Rock Wren exhibits some type of hibernation or torpidity in the heavy snowfall period (about May to September), possibly even retiring to a dry crevice or old nest beneath the boulders for warmth and shelter. Alternatively, it would be possible for it to move about under the snow cover, among the shrub bases and the

spaces under rock piles, gleaning a limited amount of sustenance; but if this were the more typical winter behaviour one might also expect to occasionally hear such activity — unless the high-pitched communication calls were completely absent during this time — an unlikely event? Allied to this is the fact that such a small bird, with its very high surface area to volume ratio, would need to be spending a large part of a winter's day (with very low ambient temperatures) in such food-gathering if it were to remain active and maintain "normal" body temperature and metabolism. On balance, I feel that some kind of hibernation is the more likely behaviour, but whether this can be proven is a matter for some speculation.

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NOTES ON POST-BREEDING MOVEMENTS OF THE NEW ZEALAND DABCHICK IN THE SOUTHERN NORTH ISLAND

By R. H. D. STIDOLPH and B. D. HEATHER

The post-breeding flocking of the New Zealand Dabchick *(Podiceps rufopectus)* has not been investigated, although this annual movement has been common knowledge. In the southern part of the North Island, some attention has been paid in the present decade to this flocking and to the subsequent dispersal. The recent rash of sewage ponds constructed by rural boroughs has added greatly to the winter range of the Dabchick, with better chances for its survival in winter. These ponds seem often to provide conditions which favour wintering birds, perhaps partly because the depth of water is constant in all weathers.

We wish to draw renewed attention to Dabchick flocking and to some of the points of interest which might arise from keeping wintering flocks under regular observation.

Following a minor population explosion in the Wairarapa and Manawatu districts about 1959 (Stidolph 1971), the Dabchick has become a much more familiar bird in these areas in the last three decades, having appeared on lakes, lagoons, farm ponding areas and man-made sewage ponds in districts where it had seldom or never been recorded or where it had not been seen for years.

It seems that the Dabchick has not been seen in cross-country flight, indicating that it moves at night. There is some support for this in that the similar Little Grebe *(P. ruficollis)* in the British Isles is a frequent casualty at lighthouses (Witherby *et al.* 1943). That the Dabchick is capable of sustained flight is shown by its ability to colonise waters in the midst of hilly pastoral lands such as the east coast district of the Wairarapa, many miles from previously known habitat. It is also clearly shown by its winter appearance in places where it does not breed and sometimes in numbers well beyond the known local breeding population (as at Waikanae); and by constant fluctuations in its wintering numbers at these places.

For breeding, the Dabchick requires waters with a certain amount of fringe cover such as raupo, cutty-grass *(Mariscus)* or overhanging branches of trees, as well as a depth of water suited to its habits. It is unlikely to breed on sheets of water with no cover, though in post-breeding flocking it is often seen on open water, such as on sewage ponds.

NOTORNIS 25: 84-88 (1978)

Post-breeding dispersal in the Wairarapa has come into prominence since 1970 when the construction of the Masterton Sewage Ponds highlighted it. Three ponds, each of about 9.3 ha (23 acres) were established at Homebush, about 6 km east of Masterton, adjoining the Ruamahanga River. The filling of the excavations began about November 1971 and extended over many months, the northern pond being filled by 8 February 1972, and, although the other two were only partly filled, by 8 March 3 Dabchicks had appeared. On 3 April the middle pond, only one-third full, had 8 Dabchicks. This pond, with vegetation showing above water level, had 3 birds on 3 May and the southern pond, with only small areas of water, more in the nature of deep pools, had attracted 4 Dabchicks. On 11 June only 2 birds were seen on the southern pond, still at a low level. No birds were seen on 17 July, when the middle pond had filled, but on 13 August 3 Dabchicks, one in pursuit, were on the southern pond, still low. 4 birds were recorded on this pond on 5 September when it was half-full. Although no birds were seen on 14 October, 3 were present on 21 October and 2 on 5 November, when 2 were also seen on the half-filled middle pond; all had disappeared by 8 December. The more attractive southern pond, still half-full, had one bird on 14 January 1973.

The presence of Dabchicks during the 1972 summer was probably induced by the state of the ponds which still showed considerable emergent vegetation, offering sufficient cover for possible breeding.

A protracted dry spell occurred in the Wairarapa in the beginning of 1973 when many farm dams, lagoons and other waters more or less dried up. This seemed to be reflected by an influx of Dabchicks to the southern pond, 25 being recorded on 11 March, rising to about 35 on 7 April, when several juveniles were seen in the group. This number, which reached a maximum of 40 (29 April, BDH), was more or less maintained, as shown on visits on 2 and 22 May and 15 July (30 birds). The next visits were on 8 and 28 October when there were no birds.

No close watch was kept in 1974 when the now full southern pond had 8 birds on 6 July. In 1975, 4 were on the southern and 6 on the middle pond, both now full, on 18 May, though Michael Dennison had recorded 22 on 1 April. In 1977 no Dabchicks were noted on 14 March but on 1 April 14 were seen, dropping again to 3 on 18 April and 3 May, with 2 on 17 May and none on 30 June and 18 July. This was an abnormally wet winter.

Towards the end of 1973 the former shallow ponds at the Waingawa Freezing Works effluent system in Hughes Line (some 4 km south of Masterton) were excavated into two deep 2.4 ha (six-acre) ponds, destroying the previous shallow areas so attractive to stilts and Black-fronted Dotterels. On 18 April 1976, 12 Dabchick, the first to be seen in this area, were recorded by BDH, though this

number had dropped to 5 on 18 May; 2 were there on 12 June (RHDS) but none on 9 July and 1 on 4 September (BDH). In 1977, 3 were noted on 12 and 25 March and 18 April, rising to 6 on 2 May, none on 19 May (RHDS), 7 on 21 May (BDH) but back again to 5 on 1 July and then to 9 on 18 July (RHDS) and 8 on 30 July (BDH).

The sewage ponds at Carterton which on 9 July 1976 had 9 Dabchicks (BDH) have been faithfully watched by B. D. Boeson in 1977 but the ponds are being rebuilt and Dabchicks have not appeared. He also watched Kourarau Dam and likely spots near Gladstone, without success.

These fluctuations have been given in some detail to indicate the considerable movement by Dabchicks in the non-breeding period. It is a bird likely to turn up on any stretch of water at this period and could remain to breed if conditions suit it.

It is worth noting that Kourarau Dam in the hills east of Masterton, the first water in the northern Wairarapa to be reported colonised by Dabchick (in 1950/51, when young were reared), remained tenanted, despite occasional lowering for cleaning purposes, until the latter part of 1969 when 3 were reported present. A visit on 10 August 1971 revealed no Dabchicks, nor have any been seen on subsequent checks. It may be significant that a row of willows along the eastern shore, which provided good cover for breeding, has been killed. It is worth noting, too, that during the 20 years of occupancy, no build-up of numbers was seen in the post-breeding period.

In west Wellington and Manawatu, somewhat fragmentary reports (in *Notornis,* Classified Summarised Notes) from various places have indicated that flocking and considerable movement occur there also, A build-up to flocks may begin from early February: Lake Koputara (north of Foxton), about 30 on 1 February 1975 (J. L. & M. Moore); Lake Papaitonga (south of Levin), 20+ on 16 March 1975 (L. & P. Griffin); Marton Sewage Ponds, 19 on 7 April 1973 (H. A. Robertson & I. G. Andrew) and 28 on 11 July 1977 (BDH). A flock of about 50 is recorded for Lake Horowhenua (Levin) on 9 May 1970 (E. B. Jones).

In 1977 E. B. Jones began in late May to make regular counts at the north end of Lake Horowhenua, the part most favoured by Dabchick (although he did see 6 at the southern end on 26 March). Figures rose from a late-May maximum of 21, sustained in June, to a late July maximum of 33, down again to 21 on 30 July, maintained until at least 22 and 21 August, an unusually late flock. On 4 September, there were still over 20, together with a Hoary-headed Grebe (EBJ, BDH, W. F. Cash).

At Lake Wairongomai, near the coast between Otaki and Manakau, were 9 Dabchick on 24 April 1976 (BDH) and 12 on 8 May

(P. C. Bull) where a single pair is usually present in summer. Unfortunately a regular watch could not be kept here, nor at Lake Papaitonga.

At Waikanae, Sir Charles Fleming has kept 1977 counts at the new Waikanae Sewage Ponds and nearby Waimeha Lagoon where a pair bred in the 1976/77 season. Waikanae is close to few likely breeding places for Dabchick. From 17 or 18 on 20 March when counting began, and 14 on 17 April (no May counts), the number rose to 28 on 12 June, then dropped to 14 on 9 July, 5 on 23 July, 16 on 7 August, 0 on 14 and 20 August. Throughout this period, the Waimeha pair, a mere 2 km away, remained on their home lagoon, until end of January with their fully grown chick, then alone apart from an occasional absence of one or both in late July/early August.

It seems that there were more Dabchicks in winter in the Waikanae-Levin district than could breed in the district, particularly as Manawatu members continued during the winter to encounter Dabchicks on Manawatu dune wetlands.

As a sample of the type of seasonal changes that may occur at a typical dune lake of moderate size, we have taken from Wildlife Service files the maximum counts recorded by W. J. Pengelly during his almost daily wildfowl counts at Lake Pukepuke through 1973 and part of 1974. From a maximum of 16 (9 adults and 7 chicks) in the first half of January 1973, the numbers sharply declined to the first week of February when, from 8 February, none was seen until 4 May when there was a single bird. The highest count in May was 3, rising to 11 in June, a number more or less maintained during July and August, then dropping slightly to 8 in September and 7 in October. The first chick was seen on one of the adjacent ponds on 26 October, by which date 10 adults were present, rising to a maximum of 12 in November and December. Chicks were evident in every count until 27 January 1974, when records were temporarily suspended, up to nine chicks being recorded in January. No counts were made in February but March, April and May showed no Dabchicks, the first 2 birds appearing on 10 June, up to 9 by 1 July and 16 by 17 August.

The desertion of Pukepuke from February to April/May may be accounted for by the drop in water level which occurs in dune lakes, as well as in some farm ponds, at this period. However the pattern of movement at Pukepuke does not correspond clearly with flocking numbers elsewhere in other years, so that no conclusions can yet be drawn.

There is some evidence that pairing of birds in winter flocks may occur before flocks break up. For example, all 28 birds at Marton sewage ponds on 11 July 1977 appeared to be in pairs, their plumage was richly coloured compared with the drabness of early winter and all were continuously showing the white face-like pattern

at the rear which Storer (1971) states is a posture used by birds on territory only. This point needs closer study.

The recent appearance in New Zealand of two species of grebe from Australia, the Little Grebe *(P. novaehollandiae)* and the Hoary-headed Grebe *(P. poliocephalus)* makes it imperative that all groups of small grebes following the breeding season be critically examined. This is not always an easy task, since both juvenile and non-breeding adult plumages of New Zealand Dabchick have not been clearly described; nor have those of the Hoary-headed Grebe. A critical watch of all known post-breeding flocking localities should provide a reasonable means of assessing the national abundance of Dabchick, of learning more of seasonal movements and their causes, of studying feeding behaviour and even, it seems, of studying mating behaviour.

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SHORT NOTES

AUSTRALIAN PELICAN *(Pelecanus conspicillatus)* IN KAIPARA HARBOUR

A pelican was present on Northern Wairoa River 23-28 August 1976. During this period it was watched by Barrie Searle, who lives at Te Kopuru, and also observed by C. D. & C. Clunie, R. A. Froggatt and A. T. Edgar. It was apparently adult; general plumage white, nape grey; wing and tail quills and lower back black, with no brownish tinge; bill yellowish, pouch pinkish.

The Northern Wairoa is tidal. Deep drainage channels have been cut through farmland on both sides of and at right angles to the river, opposite Te Kopuru and further south at Tatarariki. At the mouth of the channel opposite Te Kopuru there is a mud bank and a large fallen tree, both used by the bird as low tide roosts, on which it was frequently observed sleeping, with its head on its back. It was seen feeding in shallow water in the main river, swimming or walking with beak submerged, once with its wings spread, but most of its feeding was done up the drainage channels over the period of high tide.

While in Tatarariki channel it permitted close observation at about 20 m without apparent alarm but for most of its stay it appeared restless and wary, often swimming or flying up and down a 6 km stretch of river between Mititai and Tokatoka, or returning to its roost. On 26 August it was on its roost as the tide started to flow; the sound of trucks changing gear on a road some distance from the river caused it to stand alert. Ducks took no notice of it, or it of them; it appeared uneasy at the presence of Black-backed Gulls and was once put to flight by close approach of a Black Shag. It flew when disturbed by a fisherman setting his net at the channel mouth and on another occasion made an extended flight at considerable altitude when disturbed by a motor boat. Take-off was rather laboured, flight easy and graceful with much soaring and gliding.

On 28 August, again disturbed by a passing boat, the pelican took off, gained height, soared and circled over the area for about 30 minutes till it was so high above the patchy clouds that it could only be seen through binoculars and when last seen appeared to be heading west.

On 2 September at Helensville (extreme south end of Kaipara harbour and about 70 km south of Te Kopuru) Mrs Rae Nicholls had her attention drawn to a pelican approaching from the north-west in a long circling glide, losing height till eventually it lowered its feet to splash down in the river behind some mangroves. Mrs Nicholls

has observed pelicans in Queensland and has no doubts about her identification; she was able to watch the bird swimming and feeding in the muddy shallows, for part of the time with its whole body submerged except for the curve of its back and its crown which showed above the water surface. This was her only sighting; though diligently searched for over the following days and weeks the bird was not seen again.

A. T. EDGAR, *Inlet Road, Kerikeri*

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AGGRESSIVE BEHAVIOUR BY FEMALE BLACKBIRD

My suburban garden is bounded by a hedge, with a central gate opening on to a public footpath, on which children sometimes play. In 1976-77 season the garden was breeding territory for a pair of Blackbirds, which built three nests in the hedge. Nest material was being carried to an escallonia bush on 8 September 1976, the first egg was laid on 13 September, a clutch of four eggs was complete on the 16th and hatched on 28-29 September; the chicks were fed by both parents. On the morning of 6 October the nest was empty, probably the result of cat predation; only one dead chick was found.

Building of the second nest started on 9 October in a privet bush on the other side of the gate. Two eggs had been laid by 0745 hours on 14 October; the full clutch of five was confirmed on the 19th and hatched on 29 October. On 5 November the hen was seen on the nest with her wings spread to shield the chicks from heavy rain; the chicks left the nest on 12 November.

The hen had shown no signs of undue alarm during my inspections of the first nest or of the second nest up to 6 November; but on the evening of the 9th when I attempted to check the nest contents (chicks then 11 days old) she attacked, striking me a sharp blow on the right shoulder. After the attack she landed on the concrete path, scolding me, and followed me round the house till I went inside. Later the same evening when outside to the other end of the section she was perched in a cherry tree and again started to "buzz" me till I went inside. At midday on 10 November when I walked along the path past the nest she flew towards me from a perch on a power line across the road and at 1245 hours when I looked at the nest on my way back to work she attacked, striking me on the head behind my right ear. She displayed no hostility to other members of the family, but up to the evening of 12 November when the chicks left the nest, my presence near the nest or even showing myself at a window overlooking the garden produced signs of aggression. Unfortunately I had to pass the nest site at least four times each day. The male bird showed no aggression and the hen ignored me after the chicks had left the nest.

Only two of the five fledglings survived their second night in the open; they were seen frequently with both parents in attendance and on 26 November were finding food for themselves but still being fed, particularly by the male parent.

A third nest was built in a privet bush about 2 metres from Nest 1, but few details are available. Building must have started soon after the chicks had fledged from Nest 2, for on 15 November the nest was empty, with a chick about one week old dead on the ground about one metre from the hedge.

Nest 3 was used again. A clutch of 5 eggs was noted on 28 December 1976 but laying must have started shortly after the loss of clutch 3, as 5 chicks hatched on 4 January 1977. On 11 January when the chicks were a week old the hen again attacked me, hitting me on the head when I inspected the nest. Two chicks were found dead on the lawn on 12 January, one on the 15th and one later, when the nest was empty, with no sign of the fifth chick. Cause of death is unknown; all the dead chicks were in good condition, and no insecticides are used in the garden.

The parent birds remained in their territory until winter. A female blackbird was found dead in the garden on 7 June 1977 and about ten days later another female appeared.

C. S. LAUDER, *9 Winnie Street, Greymouth*

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ACCIDENTAL DISPERSAL OF THE WELCOME SWALLOW THROUGH "HITCH-HIKING" ON SHIPS

Although stragglers had been recognised earlier at infrequent intervals (Oliver 1955, Fall *et al.* 1970), it is generally accepted that the first successful colonisation in New Zealand by the Australian Welcome Swallow *(Hirundo neoxena)* followed its 1958 invasion of Northland (Edgar 1966). Since then numbers have increased dramatically. It is now a common sight about North Auckland (see Munro 1969, 1973) and widely established in Waikato, Hawkes Bay, Manawatu, Wairarapa, Edgar 1966) and Bay of Plenty (P. F. Ballance, pers comm.) as well as throughout the South Island (Tunnicliffe 1968). During field work about Northland over the past few years I have frequently encountered Welcome Swallows. I note they are quite common in the vicinity of North Cape and I have also seen a number of nests, much less than a metre above high tide level, in caves along the western shore of Hukatere Peninsula, Kaipara Harbour.

Although it is widely accepted that a southwards spread of the Welcome Swallow from Northland has given rise to the southern populations, it has also been suggested that these could be the result of further successful colonisations in the years following 1958 (Edgar 1966).

In March 1977 I was a member of the scientific party on a cruise of the N.Z. Oceanographic Institute's research vessel *RV Tangaroa.* On Sunday 27 March, the ship made an approach from the northeast to within a few kilometres of North Cape, continued southwards across Great Exhibition Bay, and then turned to sail some distance off-shore to the northeast before taking passage down the west coast to Nelson (dates, times, and the ship's track are shown in Fig. 1). Shortly after the approach to North Cape I noted that a solitary Welcome Swallow had joined the ship. This bird appeared to roost under an overhang on the upper deck near the galley whence it made forays with typical erratic swooping flight around the after parts of the ship. The Welcome Swallow stayed with the *Tangaroa* for several days and I last saw it at dusk on Wednesday 30 March shortly before we berthed at Nelson.

These observations suggest that eastwards dispersal across the Tasman Sea by strong winds during stormy autumns (Edgar 1966) may not be the only mechanism by which Welcome Swallows have reached New Zealand. It is quite possible that vagrants may also have hitched rides (or stowed away) on ships plying the Tasman Sea, as our bird did on the *Tangaroa.* This mechanism also could explain some of their sporadic appearances prior to 1958. After all, there are numerous precedents for accidental passive dispersal of marine organisms through the probable fouling of ships' bottoms. Local examples that are well documented include the arrival and spread of the Japanese oyster *(Crassostrea gigas)* in northern New Zealand waters (Dinamani 1971) and the recent discovery of a subspecies of the seaweed *Codium fragile* in Auckland Harbour (Dromgoole 1975). Similarly, *Elminius modestus,* the ubiquitous barnacle of the New Zealand foreshore successfully invaded British waters (Bishop 1947) and subsequently extended its range to the continent (Crisp 1958).

Although instances of birds in a fatigued or exhausted state alighting on ships, and as a consequence being shifted considerable distances are well known, I have seen no reports of the dispersal of healthy birds in this fashion. Nevertheless, the voyage across the Tasman is little longer than the passage between North Cape and Nelson, and one can readily envisage that birds such as swallows, and perhaps swifts and tree-martins amongst others, could spread from Australia to New Zealand in this way. Vagrant swifts and Australian tree-martins have been reported from time to time about New Zealand (see Oliver 1955; Falla *et al,* 1970). If they did, the initial colonisations would not necessarily be in the vicinity of the principal ports. These birds could quietly abandon ship where landfalls were first made — around North Cape, about the western approaches to Cook Strait, and around southernmost New Zealand. This would not be incompatible with the first sightings of Welcome Swallows noted by Edgar (1966) and Tunnicliffe (1968), and also the records of swifts and tree-martins given by Oliver (1955) and Falla *et al.* (1970).

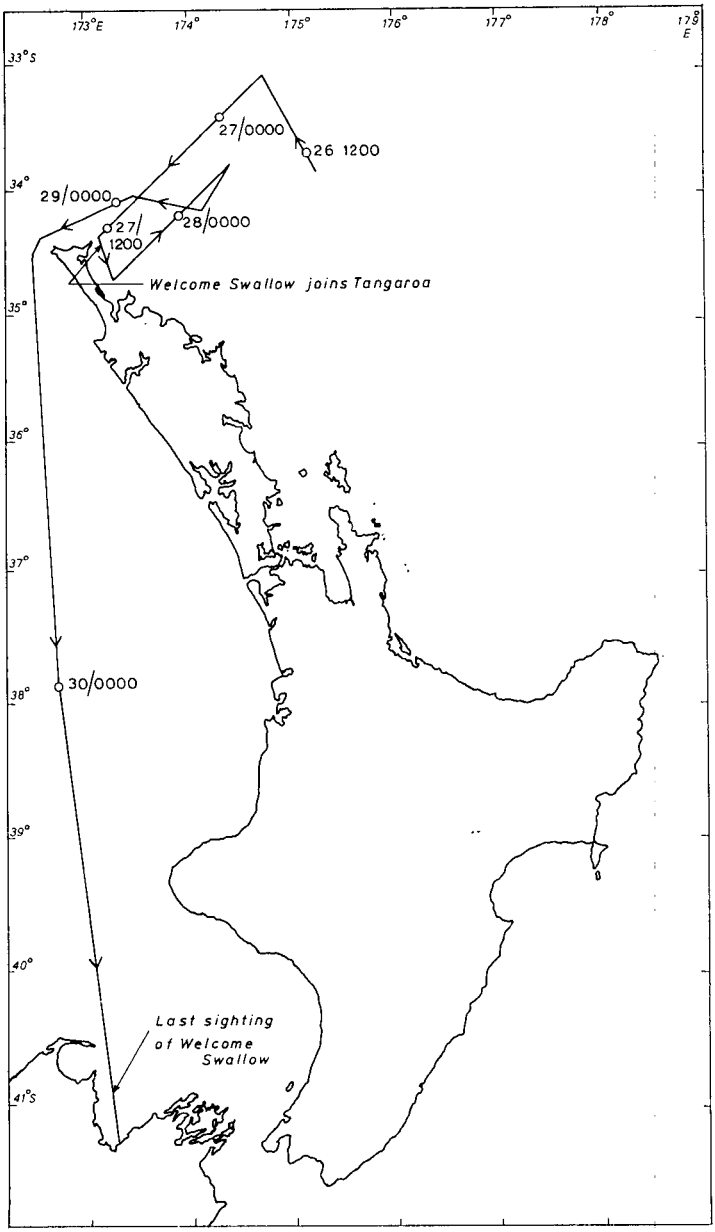

FIGURE 1 — Cruise track of the *RV Tangaroa* over the period 26-29 March, 1977.

I am indebted to Mr J. V. Eade of New Zealand Oceanographic Institute, DSIR, for the opportunity to participate in the *Tangaroa's* cruise, and to the Captain, Officers, Crew and fellow scientific personnel for a most agreeable fortnight. Some financial support came from the University of Auckland Research Committee. Dr P. F. Ballance read and criticised the manuscript and also suggested that these observations were worthy of record.

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AN ANALYSIS OF NANKEEN KESTREL PELLETS

Two years ago, I wrote some short notes (*Notornis* 22: 341-342, 1975) concerning my observations of a Nankeen Kestrel *(Falco cenchroides)* at a limestone quarry near Paki Paki. This bird was roosting on the quarry face and was still doing so when I left to go overseas on July 19 1975. When I returned nearly four months later, it had gone and I have not seen it since. However, I was fortunate in finding at the bottom of the face, several pellets in good condition. Having seen kestrel pellets whilst in England, I am quite certain the pellets I collected were ejected by the roosting Nankeen Kestrel.

Pellet	Prey Identification
No. 1	Bird, either Yellow Hammer or Greenfinsh, distal part of tarsus; grass seed.
No. 2	Mouse, upper left molars 1, 2 & 3, lower right incisor and molar 1; bird, feather fragments, species?; grass seed.
No. 3	Mouse, 1 upper left molar 1, 1 lower left incisor and molar 1, 1 lower right incisor; bird, feather and bone fragment, probably Yellow Hammer, proximal end of humerus, and Redpoll, distal part of tarsus.
No. 4	Mouse, 1 lower right incisor, 1 lower left incisor; bird, Redpoll; grass seed.

No. 5 Mouse, 1 lower left incisor, 1 lower right incisor and molar 1; bird, unidentified feather and bone fragments; grass seed.

No. 6 Mouse, 1 lower right incisor; bird, unidentified feathers and bone fragments and gizzard with grass seed and insect fragments; grass seed.

No. 7 Mouse,, upper left 1 incisor, molar 1, 1 upper right incisor, 1 lower left incisor, 2 lower right incisors, 1 molar 1 & 2, 1 humerus; bird, unidentified feathers and bone; grass seed.

No. 8 Mouse fat; bird, unidentified feather and bone fragments; grass seed.

Pellet Fragment: Mouse, 5 upper left and 4 upper right incisors, 2 upper right molar 1, 6 lower left and 5 lower right incisors, 1 lower left molar 1 & 2, 2 lower right molar 1, 1 humerus and bone fragments, fur; bird, Yellow Hammer? (proximal femur) or bird of that size, bone fragment and feathers.

The contents of these pellets shows that Nankeen Kestrels in New Zealand prey on a range of species similar to those found in Australia. Yellow Hammers and Redpolls are not found in Australia, but are prey of the European Kestrel *(Falco tinnunculus)*.

I am most grateful to Mr B. J. Karl, Ecology Division, DSIR, for his analysis of these pellets.

W. J. POWELL, *Box 3024, Mahora, Hastings*

BANDED DOTTERELS ON THE VILLAGE GREEN

On the evening of 11 January 1961 when I was staying in Hokitika, I found at least 25 Banded Dotterels *(Charadrius bicinctus)* feeding over The Square, a sort of village green and sports ground with a concrete wicket near the middle. The dotterels flew in over the houses from the direction of the riverbed and some were running actually over the surrounding footpaths and roads.

Nine years later, on 4 January 1970, I was again in Hokitika and towards dusk made my way to The Square. This time I counted 29 Banded Dotterels, sharing the short turf of The Square with c. 100 Black-billed Gulls *(Larus bulleri)*, two dogs and some children. Again some of the dotterels appeared to be finding something to eat on the tar-seal. This confident acceptance of a man-made facility is most encouraging. Perhaps evening strollers who watch birds in Hokitika will be able to confirm whether this acquired habit persists.

During three visits to Westland, all in January, these are the largest gatherings of Banded Dotterels that I have seen; although on the evening of 5 January 1970 at least 20 were moving between the shingle banks of the Whataroa River and adjacent pastures down Flat Road. At Okarito between 3 and 7 January 1940 — and this involved walking the length of the boulder bank and lagoon both ways — W. Ridland and I noted only three; on 18 January 1961 I counted up to 6 near the rivermouth and on 5 January 1970 there were a few scattered among the stock which grazed the hummocky ground beneath which lie relics of one of New Zealand's deserted villages.

As breeding birds in Westland, Banded Dotterels are sparsely distributed on beaches, estuaries and the few suitable riverbeds. They have probably increased as European Man has thinned the forests and opened up the country; but short grass such as post-nuptial flocks favour is rather a scarce commodity.

The presence of flocks in winter suggests that some Westland Banded Dotterels are more or less sedentary. Peter Grant has reported (Classified Summarised Notes 1963-1970, *Notornis* Suppl. p. 48) that " a flock always winters on parks near Greymouth " and in early May 1976 P. M. Sagar recorded a flock of 20 on a paddock at Okarito township (*Notornis* 23: 337). The composition of these wintering flocks would be interesting to know. Do they contain any first-year birds ? Are they made up entirely of adults ?

The history and present status of Banded Dotterels in Westland could prove a fruitful field for research.

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REVIEW

Birds of my Kalam Country by Ian Saem Majnep and Ralph Bulmer; illustrations by Christopher Healey; published by Auckland University Press & O.U.P., 219 pp., 1977: $17.25.

This is an important book of unusual distinction. It is destined to appeal to seekers after knowledge in a variety of disciplines and it will become compulsory reading for all who are seriously studying tribal languages and ways of life in that immense island, New Guinea. The appendices are invaluable and the indexing meticulous.

The two authors, nurtured in very different backgrounds, have been happily associated since 1963 when Saem, a Kalam boy aged about 14, but already a skilful hunter and observant naturalist, impressed Bulmer by shooting a Woodcock *(Scolopax)*, a notoriously artful dodger, with a bow and arrow. Ralph Bulmer has been studying the Kalam people in the Central Highlands for twenty years; and being also an ornithologist of no little discernment, he has been especially interested in Man's use of the animals and plants provided by the forests and mountain valleys; for there is archaeological evidence that Man entered these highlands at least 15000 years ago. Bulmer defines four ecological zones in the Kaironk Valley Region, rising from 1500 m to 2700 m.

As an aid to clarity, different type-faces are used for the texts of the two authors. Of course, there were problems of language and interpretation. Saem, fortunately, is fluent in Pidgin and in conversational English; and Bulmer had acquired rather more than a smattering of Kalam. The authors thus switched backwards and forwards between Kalam, Pidgin and English as they worked together. Other experts or pioneers in Papuan linguistics were on hand for consultation. The resultant versions are a fluent English prose which is a joy to read.

In eighteen chapters Saem classifies the birds as he got to know them. Most of the titles are particularly apt, e.g. Birds that feed at flowering trees; Birds of the middle foliage; Birds that just fly constantly around; Birds of darkness, etc. Bats are treated as birds; but cassowaries apparently are not !

This substantial section is followed by six Kalam stories about birds. They should be read as Just-So Stories or Cautionary Tales, a mixture of weird fantasy and an earthiness which never becomes obscene.

Bulmer lists more than 200 species of birds reported from the Kalam country. Of the 95 non-passerines, 13 are hawks; 18 pigeons; 20 parrots and 7 cuckoos. The 107 passerines include 14 Birds of Paradise and 18 Honeyeaters. It is worth noting that *Eugerygone*, the Fidgeting Flycatcher, is placed not beside the gerygones in the Sylviinae; but among the flycatchers after *Petroica* and *Rhipidura*.

New Zealand naturalists, suffering from a historic lack of passerines, may well be green with envy. Moreover, Eurasia has come nosing into those cool highlands with *Motacilla, Saxicola, Phylloscopus, Lanius, Oriolus.* The roding of Woodcocks may be heard in the forests of beech *(Nothofagus)* and Common Sandpipers may visit the rivers.

The authors have been lucky both in their illustrator and with their publisher. Full marks to Christopher Healey for his admirable drawings in black and white; and to the craftsmen at the Auckland University Press.

New Zealanders are being urged to broaden their horizons and look out into the Pacific. Some have clearly been so doing for many years. This meaty and original book, scholarly and finely finished, should stimulate others.

R. B. S.

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Annotated checklist of the birds of New Zealand. (OSNZ)	$4.95
A field guide to the birds of New Zealand, by R. A. Falla, R. B. Sibson and E. G. Turbott, 2nd rev. ed.	$5.00

From B. D. Heather, 10 Jocelyn Crescent, Pinehaven, Upper Hutt:

A biology of birds, by B. D. Heather.	$1.33

From B. A. Ellis, 44 Braithwaite Street, Wellington 5:

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Banding reports, Nos 8-14, 50c each. (Nos 1-7 are incorporated in early issues of 'Notornis').	
Kermadec Expedition, 1964, by A. T. Edgar.	45c
Guide to Identification of Shearwaters and Petrels in New Zealand waters (Auckland Museum), J. P. Croxall	$0.50

All above, plus 10% of order to cover postage.

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GENERAL — Let at least two other people read your manuscript before sending it in and heed their comments. Check that all editorial requirements have been met and that all pages, tables and figures have been included; wrap and pack securely (especially photographs) and send to: The Editor, *Notornis,* P.O. Box 41-002, Eastbourne.

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