THE BIRDS OF WAIMEA INLET

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ABSTRACT

Monthly bird counts were made at low tide in 14 tidal zones at Waimea Inlet, Nelson, from August 1976 to July 1978. Other records, extending from 1955 to 1984, are included.

Seventy-five species were recorded: 52 estuarine species on the tidal flats and saltmarsh and 23 non-estuarine species on the inlet and its immediate shoreline.

For the estuarine species, the frequency of sightings, use of tidal zones, numbers of birds, seasonal changes in numbers, distribution, breeding status, and habits are given.

The numbers of birds at the inlet were highest from March to June in 1977 and 1978, owing to a winter increase in numbers of the South Island Pied Oystercatcher (*Haematopus ostralegus*), Southern Black-backed Gull (*Larus dominicanus*) and Red-billed Gull (*L. novaehollandiae*). Of the Northern Hemisphere migratory waders in summer, the most common were the Bar-tailed Godwit (*Limosa lapponica*) and the Knot (*Calidris canutus*).

The use of each tidal zone varied considerably month by month, some zones being notable for a high number of species, others for the particular species they attracted, often regularly.

The information collected demonstrates the importance of the inlet to a wide variety of bird species.

INTRODUCTION

Estuaries are valuable as one of the most naturally productive ecosystems. For conservation purposes, the public must understand why estuaries are valuable and hence why they should be protected from reclamation or pollution. Knowledge of the avifauna of an estuary is useful not only in itself, but also for what it can reveal of the biological productivity and other values of the ecosystem. It can be vital when the case for preservation and protection has to be argued.

In 1976 the Nelson Catchment Board asked other agencies and organisations for resource information on Waimea Inlet, in particular baseline environmental information, including the value and importance of the inlet to estuarine birds. At the time, the values of the inlet, including wildlife, were seriously threatened by reclamation and pollution, but very little was available on estuarine birds using the inlet.

The Wildlife Service decided to make regular counts of estuarine birds and to study their distribution and feeding. In August 1976, K. L. Owen (KLO) began a study of estuarine birds, namely waders, gulls, terns, shags, waterfowl, seabirds and swamp birds, at Waimea Inlet with the help of members of the Nelson Branch of the Ornithological Society of New Zealand (OSNZ) and other interested people.

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The census data show the importance of the inlet to estuarine birds and will allow early detection of detrimental changes to the habitat affecting estuarine bird numbers.

DESCRIPTION OF INLET

Physical description

Waimea Inlet is a few kilometres west of Nelson at the southern end of Tasman Bay at latitude 41° 18′ (see Figure 1). Formed in the post-glacial period, about 6000 years ago (Johnston 1979), Waimea Inlet covers about 3460 ha. It is 95% exposed at mean low water of spring tides and provides a wide expanse of intertidal land on which estuarine birds feed. The inlet comprises two major tidal areas, Mapua Arm and Waimea Arm, separated by several large islands but linked by tidal channels at the mouth of the Waimea River. Together the Mapua and Waimea Arms make up the intertidal area of the inlet.

Within the boundaries of the inlet are 10 islands: Rabbit (953 ha), Rough (142 ha), Bells (121 ha), Bests (112 ha), Bird (5.3 ha), Deadmans (4 ha), Saxton (4 ha), Oyster (3 ha), Pig (0.1 ha), and an unnamed island near Mapua that we shall call Grossis (0.1 ha).

Waimea Inlet discharges into Tasman Bay through the Mapua (west) and Waimea (east) Channels. It has two tidal cycles per day with an average flooding depth of about 1 metre. The volume of water exchanged during each cycle is 3.5 x 10^7 m^3, that is, 7 x 10^7 m^3 per day (two cycles per day). The tidal range is up to 4.2 metres on high water spring tides. The major freshwater

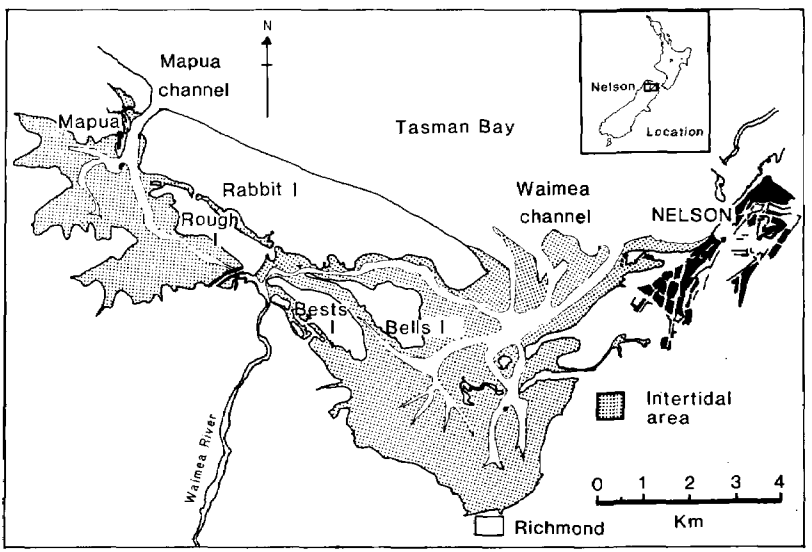

FIGURE 1 — Waimea Inlet, showing intertidal area and the position of some islands mentioned in the text

inflow is from the Waimea River which, including its major tributary, the Wairoa River, has a catchment of 800 km^2 (Stewart *et al.* 1981). The average daily freshwater input from the river to the inlet averages 1.4 x 10^6 m^3 but is much greater after heavy rains in the catchment area.

During a complete tidal cycle, the Waimea River flows into the inlet in a general westerly direction towards the Mapua Channel and Tasman Bay (K. Westcott, pers. comm.). Small streams and creeks, including Jenkins, Poorman, Orphanage, Saxton, Reservoir, Neiman, Redwoods Valley, and Pearl, flow into the inlet, but their combined flow is insignificant compared with the flow from the Waimea River.

Vegetation

The intertidal substrate varies, being mainly sandy in the outer inlet, a sand-silt mixture in the middle reaches, and mainly silty in the inner parts.

In a 1976 unpublished report to the Nelson Catchment Board Water Right Tribunal No. 765, MacRaild indicated that much of the inlet's substrate is a fine sediment which cannot support a large mass of algal material but does support beds of eelgrass (*Zostera muelleri*), microscopic algae such as *Euglena obtusa*, several species of blue-green algae, and many species of diatoms. *Zostera muelleri* is found in the Waimea Arm in a wide area, from banks near Saxton and Bells Islands to areas off the Richmond tip (K. Westcott, pers. comm.). Its distribution in the Mapua Arm is not known.

Tall saltmarsh is not widespread in the inlet and covers only about 10% of the area. Emergent vegetation is dominated by *Salicornia australis*, *Juncus maritimus* var. *australiensis*, *Leptocarpus similis* and *Spartina townsendii* (an introduced species). *Salicornia australis* has a patchy distribution just below the mean high water mark.

The rushes *Juncus maritimus* var. *australiensis* and *Leptocarpus similis* occur at high water mark and are most abundant on the upper tidal flats of the central part of the inlet. This vegetation is taller and thicker than *Salicornia australis* and provides better cover for some species of birds, but not waders.

An unpublished report (Russ 1975, NZ Wildlife Service file W/L: 31/5/1) shows that *Spartina townsendii*, planted originally at Mapua in about 1932 and at two other sites in the inlet in October 1948, has increased its range and in September 1975 covered about 16 ha of the inlet. It is still increasing. This vigorous coloniser is destroying the character of valuable estuarine habitat for waders and other estuarine species by covering the tidal flats with dense vegetation which few waders or other estuarine birds can cope with. *Spartina* marshes are therefore poorly used by birds.

Aquatic invertebrates

A study of the ecology of selected sites near Mapua in 1977 by Bolton & Knox (1977) showed that some 58 species of macrofauna were present. Compared with two other South Island estuaries, the Avon-Heathcote Estuary and Parapara Inlet, some parts of the Waimea Inlet support a very dense fauna and have high biological productivity (Bolton & Knox 1977). Further studies are needed on the macrofauna because Bolton & Knox's study covered only one small part of the estuary.

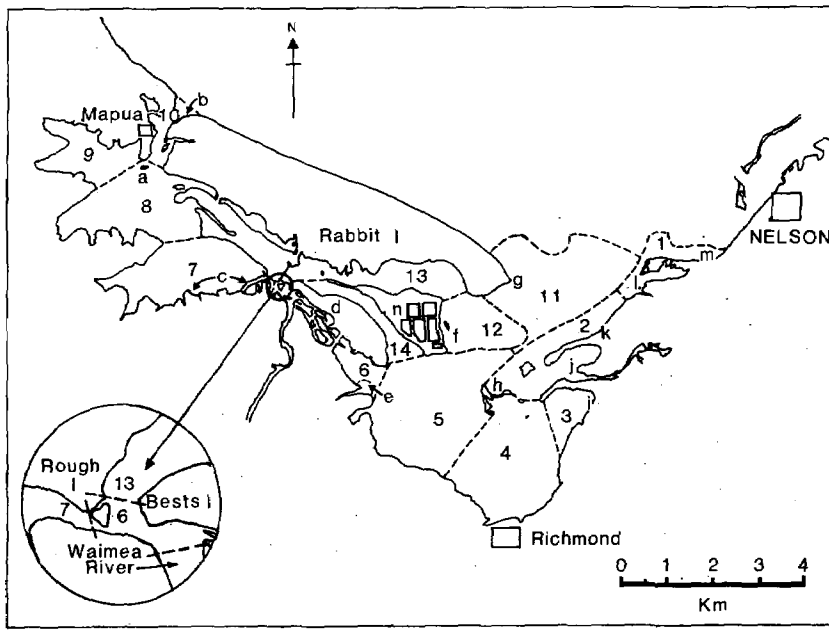

FIGURE 2 — The 14 tidal zones used in the study and the known shorebird roosts (a-m)

(a) Grossis Island (b) Rabbit Island (west end) (c) Shoreline between Redwoods Valley Stream and Redwoods Road (d) Bests Island (golf course) (e) Neiman Creek mouth (f) Bells Island shell-bank (g) Rabbit Island (east end) (h) Saxton Island (i) Songer Street at inlet (j) Jenkins Creek mouth (k) Nelson Airport (l) Parkers Road beach (m) Tahunanui Beach and sports fields and (n) Bells Island oxidation ponds

The insert shows the position of the boundaries between zones 6, 7 and 13

February 1978. The species most likely to have been affected are South Island Pied Oystercatcher, Bar-tailed Godwit, Pied Stilt, Knot and Red-billed Gull.

Further observations by OSNZ members and KLO on the birdlife of the inlet and the surrounding Nelson region before August 1976 and between July 1978 and November 1984 are included in the results and in the notes on individual species.

RESULTS

Seventy-five bird species were recorded at the inlet. The 42 estuarine species included ten waders, five shags, five terns, five waterfowl, three gulls, three herons and two egrets, and one each of skua, rail, harrier, kingfisher, swallow, gannet, spoonbill, ibis and bittern. Twenty-six species were seen on at least half of the visits to the inlet, and 16 species were seen on fewer than 25% of visits. Six of the international migratory species were observed only once.

Figure 3 shows the number of estuarine bird species observed at the inlet on each monthly visit. The number ranged from 19 species in March 1977 to 30 species in August 1977 ($\bar{x} = 24.4 \pm SD\ 2.2$).

The number of species present declined from September to November in both 1976 and 1977 and increased from November to December. The number declined as New Zealand species moved from the inlet to their nesting areas and increased as Northern Hemisphere migratory waders arrived. From

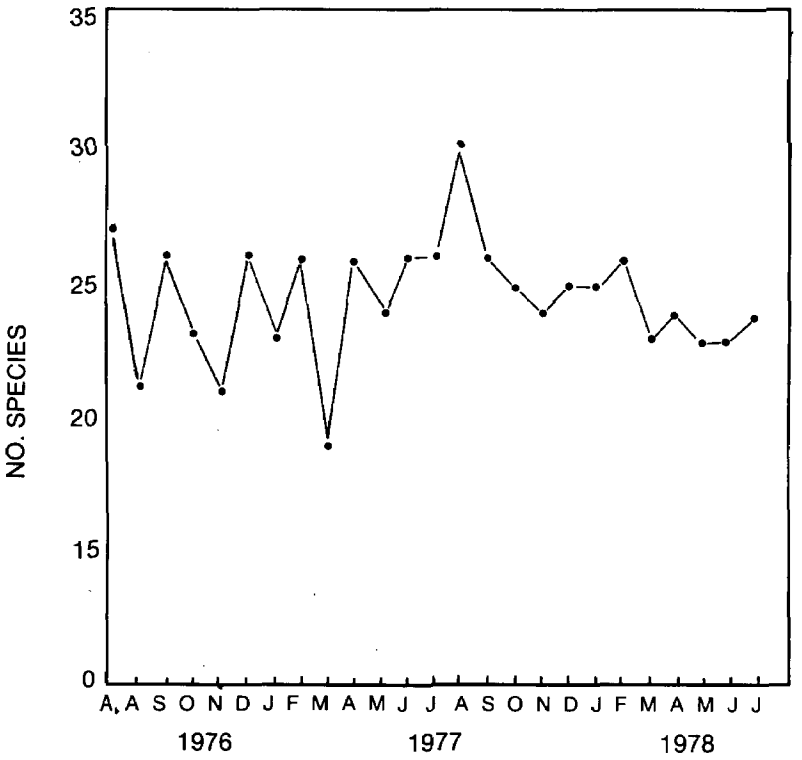

FIGURE 3 — Monthly variation in total number of species of birds observed at Waimea Inlet from August 1976 to July 1978

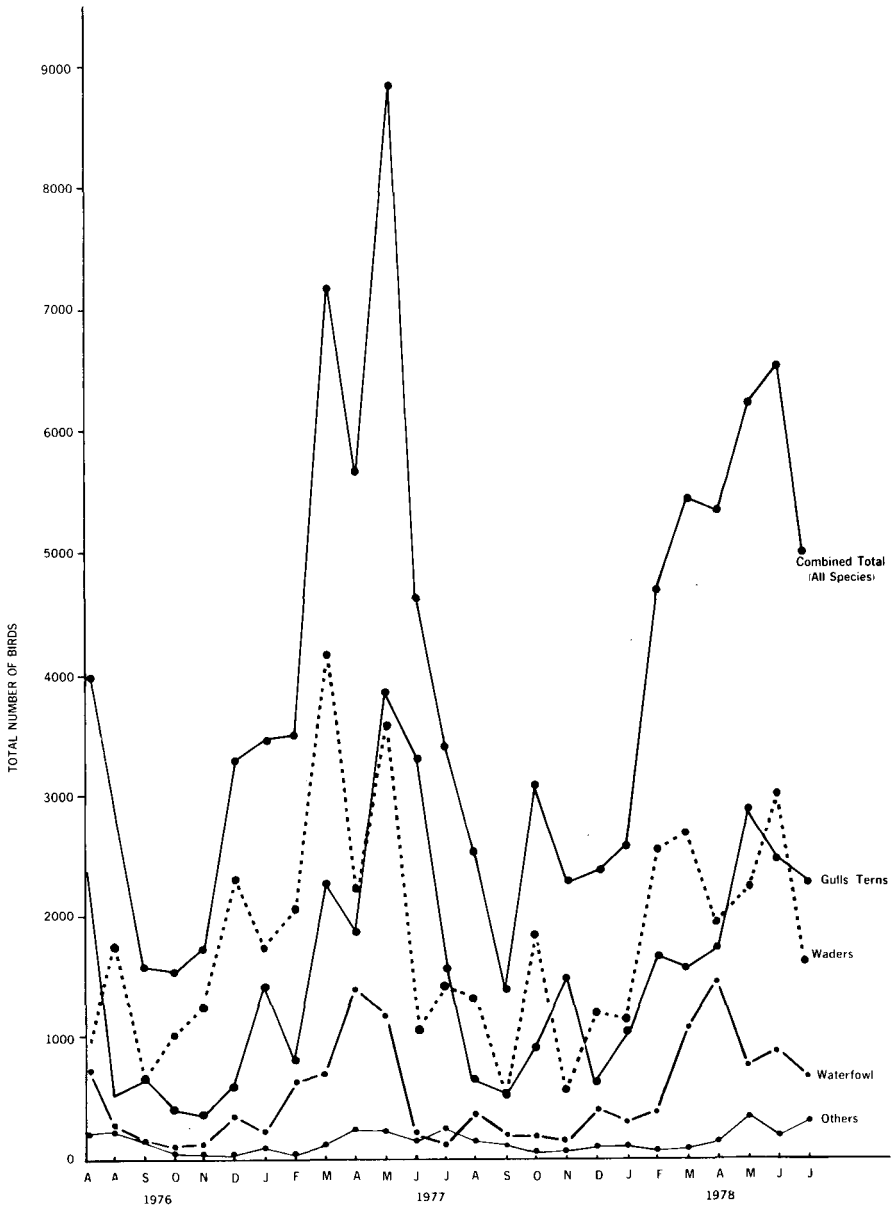

FIGURE 4 — Monthly variation in total number of birds observed at Waimea Inlet from August 1976 to July 1978. Non-estuarine birds are excluded

TABLE 1 — Number of birds at Waimea Inlet (seasonal averages)

Year	Spring (Sep-Nov)	Summer (Dec-Feb)	Autumn (Mar-May)	Winter (Jun-Aug)
1976-1977	1630	3430	7250	3490
1977-1978	2250	3260	5700	5770*

* June and July of 1978 only

February to March, the number of species again declined as the Northern Hemisphere migratory waders departed for their breeding grounds, but from March to April an increase occurred as the local breeding species returned to the inlet for the winter. The number of species was highest in the central part of the inlet (tidal zones 6, 7, 8, 12 and 13), which is generally intact, more diverse, and relatively undisturbed.

Figure 4 shows the monthly changes in the total number of birds at the inlet and in the four groups of waders, gulls/terns, waterfowl, and others.

Total numbers varied seasonally (Table 1) more than did the number of species. Numbers were highest in the autumn and early winter (March to June) of 1977 and 1978 when three local species, South Island Pied Oystercatcher, Southern Black-backed Gull, and Red-billed Gull, were at the inlet. When these species left for their nesting grounds in late winter to early spring, the total number of birds decreased greatly. Peak numbers were 8854 birds in May 1977 and 6589 birds in June 1978. Lowest numbers were 1546 birds in October 1976 and 1379 birds in September 1977.

The seasonal averages show that, in 1976-1977, the inlet was used by a similar number of birds in summer and winter but that, in 1977-1978, more birds were present in winter. The numbers of Northern Hemisphere migratory waders are small compared with those of the larger northern New Zealand estuaries (Veitch 1978), the most abundant being the Bar-tailed Godwit.

We shall now, for each species observed at the inlet, give the frequency of sightings, number of birds, seasonal variation in numbers, distribution, breeding status, and habits.

AUSTRALASIAN GANNET *Sula bassana serrator*

One bird feeding in the Waimea Channel (zone 12) near Bells Island in January 1977 is the only record of this species at the inlet.

SHAGS

Figure 5 gives the monthly variation in the total number of all five shag species seen at the inlet during this study. Each species is discussed separately below.

Shags were most numerous in autumn and winter and fewest in late spring and early summer. From only 14 birds in October 1976, the number increased to 201 in April 1977, declined to only 7 in November 1977, and rose again to 279 in May 1978. This seasonal variation occurs because the shags move to their breeding colonies in August and September and return

after breeding. The distribution pattern at the inlet suggests that the central tidal zones (zones 6, 7, 8, 13, and 14) were used all year but least in December. The eastern and western ends of the inlet were not used continuously by shags, which were rarely there in summer.

BLACK SHAG *Phalacrocorax carbo*

This shag was recorded on 24 of the 25 monthly counts. Numbers ranged from 0 in March 1978 to 164 in July 1978. The Black Shag is common at Waimea Inlet all year, mostly dispersed widely in small groups. In winter large flocks were observed resting in groups on exposed sandbanks in zones 11, 12 and 13 near the mouth of the Waimea Channel. Large flocks were recorded as follows: 125 in zone 12 on 7 August 1976, 100 in zone 11 on

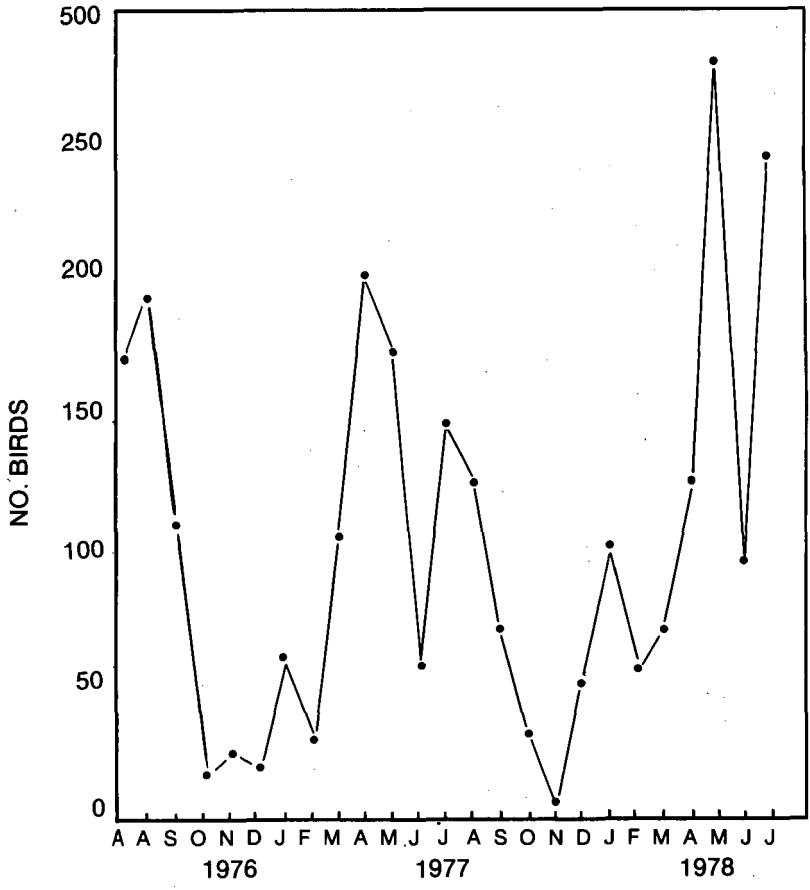

FIGURE 5 — Monthly variation in numbers of the five shag species (totals combined) at Waimea Inlet from August 1976 to July 1978

28 August 1976, 58 in zone 13 in September 1976, 37 in zone 12 in May 1977, and 155 in zone 11 in July 1978. From mid-July to late August, just before the breeding season, the numbers increased considerably. Numbers were lowest in spring and early summer.

The Black Shag breeds on inland rivers and along the coast. Breeding colonies are on the Motueka, Pelorus, Gowan, and Sabine Rivers in the Nelson region (D. Zumbach, pers. comm.) and at 'Harvey's' Lagoon, Croixelles Harbour, Marlborough Sounds. The Motueka River colony has about 35 pairs of Black Shags (D. Zumbach, pers. comm.) and 'Harvey's' Lagoon had 15 pairs in August 1977 (KLO).

PIED SHAG *P. varius*

This shag is not as abundant at Waimea Inlet as the Black Shag but was seen on 22 of the 25 counts. Numbers ranged from 0 in March 1977 to 101 in April 1977. Fewer than 10 birds were counted 15 times; 11-33 birds five times; and over 100 birds once.

Moncrieff (1928) noted that in 1926 Pied Shag numbers increased in autumn in Nelson Bay. A similar seasonal increase was noted in this study.

One of the nearest known breeding sites to the inlet is at Croixelles Harbour, Marlborough Sounds. In August 1977, about 25 pairs of Pied Shags nested there, along with Black and Little Shags, in a small coastal-forest remnant overlooking 'Harvey's' Lagoon. A small colony is also in Whangarae Bay nearby (J. M. Hawkins, pers. comm.). Other colonies have been recorded in the Marlborough Sounds in the past but their present status is little known. Recent nesting has taken place on the eastern side of D'Urville Island and at Post Office Point at the entrance to Pelorus Sound (J. M. Hawkins, pers. comm.). For the last 15-20 years, up to 20 Pied Shags, along with a few Little Shags, have roosted in a row of tall Norfolk pines on Rock's Road, Nelson City, 3 km northeast of the inlet. In 1979, 1980 and 1981 one pair nested and reared young there. Since 1982, this colony has grown to about 10 breeding pairs (J. M. Hawkins, pers. comm.). Some of these birds fly to the inlet to feed.

LITTLE BLACK SHAG *P. sulcirostris*

This shag was seen at Waimea Inlet on 15 counts, but the numbers were always low. The number of birds ranged from 0 (10 counts) to 8 (November 1977). This shag is uncommon at the inlet and in the Nelson area generally (Zumbach, CSN 1972, KLO pers. obs), but recent observations at the inlet show that it is seen in most summers (J. M. Hawkins, pers. comm.). The presence of this species in summer differs from coastal places elsewhere, where it appears in winter months, except in breeding localities such as Rotorua and Waikato (B. D. Heather, pers. comm.).

LITTLE SHAG *P. melanoleucos*

This shag was seen on all 25 counts. The number of birds ranged from 2 in December 1977 to 179 in May 1976. They were fewest from mid-September to March, while adults were at their inland breeding sites. Small coastal breeding colonies are present from Nelson to French Pass (Zumbach, CSN 1972). The 'Harvey's' Lagoon colony in Marlborough Sounds had nine nesting pairs in August 1977 (KLO, pers. obs). The Little Shag has nested at several other sites in the Marlborough Sounds in the past, but their present status is unknown.

It has recently been seen nesting with Pied Shags at D'Urville Island, Post Office Point (Pelorus Sounds), and Whangarae Bay in the Croixelles Harbour (J. M. Hawkins, pers. comm.).

SPOTTED SHAG *Stictocarbo punctatus*

This shag, primarily a coastal bird, was seen at the inlet on 10 counts, but only in late autumn, winter and early spring (May-September). The number of birds ranged from 1 in November 1977 and May 1978 to 86 in July 1977. During the autumn of 1977, Spotted Shags were more common than usual, many birds looking in poor condition. Perhaps sick birds had entered the inlet to feed and rest. From 24 April to 5 May 1977, 40 dead Spotted Shags were collected by KLO from inner Tasman Bay beaches, including the inlet, and dead birds were found also in Golden Bay and as far away as Wellington (J. A. Bartle, pers. comm.). Many of the dead shags were emaciated, and a post mortem of two birds disclosed worms in their proventricular intestines (Owen, CSN 1977). The sudden deterioration of the autumn weather noted at the time may have increased the mortality — temperatures dropped sharply and snow fell on local mountains.

In winter, more than 500 shags roost daily on Fifeshire (Arrow) Rock, a small coastal rock stack near Tahunanui Beach (zone 1), 3 km east of Waimea Inlet and several hundred shags roost on the Nelson Harbour breakwater further to the east. Pepin Island is another notable roost, where up to 2000 birds are regularly seen in winter. Shags fly regularly from these roosts to the nearby feeding grounds of inner Tasman Bay, including the inlet.

Spotted Shags leave the inner Tasman Bay winter roosts by late September and either return to the small breeding colonies in the Marlborough Sounds or, by the Marlborough Sounds and the Kaikoura coast, to the large breeding colonies on Banks Peninsula.

Spotted Shags breed in Admiralty Bay, Marlborough Sounds, while large numbers are still in Tasman Bay (J. M. Hawkins, pers. comm.). Moncrieff (1928) recorded in 1926 that "black shag (*Phalacrocorax carbo*) were more numerous in the autumn months in Nelson Bay, following the movements of fish" and "once, when a shoal entered the harbour, over a hundred shags were on Fifeshire (Arrow) Rock where usually there are from a dozen to twenty". Moncrieff's 'black shag' were probably wintering Spotted Shag, which have traditionally used Fifeshire Rock as a roost for many years, arriving in autumn and leaving the Rock and Tasman Bay in early spring. Moncrieff's notes therefore indicate that Fifeshire Rock has been used by wintering Spotted Shags for at least 59 years. Over the last 9 years, Black Shags have only rarely been seen on Fifeshire Rock and then very few (KLO).

WHITE-FACED HERON *Ardea novaehollandiae*

This heron was seen in all counts, the numbers ranging from 19 in September 1977 to 143 in May 1977, as shown in Figure 6.

Numbers varied strongly in 1976-1977 but less so in 1977-78. From August to November 1976, fewer than 50 birds were present. This may reflect a movement of breeding birds away from the inlet to nearby inland nesting sites.

Adults and juveniles returned to the inlet in December 1976, and numbers fluctuated before increasing from 78 in February 1977 to a peak of 143 birds in May 1977. In the following winter and early spring, numbers decreased sharply as adults moved inland and then increased again from a low of 19 in September 1977 to a peak of 104 birds in February 1978. The sharp decline in winter 1977 reflects the movement of birds away from the inlet to feed on coastal farmland.

The first record of White-faced Heron in the southern estuaries of Tasman Bay was by Wakefield in 1888, who noted that the species had been present for many years (Carroll 1970). Carroll's study showed that the species became common in the Nelson region in the 1945-1950 period (Carroll 1970).

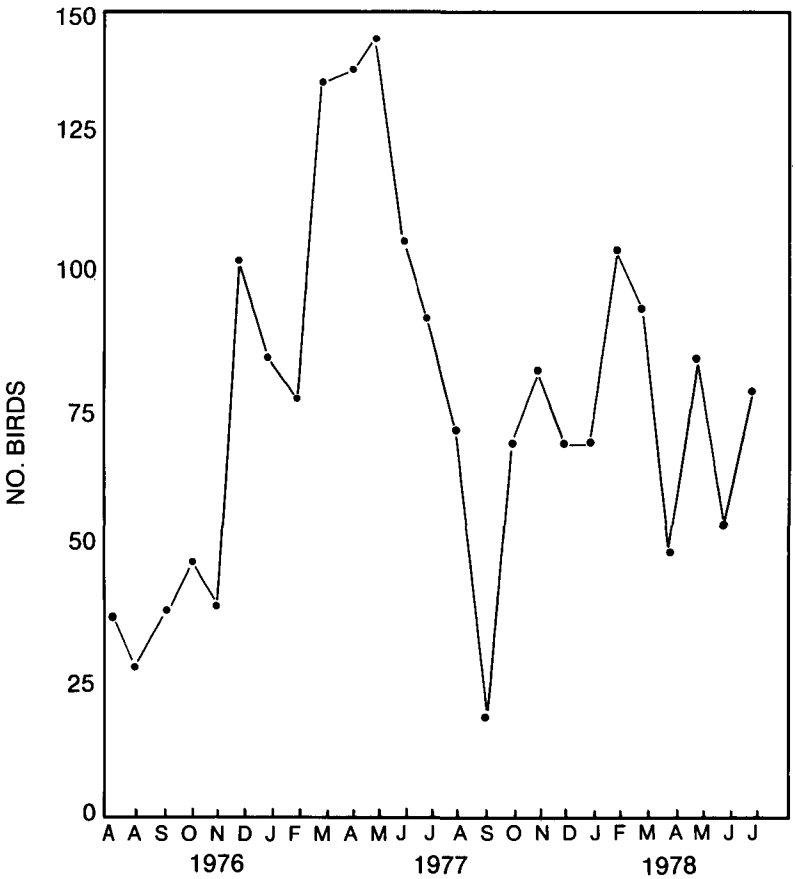

FIGURE 6 — Monthly variation in numbers of White-faced Herons at Waimea Inlet from August 1976 to July 1978

The White-faced Heron seemed to keep changing its use of the estuary during the study period. For example, tidal zone 2 was used by more birds in March and April than at other times of the year. Birds were most abundant in the central and eastern parts of the inlet (zones 2, 4, 5, 7 and 8), but other zones that included tidal channels were also frequently used.

WHITE HERON *Egretta alba*

This species was recorded at the inlet in June 1962 (Cavanagh, CSN 1972) and December 1962 (Kinsky, CSN 1972). A few White Herons were present on 23 of the 25 monthly counts. They did not associate in groups, even when as many as 11 were at the inlet in August 1977. Usually 2-6 birds were seen in the central part of the inlet (zones 6 and 7), where human disturbance was least.

Only 1 or 2 birds were seen at the inlet in November and December each year. These birds may have been immature non-breeders or Australian vagrants.

The inlet is of national importance for the number of White Heron it supports regularly (2-6 birds). In the OSNZ national survey of egrets on 27-28 August 1977, of the national total of 83 White Heron recorded, 7 (8%) were in the inlet (Heather 1978; J. M. Hawkins, pers. comm.). Of the South Island subtotal of 42 White Heron recorded, about 16% were at the inlet.

Table 2 shows the monthly numbers of White Herons, Little Egret and Royal Spoonbill and the tidal zones of the inlet that they were in.

The table shows that White Herons most favoured tidal zone 7. Of the 71 observations in the table, 19 were of 1-4 birds in tidal zone 7. Other favoured tidal zones, in order of preference, were 6 (12 observations), 8 and 10 (8 observations), 5 and 14 (5 observations), 4 and 13 (4 observations) and 2, 3 and 9 (2 observations). In tidal zone 10, nearly all sightings were made at or adjacent to the enclosed tidal arm at Mapua. This tidal arm ponds water at low tide, making it a popular site for feeding and resting White Herons.

White Herons were not recorded in tidal zones 1, 11 or 12. These tidal areas are at the mouth of the Waimea Arm of the inlet adjacent to the open sea, but whether this makes them unattractive to White Heron is not known.

Tidal zone 7 was most favoured probably because it provides adequate food and is relatively free from disturbance so that the White Herons can rest and preen when not feeding.

LITTLE EGRET *Egretta garzetta*

The only records at the inlet before the present study were of single birds at the mouth of the Waimea River in November 1955 (Heather 1957) and November 1958 (MacKenzie, CSN 1960).

During this study, 1-4 Little Egrets were seen on 22 of the 25 monthly counts (Table 2). An OSNZ national survey in August 1977 revealed 22 Little Egrets in New Zealand (Heather 1978), and in the same month, 3 Little Egrets were seen in the inlet. The inlet is therefore of national importance for Little Egrets. Table 2 shows that Little Egrets clearly preferred tidal zone 7. Of the 36 observations in the table, 21 (58%) were of 1-3 birds in tidal zone 7. The other tidal zones, in decreasing order of use, were zones 6, 8, 9, 14, 2, 3, and 10.

TABLE 2 — Numbers of White Heron, Little Egret and Royal Spoonbill and their tidal zones, April 1976 — July 1978

Dates	WHITE HERON Number/Tidal Zone	LITTLE EGRET Number/Tidal Zone	ROYAL SPOONBILL Number/Tidal Zone
13/04/76 (KLO pers. obs.)	1/3 1/4 3/7	-	21/7
29/04/76 (KLO pers. obs.)	2/6 2/7 1/13	-	19/7
12/06/76 (KLO pers. obs.)	2/7	2/7	7/7 2/8
STUDY PERIOD			
07/08/76	3/6 1/8	1/7 1/8	2/5 7/7
28/08/76	1/6 2/7 1/10/ 1/13	-	7/7
18/09/76	1/7 1/8 1/10	2/7	7/7
30/10/76	4/7	1/6 2/7	4/7
13/11/76	1/10	1/7	4/7
11/12/76	1/6	1/7	7/7
15/01/77	-	2/7	11/7
14/02/77	2/7	1/7	14/7
26/03/77	1/4 1/5 2/7 1/10	-	16/7
23/04/77	1/4 2/6 1/7 1/8	1/6 1/7	12/8
07/05/77	1/5 2/6 1/8 1/9	2/6	6/5 1/9
11/06/77	2/7 1/8 1/9 1/13 1/14	1/7 1/8	-
09/07/77	1/7 1/8 1/10	1/7 3/8	-
20/08/77	1/2 1/3 1/4 1/6 3/7 1/10 1/13 2/14	1/7 1/8 1/14	10/7
03/09/77	1/2 1/7 1/8 1/10 1/14	1/3	7/7
18/10/77	1/5 1/6	1/7	12/7
05/11/77	2/6	3/7	7/7
13/12/77	-	2/7	-
14/01/78	5/5 1/7	1/7	4/7
11/02/78	2/7	2/7	9/7
04/03/78	2/6 2/7 1/14	2/7	10/7
01/04/78	1/6 2/7 1/8 1/14	3/7	17/7
27/05/78	1/5 2/6 2/7	1/7 2/9 1/14	5/7
24/06/78	1/10	1/6 1/9 1/10	2/7
15/07/78	3/7	1/2 2/7	-

The species was not recorded in tidal zones 1, 4, 5, 11, 12 and 13, which are in the Waimea Arm of the inlet. Why these zones were not used is not known, but human disturbance could be a factor.

REEF HERON *Egretta sacra*

One recorded in June 1978, in zone 6, is the only record for the inlet.

CATTLE EGRET *Bubulcus ibis*

The first record in Nelson was at Swamp Road (near zone 5) in the 1963-1970 period (Boyce, CSN 1972).

The only Cattle Egret seen on the inlet during the study was one in September 1977 in tidal zone 7. During the study period, however, 5-20 Cattle Egrets were seen on five occasions with cattle on farmland at nearby Appleby on the Waimea Plains, adjacent to the central part (zones 6 and 7) of the inlet. Cattle Egrets have increased steadily since 1976, arriving in May, wintering near Appleby, and leaving in late October-early November to breed in south-eastern Queensland and north-eastern New South Wales (Heather 1982). Recoveries in New Zealand of birds banded at these colonies confirms that birds do disperse to New Zealand (B. D. Heather, pers. comm.).

More recently groups of 20 or more birds have been observed on the Waimea Plains and at other localities in the region each winter. However, since 1981, no more than 6 have been recorded on the Plains (J. M. Hawkins, pers. comm.), perhaps because much of its favoured habitat, open grazed pasture, has been replaced by intensive horticulture farming.

AUSTRALASIAN BITTERN *Botaurus stellaris*

Bitterns were seen four times during the study: at the wetland habitats of Neiman and Pearl Creeks near the central part of the inlet, in the saltmarsh communities of Rough Island, and on the edge of tidal zone 7 at the mouth of Redwoods Valley Stream. Waimea Inlet is one of the few places where this species can be found in the Nelson region (Golden Bay and Waimea Counties), although the numbers are very low (KLO, pers. obs.).

GLOSSY IBIS *Plegadis falcinellus*

One was recorded during the study at tidal zone 5 in April 1977. Previous records at the inlet are one at Rough Island (zone 7) associating with Paradise Shelduck on wet boggy land in July 1970 (Boyce, CSN 1972) and three over several weeks in November 1972 (Boyce, CSN 1973). None of the birds stayed long at the inlet.

ROYAL SPOONBILL *Platalea leucorodia*

Royal Spoonbills have been seen at the inlet for many years with sightings in June 1962 (9 birds at Mapua) (Cavanagh, CSN 1972), June 1972 (5 at Rough Island) (Keeley, CNS 1972), 11 in March-April 1974 and at least 5 in June 1974 (Boyce, CSN 1974) and 21 in zone 7 in April 1976 (KLO, pers. obs.). This species was seen on 21 of the 25 counts at the inlet. Highest numbers were observed in late summer and autumn of 1976, 1977 and 1978, when between 9 and 21 birds were counted.

The inlet is of national importance for Royal Spoonbill, having at times between 4% (2 birds) and 43% (21) of the national population. In the national OSNZ survey of egrets in August 1977, the national total was 49, of which 9 (18%) were at Waimea Inlet (Heather 1978; J. M. Hawkins, pers. comm.).

Table 2 shows the monthly numbers of Royal Spoonbill during the study and the tidal zones they were in. Tidal zone 7 was by far the most preferred zone.

In the 27 observations between April 1976 and July 1978, Royal Spoonbills were recorded in only three tidal zones: zone 7 (22 observations), zones 5 and 8 (twice each) and zone 9 (once).

These tidal zones (5, 7, 8 and 9) were in the centre and at the eastern end of the inlet, where human disturbance was least. The largest number

was 21 in April 1976 (KLO, pers. obs.). In recent high-tide observations, numbers have ranged from 16 to 22 birds at the inlet (J. M. Hawkins, pers. comm.).

Royal Spoonbill were usually absent from the inlet in June and July in 1977 and 1978. They were probably at nearby Moutere Inlet and Motueka Spit estuary, 19 km northwest of the inlet, where Royal Spoonbill numbers increased in June and July. This pattern of Royal Spoonbill movement between these two estuaries has been confirmed more recently (J. M. Hawkins, pers. comm.).

Royal Spoonbills were almost always at the inlet as one loose flock, whereas White Herons were always solitary. The Royal Spoonbill, White Heron and Little Egret all had a marked preference for zone 7, suggesting that some of their habitat requirements could be similar. All three return each year and re-establish feeding territories in tidal zone 7. Similar fidelity to winter feeding sites by White Heron and Royal Spoonbills has been observed over many years at the Moutere Inlet and at Motueka Spit estuary.

Tidal zones 1, 11 and 12 were not frequented by Royal Spoonbills, White Heron or Little Egrets and zones 4 and 13 were not frequented by Royal Spoonbill or Little Egret. These seemingly unattractive tidal zones, all in the Waimea Arm, are subject to human disturbance and are well away from a freshwater influence.

For many years Royal Spoonbills have nested, or attempted to nest, at the White Heron colony in South Westland, with little success in recent years. Since 1980, they have also bred at Wairau Lagoon, near Blenheim (Holdaway 1980), and the numbers breeding there have increased slowly each year (W. F. Cash, pers. comm.).

BLACK SWAN *Cygnus atratus*

Black Swan were uncommon at the inlet. They were recorded on only 6 counts during the study and no more than four were seen. The central tidal zones were the preferred habitat, corresponding with the known beds of eelgrass (*Zostera muelleri*), an important food for swan but a sparse plant at the inlet. Birds were seen only in summer and did not seem to stay long, perhaps being on migration to Farewell Spit, 82 km northwest of the inlet. In November-March each year, up to 13 000 Black Swan congregate at Farewell Spit to moult and to feed on extensive beds of eelgrass (Williams 1977).

CANADA GOOSE *Branta canadensis*

One bird seen in tidal zone 4 on September 1976 seems to be the first record at the inlet. Few Canada Geese are known in the Nelson region, but transient birds or pairs are occasionally seen on the river flats and lakes of the high country at the southern end of the region.

PARADISE SHELDUCK *Tadorna variegata*

Paradise Shelduck were most abundant at the inlet in late summer and autumn. Few were present in winter. They varied from 0 to 352 birds, usually in the central part of the inlet. Numbers were highest in March 1977 (126) and April 1978 (352). The main influx was just before the waterfowl hunting season, when several large flocks of non-breeders were observed. Tidal zones 5, 6 and 7 were favoured, probably because they are adjacent to farmland

with the grass and clover pasture the shelducks prefer. The Paradise Shelduck, a popular gamebird, is hunted in many parts of the Nelson region, especially in the southern and western parts, where large numbers use the grass riverflats and terraces of the wide river valleys, e.g. Matakitaki River valley.

GREY DUCK *Anas superciliosa*
MALLARD *Anas platyrhynchos*

Grey Duck and Mallard numbers were combined for this study because they could be confused at a distance, although most of the ducks seen well were Mallard. One or other of these two species was observed at each count. They were seasonal (see Figure 7), highest numbers occurring from February to May in 1977 and from March to July in 1978.

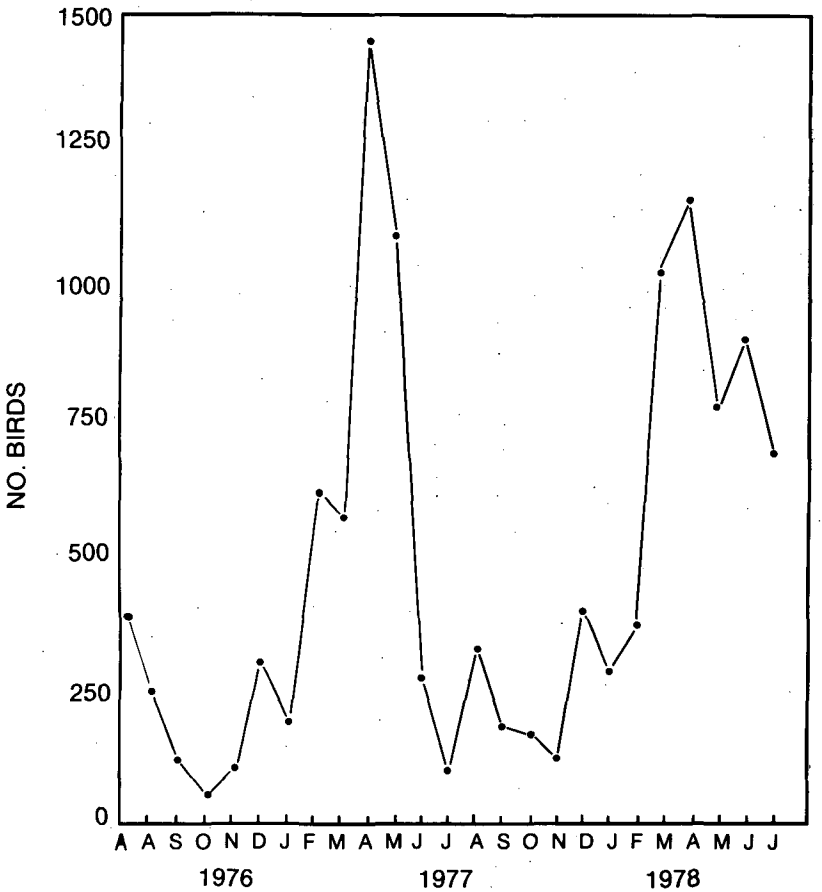

FIGURE 7 — Monthly variation in numbers of Grey Duck and Mallard at Waimea Inlet from August 1976 to July 1978

Maximum numbers were 1390 in April 1977 and 1150 in April 1978. The numbers were lowest from August 1976 to January 1977 and from June 1977 to February 1978, when fewer than 400 were recorded in any one month. In both years, the numbers were lowest in September-November and highest in April.

Figure 7 shows that the influx of these two species to the inlet occurs just before the waterfowl hunting season, which is from mid-April to late June. The inlet provides some safety and has suitable habitat and food. Both species filter marine organisms and plant matter from the water and mud of the inlet, dabbling in shallow water and feeding over the exposed tidal flats at low tide. They were most numerous in zones 4 and 7, which have large tidal flats with many channels. During the waterfowl hunting season the numbers increased greatly in areas 6 and 12, possibly because hunting and disturbance were less there. In all the tidal zones, peak numbers seemed to coincide with waterfowl hunting on the inland ponds and dams that the ducks normally frequent. The inlet is the most important waterfowl hunting area in the Nelson region, with 64 maimais (hunting stands) used by about 120 hunters, but despite this heavy hunting pressure, it is a haven for ducks.

Both species breed around the margins of the inlet and along the tidal creeks.

NEW ZEALAND SHOVELER *Anas rhynchotis*

Although Shovelers were seen twice on freshwater creeks that flow into the inlet, they were not recorded in the inlet. The Shoveler is a rare visitor to the Nelson region, which lacks suitable freshwater wetland habitat.

NEW ZEALAND SCAUP *Aythya novaeseelandiae*

This species is a rare visitor to the coastal areas of the Nelson region, although it is common on the inland lakes of Nelson Lakes National Park North-West Nelson Forest Park. A female handed in by a waterfowl hunter to the Nelson Acclimatisation Society ranger in April 1980 seems to be the first record from the inlet. This bird was mistakenly shot during the gamebird season in a tidal channel between Rabbit and Rough Islands, locally known as the "traverse".

AUSTRALASIAN HARRIER *Circus approximans*

The Harrier was seen on 20 of the 25 counts, its numbers ranging from one to six. Most of the sightings were in tidal zones 5, 6, 7 and 8, which have farmland nearby and the least human activity. The birds were seen resting on the *Salicornia australis* saltmarsh meadows feeding on prey or quartering the upper tidal reaches searching for prey. Suitable nesting areas are the margins of the central part of the inlet with tall saltmarsh vegetation. With adequate food supply and nesting places, the Harriers seen were probably permanent residents of the inlet and its margins.

BANDED RAIL *Rallus phillippensis*

Banded Rails were not recorded during this study, but they are secretive and were not specifically searched for. Since July 1978 they have been seen on the upper tidal flats of the inlet. Tidal zones 5, 6, 7, 8, 9 and 10 have large saltmarsh areas, comprising *Juncus maritimus* var. *australiensis* and *Leptocarpus similis*, which are an important habitat for Banded Rails at the

inlet. In the 1980-81 breeding season several nests were found in these saltmarsh zones (G. Elliott, pers. comm.).

Banded Rails have been found in various tidal creeks and saltmarsh areas within the estuaries of Tasman and Golden Bays since the study. Using tape recordings of Banded Rail calls, KLO was able to elicit responses from birds in dense saltmarsh areas in a number of estuaries (KLO, pers. obs.). Banded Rail saltmarsh habitat is under continuous threat at the inlet from human development because it is at the upper margins, the first parts to be taken by reclamation. Since 1956, many areas of saltmarsh have been reclaimed for farmland, industry or other purposes at the inlet, greatly reducing the Banded Rail habitat.

Banded Rails have a discontinuous distribution in the South Island, being restricted to Buller, Golden Bay, Nelson, Marlborough Sounds, and, after a large gap, the islands around Stewart Island. Because of the bird's limited range in the South Island, every saltmarsh area it uses at the inlet should be preserved.

MARSH CRAKE *Porzana pusilla*

This species was not seen during the study period. Previous sightings were of 4 birds on mudflats near Richmond in April 1963 (Zumbach, CSN 1972), 2 in March 1973 and 5 on a later occasion (Boyce, CSN 1973), and 1 near Nelson Airport in an enclosed tidal embayment in February 1977 (Owen, CSN 1977). All these birds were in tidal creeks or saltmarsh areas around the upper margins of the inlet. The Marsh Crake occupies similar saltmarsh habitat to that of the Banded Rail at the inlet. This observation was confirmed in 1980 when both species were seen on several occasions in the same saltmarsh areas of the inlet (G. Elliott, pers. comm.). Reclamation has diminished the habitat of the Marsh Crake at the inlet, and so its numbers there are probably low.

PUKEKO *Porphyrio porphyrio*

The Pukeko was in every count during the study, usually near saltmarsh areas on the upper tidal flats or on adjacent farmland. The number of birds ranged from 2 to 22 but was usually fewer than 10. Figure 8 shows the seasonal variation. More birds were seen from August to November of 1977 than in other months, but a similar trend did not occur in 1976. The Pukeko is a permanent resident of the upper saltmarsh and adjacent farmland. The higher numbers recorded are probably near the actual number that the inlet and its margins support. Some breed at the edge of the inlet and along the margins of tidal creeks.

SOUTH ISLAND PIED OYSTERCATCHER *Haemotopus ostralegus finschi*

This was one of the most abundant species at the inlet. It was seen in every monthly count, the numbers ranging from 332 in September 1976 to 2885 in May 1977. Figure 9 shows the seasonal variation of total numbers at the inlet.

During the 1976 breeding season, from early August 1976 to December 1976, many birds were absent from the inlet, presumably on their inland breeding grounds. The nearest breeding grounds from the inlet are south along the wide braided sections of the Upper Buller, Wairau, and Matakitaki River systems (KLO).

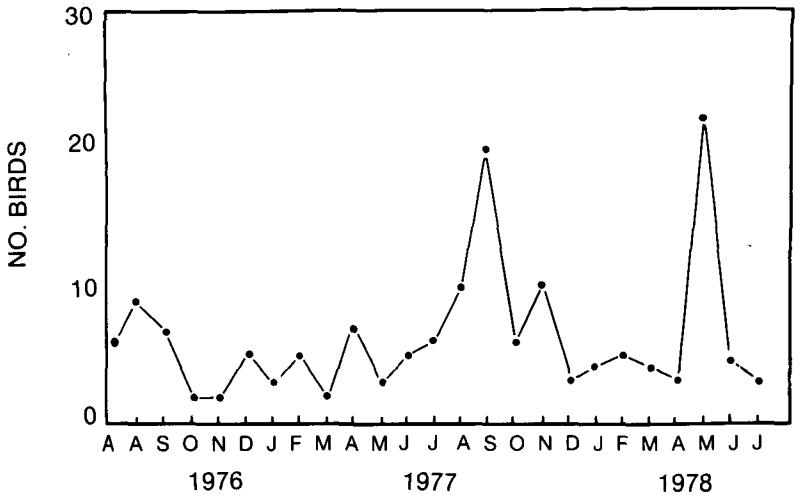

FIGURE 8 — Monthly variation in numbers of Pukeko at Waimea Inlet from August 1976 to July 1978

In February 1977, numbers began to increase again, and higher numbers remained until May 1977. From early winter (June 1977) to mid-summer (January 1978), numbers dropped to below 1150 birds while the breeding birds were away. Numbers then increased after January 1978, through the autumn months, to a peak of 2250 in June 1978, before dropping away in July at the end of the study period.

The highest concentrations of feeding birds were at the western end of the inlet at tidal zones 8 and 9 near Mapua and at the eastern end of the inlet at tidal zones 5 and 12 near Bells Island. Tidal zones 2 and 11, adjacent to Nelson Airport, were also popular. These six favoured zones coincided with the four main high-tide roosts for waders at the inlet (see Figure 2 and description of inlet), the birds moving between the high tide roosts and the adjacent tidal zones as the tide rose and fell.

During the study period, the average density of this species was about one bird per 3 ha of tidal flat at the inlet. In the summer and autumn, from January to May, the average density increased to about one bird per 1.5 ha of tidal flat in 1977 and one bird per 2.2 ha of tidal flat in 1978. From September to December of 1976, the density averaged one bird per 6.5 ha of tidal flats and, for the same period in 1977, the average was one bird per 6.7 ha of tidal flat. These values for average density are probably underestimates because birds feeding out of sight in tidal channels or away from the inlet on farmland would not have been counted and oystercatchers were not counted at the Bells Island shellbank until February 1978.

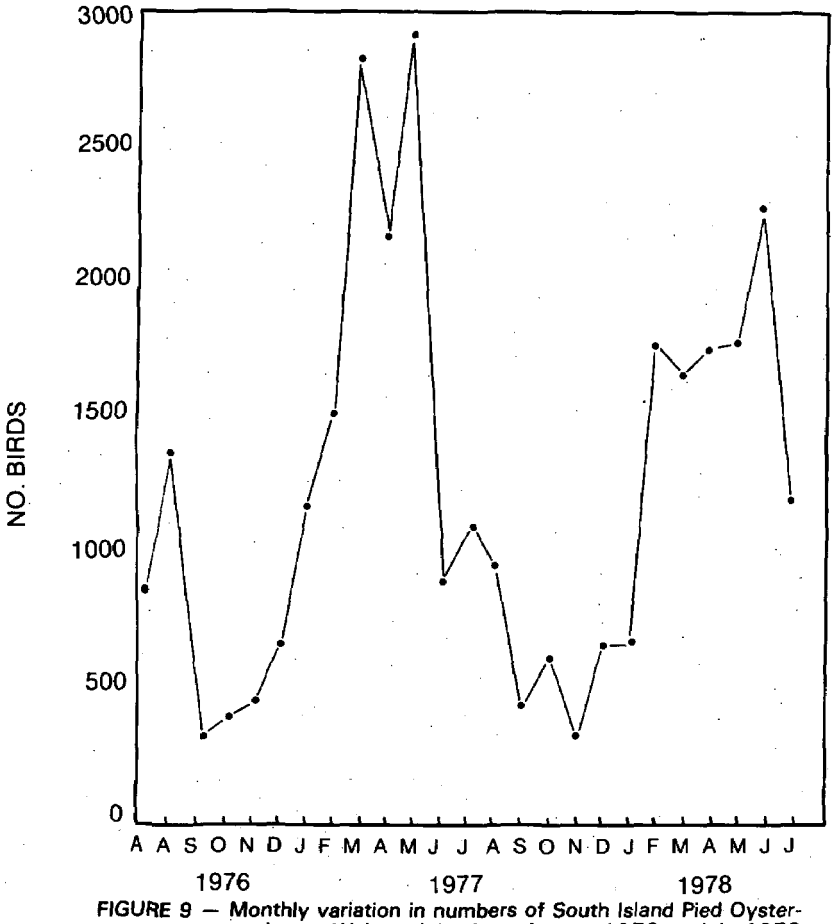

FIGURE 9 — Monthly variation in numbers of South Island Pied Oystercatcher at Waimea Inlet from August 1976 to July 1978

The abundance of oystercatchers in a tidal zone generally depends on food supply, especially high numbers of molluscs. The most common bivalve mollusc at the inlet is the cockle (*Chione stutchburyi*), which is the major food of South Island Pied Oystercatchers at the inlet.

Studies elsewhere have shown that South Island Pied Oystercatchers prey heavily on cockles. Baker calculated that, at the Avon-Heathcote estuary, near Christchuch, the mean daily cockle consumption in winter by 4000 South Island Pied Oystercatchers was about 1 472 000 cockles with a mean yearly food intake per oystercatcher of 190 179 cockles and by 4000 oystercatchers of 438 876 000 cockles (A. J. Baker, unpub. data). There is no reason to suppose that Waimea Inlet is less productive than the Avon-Heathcote estuary.

VARIABLE OYSTERCATCHER *Haemotopus unicolor*

The most seen was 41 in June 1978, but the usual number was between 4 and 26. Numbers varied monthly but to no obvious seasonal pattern. This species preferred tidal zones 9 (25 observations), 2 (13 observations), 10 (12 observations) and 3 (10 observations). All except zone 3 are adjacent to the Mapua and Waimea Channels, where low tides expose the cobble rocks of the shoreline and channels. These zones are close to favoured sites for high tide roosts and nesting. Several of the inlet's islands are used as nesting sites, e.g. Grossis, Bird, Rabbit and Saxton. The main form of the Variable Oystercatcher seen at the inlet was black.

SPUR-WINGED PLOVER *Vanellus miles*

Although none was seen at the inlet during the study, it had been seen previously on the tidal flats (KLO, pers. obs.). On the adjoining Waimea Plains, the Spur-winged Plover has steadily increased since 1976 from single birds to groups of 30-40. A wildlife survey by the Wildlife Service in 1979 and 1980 revealed that Spur-winged Plovers are widely distributed in the Nelson region and breed regularly (KLO).

LEAST GOLDEN PLOVER *Pluvialis fulva*

In December 1976, seven birds were observed resting in tidal zone 6, near the Waimea River mouth. The only previous records at the inlet were of three birds in November 1958 on tidal flats near Richmond and two birds in January 1959 (Webber & McKenzie, CSN 1960).

BANDED DOTTEREL *Charadrius bicinctus*

Banded Dotterel were at the inlet on 16 of the 25 monthly counts. The highest numbers were present from January to June 1977 and from February to July 1978 with only a few at other times of the year. The highest number was 102 in July 1978. The preferred habitats at low tide were tidal zones 2, 7 and 10. During high tides and at some low tide periods, Banded Dotterel often rested or fed in the short grass at Nelson Airport, which is adjacent to tidal zone 2. The only previous sightings at the inlet were of two at Waimea Inlet and two at Richmond flats in November 1958 (McKenzie, CSN 1960).

The nearest rivers where nesting is regular are the braided sections of the Upper Buller, Wairau, and Matakitaki Rivers (KLO). A few birds nest on the Howard and lower Waimea Rivers and on small sections of the Motueka River near Tapawera (KLO). On some of these rivers, flood control works (river confinement, embankments and plantings of willow, *Salix* spp.) by Westland and Nelson Catchment Boards have greatly reduced the nesting habitat for Banded Dotterel and other species that nest on braided rivers. A few also nest on several coastal sandspits in Tasman Bay and Golden Bay.

WRYBILL *Anarhynchus frontalis*

Wrybills were recorded four times during the study, in April, May, June, and August 1977. Numbers were 6, 18, 3 and 4 respectively. Outside the study counts, 21 were seen in March and 24 in July 1978 (KLO). The presence of these birds from March to August indicates that a small group of Wrybill is at the inlet in autumn and winter each year. The extensive open tidal flats of zones 4, 5 and 11 were the preferred low-tide habitat.

FAR-EASTERN CURLEW *Numenius madagascariensis*

Although not seen at the inlet during the study, one was seen occasionally at the nearby Nelson Haven estuary. It has been recorded at the inlet only twice. In 1970, two birds were seen in late April at Rough Island (zone 7) and one or two until early May (Boyce, CSN 1963-70). One was seen in November 1980 in tidal zone 6 (G. Elliott, pers. comm.).

WHIMBREL *Numenius phaeopus*

This species was not recorded at the inlet during the study, but single Asiatic Whimbrels (*N. p. variegatus*) were seen at tidal zone 7 on two occasions in the early 1970s (B. D. Bell, pers. comm.) and at tidal zone 7 in January 1979 (J. M. Hawkins, pers. comm.).

BAR-TAILED GODWIT *Limosa lapponica*

This species was recorded on all 25 monthly counts. Numbers were highest at the inlet from October to March (spring and summer of 1976-77 and 1977-78) and lowest from May to September (autumn and winter of 1976-77 and 1977-78). The highest number counted was 1150 in December 1976 and the lowest was 9 in September 1977. Figure 10 shows the monthly variation in total numbers.

The first arrivals in October 1976 seemed to congregate in tidal zones 5 and 7, but during November and December 1976 and January 1977, zones 4, 5, 7, 8 and 12 were preferred. In February 1977, zones 7 and 8 were the primary areas of use, and then zone 5 was used just before departure for the Northern Hemisphere in March 1977. In October 1977, the arrivals were in zones 2, 4, 5, 7 and 8, and zone 5 was not used during the counts taken in the 1977-78 summer. During this period, zones 2, 3, 4, 8, 9 and 12 were the usual feeding areas. Before departure in March 1978, zones 2, 3, 7, 8, 9 and 12 were used. Birds that remained through the winter months were recorded mainly in zones 2, 11 and 12 at the eastern end of the inlet.

During the 1976-1977 summer, an average of one godwit per 5.7 ha of tidal flat was at the inlet, and during the 1977-1978 summer the average was one godwit per 7.1 ha of tidal flat. Tidal zone 8 had the highest concentration of birds, during the 1976-1977 summer, of one bird per 2.2 ha, which dropped to one bird per 100 ha in the 1977 winter. These values for average density are also likely to be low because sometimes birds feeding out of sight in tidal channels would not have been counted and counts at the Bells Island shellbank were not made until February 1978.

In both 1977 and 1978, the number of godwits in the inlet almost doubled from February to March and then decreased again in April. This pattern was also noted for godwit at nearby Nelson Haven estuary at the same time (Hawkins 1980). This fluctuation in numbers is probably due to birds from estuaries south of Waimea Inlet stopping briefly at the inlet for a few days before continuing their northward migration to Northern Hemisphere breeding grounds.

GREENSHANK *Tringa nebularia*

One bird at tidal zone 8 in April 1978 is the first record at the inlet. It is a rare visitor to the Nelson region, being recorded previously only at Farewell Spit and Puponga Inlet.

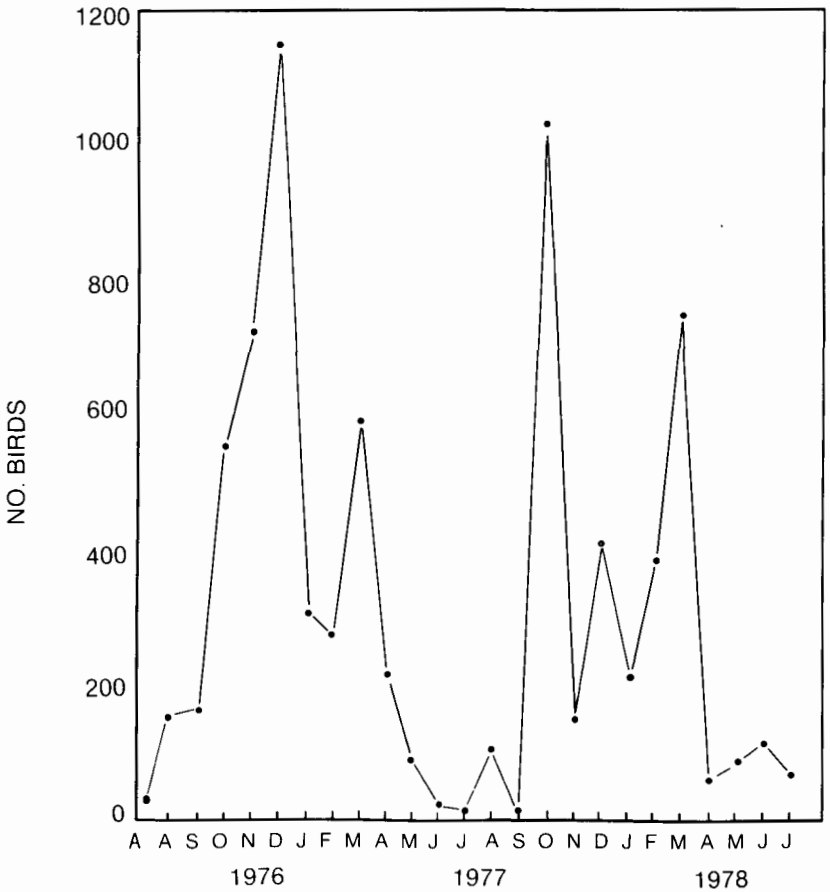

FIGURE 10 — Monthly variation in numbers of Bar-tailed Godwits at Waimea Inlet from August 1976 to July 1978

SIBERIAN TATTLER *Tringa brevipes*

This is another uncommon visitor to the inlet. Although not seen during the study, it was seen at the inlet in zone 7 on several occasions during the early 1970s (B. D. Bell, pers. comm.), and one was seen on the Bells Island shellbank in December 1980 (J. M. Hawkins, pers. comm.).

TURNSTONE *Arenaria interpres*

This species was seen at the inlet on three occasions during the study: 2 at zone 2 in early August 1976, 1 at zone 5 in late August 1976, and a flock of 29 at zone 5 in October 1977. Tidal zones 2 and 5 include along

FIGURE 11 — Tidal zone 2, a favourite zone of Bar-tailed Godwits. View from Martin Point (Monaco Peninsula) out to the mouth of the Waimea Arm and Tasman Bay. Oyster Island on left, Rabbit Island at centre, Nelson Airport (peninsula) on right.
Photo K. L. Owen

the shoreline and channels large areas of rock cobble, the preferred habitat of Turnstones. These zones are in the Waimea Arm of the inlet.

The few birds recorded in August may have been immature non-breeders overwintering at Waimea Inlet, whereas the larger flock in October may have been at the inlet for the Northern Hemisphere winter. Since the study, a few Turnstones have been regularly seen at the Bells Island shellbank during 6-monthly wader counts (J. M. Hawkins, pers. comm.).

Further studies may show that the Turnstone is a more frequent visitor to the inlet than it seems because the nearby Motueka Spit estuary, which is much smaller than the inlet, has 150-220 Turnstones overwintering each year.

KNOT *Calidris canutus*

One bird seen at tidal zone 5 during the count in August 1977 seems to be the first record at the inlet.

In late February 1978, when the Bells Island shellbank roost was discovered, 54 Knots were roosting there among other shorebirds. When the shellbank was visited on two non-count dates, 130 Knots were seen in March 1978 and 1 was seen in July 1978. Although these birds were present from February to July 1978 (during the study period), they were not included in the monthly totals because they were not counted on the correct dates.

High tide counts of the shorebirds at the shellbank since November 1978 (after the study concluded) suggest that Knots reach a peak of about 150 birds at the inlet each February and March before migrating to Northern Hemisphere breeding grounds (KLO).

SHARP-TAILED SANDPIPER *Calidris acuminata*

This rare visitor to Waimea Inlet was not seen during the study. In November 1958, two were seen in a muddy creek near Richmond (McKenzie, CSN 1960).

PIED STILT *Himantopus himantopus*

The Pied Stilt was seen on all 25 monthly counts during the study period.

Figure 12, which gives the monthly variation in total numbers, shows that stilts were most abundant from March to May in 1977 and in February and June in 1978.

The numbers were low in the spring, from September to December, of 1976 and 1977, when the average number of birds was 70 in 1976 and 61 in 1977. Peak numbers were generally recorded from February to June, averaging 379 birds in 1977 and 273 birds in 1978. These seasonal variations reflect a movement of breeding adults and juveniles to the inlet in late summer from inland breeding grounds and a movement of breeding adults from the inlet to breeding grounds the following spring. Birds at the inlet during the nesting period were non-breeders and birds that nest locally.

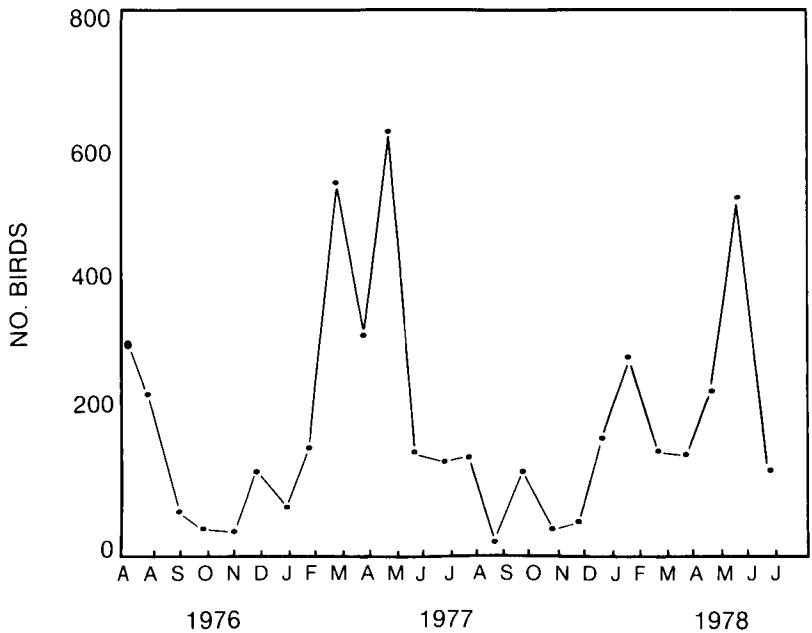

FIGURE 12 — Monthly variation in numbers of Pied Stilt at Waimea Inlet from August 1976 to July 1978

FIGURE 13 — *Tidal zone 5, comprising tidal flats and saltmarsh. A favourite feeding and nesting area for Pied Stilts. View from lower Queen Street at Swamp Road, looking towards Bests Island (left), Bells Island (centre) and Rabbit Island beyond. A waterfowl hunting stand (maimai) is in centre rear of photograph.*
Photo K. L. Owen

In terms of birds per hectare of tidal zones, zones 3 and 4 were preferred from January to July in 1977 and 1978 and zones 4, 6 and 10 were preferred from September to December 1977.

The Pied Stilt seemed to concentrate in two types of estuarine habitat at the inlet. The highest numbers were counted on tidal flats adjacent to industrial sites, namely, the Waitaki-NZR Freezing Works, an apple juice factory, the Richmond rubbish tip, and the Richmond sewage treatment plant. The second preferred habitat was tidal zones with the saltmarsh plant *Salicornia australis*.

Salicornia habitat is around the upper margins of the inlet, and zones 5 and 7 are especially important, being alongside nesting sites.

Small colonies and isolated pairs of Pied Stilt have nested around the inlet's upper margins, on areas of raised *Salicornia australis*, on several islands, and on the nearby Waimea River. Specific localities are the low-lying wet paddocks at lower Queen Street, bundwalls of the Chipmill effluent pond, *Salicornia australis* areas at the mouth of Neiman Creek, an enclosed tidal wetland at Mapua (zone 10), on Saxton and Grossis Islands, and along the braided section of the lower Waimea River between Brightwater and the inlet.

SKUA *Stercorarius* sp.

A skua was seen in tidal zone 10 during the August 1977 count but could not be identified to species. This seems to be the first record of a skua at the inlet.

SOUTHERN BLACK-BACKED GULL *Larus dominicanus*

This gull and the South Island Pied Oystercatcher were the most abundant species at the inlet.

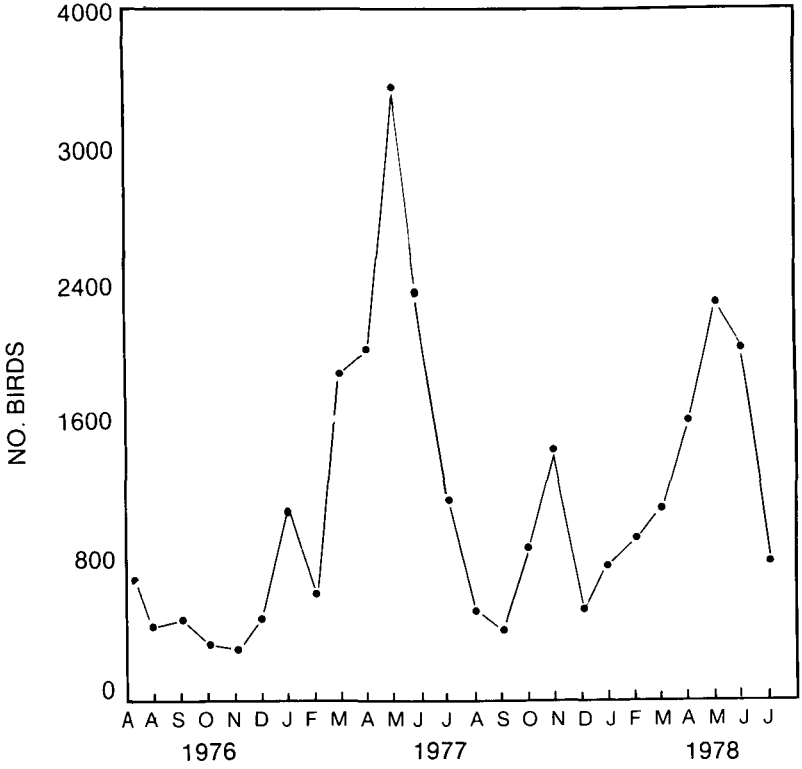

FIGURE 14 — Monthly variation in numbers of Southern Black-backed Gulls at Waimea Inlet from August 1976 to July 1978

It was present on every monthly count. Figure 14 shows the monthly variation in numbers. During the study, numbers were highest in May 1977 and May 1978 and lowest in October and November 1976 and September 1977. The period of peak abundance was April to June of 1977 and 1978. From August to December 1976 and 1977, the numbers dropped greatly while adults were away breeding. For example, the count for May 1977 was 3607 birds, but 4 months later, in September, only 397 birds were counted.

Nesting colonies are on Rabbit, Bells, Saxton and Grossis Islands and on the Bells Island shellbank (KLO). The numbers at these colonies are, however, much smaller than the number of gulls at the inlet. In November 1983, 238 nests were counted on Bells Island and 68 nests on Rabbit Island (J. M. Hawkins, pers. comm.). The region's largest colony, on Nelson's Boulder Bank, 5 km from the inlet, seems to contribute largely to the gulls at the inlet. Counts at the Boulder Bank colony show that the breeding Southern Black-backed Gulls have increased from about 650 breeding pairs in 1969 (Collyer 1976) to 1546 breeding pairs in the 1980 breeding season (J. M. Hawkins, pers. comm.). This large increase over the last 12 years is a direct result of the Nelson City rubbish tip being set up in 1970 on reclaimed tidal land

at the edge of the Nelson Haven estuary. This tip, 2 km from the Boulder Bank and 5 km from the inlet, is still in use.

The Southern Black-backed Gull was most abundant in tidal zones 3, 4, 5 and 6, which are in the Waimea Arm of the inlet close to sewage and industrial sites. Zone 3 has the effluent from the apple juice factory discharging into it. Tidal zone 4 has the Richmond rubbish tip and sewage treatment plant nearby, and effluent from the Waitaki-NZR Freezing Works discharges into it. The gulls tended to concentrate in zone 4 from late March to early June each year, which coincides with the peak operation of the freezing works. From mid-June to mid-November, the freezing works operate at a lower production rate than in other months, and so gulls were less abundant in the zone. Zone 5 was also favoured by the gulls, perhaps because it adjoins zones 4 and 6, which have industrial sites adjacent to them. The large piggery on Bests Island attracts gulls in large numbers. Often birds that have congregated there fly to the channel of zone 6 nearby to bathe after feeding at the piggery. Those tidal zones that were least affected by urban activities (zones 7, 8, 9, 10, 11, 12, 13 and 14) usually had few gulls.

Most of these sewage and industrial discharges are now treated at the regional sewage plant on Bells Island before being discharged into the inlet, and so the numbers and distribution of gulls may have changed since the study.

RED-BILLED GULL *L. novaehollandiae scopulinus*
BLACK-BILLED GULL *L. bulleri*

On several occasions these two species were counted together as a mixed flock, and the counts are therefore presented as a combined total. The Red-billed Gull, by far the more abundant of the two, was recorded on all 25 monthly counts during the study period. Although the Black-billed Gull was recorded on at least 18 of the monthly counts, it was always in low numbers.

Figure 16 shows the monthly variation in total numbers for this combined group. The numbers were lowest from late August to December in 1976 and 1977 and highest in early August 1976 (1738 birds), and from March to July in 1977 and from February to July, except for April in 1978. The decline in numbers in August/September of 1976 and July/August 1977 is due to breeding adults moving away to their nesting grounds. Neither species breeds at the inlet.

From September to December 1976, these two species combined had an average density of 1 bird per 33 ha of tidal flat at the inlet, a value that increased to 1 bird per 7.1 ha from March to July 1977. The number decreased again to 1 bird per 33 ha from September to December 1977, and then increased to 1 bird per 4.1 ha from May to July 1978. Most of these birds preferred the tidal flats at the eastern end of the inlet, especially tidal zones 1, 2, 3 and 4, which adjoin residential and industrial areas. During the breeding season, the density of birds per hectare was similar throughout the inlet, but during the autumn and winter, the population concentrated in zones 1, 3 and 4.

The nearest Red-billed Gull breeding place is Nelson's Boulder Bank, where the gulls have increased steadily from 67 pairs (1943-1944), 100 pairs (1944-45), 200 pairs (1950-51), and 890 pairs (1964-65) (Gurr 1953) to an

FIGURE 15 — Tidal zone 4, looking towards apple-juice factory at centre, Waitaki-NZR Freezing Works on right of centre, and Richmond township on far right. The exposed tidal flats and channel are favoured by Southern Black-backed Gulls.

Photo K. L. Owen

estimated 2000 pairs in the 1972-73 breeding season (Collyer 1976). The numbers are now down to about 900 pairs in the 1980 breeding season (J. M. Hawkins, pers. comm.).

While the number of Southern Black-backed Gulls breeding on the Boulder Bank has greatly increased (almost three-fold from 1969 to 1981), the number of Red-billed Gulls breeding has, for some unknown reason, decreased by almost 50% since the 1972-73 breeding season. One reason for this decline may be the large increase in breeding Southern Black-backed Gulls. As their colony has expanded along a great deal of the bank, it may have reduced the nesting habitat for Red-billed Gulls. Black-backed Bulls are very adaptable and tend to spend longer at the colony than Red-billed Gulls do. They may therefore have forced the Red-billed Gulls, which form smaller denser colonies, to go elsewhere on the bank. Because they are smaller, Red-billed Gulls are also vulnerable to predation by Black-backed Gulls. Black-backed Gulls, therefore, may even have reduced the Red-billed Gull population directly by competing for nesting sites and food, and perhaps even by taking eggs and young.

The nearest breeding places to the inlet of the less common Black-billed Gull are the braided sections of the Wairau, Buller and Matakitaki Rivers, Several quite large Black-billed Gull colonies exist on the Wairau River, some 35 km south of the inlet (B. D. Bell, pers. comm.). The Buller River, about 60 km southwest of the inlet, has one nesting colony, between the Howard

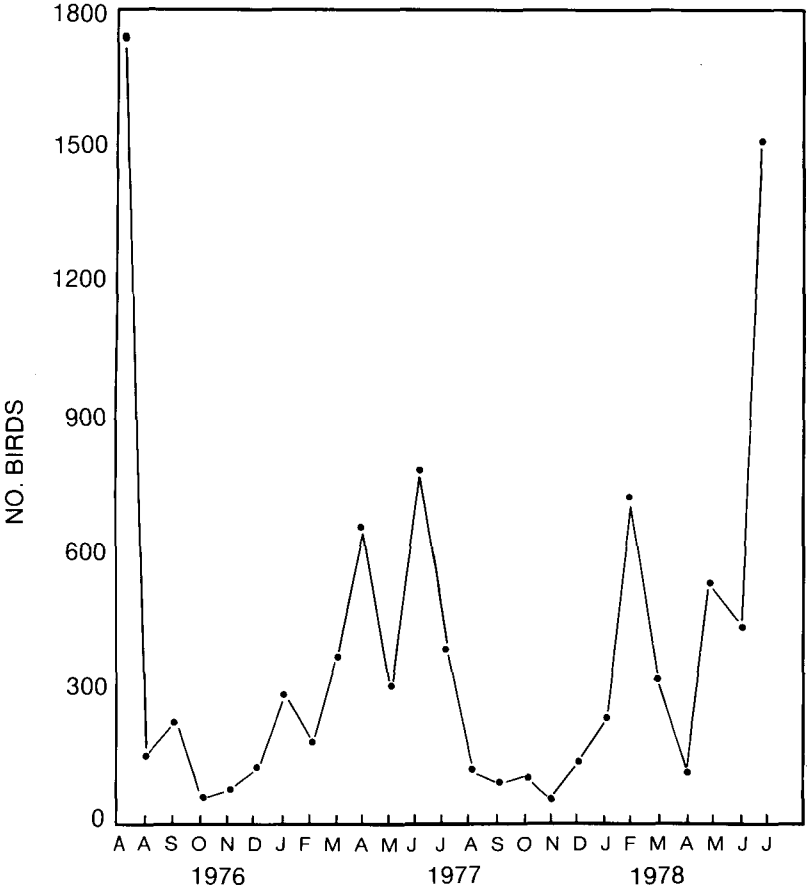

FIGURE 16 — Monthly variation in numbers of Red-billed and Black-billed Gulls at Waimea Inlet from August 1976 to July 1978

River and Station Creek, of usually about 50 pairs (KLO). The site, near the Howard River confluence, has been used since about 1971, although in 1976 shingle-extraction work at the site forced the colony to shift a few kilometres downstream to near Station Creek, where it has been since (P. Jenkins, pers. comm. to B. D. Bell).

The Matakitaki River, 95 km southwest of the inlet, has several colonies of only a few pairs each. A few pairs nested at the tip of Farewell Spit about 3 years ago but have not been seen since (B. D. Bell pers. comm.).

Some Black-billed Gulls apparently once bred on Nelson's Boulder Bank (Zumback, CSN 1963-1970). This record may be in error and needs to be confirmed.

BLACK-FRONTED TERN *Sterna albostriata*

This tern was seen at the inlet on only three occasions during the study: 1 at zone 12 in September 1976, 11 at zone 7 in February 1978, and 11 in zone 7 in March 1978. As many as 15 were seen at the inlet in February 1978 in a count outside this study (Hawkins & Gaze, CSN 1978). The Black-fronted Tern disperses from inland breeding areas along rivers to coastal regions, where they usually remain from January to July or August (Lalas 1979). These findings are supported by sightings at the inlet during February and March 1978 and from observations at the Motueka River mouth, a favoured habitat in autumn and winter (KLO). The nearest breeding colonies are on the Upper Buller, Wairau, Matakitaki Rivers (KLO) and the Motueka River (J. M. Hawkins, pers. comm.) south of the inlet.

WHITE-WINGED BLACK TERN *Chlidonias leucopterus*

This tern was seen at the inlet twice during the study: one bird at zone 7 in February 1977 and two at zone 7 in February 1978. Independently of this study, two were seen at the inlet in mid-January 1978 (Gaze, CSN 1977-1978). All sightings were made in the summer.

CASPIAN TERN *Hydroprogne caspia*

This tern, a resident at the inlet, was recorded on 24 of the 25 monthly counts, although usually in low numbers. The highest number was 21 in May 1977 and the lowest was 1, on three occasions. In counts outside this study, 34 birds were recorded at the Bells Island shellbank in February 1978 and 22 in March 1978 (KLO).

During the study most birds were seen in the western and central parts of the inlet feeding over water and along tidal channels in tidal zones 7, 8, 9, 10, 13, and 14. They were fewest in spring and early summer, and no more than 4 were seen from October to December 1976 and 1977, when adult birds were away breeding. No Caspian Terns were known to breed at the inlet during the study period, although one or two pairs breed annually at Nelson's Boulder Bank (Collyer 1976).

The nearest major breeding colony is at Farewell Spit, where about 100 pairs nest on a shellbank near the lighthouse (Edgar 1974). Some of the inlet's birds probably breed at this colony. Most of the Caspian Terns in February and March 1978 were juveniles, many of them soliciting food from parents while resting on the Bells Island shellbank. These adults and their young may have come from the Farewell Spit colony. Recently, since 1978, one pair nested on the Bells Island shellbank (J. M. Hawkins, pers. comm.).

LITTLE TERN *Sterna albifrons*

One seen in February 1977 at tidal zone 8 is the first record for the inlet. Each summer during the study, up to 10 were seen at Moutere Inlet and the adjoining Motueka Spit estuary 19 km northwest of the inlet (KLO). Throughout the winter of 1984, four were seen near Bells Island (J. M. Hawkins, pers. comm.).

WHITE-FRONTED TERN *Sterna striata*

This tern was seen at Waimea Inlet on 16 of the 25 monthly counts. The numbers ranged from 1 to 149 birds. On 15 of the counts, there were fewer than 31 birds, the average being about 17. Numbers were highest from

December 1976 to January 1977 and from December 1977 to March 1978 and lowest from February to June in 1977 and from April to July in 1978.

This species generally preferred tidal zone 10 at the western end of the inlet but was also seen in zone 1 at the eastern end. Both zones are within the two main channels linking the inlet to Tasman Bay. White-fronted Terns do not breed at Waimea Inlet, but in most years a breeding colony of up to 2000 pairs is on nearby Nelson Boulder Bank (Collyer 1976). This colony is now much smaller than in the 1970s, being about 500 pairs in the 1980 breeding season (J. M. Hawkins, pers. comm.).

NEW ZEALAND KINGFISHER *Halcyon sancta vagans*

Kingfishers were seen at the inlet on 22 of the 25 counts, the numbers ranging from 1 to 88. It has an obvious seasonal preference for the inlet, very few birds (1-13) being present from about mid-September to early April. From mid-April to early September 1977 and from late May to mid-July 1978, it was more abundant (23-88 birds) than during the summer. Similar seasonal variation in the numbers of Kingfisher has been recorded by observers in the Nelson area on previous occasions (Edgar, CSN 1963 to 1970). Taylor (1966) recorded that no birds were counted above 500 feet (166 metres) altitude in mid-winter, when peak densities were recorded near the coast.

The results of our study show that the Kingfisher numbers fluctuate widely at the inlet by season, greatest numbers being present in mid-autumn and winter. Why Kingfisher numbers vary seasonally is not known. Taylor (1966) suggested that seasonal changes in distribution almost certainly reflect the availability of food rather than a direct effect of temperature change with season. We believe that, at Waimea Inlet, food is not a likely reason because observations show that fish, crabs and other small marine animals remain active all the year in the coastal parts of Nelson (Taylor 1966).

The seasonal data on Kingfisher numbers at the inlet in this study suggest that changes in number relate directly to temperature changes with season rather than to the availability of food, although the latter may apply to inland sites. The seasonal and altitudinal distribution of the Kingfisher in the Nelson region remains little known.

Tidal zones 6, 7, 8, 9, 13 and 14, in the central part of the inlet, were the most used, the numbers ranging from 2.4 birds (zone 13) to 3.6 birds per count (zone 6) over the 25 sampling periods. The preference for certain tidal zones may reflect either an abundance of food or the availability of perching sites. The choice could also be influenced by how close nesting sites are to the zones.

Tidal zones 1, 2, 3, 4, 5, 10, 11, and 12, all but one of which (zone 10) are in the Waimea Arm, were seldom used by Kingfishers.

We do not know the reason for Kingfishers being scarce in these zones, but it could be human disturbance, limited food, pollution, or lack of suitable perching or nesting sites.

WELCOME SWALLOW *Hirundo tahitica neoxena*

This is a fairly new arrival to the Nelson region. The first record for the Nelson region was of one bird at the base of Farewell Spit in November 1955 (Heather 1956). In the 1972-73 period none were seen at Waimea Inlet,

although they were looked for specifically (Boyce, CSN 1973). Swallows were seen regularly in the Nelson region in 1974-1975 (O'Donnell, CSN 1974-75) and at the inlet soon after (KLO).

Welcome Swallows were seen at Waimea Inlet on 18 of the 25 monthly counts during the study, the numbers ranging from 2 to 16. Although numbers have steadily increased in the Nelson region, a similar trend was not found during this study for the inlet. However, in the 1984 winter up to 300 birds were seen at a time roosting and feeding over the Bells Island oxidation ponds (J. M. Hawkins, pers. comm.). Today Welcome Swallows are common throughout the Nelson region and breeding is regular.

SOUTH ISLAND FERNBIRD *Bowdleria punctata punctata*

The Fernbird was not recorded during the study at the inlet, but one was seen in 1980 in tidal zone 8 at the mouth of Stringer Creek, in an area of mixed saltmarsh (*Juncus maritimus* var. *australiensis* and *Leptocarpus similis*) and manuka shrub (G. Elliott, pers. comm.). A careful search for Fernbirds around the inlet's saltmarsh and shrub zones by KLO during the study period (1976-1978) was not successful. Stringer Creek is one of the last parts of the inlet that could provide suitable habitat for Fernbirds, which may not have survived because recent intensive searches at Stringer Creek have been unsuccessful (G. Elliott, pers. comm.). The nearest known Fernbirds to Stringer Creek are in an 8 ha freshwater swamp at the head of Trafalgar Road, 1 km inland from tidal zone 9. This wetland used to be connected to the inlet's saltmarsh zone, but swamp drainage and reclamation for farmland and roading have isolated it. Fernbirds could straggle to the inlet from the swamp perhaps through a nearby pine plantation with its dense understorey of shrubs and ferns.

A regional wildlife survey has shown that the Fernbird is now rare in coastal Tasman Bay and the surrounding Waimea County (KLO) because land development has taken their estuarine, freshwater and shrub habitats. Areas of saltmarsh habitat suitable for the reintroduction of Fernbirds to the inlet are on the margins of tidal zones 6 and 7 at the mouths of Waimea River and Redwoods Valley Stream. Although these areas are small they could provide habitat that, with intensive management, could ensure the survival of the Fernbird at the inlet.

OTHER SPECIES

Only presence/absence records were kept and a few casual observations were made.

Skylark (*Alauda arvensis*), New Zealand Pipit (*Anthus novaeseelandiae*), Starling (*Sturnus vulgaris*) (often in flocks of about 20-50) and Song Thrush (*Turdus philomelos*) were frequently seen foraging on the *Salicornia australis* and bare tidal flats at the inlet. Song Thrushes were observed on several occasions to feed on mudsnails (*Amphibola crenata*). This habit has been noted before at the inlet (Kinsky 1970), at Papanui Inlet, Otago Peninsula (Nye 1971), and in other Tasman Bay estuaries in winter (KLO).

Flocks and small groups of Yellowhammer (*Emberiza citrinella*), Chaffinch (*Fringilla coelebs*), Greenfinch (*Carduelis chloris*), Goldfinch (*C. carduelis*) and Redpoll (*Acanthis flammea*) were seen feeding on the seeds of the saltmarsh plant *Spartina townsendii* at the inlet.

On one occasion during the study a juvenile Rook (*Corvus frugilegus*) was seen at tidal zone 7 (at low tide) stripping bark from a log in search of food (KLO). The rook is a rare visitor to the Nelson region.

Domestic Rock Pigeons (*Columba livia*) were seen in small groups feeding over the *Salicornia australis* flats on several occasions.

The pine plantations of Rabbit and Rough Islands and the shoreline of the inlet were inhabited by the following species: Grey Warbler (*Gerygone igata*), South Island Fantail (*Rhipidura fuliginosa fuliginosa*), Yellow-breasted Tit (*Petroica m. macrocephala*), Silvereye (*Zosterops lateralis*), Bellbird (*Anthornis melanura*), Hedge Sparrow (*Prunella modularis*), Blackbird (*Turdus merula*), House Sparrow (*Passer domesticus*), California Quail (*Lophortyx californica*), Skylark, New Zealand Pipit, Starling, Song Thrush, Yellowhammer, Chaffinch, Greenfinch, Goldfinch, and Redpoll.

The Tui (*Prosthemadera novaeseelandiae*) was recorded from June to September each year in tall, flowering (white) gum trees (*Eucalyptus* sp.) in the public reserve at Grossis Point, Mapua, on the edge of the inlet. Numbers ranged from 2 to 20 birds.

One cock Pheasant (*Phasianus colchicus*) was seen on the shoreline of tidal zone 10 in September 1977.

Domestic geese from an adjoining farm were seen at tidal zone 7 on several occasions in numbers ranging from 14 to 31.

CONCLUSIONS

Very little was known about the birds of the Waimea Inlet before this study. The information collected on species present, frequency of sightings, number of birds, seasonal variation in numbers, distribution, breeding status, and habits is a valuable addition to knowledge of the inlet's avifauna. The study has revealed that Waimea Inlet is an important habitat for estuarine birds, in terms of both numbers and species diversity.

Of the 75 bird species recorded at the inlet, 52 were estuarine species observed on the tidal flats and saltmarsh and 23 were non-estuarine species observed at the inlet and on the immediate shoreline.

Of these, the waders are the most important group. They include New Zealand endemic migrants and residents and Northern Hemisphere migrants.

The highest numbers of estuarine birds were at the inlet from March to June in 1977 and 1978, owing to a winter increase in numbers of three local species, South Island Pied Oystercatcher, Southern Black-backed Gull and Red-billed Gull.

Northern Hemisphere waders were in greatest numbers in summer, the most common species being the Bar-tailed Godwit and the Knot.

Migratory species (both migrants within New Zealand and migrants from the Northern Hemisphere), that is, waders, gulls, and terns, represent about half the total estuarine birds using the inlet.

The study has shown that the inlet is nationally important for the regular occurence of three nationally rare species: White Heron, Royal Spoonbill and Little Egret.

Uncommon sightings of migratory species from the Northern Hemisphere include White-winged Black Tern, Glossy Ibis, Greenshank, Little Tern, Far-eastern Curlew, Asiatic Whimbrel, Siberian Tattler and Sharp-tailed Sandpiper.

The saltmarsh rush zones of the inlet provide essential habitat for the uncommon Australasian Bittern, Banded Rail and Marsh Crake. These three species preferred the central and western zones of the inlet, where suitable saltmarsh habitat is found.

Rabbit, Bells, Saxton, Grossis and Bird Islands and the upper saltmarsh flats of the inlet provide nesting sites for the following species: Variable Oystercatcher, Banded Dotterel, Pied Stilt, Caspian Tern, Southern Black-backed Gull, Pukeko, Mallard, Australasian Harrier, Grey Duck, Australasian Bittern, Banded Rail and Marsh Crake.

Grossis Island, Neiman Creek mouth, Bells Island shellbank, Bells Island oxidation ponds and the Nelson Airport were the main high-tide roosts for estuarine birds at the inlet, and other secondary roosts were used when conditions were suitable.

FIGURE 17 — Tidal flats of zone 13, showing clumps of *Spartina townsendii* an exotic cordgrass

Photo B. Armstrong

Spartina townsendii, an introduced cordgrass, covers at least 16 ha of valuable intertidal bird habitat and is spreading. This exotic plant should be eradicated from the inlet to regain these areas for estuarine birds.

Reclamation of intertidal habitat for a wide range of inappropriate uses has reduced the amount of tidal flat and saltmarsh available to estuarine birds. The actual area lost is not clear, but records show that at least 59 ha have been reclaimed since 1956. The full figure is likely to be closer to 200 ha lost to inappropriate uses since European settlement. This activity, by greatly reducing the littoral fingers of the upper estuary margins, has affected the productivity of the estuary. Authorisation for the reclamation of a further 500 ha of inlet tidal land exists under the Nelson Harbour Board Empowering Act 1970.

The use of the 14 tidal zones by the various species varied considerably, month by month, over the 2-year period, zones 6, 7, 8, 12 and 13 being notable for the high number of species present.

Zone 7 was notable for attracting White Heron, Royal Spoonbill and Little Egret. Some zones were attractive to a few common species, which were often in large numbers because of abundant food. For example, high numbers of Southern Black-backed Gull were recorded in zone 4, where the Waitaki-NZR Freezing Works discharged its effluent and the Richmond refuse tip is located.

We hope that the information collected during this study will encourage further studies on the estuarine birds of the inlet. The inlet is important to estuarine birds and deserves to be protected from encroaching development and from pollution.

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SHORT NOTE

Fledgling Starling finds itself a foster home

Human disturbance often causes nestlings to leave their nest prematurely, but their fate is seldom known. During a study of the physical condition of Starling *(Sturnus vulgaris)* chicks in relation to brood size (Thompson & Flux, in prep.) many complete broods were collected when about 21 days old from the 500 nest-box colony at Belmont, Lower Hutt, described by Flux & Flux (1981).

On 26 November 1984 two 21-day-old fledglings (chicks A and B) left box 1 on our approach and flew about 50 m before landing in rough grass, where we lost them; we collected the third (C). Four days later we took six chicks from box 2, out of sight and 600 m from the first box. Only five chicks (D, E, F, G, H) had been present previously, and the sixth could be identified by toe-nail clips as chick A of the two fledglings lost from box 1. To reach box 2 in a direct line, it would have passed 5 occupied boxes, and 20 were within 200 m of this line. It appeared to have been pecked and was bleeding around the face, something not seen in 375 other chicks handled that year. Table 1 compares measurements of the lost fledgling with its sibling in box 1 and with later companions in box 2. The pair (A and B) in box 1 were