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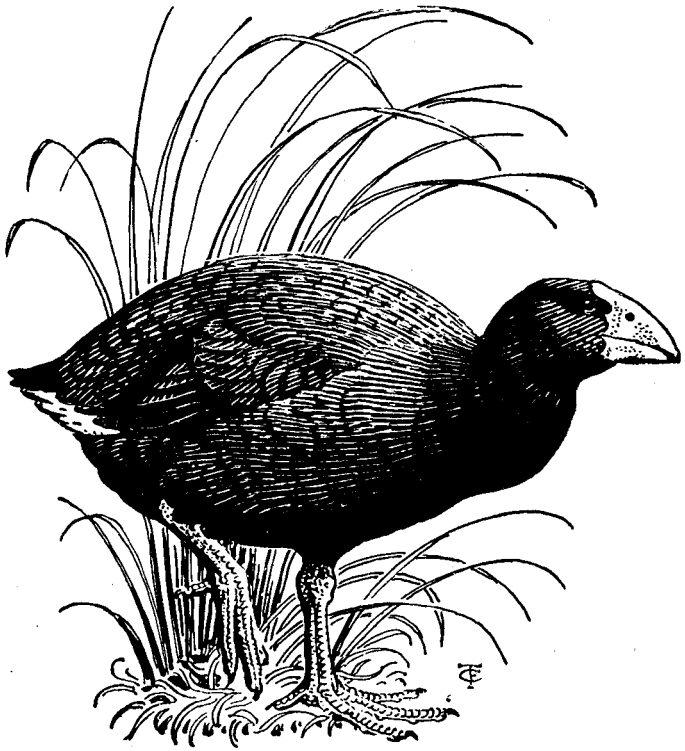

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DISTRIBUTION OF YELLOWHEADS (Mohoua ochrocephala) IN NEW ZEALAND

By P. D. GAZE

ABSTRACT

Historical records show that Yellowheads were once present in most forest habitats of the South Island and Stewart Island but they have become less widespread over the last 100 years. Disappearance from some areas was rapid at the end of the last century but Yellowheads survived in other forests until quite recently. Reasons for this decline should be investigated in the hope that appropriate management may prevent this species from becoming endangered.

INTRODUCTION

The Yellowhead (*Mohoua ochrocephala*) belongs to the subfamily Malurinae, which on the New Zealand mainland also includes the Whitehead (*Mohoua albicilla*), Brown Creeper (*Finschia novaeseelandiae*) and the Grey Warbler (*Gerygone igata*). With the exception of the ubiquitous Grey Warbler, all three species are associated mainly with forest and are frequently found in small very vocal flocks. The Whitehead is restricted to the North Island and some offshore islands (Falla *et al.* 1979), where it has in places adapted to exotic plantations and seral vegetation. The Brown Creeper occurs in the South Island and Stewart Island, and Yellowheads are now found only in the South Island. Brown Creepers are characteristically found in forests of simple structure such as high-altitude beech (*Nothofagus*) and mature exotic plantations (*Pinus* spp., *Pseudotsuga menziesii* and *Larix* spp.). The Yellowhead is confined to native forest, where its already disjunct distribution has become even more restricted in recent years. This study was initiated by the Ornithological Society of New Zealand to record the present distribution of Yellowheads and to compare this with historical records. Members contributed many of the records directly from notebooks or through their contributions to the Society's Bird Mapping Scheme (Bull *et al.* 1985).

METHOD

The distribution of Yellowheads is discussed by regions as shown in Fig. 1. When locality names are used they are followed by the relevant 10 000 yard grid square in brackets. All records, including many not referred to specifically in the text, are filed by square number with the Society's Recording Scheme.

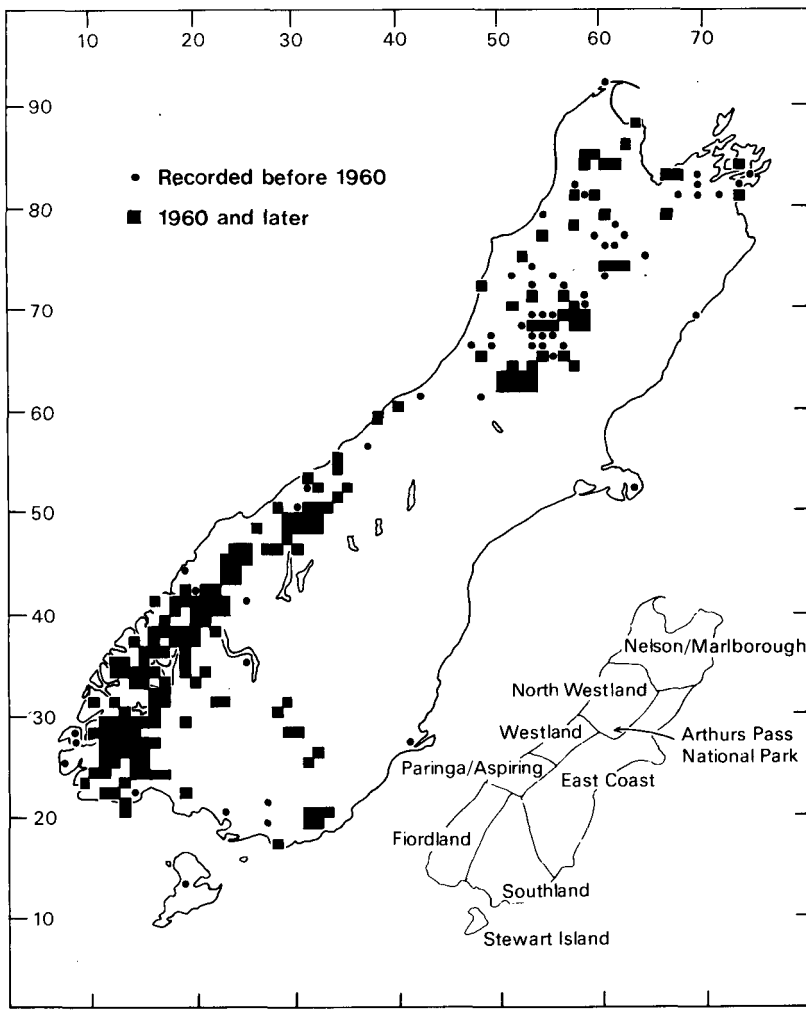

FIGURE 1 — Distribution of Yellowheads

DISTRIBUTION

Nelson/Marlborough

The reduction in the range of Yellowheads has been most dramatic in this region. Today the species is almost absent, although early collectors had little trouble obtaining specimens. In the 1890s, Buller collected Yellowheads from Cape Farewell (6092) and Woods collected at Pelorus Bridge (6982). During the 1920s and early 1930s, Stead obtained specimens from the Nelson area and O'Connor from Gowan Bridge (5977). Yellowheads must have begun to disappear from their former range by the 1920s because Moncrieff (1925) recorded that they had apparently vanished from the forests around Nelson.

North of the Buller River, records exist from a number of localities where Yellowheads were seen regularly up to the 1950s (K. Westbrook, pers. comm.). Trends in the distribution of the species are difficult to establish for areas that are seldom visited; however, in recent years several ornithologists have traversed this heavily forested area without seeing Yellowheads (R. Buckingham, R. Jackson, P. Lusk and K. Walker, pers. comm.). None were recorded by DSIR ornithologists in the southern part of Big Bush (6177) during hundreds of visits at all times of year between 1962 and 1973 (R. Taylor and B. Thomas, pers. comm.). Yellowheads were recorded until 1975 in regular visits to Flora Stream (6184) and Cobb Valley (6084). Apart from a sighting of one bird near the Flora Saddle in 1984, there have been no recent records from this area despite frequent visits by naturalists. In 1978 a single bird was seen in the hills behind Nelson (6683; A. Parrott, pers. comm.).

In two areas, however, the birds have been reliably seen on several occasions over the last few years: Little Wanganui Saddle on the Wangapeka Track (5781) and 70 km northeast on the bush edges of Pikikiruna Range above Abel Tasman National Park (6286). This latter location is historically interesting because it is where H. Guthrie-Smith studied and photographed the Yellowhead (Guthrie-Smith 1936). If Yellowheads still breed in the Nelson region, these may be the only two localities.

Yellowheads were once widespread throughout the forested areas of Marlborough and the Richmond Range, and Forster collected the type specimen in 1773 from Queen Charlotte Sound (7483). According to Handly (1896) Yellowheads were common in Marlborough, but never in large flocks. In 1942, writers to the *Marlborough Express* reported Yellowheads as common 30-40 years previously in various localities in the inner Sounds and parts of Richmond Range, although they were no longer present. Oliver (1930) recorded that Yellowheads were in forested areas of Marlborough but had disappeared from D'Urville Island. The species did not decline suddenly from all areas of Marlborough because, during the 1950s, Nevil Matthews (pers. comm.) recorded large flocks from Leatham River (6475). D. V. Zumbach (pers. comm.) saw Yellowheads in the upper Wairau (6274) on one occasion during the mid-1960s. In recent years, two sightings have been made in the Richmond Range, one at Lake Chalice (6679; Guest 1975) and another on the Whangamoa Saddle (6783; Guest 1976). In 1970, Yellowheads were possibly heard on Mt Robertson (7381; S. Kennington, pers. comm.). The only evidence that Yellowheads might still breed in Marlborough comes from a report of five birds near the summit

of Mt Stokes in Queen Charlotte Sound (7384). These birds were reported by Bob Ryan and Peter Brady, who saw and heard them in the company of Brown Creepers on 12 March 1985. In November 1985, I also saw these birds.

North Westland

The former presence of Yellowheads in Nelson Lakes National Park is well known. Moncrieff (1925) described Yellowheads at Lake Rotorua (6076) as being the second most common bird after the Tui (*Prosthemadera novaeseelandiae*). Yellowheads were still plentiful in the 1930s, when Guthrie-Smith saw them, and in 1944 Stidolph (1971) found six birds in 350 acres of forest at Gowan Bridge (5977). At Lake Rotoiti, Alex McConochie believed that Yellowheads had almost disappeared by the 1920s, and yet D. Cummings found the species plentiful in the Speargrass and Howard Valleys in the mid-1950s (Bull 1965). DSIR ornithologists found none during numerous visits to the Travers, Speargrass, Maud and Howard Valleys between 1962 and 1975 (R. H. Taylor, pers. comm.). Yellowheads were, however, occasionally encountered in the Travers, Sabine and D'Urville Valleys up until the 1970s. Zumbach (1965), referring to the D'Urville River (6073 and 6074), said that Yellowheads could be heard frequently at certain times of the year but were not often seen. Kikkawa (1966) did not find Yellowheads during seven days in the same area at the head of Lake Rotoroa in 1961, and DSIR orniithologists did not record them during more than 120 visits to the lower D'Urville Valley and Mt Misery (including over 6000 five-minute bird counts) since 1973. The last report of Yellowheads within the Park was from the Sabine Forks (6074) in 1977 (B. Enting, pers. comm.).

A similar decline occurred in the beech forests surrounding Reefton and Lewis Pass. In 1910, "coveys of Yellowhead" were recorded from the Inangahua Valley (O'Reagan 1966). J. Creighton (pers. comm. to J. R. Jackson) observed Yellowheads frequently in the Maruia Valley between 1930 and 1935 but observed his last bird in that locality near the treeline on Mt Crosscut (5672) in 1938. The same observer and others regularly recorded Yellowheads from Lewis Pass and the upper Maruia, with Creighton seeing one on the west face of Faerie Queen (5871) in 1950. In January 1984, Dean Buzan (pers. comm.) heard a Yellowhead at three localities on the West Bank of the Maruia River (5671). Yellowheads were reported from the Lewis Pass road (5868 and 5869) until the mid-1970s (J. R. Jackson, pers. comm.). The species persisted through the 1960s at nearby Lake Daniells (5770), where Zumbach (1972) reported flocks of up to 20 birds, and in April 1984, G. Harrow saw three Yellowheads there and another near Lake Christabel (5669).

I know of only three records from the Paparoas. In the 1960s one was recorded near Punakaiki (4872; Grant 1972) and in 1979 another at Hawkes Crag (5275) near the Buller River. In 1973 Cowlin (1974) reported the species from the headwaters of the Otututu River (5173). Penniket (1955) and Onley (1980) did extensive bird research in these forests and failed to record Yellowheads. During the mid-1970s, ornithologists from DSIR spent well over 200 person days in the forests of the eastern Paparoas and southern Victoria Range south to Lake Hochstetter. During this period the only Yellowhead encountered was at Merrijigs (5371).

Yellowheads have been recorded from beech forest south from Springs Junction to the Taramakau and Hurunui Rivers. Large flocks of up to 200 birds were recorded by Smith (1888) around Lake Brunner, and good numbers persisted in the Upper Grey, Robinson and Ahaura Rivers through to the 1950s (J. R. Jackson, pers. comm.). Since then, reports have been infrequent and of few birds, although in 1982 Marion Lane (pers. comm.) recorded Yellowheads from the junction of the Wainihinihi and Taramakau Rivers (4865).

The dramatic loss of Yellowheads from this region during the past 30 years is made more apparent by extensive ornithological research in recent years by DSIR, Wildlife Service and Forest Service staff, who recorded no Yellowheads (Morse 1981).

Arthur's Pass

Arthur's Pass National Park is probably the most northerly place where Yellowheads are present in sustainable numbers. The species is occasionally encountered in the tributaries of the Waimakariri River on the eastern side of the Park, particularly the Mingha, Sudden, Hawdon and Poulter River valleys (50-5362). The abundance and habitat use of Yellowheads within the Park have been studied by Read (1984), who reported some contraction in their range. Sightings from the Otehake River, Arthur's Pass township and the Taramakau River during the late 1960s and early 1970s have apparently not been repeated since. Although apparently absent from the Puketeraki Range, Yellowheads have recently been reported from the Hurunui Valley (Jackson 1974).

Westland

Yellowheads are rare in Westland. In the 1860s, Douglas reported them as common (Pascoe 1957), but since then few historical records exist between the Taramakau River in the north and Paringa in the south. Hamilton (1878) recorded Yellowheads from Okarito (3859). Cockayne and Teichelmann (1930) noted that Yellowheads had been present at Franz Josef and Fox Glaciers (3756) at the turn of the century but had disappeared by 1930. In 1949 a single Yellowhead was reported from near Lake Ianthe (4261; J. Penniket, pers. comm. to J. R. Jackson). During the 1960s, isolated reports occur from Mt Hercules (4060) and the Manakaiaua (3454; O'Donnell & Dilks 1983). In 1976, D. Onley (pers. comm.) saw a Yellowhead at Okarito, and R. Laing (pers. comm.) saw the species in 1982 and B. King (pers. comm.) in 1983, as recorded by O'Donnell & Dilks (1983). In the early 1980s, during a survey of birdlife in over 200 000 ha of forest from the Whataroa River south to the Karangarua River, Yellowheads were not found (G. McSweeney, pers. comm.). Detailed surveys of Hunts Beach, Makawhio and Bruce Bay State Forests in 1983-84 by Wildlife Service did not record Yellowheads. In April 1985 a single bird was recorded by DSIR staff working in dense kahikatea forest in Hunts Beach State Forest (R. Stewart, pers. comm.).

Paringa/Mt Aspiring

Yellowheads occur sparingly at Lake Paringa (3153; McKenzie 1961) and elsewhere in this vicinity. In 1983/84, Yellowheads were only rarely encountered by Wildlife Service staff working in silver beech (*N. menziesii*) forest in the hill country around Lakes Paringa and Moeraki (C. O'Donnell, pers. comm.). In July 1984 I heard one bird on the north bank of the Paringa

River 3 km above the highway (3252). Reports of Yellowheads through the Haast Pass (3149) and in the tributaries of the Makarora River occur frequently in Classified Summarised Notes and in personal correspondence. Yellowheads have been recorded several times recently in the Landsborough River, including a flock of 18 birds seen by Bruce Robertson (pers. comm.) between Kea Flat and Hinds Flat (3451). The birdlife of Mt Aspiring National Park has been well researched in recent years and Yellowheads were found to be widely distributed in many of the eastern catchments but nowhere were they common (Child 1981).

Fiordland

Yellowheads are widespread through Fiordland but appear to be more common in the beech forests to the north and east. This opinion was also stated by Dorizac (1972), who decribed Yellowheads as abundant in the tall forests of Fiordland but less so in the southwest. Data in the Ornithological Society's Bird Mapping Scheme (Bull *et al.* 1985) show a similar trend with a greater proportion of records listing Yellowheads from the squares at the head of Lake Te Anau. Yellowheads were on Resolution Island (0828) early this century (Henry 1908). Reischek (1884, 1887) recorded Yellowheads as common along the coast of western Fiordland, but there are few recent records and many of the contributors to the mapping scheme did not find them. Yellowheads were recorded in Dusky Sound (1128) by Robertson (1982), and Kim Morrison (pers. comm.) recorded them as well distributed along the Lake Hauroko-Dusky Sound-Lake Manapouri track in October/November 1984. Reid (1970) described the birds of the Takahe study area in the Murchison Mountains in central Fiordland: Yellowheads were recorded on nine of 22 visits between 1949 and 1969. On only one of those visits was the species common enough to be called "quite plentiful".

Southland

A stronghold of the species must be in the forests of the Routeburn Valley to the head of Lake Wakatipu (2140). Many records have been submitted from this area both to the Bird Mapping Scheme and through personal communications. In November 1983, Yellowheads were the most common bird in the red beech (*N. fusca*) of the Caples Valley (2139; G. P. Elliott, pers. comm.).

Elsewhere in Southland the distribution is disjointed but closely follows the distribution of beech forest. Examples of these isolated populations are: Longwood Range (1922; Bull *et al.* 1985), Rowallan State Forest (1724; E. Spurr, pers. comm.), Takitimu Mountains (1929; Nilsson 1972) and the Eyre Mountains (2231; Sutton 1972). Recent records have also been obtained from the Blue Mountains (3226; A. Austin and M. Foord, pers. comm.), the headwaters of the Waikaia River (2830, etc.), Leithen Bush (2928) and Tautuku Forest (3219, etc.; Buckingham 1982). Early this century Fulton (1907) described Yellowheads as quite scarce in the Catlins, but these birds have continued to survive in low numbers to the present day.

Early records show the species to have been present in the vicinity of Invercargill (2719; Philpott 1919). Fulton (1907) recorded them as being found sparingly at Wyndham (2721). As recently as 1979, Yellowheads were found at Otara (2817).

East Coast

Few records exist of Yellowheads in Canterbury and Otago. A specimen in the Canterbury Museum was collected near Kaikoura (6969) by Buller in 1891. A nest was recorded by Potts (1869) from the headwaters of the Wilberforce River (4861). Hope (1927) recorded that Yellowheads had almost disappeared from Canterbury but that 25 years before they had been plentiful in flocks of up to 30 birds in the 'main bush'. The Canterbury Museum holds a number of Yellowhead eggs collected from Banks Peninsula and Akaroa (6352) about the turn of the century. Turbott (1969) recorded the comments of a Mrs Duxbury that Yellowheads survived in small numbers in the forest remnants of Banks Peninsula up to about 1900 but disappeared shortly after this. The forests in this area had been largely destroyed by fire between 1859 and 1863. The last record for the Peninsula is a specimen collected by Waite from Akaroa in 1910 and now in the Hokitika Museum.

Several specimens collected from the vicinity of Dunedin (4127) by W. Smyth at the turn of the century are now in the Auckland and Canterbury Museums. Fulton (1907) described Yellowheads as having once been common at Taieri and around Dunedin but having disappeared by the time of writing. Large flocks were recorded near Dunedin by Bathgate (1922), but these disappeared with removal of the forest. As late as 1946 Yellowheads were recorded from the bushed valleys still existing behind Dunedin (Dunedin Naturalists Field Club 1949).

Stewart Island

Yellowheads on Stewart Island were regarded by Fulton (1907) as still being common, and Oliver (1930) included Stewart Island in the distribution of Yellowheads on the basis of a report from Cockayne (1909). Williams (1962) disputed this report as he doubted Cockayne's ornithological ability and the lack of other sightings or museum specimens. However, a long-time resident, Roy Traill, claimed in 1962 in a letter to J. R. Jackson that both he and his elder brother had seen one. In another letter (1963), Traill stated that they are no longer seen. Both men were familiar with the species from South Island bush. Two Stewart Island specimens are in the Otago Museum collection.

DISCUSSION

The distribution of Yellowheads had been considerably reduced over the past 100 years. Unlike other species such as the Saddleback (*Philesturnus carunculatus*), Kokako (*Callaeas cinerea*) and Piopio (*Turnagra capensis*), which declined rapidly towards extinction with the introduction of predators, the Yellowhead has declined gradually in both distribution and flock size through to the present day. There is evidence for a decline in Yellowheads in all parts of the country except eastern Fiordland. The most noticeable decline has been from the north of the South Island south to the Hurunui and Taramakau Rivers (Fig. 1). This process has been progressive, with the birds in the beech forests of the Grey River being the last to disappear. The decline may be continuing further south, affecting the Yellowhead in Arthur's Pass National Park. The virtual absence of Yellowheads between Arthur's Pass and Paringa corresponds well with the absence of beech forest (which has not recolonised this area since the last glaciation). Although there is good evidence that Yellowheads were once common in podocarp and hardwood forests of Westland

and Stewart Island, most recent records are from beech forests. Pascoe (1957) quoted Charles Douglas describing Yellowheads as "... at one time very common all over the country but now they must be very rare — cats again — I haven't seen one in years". Douglas was presumably referring to South Westland, where he lived from 1868 to 1900. This apparent affinity with beech forests is again emphasised in Waitutu State Forest, where in 1983 G. P. Elliott (pers. comm.) found Yellowheads in the silver beech (*N. menziesii*) but not in adjacent podocarp forests.

In 1888 Buller described the Yellowhead as being "... quite as common as the preceding species [Whitehead] formerly was in the North" (Turbott 1967). The Whitehead was once abundant throughout the North Island but disappeared from large areas with the clearing of the forest (Oliver 1930) and has not returned to the northern parts of the island. However, Buller's statement implies that the reduction of Whiteheads was more widespread and dramatic than this. South of the Coromandel Peninsula, Whiteheads are now common and in some areas have colonised exotic forest and seral vegetation (pers. obs.).

This decrease in numbers and retraction of the range towards the south, which occurred with Whiteheads in the North Island, is happening with Yellowheads in the South Island. The reason for the gradual decline of Yellowheads is not known. On the east coast, loss of habitat may be the major cause, but the birds have also disappeared from large areas of intact forest in Nelson and North Westland. The introduction of rodents, mustelids and cats cannot be entirely blamed for the decline because the Yellowhead still survives in parts of Fiordland which have large numbers of some of these predators. Disease may be an explanation but no information exists.

Research on Yellowheads, preferably at Arthur's Pass, may reveal whether their distribution is still diminishing or whether they are beginning to stabilise and perhaps recover. The cause of the reduction should also be investigated, with a view to management of the species if necessary. If the number of nests being preyed on is affecting the population significantly, the use of nest boxes may be justified.

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Most of the data presented have been provided by members of the Society through their contributions to the Bird Distribution Mapping Scheme and the Classified Summarised Notes of *Notornis*. Two ornithologists, Dick Jackson and Peter Child, have been particularly helpful in supplying information on the distribution of Yellowheads. Their knowledge comes from an enthusiasm for venturing into the mountains and actively searching for such rarer species. This paper has also benefited from local knowledge provided by a younger generation of ornithologist, in particular Graeme Elliott, Kim Morrison, Colin O'Donnell and Andrew Read. I thank them for their efforts and their willingness to share this knowledge. Colleagues in Ecology Division helped with the manuscript.

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SHORT NOTE

Red-billed Gulls robbing Wrybills

On 26 March 1985, at Access Bay in the Firth of Thames, while watching hundreds of waders moving out over newly exposed mudflat as the tide receded, I became aware of consistent attacks by Red-billed Gulls (*Larus novaehollandiae*) on feeding Wrybills (*Anarhynchus frontalis*).

Of the 30 or more gulls scattered over the area under study, not more than five seemed to be involved in this food-piracy, and only Wrybills were victimised. The attacks, which were initiated occasionally on the ground but mainly from the air, consisted of an aggressive approach towards a Wrybill carrying a worm (presumably polychaete) in its bill, followed by a rapid zig-zag aerial pursuit. Whenever the food was released by a Wrybill, the 'pirate' would stoop rapidly to retrieve it from the ground. Sometimes two gulls chased one Wrybill.

Perusal of available literature confirms food-piracy as a common feature of many species of Laridae, with a wide range of other species as victims, especially other gulls and terns, auks and ducks. Waders, however, do not feature prominently among victims cited, apart from Lapwing (*Vanellus vanellus*) and Golden Plover (*Pluvialis apricaria*) by the Black-headed Gull (*L. ridibundus*) and the Common Gull (*L. canus*) (Cramp *et al.* 1974). The Bar-tailed Godwit (*Limosa lapponica*) is also recorded as a victim of *L. canus* (Cramp & Simmons 1983).

Although the general aggressiveness of the Red-billed Gull is well known and its predation of eggs and chicks is mentioned in several standard texts, there appear to be few references to actual food-piracy.

J.A. Mills (1985) listed "white-fronted terns, gannets, oystercatchers, shags and even other red-billed gulls" as victims. Serventy *et al.* (1971), describing *L. novaehollandiae* in Australia, stated that "some individuals have been reported with piratical habits attacking fishing terns and pelicans".

Piracy seems to be just one option within the wide repertoire of this versatile opportunist feeder. The above case of Wrybill molestation at Access Bay raises the question of what factors might influence some gulls to be piratical while most apparently are not. R.B. Sibson (pers. comm.) suggests the possibility of extreme hunger (or 'mischievous' disposition).

Data on the incidence of piracy would need to be examined in relation to season, food supply, the density of birds and the number of species.

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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

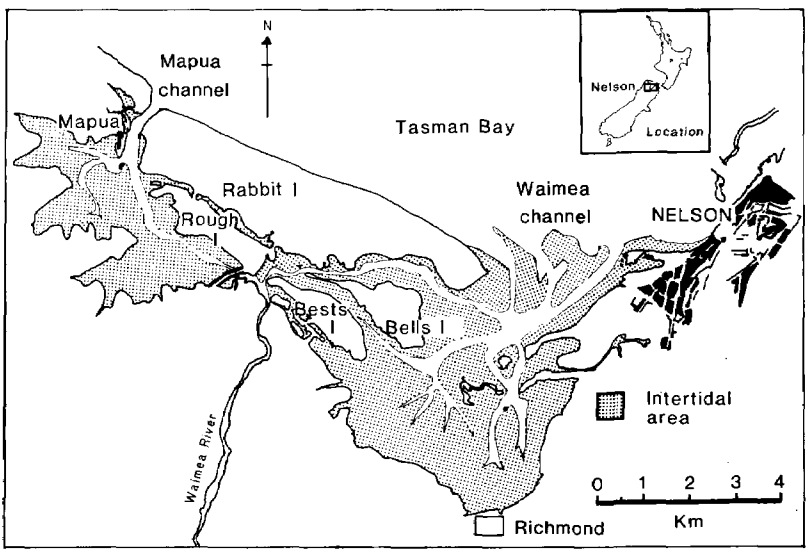

FIGURE 1 — Waimea Inlet, showing intertidal area and the position of some islands mentioned in the text

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.

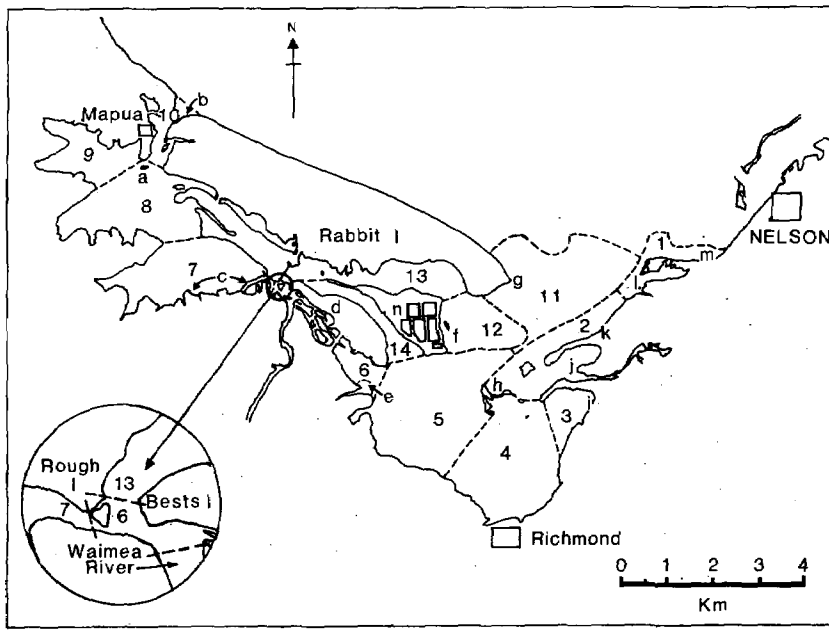

FIGURE 2 — The 14 tidal zones used in the study and the known shorebird roosts (a-m)

(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

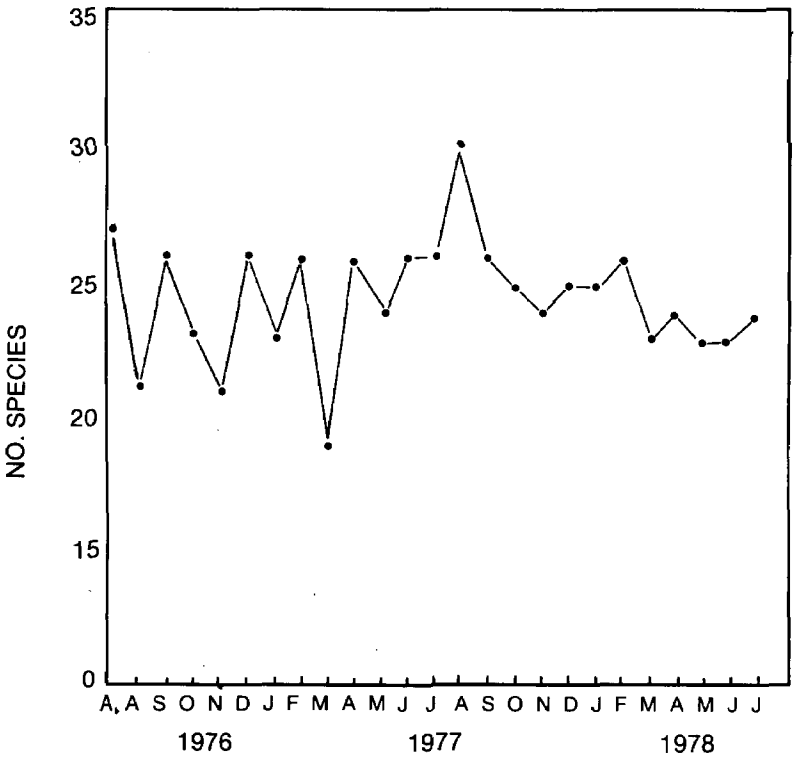

FIGURE 3 — Monthly variation in total number of species of birds observed at Waimea Inlet from August 1976 to July 1978

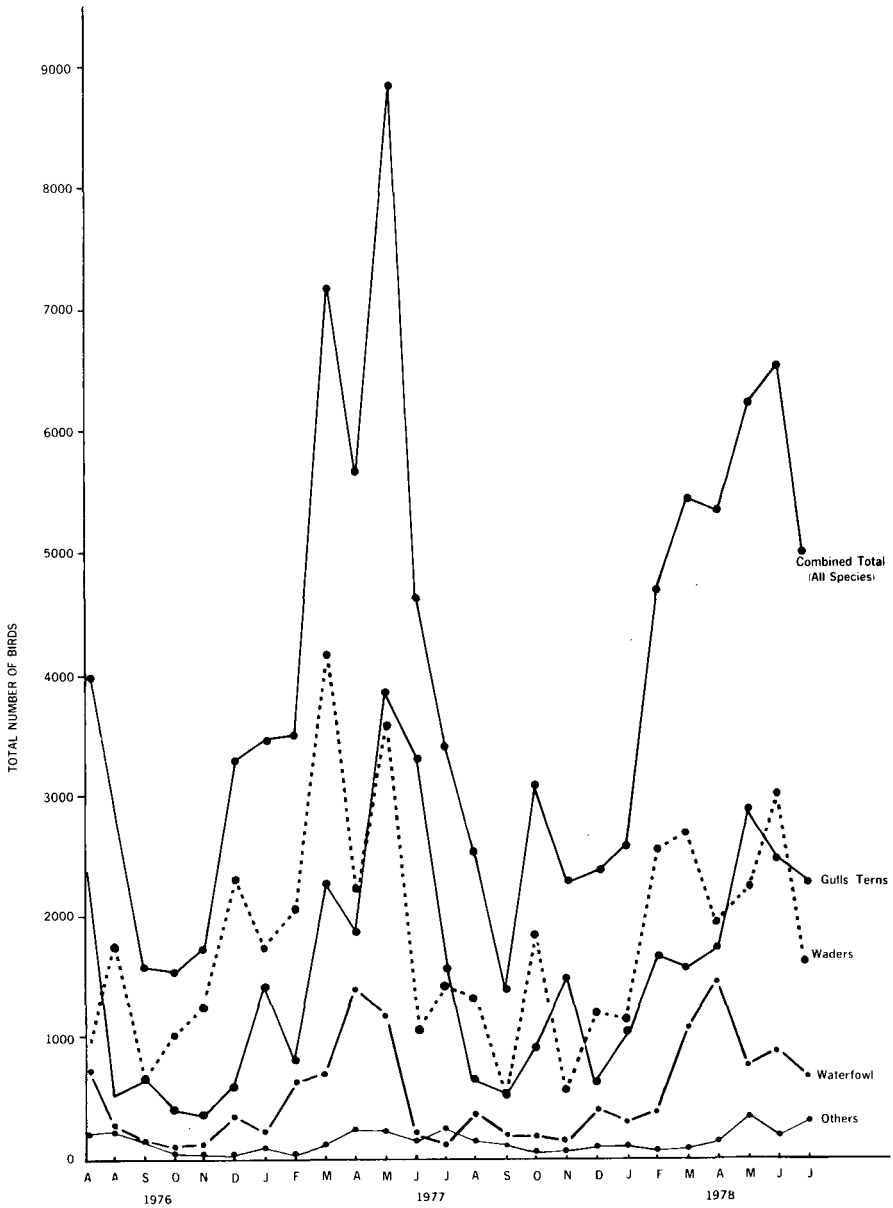

FIGURE 4 — Monthly variation in total number of birds observed at Waimea Inlet from August 1976 to July 1978. Non-estuarine birds are excluded

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

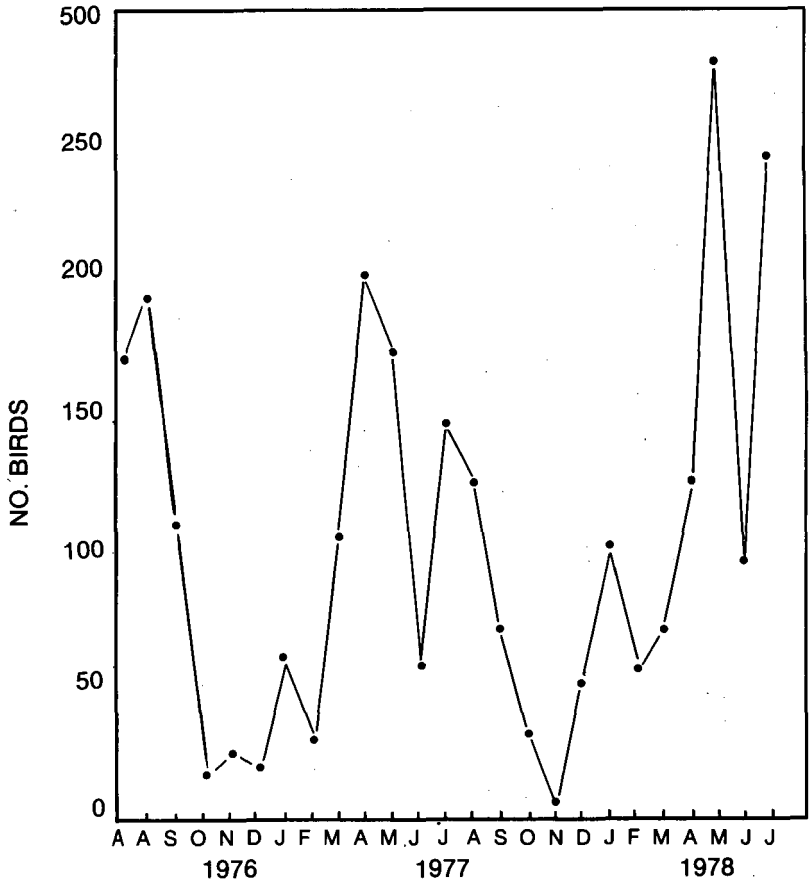

FIGURE 5 — Monthly variation in numbers of the five shag species (totals combined) at Waimea Inlet from August 1976 to July 1978

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).

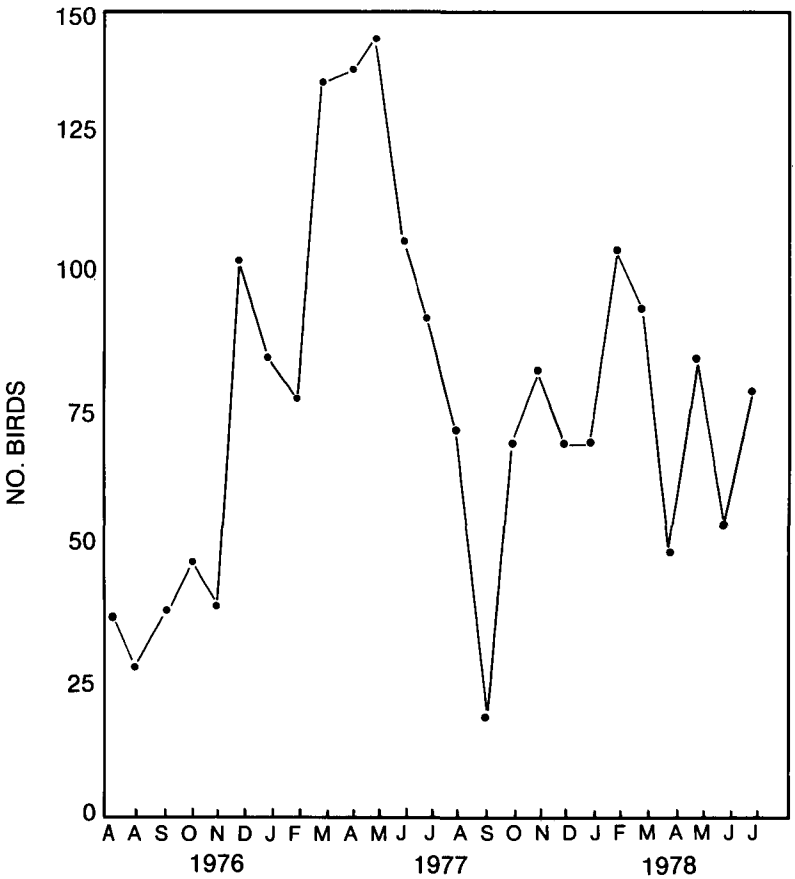

FIGURE 6 — Monthly variation in numbers of White-faced Herons at Waimea Inlet from August 1976 to July 1978

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.

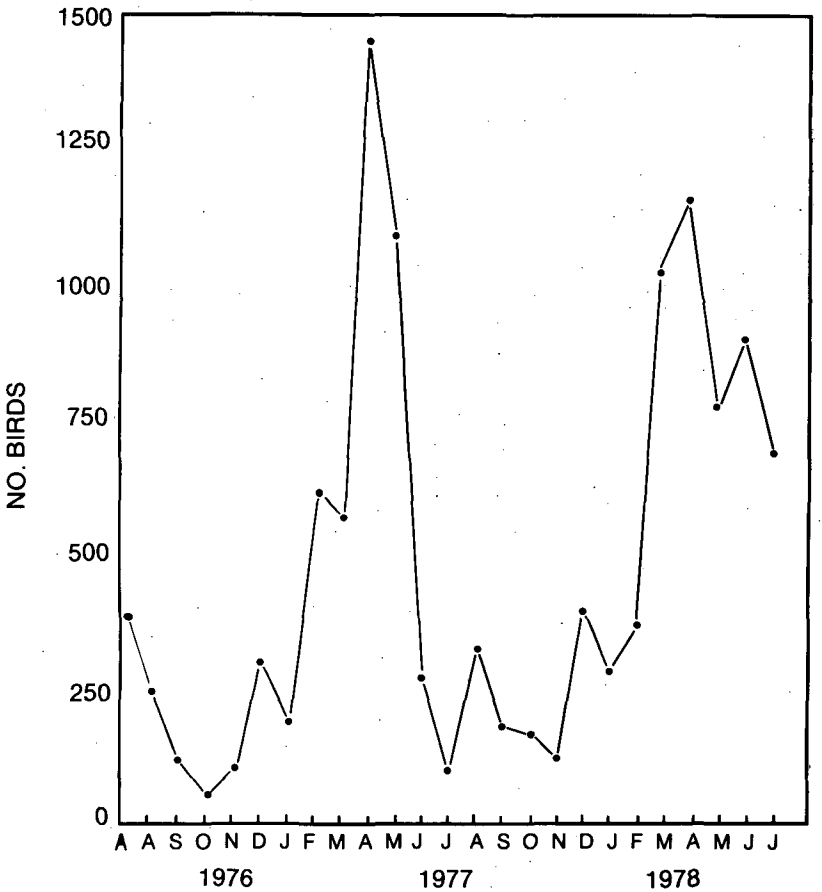

FIGURE 7 — Monthly variation in numbers of Grey Duck and Mallard at Waimea Inlet from August 1976 to July 1978

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).

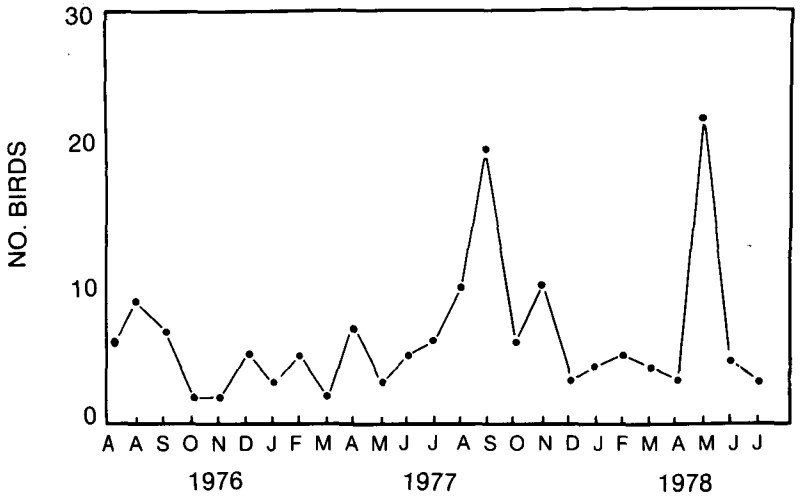

FIGURE 8 — Monthly variation in numbers of Pukeko at Waimea Inlet from August 1976 to July 1978

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.

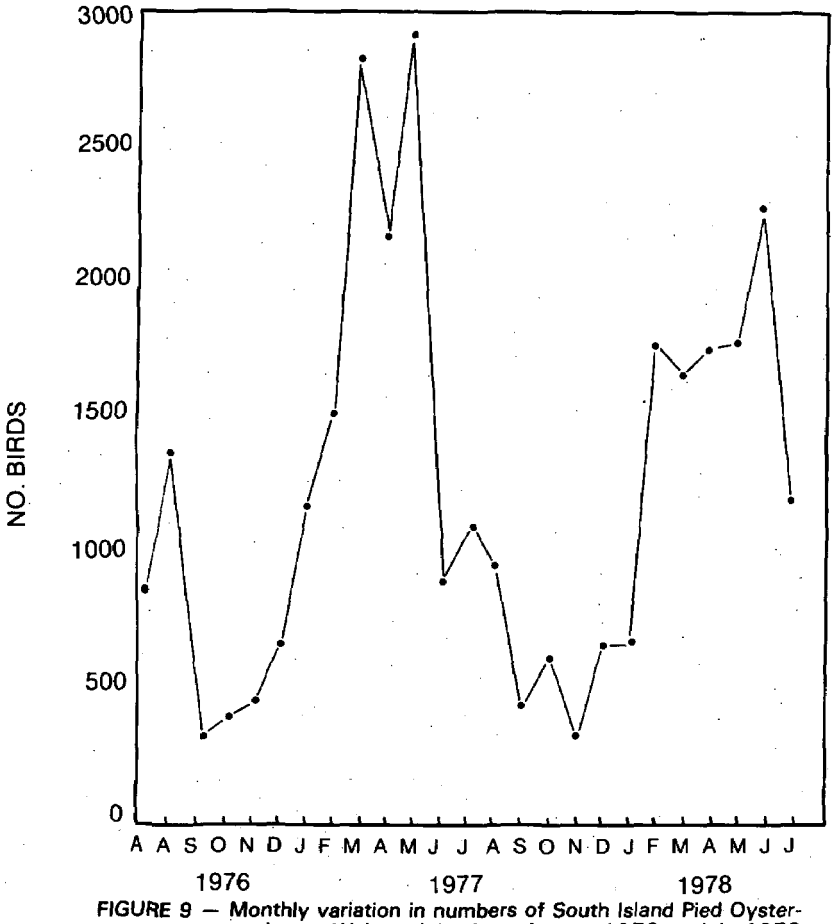

FIGURE 9 — Monthly variation in numbers of South Island Pied Oystercatcher at Waimea Inlet from August 1976 to July 1978

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.

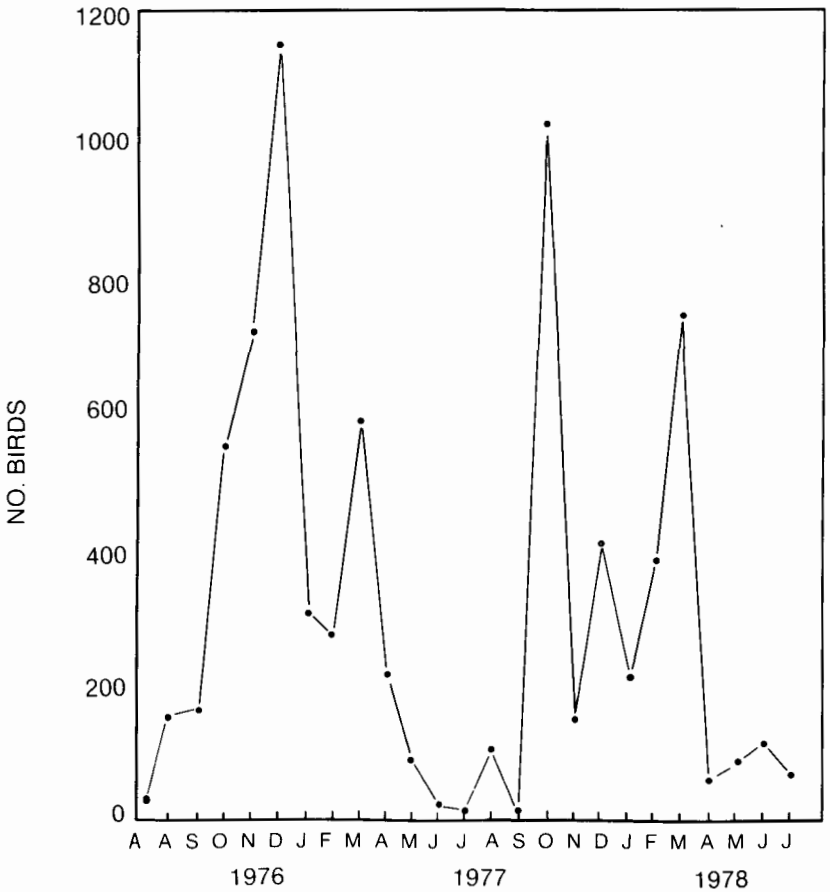

FIGURE 10 — Monthly variation in numbers of Bar-tailed Godwits at Waimea Inlet from August 1976 to July 1978

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.

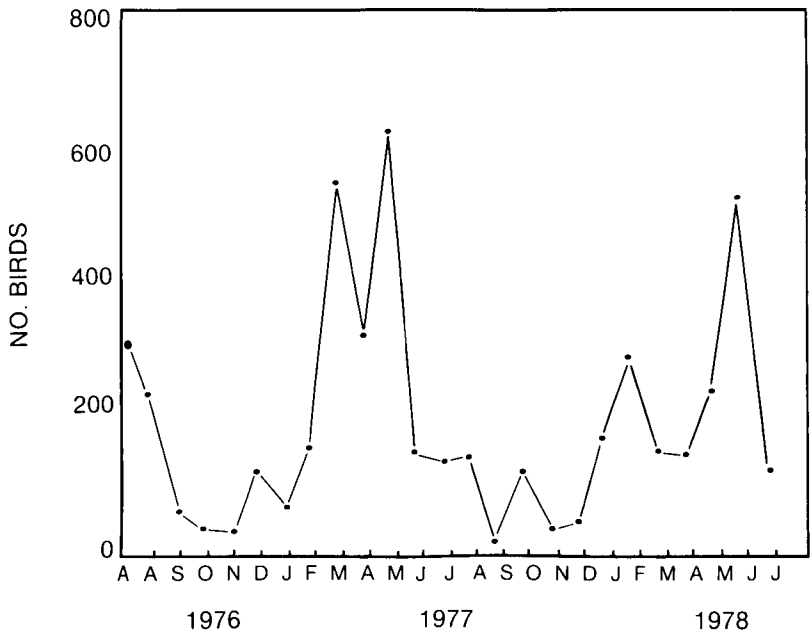

FIGURE 12 — Monthly variation in numbers of Pied Stilt at Waimea Inlet from August 1976 to July 1978

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.

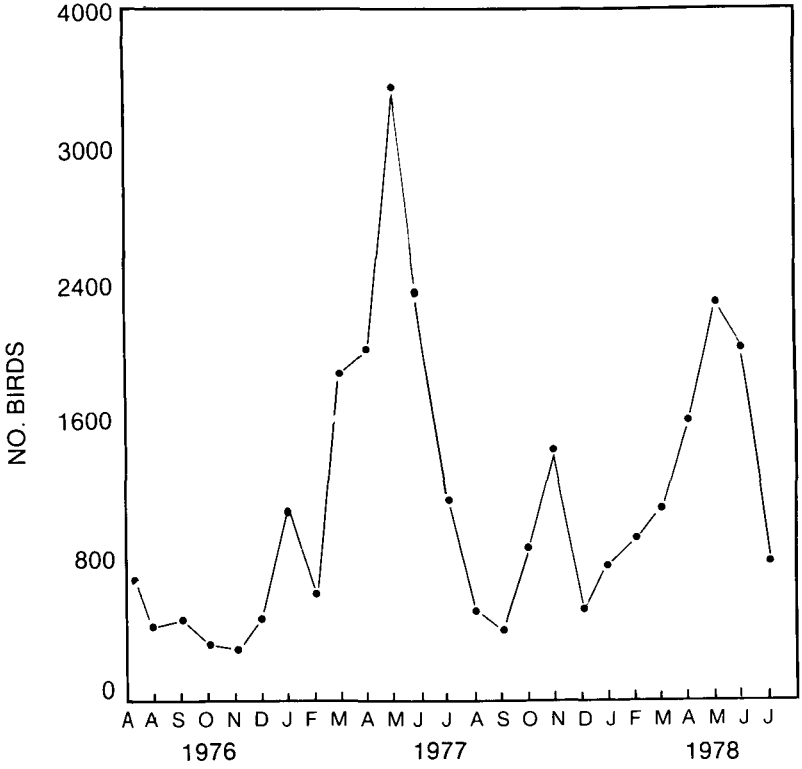

FIGURE 14 — Monthly variation in numbers of Southern Black-backed Gulls at Waimea Inlet from August 1976 to July 1978

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

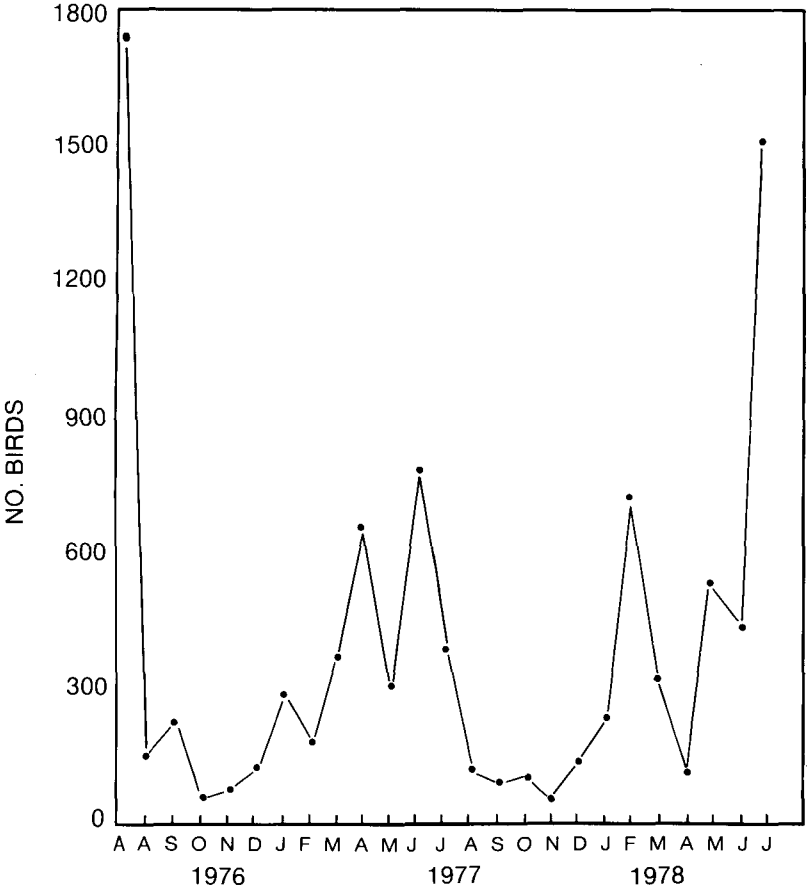

FIGURE 16 — Monthly variation in numbers of Red-billed and Black-billed Gulls at Waimea Inlet from August 1976 to July 1978

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

TABLE 1 — Measurements of chick A compared with its sibling (C) and range of later companions (D-H). Fat index is the ratio of dry fat to dry fat-free residue

Bird	Age (days)	Weight (g)	Outermost primary (mm)	Longest rectrix (mm)	Fat index	Wet weight gut contents (g)
C	21	76	68	48	0.31	1.1
A	25	61	69	47	0.21	1.3
D-H	21	68-79	70-75	50-55	0.18-0.20	0.2-0.9

probably very alike on 26 November because they had grown at the same rate, being 33 and 32 g on day 6 and 73 and 76 g on day 12, respectively.

It is interesting that fledgling A had apparently been deserted by its parents, which had only two chicks to care for; that it had found a foster home for itself among five younger but larger chicks; and that it was being fed and was still the fattest, albeit lightest, chick in the box, despite having been injured by the other chicks, their parents, or while trying to enter some other box. Young scroungers trying to enter boxes are chased vigorously by adult Starlings (Flux 1978) and such treatment may explain the reduced body weight and apparent check in flight feather growth of this enterprising fledgling.

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NORFOLK ISLAND NOTES 1968 TO 1984

By J. L. MOORE

This is the first report to be issued based on information submitted under the OSNZ South-west Pacific Islands Records Scheme, which was instituted in 1981.

The format of the report follows closely that of *Norfolk Island Notes 1971 to 1980* (Moore 1981), which was based on data supplied by OSNZ members and provided the stimulus for OSNZ to introduce a records scheme for the islands of the SW Pacific.

Much of the data presented here predates the formal introduction of the records scheme and clearly demonstrates that the value of such observations does not diminish with age. Anyone having observations made during a visit to any SW Pacific island in earlier years should therefore submit their notes to the records scheme.

Norfolk Island notes have been received for 10 visits to the island plus notes from the seabird log of the yacht *Derwent* as it passed close by the eastern side of Norfolk Island. Observations relate to periods varying from a few hours to over three weeks, and the month, year and period, together with the names of the ten observers are given below in chronological sequence.

1968 January	16 days	R. B. Sibson
1971 November	14 days	H. L. Wakelin
1971 November/December	7 days	C. A. Fleming
1974 March	14 days	H. L. Wakelin
1976 March	15 days	H. L. Wakelin
1979 November	9 days	A. Habraken & D. White
1981 November	17 days	J. L. & M. Moore
1982 September	6 days	B. D. Heather
1982 September	5 hours	T. Lovegrove
1982 September	10 days	J. C. Henley
1984 December	23 days	J. L. & M. Moore

Records have been received on 69 species, of which seven have not previously been recorded for the island. These seven species are marked with an asterisk in the species notes which follow.

The 53 species in the notes are those for which the data submitted appear to be of significance in the light of published information, unnecessary duplication being avoided.

The passage close to Norfolk Island of the ornithological expedition aboard the yacht *Derwent*, on its homeward leg from Ile des Pins to New Zealand, has provided a brief insight into the seabird fauna around the island not previously available from land-based observations. As the results of the expedition are to be reported elsewhere, the data included here are limited to observations made during the period 5.30 to 10.10 a.m. on 19 March 1982 while the yacht was within the latitudes 28°54′ S and 29°12′ S. Data from the log of the *Derwent* have been used in the preparation of Figure 1 to show

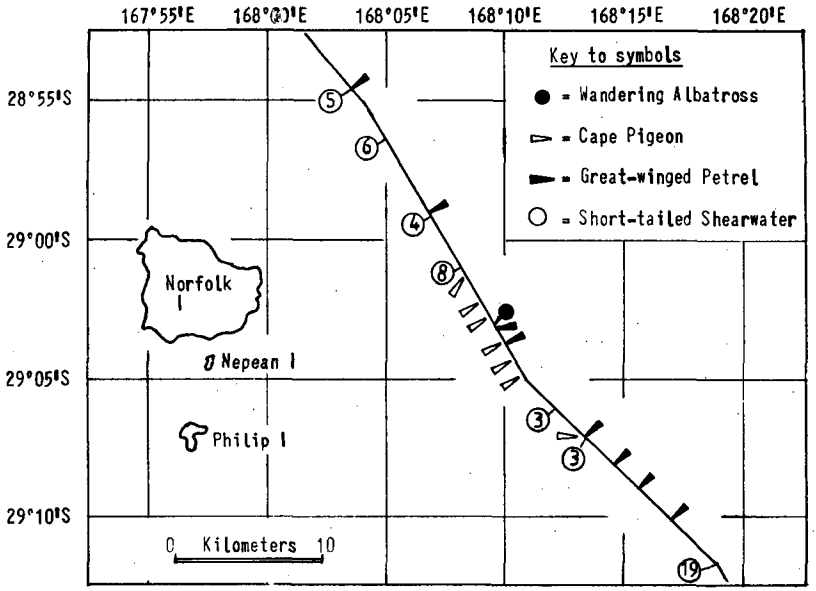

FIGURE 1 — The course of the yacht *Derwent* on 19 September 1982, showing the positions where seabirds not normally recorded from Norfolk Island were logged. The figures in the open circles are the number of Short-tailed Shearwaters in each party

the yacht's approximate positions when seabirds not normally recorded from Norfolk Island were logged.

As with the 1981 report, many of the records relate to migrant waders and a clearer picture is now emerging of the value of the island, both as a stopping-off place for small numbers of a wide variety of species, and also as an area for such species as Least Golden Plover, Whimbrel, Turnstone and the tattlers, which are able to exploit the open grassland and coral reef habitats, to spend the Northern Hemisphere winter.

In keeping with other recent publications on Norfolk Island ornithology, Australian vernacular names have (with minor exceptions) been used in the species notes.

I thank all those who submitted their records to the SW Pacific Islands Records Scheme, particularly those whose notes are in this report. I hope that they will feel the same sense of achievement at seeing their records in print as I do.

SPECIES NOTES

WANDERING ALBATROSS *Diomedea exulans*

One seen from the *Derwent* on 19 September 1982 about 16 km (10 miles) east of Norfolk Island (TL). See Figure 1.

*CAPE PIGEON *Daption capense*

One or two birds accompanied the *Derwent* intermittently from 7.20 a.m. onward on 19 September 1982 as it passed to the east of Norfolk and Philip Islands (TL). See Figure 1.

*GREAT-WINGED (GREY-FACED) PETREL *Pterodroma macroptera*

One or two seen from the *Derwent* on several occasions on 19 September 1982 as it passed to the east of Norfolk and Philip Islands (TL). See Figure 1.

BLACK-WINGED PETREL *P. nigripennis*

Many over Headstone at dusk in January 1968 with smaller numbers elsewhere by day and c.40 dead at Cook Memorial (RBS). Aerial display observed November-December 1971 (CAF). Only two seen 10-23 March 1974 but recorded in some numbers at Black Bank and Rocky Point from 1 to 14 March 1976 (HW). Birds inspecting nest burrows on Philip Island on 15 November 1979 (AH, DW). Two off Kingston on 11 December 1984 and two at Anson Bay on 20 and 21 December (JL&MM).

FLESH-FOOTED SHEARWATER *Puffinus carneipes*

One found ashore among Wedge-tailed Shearwaters near the golf course on the evening of 16 November 1979. It was measured to confirm the identity and released (AH, DW).

WEDGE-TAILED SHEARWATER *P. pacificus*

Rafts of birds still present at dusk between 10 and 23 March 1974 (HW). An estimated 10 000 rafting off Anson Bay on 18 November 1979 (AH, DW). Large numbers calling at night over Burnt Pine during mist and rain in mid-December 1984 (JL&MM).

*SHORT-TAILED SHEARWATER *P. tenuirostris*

Several parties of 3-19 birds logged by the *Derwent* on 19 September 1982. All moving SW on return migration to the Bass Strait breeding grounds after wintering in the N. Pacific (TL). See Figure 1.

LITTLE SHEARWATER *P. assimilis*

A dead bird at Rocky Point in November 1971 (CAF) and several dead on Philip Island on 15 November 1979 (AH, DW). An injured bird at Slaughter Bay on 10 November 1981, found dead next day (JL&MM). Parties of 1-14, totalling 48 birds, logged by the *Derwent* between 5.28 and 10.10 a.m. on 19 September 1982 (TL). One brought from Cascade to New Zealand trapped in the hold of the *Isle de Lumière* was released in Auckland on 11 November 1982 (DW).

RED-TAILED TROPICBIRD *Phaethon rubricauda*

Birds disputing over nest sites between 1 and 13 November 1971 (HW). Some fledglings still at nests from 10 to 23 March 1974, and nests at all stages from eggs to fully fledged young from 1 to 14 March 1976 (HW). At Cascade c.150 displaying on 17 November 1979 (AH, DW). First eggs laid at Cascade on 11 November 1981 (JL&MM).

AUSTRALASIAN GANNET *Sula bassana serrator*

Three birds sitting on nests on Philip Island on 15 November 1979 (AH).

BROWN BOOBY *S. leucogaster*

One on Nepean Island and one flying past Cook Memorial between 4 and 9 September 1982 (BDH).

MASKED BOOBY *S. dactylatra*

At Rocky Point a few pairs with one egg and four chicks in January 1968 (RBS), three chicks there in November/December 1971 (CAF), and young there in March 1974 (HW). On 15 November 1979 nests on Philip Island contained eggs or downy young, whereas on Nepean Island young were already fully fledged (AH, DW). On islands near Cook Memorial, several nests incubating and one chick in down by 9 September 1982 (BDH). A bird found near Hamilton, New Zealand, in July 1983 (which subsequently died) had been banded six months previously on Philip Island (confirmed by O. Evans, pers. comm.).

WHITE-FACED HERON *Ardea novaehollandiae*

Singles at Kingston and near Anson Point in January 1968 (RBS). Two in November/December 1971 (CAF). Present Kingston and two at Mission Pond in March 1974 and very common in March 1976 (HW). Four at Kingston and one at Cascade in November 1981 (JL&MM). Up to nine at Kingston in September 1982 (BDH), and up to 16 there in December 1984 (JL&MM).

WHITE HERON *Egretta alba*

One at Kingston between 1 and 14 March 1976 (HW). Probably the same bird previously reported there in July 1976 (Moore 1981).

SACRED IBIS *Threskiornis molucca*

One at Kingston between 1 and 14 March 1976 (HW). Probably the same bird as reported there in November 1975 (McKean *et al.* 1976) and in July 1976 (Moore 1981).

ROYAL SPOONBILL *Platalea leucorodia*

Singles at Kingston from 1 to 13 November and 28 November to 4 December 1971 (HW, CAF) and also between 1 and 14 March 1976 (HW). Probably the same birds previously reported for September 1971 and July 1976 (Moore 1981).

There is also a need to set the record straight regarding the Spoonbill reported on Norfolk Island in 1892 by Basset Hull (1909). Although often quoted and widely accepted, the record is incorrect. Reference to North (1892) and to Hindwood (1940) shows that the bird was in fact taken on Lord Howe Island.

*MOUNTAIN DUCK *Tadorna tadornoides*

A female at Kingston from 2 to 24 December 1984 (JL&MM).

MALLARD *A. platyrhynchos*

Three Mallard/Black Duck hybrids at Kingston in November 1981 (JL&MM). More than 50 Mallard present in September 1982 (BDH). One banded on Norfolk Island in August 1982 was shot near Waipu, New Zealand, on 30 April 1983 (confirmed by O. Evans, pers. comm.). A male at Watermill

Pond in December 1984 and up to 20 females and immatures there, including several hybrids (JL&MM).

BLACK (GREY) DUCK *Anas superciliosa*

Three at Kingston and four near South Pacific Hotel in January 1968 (RBS). A few in November/December 1971 (CAF). Two at Mission Pond and 22 near Headstone in March 1974 (HW). Two at Mission Pond and 15 at Kingston in November 1981 and up to 15 there in December 1984, including three females with broods (JL&MM).

AUSTRALIAN KESTREL *Falco cenchroides*

A pair at Headstone between 28 November and 4 December 1971 (CAF). One at Rocky Point in March 1974 and birds at several localities in March 1976 (HW). A pair with two fledged young in November 1979 (AH, DW). Single birds at four widespread localities in November 1981 (JL&MM) and still widespread in September 1982 (BDH), but seen only in the Kingston/ Middlegate area in December 1984, reports indicating that some had been culled to protect endemic species (JL&MM).

The 1971 record is the first occasion that more than one bird was reported and probably indicates the start of colonisation of the island by this species.

SPOTLESS CRAKE *Porzana tabuensis*

Between 4 and 9 September 1982 several heard at Mission Pond and one seen and another heard at New Cascade Road in response to taped calls (BDH).

PURPLE SWAMPHEN *Porphyrio porphyrio*

Two at Mission Pond and one near South Pacific Hotel in January 1968 (RBS). One at New Cascade Road in November 1981 (JL&MM). Several at Mission Pond in September 1982 (BDH), and two there and one at New Cascade Road in December 1984 (JL&MM).

PIED OYSTERCATCHER *Haematopus ostralegus*

One at Kingston on 22 September 1982 (JCH).

LEAST GOLDEN PLOVER *Pluvialis fulva*

At Kingston, 43 max. in January 1968 (RBS). Widespread on grasslands in November and December 1971 (HW, CAF). Up to 30 in March 1974 (HW). An island census of 140 in November 1979 (AH, DW). Up to 70 at Kingston and 20 at Airport in November 1981 and c. 70 at Kingston in December 1984 (JL&MM).

DOUBLE-BANDED PLOVER *Charadrius bicinctus*

Eight at Slaughter Bay between 10 and 23 March 1974 (HW).

EASTERN CURLEW *Numenius madagascariensis*

One found dead on the golf course on 17 November 1979 was presumably the bird seen a few days previously at Kingston (AH, DW). One at Kingston from 14 to 17 December 1984 and two there from 18 to 24 December (JL&MM).

WHIMBREL *N. phaeopus*

Asiatic race (*N.p. variegatus*): Up to 11 in January 1968 (RBS). Up to eight in November and December 1971 (HW, CAF). One in March 1974 and three in March 1976 (HW). Up to nine in November 1981 and up to 12 in December 1984 (JL&MM). The above maxima all relate to the Kingston area but birds also recorded at other localities both coastal and inland.

American race (*N.p.hudsonicus*): One at Kingston and Watermill Valley from 7 to 16 November 1981 did not associate with the Asiatic birds present (JL&MM).

*BRISTLE-THIGHED CURLEW *N. tahitiensis*

One at Kingston on 20 January 1968 after high winds on the previous day; not present on 21 January (RBS).

BAR-TAILED GODWIT *Limosa lapponica*

One on 13 January 1968 (RBS). Up to 12 between 1 November and 4 December 1971 (HW, CAF). One in March 1974 and one in March 1976 (HW). Up to 12 from 1 to 16 November 1981 and one on 2 and 3 December 1984 (JL&MM). All in the Kingston-Watermill Valley area.

*MARSH SANDPIPER *Tringa stagnatilis*

One at Kingston from 31 October to 13 November 1981; three on 14 November and five on 15 and 16 November. One at Kingston from 4 to 11 December 1984 (JL&MM).

WANDERING TATTLER *T. incana*

At Kingston/Point Hunter, three from 20 to 23 January 1968 (RBS), one on 10 March 1974 (HW), and one identified by its call on 15 December 1984 (JL&MM).

GREY-TAILED TATTLER *T.brevipes*

Two at Kingston/Slaughter Bay between 1 and 13 November 1971; singles there on 10 March 1974, in March 1976 (HW), and between 1 and 15 November 1981 (JL&MM). One at Kingston Common pond daily from 2 to 24 December 1984, identified by call (JL&MM).

TATTLER sp.

As both tattler species have now been recorded on several occasions, and as identification as to species is possible only under unusually favourable conditions, the total number of tattlers present is often the only complete data available. For consistency the following records cover all birds seen, and where individual birds have been identified as to species, they are listed both here and under the separate species heading. All records are for the Kingston area except for occasional birds at Cascade.

Up to 6 in January 1968 (RBS). Two during November and December 1971 (HW, CAF). Two in March 1974 and two in March 1976 (HW). Up to three in November 1981 (JL&MM). One in September 1982 (BDH). Up to 5 in December 1984 (JL&MM).

TEREK SANDPIPER *Xenus cinereus*

One at Kingston on 9 and 10 December 1984, two between 11 and 17 December, and one remaining to 18 December (JL&MM).

TURNSTONE *Arenaria interpres*

At Kingston up to 50 in January 1968 (RBS). Up to 20 in November and December 1971 (HW, CAF). Up to 100 in March 1974 (HW). Four on Philip Island on 15 November 1979, and a Norfolk Island census of 110 on 16 November (AH, DW). Up to 60 at Kingston and 12 at Airport in November 1981 and up to 128 at Kingston and three at Crystal Pool in December 1984 (JL&MM).

LATHAM'S SNIPE *Gallinago hardwickii*

One at Kingston on 15 November 1981 (JL&MM).

KNOT *Calidris canutus*

At Kingston, one from 31 October to 6 November 1981 with up to five from 7 to 16 November. One from 9 to 24 December 1984 (JL&MM).

SHARP-TAILED SANDPIPER *C. acuminata*

Up to 12 at Kingston and Watermill Valley between 1 and 13 November 1971 (HW). One at Kingston from 31 October to 8 November 1981, increasing to a maximum of 13 on 15 November (JL&MM).

*PECTORAL SANDPIPER *C. melanotos*

One to three at Kingston from 31 October to 16 November 1981 (JL&MM).

RED-NECKED STINT *C. ruficollis*

At Kingston, one or two from 1 to 13 November 1971 (HW) and up to six from 28 November to 4 December (CAF). Nine there on 15 November 1981 and six on 16 November, with up to four there between 2 and 24 December 1984 (JL&MM).

BLACK-WINGED STILT *Himantopus himantopus*

One at Kingston on 16 November 1981 after severe storms between Norfolk Island and New Zealand the previous day (JL&MM).

SILVER GULL *Larus novaehollandiae*

An adult and four immatures at Emily Bay on 9 September 1982 (BDH).

WHITE-WINGED TERN *Chlidonias leucopterus*

At Kingston, single birds between 1 and 13 November 1971 (HW), from 31 October to 4 November 1981, and from 18 to 24 December 1984 (JL&MM).

BLACK NODDY *Anous minutus*

Thousands of birds at breeding colonies in gullies to north-east of Prince Phillip Drive in early December 1971 (CAF). Of several dozen nests inspected between 10 and 23 March 1974 only two were still occupied, each with a single well-developed chick (HW). On Philip Island on 15 November 1979, most birds sitting on eggs, whereas breeding had not started on Norfolk Island (AH,DW).

WHITE TERN *Gygis alba*

On 17/18 March 1974, many almost fledged young blown from their nest trees by very strong westerly winds were resting on the ground, tree stumps and fence posts (HW).

GREY TERNLET *Procelsterna cerulea*

Birds still present at nest sites at Duncombe Bay on 10 to 23 March 1974 (HW). At Philip Island, birds sitting on eggs and some nests with newly hatched chicks on 15 November 1979; with c.400 feeding offshore (AH, DW). Up to eight at Cook Memorial by 9 September 1982 (BDH).

CRIMSON ROSELLA *Platycercus elegans*

Very few present in March 1976 due to a disease causing extensive feather loss but which did not affect other species (HW).

NORFOLK ISLAND PARAKEET *Cyanoramphus novaezelandiae cookii*

Single birds at Mt Pitt, King Fern Gully and Selwyn Pine Road in January 1968 (RBS). Two at Mt Pitt and two at Red Road in November 1971 (HW). One seen in March 1974 and several groups heard between Mt Bates and N Coast in March 1976 (HW). Three at Mt Bates, three at Red Road and one at McLauchlan's Lane in November 1981 (JL&MM). One or two in September 1982 (BDH, JCH). Heard but not seen at Mt Bates in December 1984 (JL&MM). A captive breeding programme was initiated in 1984 by the Australian National Parks and Wildlife Service in an attempt to stem the decline in the parakeet population, and some birds were captured for this purpose.

SHINING BRONZE-CUCKOO *Chrysococcyx lucidus*

Calling birds heard near the Settlement in January 1968 (RBS), Cook Memorial and Burnt Pine in November 1981, and at Crystal Pool and Douglas Drive in December 1984 (JL&MM).

NORFOLK ISLAND BOOBOOK OWL *Ninox undulata*

One heard screeching at Rocky Point at night on 12 November 1979 (AH, DW).

WELCOME SWALLOW *Hirundo tahitica neoxena*

Up to seven at Kingston and Mt Pitt between 1 and 14 March 1976 (HW). One at Kingston between 7 and 16 November 1981 and two there between 3 and 22 December 1984 (JL&MM).

SCARLET ROBIN *Petroica multicolor*

Small numbers recorded by most observers, from fairly widespread localities, the largest count being 12 pairs and two singing males from Mt Pitt via the Bridle Path to Duncombe Bay Road in March 1976 (HW).

LONG-BILLED WHITE-EYE *Zosterops tenuirostris*

Small parties reported from several localities in November/December 1971 (HW, CAF), November 1981 (JL&MM), September 1982 (BDH) and December 1984 (JL&MM).

WHITE-BREASTED WHITE-EYE *Z. albogularis*

Birds thought to be of this species heard near Mt Bates in November 1981 but too high in the canopy for confirmation by sight ((JL&MM).

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SHORT NOTES

Ensign Best's bird observations on Norfolk Island

Except for a small party sent ashore by Captain Cook when the island was discovered in 1774, no landing is known to have been made on Norfolk Island, or either of the other islands of the group, until February 1788, when Lt Gidley King arrived with a party of settlers and convicts under orders from the British Government to "secure the island".

Apart from an 11-year break between 1814 and 1825 the island was to remain a penal settlement for 66 years until 1854, eventually accommodating a population of over 2000, of which about 1800 were convicts.

During this period as a penal colony, the island was extensively modified with considerable effects on the native birds. Much of the island was affected directly by clearance for building and for agriculture, and the rest was indirectly affected by the deliberate liberation of domestic animals.

Although the island's birds are mentioned occasionally in the official records kept by the officers of the prison settlement, these observations were limited to species such as parakeets and Providence Petrels which in some way affected human life on the island.

While Norfolk Island was a penal colony, naturalists had little opportunity to visit the islands and, apart from the botanist Cunningham, who spent a short time there in May 1830, apparently none did so.

The private journals of Abel Dottin William Best were discovered in 1955 and published in 1966 (Nancy M. Taylor, ed. *The journal of Ensign Best 1837-1843*. Wellington; Govt Printer). These journals provide a valuable, if rather limited, insight into the birdlife of the islands during this critical part of their history.

Born into the English middle class in about 1815, Best enlisted as an officer in the British Army in 1837 and, until 1843, maintained a journal of his daily life.

Best spent some 19 months on Norfolk Island, arriving from New South Wales in August 1838 and departing for New Zealand in April 1840.

Unfortunately, for reasons unknown, the Norfolk Island section of his journal was maintained only for the first seven months. A further gap in his diary occurred, due to an unspecified illness, which reduces the account to a total of about 20 weeks. This is broken into approximately equal periods from 27 August to 2 November 1838 and from 2 February to 9 April 1839.

The first of these two periods is the more interesting ornithologically because it coincides with the breeding of most of the seabirds and the arrival of migrant waders from the Northern Hemisphere.

Like most of his fellow officers, Best's main spare-time occupations were riding, shooting and fishing, partly for the table but mainly for sport. However, Best's interests in things around him extended into many other fields

and, in keeping with the times, he appears to have been something of a collector, shooting terns and parakeets for their skins or for stuffing, and later preserving a collection of beetles.

By the time Best arrived, Norfolk Island had been in use as a penal colony for some 50 years and the effects of the deliberate introduction of pigs, goats and rabbits on Philip Island are already apparent in Best's writings.

During his first few months Best visited Philip Island with shooting parties and records returning with 50-100 rabbits on several occasions. He also referred to pigs, goats and feral chicken as present on Philip Island, although he does not record any of these being killed for food.

On Norfolk Island itself, feral wild cats were well established in the native bush and were already regarded as a serious pest because of their predations on the bird life. Wild cats were hunted by Best with his dogs and seven were killed by him over a 27-day period during September/October 1838. Best stated "you must know that the reason that I am so inveterate against them is that they destroy Quail and we intend introducing them again; it was tried once but the cats soon cleared them off."

Best made reference in the Norfolk Island section of his journal to 11 bird species, most of which can be identified with reasonable certainty. His comments on these 11 birds are summarised in the following list.

We may also perhaps draw some conclusions from Best's lack of reference to species which might reasonably have been expected to attract his attention. For example, he makes no mention of wild duck, although from numerous references in the New Zealand section of his journal he rated these highly for both sport and table, and it seems probably that wild duck were not on Norfolk Island at this time. It also seems likely that he would have observed and commented on the Norfolk Island Kaka (*Nestor productus*) had it been present, and his lack of reference to it may suggest that by 1838 it was already extinct, at least on Norfolk Island.

It is also interesting to note that, although Best had a range of domestic animals, including hens, ducks, geese, turkeys and pigs, he makes no mention of any problem with rats. This suggests that the large population of rats which caused so much trouble in the early days of settlement had been brought well under control by the time Best arrived on the island.

LIST OF SPECIES

WEDGE-TAILED SHEARWATER *Puffinus pacificus*

On 1 November 1838 Best recorded shooting a muttonbird near Steele's Point while his companions took two on a small island nearby. The following day Best and a fellow officer captured two more on an island off Duncombe Bay.

The time of year indicates that it was the Wedge-tailed Shearwater to which best referred rather than the winter-breeding Bird of Providence (*Pterodroma solandri*), which was almost certainly extinct on Norfolk Island some years before Best's arrival.

RED-TAILED TROPICBIRD *Phaethon rubricauda*

After returning from the island off Duncombe Bay on 2 November

1838, Best stated that "McLean and I returned to the hut whilst Storey went to catch some Boatswains. In an hour or more he returned with three".

MASKED BOOBY *Sula dactylatra*

Best made a single reference to a young 'Gannet' being captured on an island off Duncombe Bay on 2 November 1838.

FERAL CHICKEN *Gallus gallus*

Of a day spent on Philip Island on 12 October 1838, Best recorded that "we all heard the crowing of the wild fowls but only one cock was seen".

LEAST GOLDEN PLOVER *Pluvialis fulva*

Best's entry for 18 September 1838 reads "After breakfast went down to the Bay to shoot plover and curlew, we killed about 10 brace." On 28 September he again recorded shooting plover in Emily Bay but on this occasion "only killed a very few".

Although 'plover' could be interpreted as referring to several other wader species which occur on Norfolk Island, the Least Golden Plover appears most likely to be the bird intended. It is the commonest wader occurring on the island, the September date is appropriate, and it has a close similarity with the European Golden Plover (*C. apricarius*), with which someone of Best's background would probably be familiar.

WHIMBREL *Numenius phaeopus*

On 18 September 1838, Best recorded shooting 'curlew' together with plover at Emily Bay.

Although the Eastern Curlew (*Numenius madagascariensis*) has been seen rarely on Norfolk Island, Best's observation probably refers to the Whimbrel, which is an annual visitor to the island and to other islands in the SW Pacific.

SOOTY TERN *Sterna fuscata*

On 1 November 1838, Best recorded the capture of three 'Black and White Swallows' from islands off Steele's Point and on the following day the capture of three more from an island off Duncombe Bay. Best stated on 2 November that the birds had "done hatching".

COMMON NODDY *Anous stolidus* or
BLACK NODDY *Anous minutus*

In his entry for 1 November 1838, Best recorded shooting a pair of 'slate-coloured birds' near Steele's Point and the capture of a third by his companions on an adjacent island.

Although one of the noddies is clearly intended, one cannot be certain which species is referred to as both are about the island in October/November.

WHITE TERN *Gygis alba*

Best's entry for 1 November 1838 states "we went first to Steele's Point for White Swallows, they were too wild however to allow themselves to be knocked down and out of four I shot only one was fit for stuffing".

NORFOLK ISLAND PIGEON *Hemiphaga novaeseelandiae spadicea*

This pigeon was clearly still quite common on the main island in Best's time. During the brief period of his records, Best, either alone or with one of his companions, killed at least 72 during 17 hunting expeditions. The largest bag was 25 taken by two men on 18 September 1838.

In the New Zealand part of his journal, Best used as synonyms the terms *Pigeon*, *Wood Pigeon* and *Wood Quest* when referring to the New Zealand Pigeon (*Hemiphaga n.novaeseelandiae*).

I have therefore assumed that his references to pigeons and wood quests on Norfolk Island relate to the *Hemiphaga* pigeon rather than the dove (*Gallicolumba (?) norfolkiensis*), both of which are now extinct.

NORFOLK ISLAND PARAKEET *Cyanoramphus novaezelandiae cookii*

Best recorded shooting five or six 'Lowries' in the bush at Ball's Bay on 21 September 1838, but on the following day he wrote "Got up at six to skin my birds, found them all too much shot about the body so cut off the wings and tail."

An editorial footnote to this entry, probably attributable to the late Sir Robert Falla, states "Any kind of parakeets would be loosely referred to as Lowries".

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Asiatic Dowitcher at the Heathcote-Avon Estuary, Christchurch

On 29 August 1985, Andrew Crossland visited the Heathcote-Avon estuary and found a wader that was unfamiliar to him.

The next day, Peter Langlands found the same bird on the western shore of the estuary and compared it with the Bar-tailed Godwit (*Limosa lapponica*) it was associating with. The bird was observed again by AC and PL for about one hour on 4 September. It was identified as a dowitcher (*Limnodromus* sp.) and other local observers were informed of the sighting.

On 6 September JF and JF found the bird in the same place feeding on the tidal mudflats with both Bar-tailed Godwit and five Asiatic Black-tailed Godwit (*Limosa limosa melanuroides*).

The dowitcher associated closely with the Bar-tailed Godwit, which it resembled in general colouring. However, the dowitcher could easily be distinguished by its smaller size, darker back, straight bill and different feeding technique.

The dowitcher was estimated to be about two-thirds the size of the Bar-tailed Godwit. Bar-tailed Godwits vary considerably in size, but the dowitcher was smaller than any of the godwit present.

Its back was grey-brown, and the lighter feather edgings made it look streaked. A dark brown patch at the bend of the wing was a feature noted by all of the observers. The nape was light brown and finely streaked. Its crown was grey-brown, and it had a light superciliary stripe and a darker eyestripe. No eye ring was distinguished.

The underparts were whitish with light brown barring on the flanks and under the tail. The tail looked brown, and the rump was pale with brown

barring visible on the upper tail-coverts. The wings were as long as the tail when folded.

When the bird was seen briefly in flight, its wing and rump pattern seemed similar to the Bar-tailed Godwit's.

The face tapered from the crown to the bill and looked noticeably different in shape from the high crown of the godwit. The bill was dark, straight, thickened at the tip and about twice the length of the head. The legs were dark and shorter than those of the godwit.

The bird fed actively, walking about with its bill pointing obliquely downwards, thrusting deeply into the mud to feed.

On the basis of size, straight bill, plumage characteristics and dark leg colour the bird was identified as an Asiatic Dowitcher (*Limnodromus semipalmatus*).

Identification features of the dowitcher species were summarised by Nisbet (1961).

The Asiatic Dowitcher is the largest dowitcher, being about the same size as a Greenshank (*Tringa nebularia*). However, in plumage it most closely resembles a Bar-tailed Godwit. It has dark legs and the lower back and rump are closely barred white and dark brown, giving the tonal effect of being slightly paler than the rest of the back (Paige 1965).

The Long-billed Dowitcher (*L. scolopaceus*) and Short-billed Dowitcher (*L. griseus*) have greenish legs and a white back and rump.

The Asiatic Dowitcher is also distinguished from the Long-billed Dowitcher and generally from the Short-billed Dowitcher by a narrow white wingbar at the base of the primaries and secondaries in addition to the white tips to the secondaries common to both other species. Unfortunately our brief flight view did not let us see this character.

The Asiatic Dowitcher breeds in Siberia, Mongolia and northern China and migrates to south-eastern Asia. It winters on muddy estuaries, occasionally on inland lakes, mainly in Thailand, Indochina, the Malay Peninsula and India (de Schauensee 1984). It regularly reaches Australia, mainly on the northern coasts (Blakers *et al.* 1984).

This first New Zealand record has been accepted by the OSNZ Rare Birds Committee.

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Banded Dotterel breeding at Stewart Island

Oliver (1955, *New Zealand Birds* p.260) says of the Banded Dotterel (*Charadrius bicinctus*): "Stewart Island, not known to breed". Likewise, the other usual references do not include Stewart Island in its breeding distribution. In personal observations and inquiries over many years, I have failed to produce evidence of its breeding there. In 1983, Ida Collett of Halfmoon Bay, after extensive inquiries of local residents, including well-known long-time naturalist Roy Traill, wrote to me that "there is no written record that it does breed here".

Thus the following observation from the diary of Rhys Buckingham (pers. comm.) is of considerable interest:

"26.11.1980 (1515 h) walking along West Ruggedy beach southwards from a cave, past the bluff (a high-tide impasse) to the first big creek near the south end. One Banded Dotterel chick with three adults nearby; the adults moved up to the chick as if attempting to protect it. I had a good look at the chick in my hands — it would have been just a day or two old. There was no sign of nests or other chicks."

Although the Banded Dotterel is regularly reported on Stewart Island, which has large areas of potential breeding habitat, this seems to be the first positive evidence of its breeding there.

PETER CHILD, *10 Royal Tce, Alexandra*

Fairy Terns at Tapora, Kaipara Harbour

On 22 June 1985, while counting waders near Tapora, Kaipara Harbour, we noticed a group of 10 small terns. They were roosting next to, but not mixed with, a group of waders consisting mainly of Bar-tailed Godwit (*Limosa lapponica*) and Pied Stilt (*Himantopus h. leucocephalus*). While we examined these terns, a White-fronted Tern (*Sterna striata*) landed among them, emphasising their small size.

On consulting *The new guide to the birds of New Zealand* (Falla *et al.* 1979), we determined that the small terns were Fairy Terns (*S. nereis*). Seven were adults with orange legs, yellow bill and black eye patch not reaching the base of the bill, features which distinguished them from the Little Tern (*S. albifrons*). Three were immature with dull grey-brown legs and mottled crowns, the black cap being incomplete. We watched the birds for about 30 minutes, during which time two New Zealand Dotterels (*Charadrius obscurus*) moved freely among them.

According to Falla *et al.* (1979), the Fairy Tern is "Now known as a breeding bird in New Zealand only from Northland, where probably fewer than ten pairs attempt to nest". The Classified Summarised Notes in *Notornis* suggest that numbers have not increased greatly since 1979, and they contain few breeding records of *S. nereis*. A winter flock of 13 Fairy Terns with 12 Little Terns was reported 7 years ago at the site of our present observation (R. B. Goffin, 1978, *Notornis* 25: 331).

Observers of shorebirds at other Kaipara sites did not record small terns on the day of our count. For several years the Wildlife Service has been trying to protect the nests of Fairy Terns, and the presence of immature birds among this flock may be an encouraging sign.

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Cattle Egrets near Antarctica in April

On 24 April 1985, during the voyage of SRV *Totorore* from the Antarctic Peninsula to Punta Arenas, Chile, two Cattle Egrets (*Bubulcus ibis*) were seen in 61°23'S, 63°39'W, flying north.

One bird tried to land on board but fell into the water. After about a minute it managed to take off again and make a successful landing. It was emaciated and weak and, although it was kept warm and force fed with sardines and oil, it died after two days. The specimen is now at the Instituto de la Patagonia. It had dark legs with yellowish on the rear of the tibias, and it had a tinge of buff on the crown.

Measurements were: length 480 mm, bill 53.9, gape 74.7, wing 258, tail 93, tarsus 84, mid-toe 81.

The birds were seen after a northeasterly gale with snow and sleet, sea temperature 1.4 °C, air -1 °C. By this date the Bransfield Strait was already blocked by pack ice, and so if the egrets had been in the South Shetland Islands or on the Antarctic Peninsula, as seems likely, they had left their departure for the north very late.

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This record refers to the African subspecies *B. i. ibis*, which now breeds and migrates widely in South America, not the Indian subspecies *B. i. coromandus* that occurs in New Zealand and Australia. See similar records in *Distribution of Cattle Egrets to the Falkland Islands*, I. J. Strange, *Le Gerfaut* 1979 — Ed.

★

A probable record of Audubon's Shearwater from Rarotonga

On 14 October 1983, at about 5 a.m., while waiting to leave Rarotonga by air, I watched a shearwater in the loading lights adjacent to the aircraft for about 30 minutes. The bird appeared suddenly in the zone of very bright light produced by the loading lights (one situated high up on a standard) and circled repeatedly in the general area over and in front of the aircraft, rather than being attracted to the actual lights. Its flight was sometimes quite close to the ground, and it was undeterred by the considerable activity all around the aircraft. It disappeared and reappeared out of the dark, and I watched at least five appearances.

Visibility was good as the bird was so close and in such strong light. The weather was fine and clear. Features noted were its typical shearwater shape, its comparatively small size and its stiff shearwater flight with alternating flapping, gliding and banking. Field marks: gleaming white (flashing in lights) underparts, black (or possibly brownish black) upperparts, black semicollar coming slightly down sides of neck (but not as prominently as the Fluttering Shearwater *Puffinus gavia*), and white underwings. Unfortunately the colour

of the undertail coverts was not recorded (variable from dark to mottled white in Audubon's Shearwater *Puffinus lherminieri*, distinguishing this species from the Little Shearwater *P. assimilis*, which has pure white undertail coverts). The impression gained was of a size larger overall that that of *P. assimilis* but definitely smaller than that of *P. gavia*. Wing beats were distinctly slower than in the whirring flight of *P. assimilis*.

These observations seem sufficient for the bird to be recorded as Audubon's Shearwater. Further comments on the field characters of Audubon's Shearwater may be of interest. The extensive dark mottling often present along the leading edge of the underwing (well shown in a photograph in Jenkins 1973) is variable, being much reduced in one of a breeding pair of this species from Canton Island in the Auckland Museum, collected by G. A. Buddle on 6 June 1937 (Buddle 1938). The amount of dark edging on the anterior underwing of *P. assimilis* is variable in material from New Zealand in the Museum collection. As noted above, the extent of the dark undertail-covert shading in Audubon's Shearwater is also variable, this area sometimes showing a large amount of white (see photograph in Jenkins 1973 and the above two specimens in the Auckland Museum). These two characters are thus probably unreliable for Audubon's Shearwater to be distinguished from the Little Shearwater in flight. Further, the pale line above the eye, often mentioned as a field character for some races of the Little Shearwater, varies considerably in the New Zealand material in the Auckland Museum.

Audubon's Shearwater is widespread in the tropical Pacific. The only records from the Cook Islands area are those of Holyoak (1980), who saw about ten at sea in the southern Cook group in July and August 1973 and five at sea in the northern Cook group in August 1973. In addition, T. G. Lovegrove saw a shearwater identified as probably Audubon's offshore from the south-eastern end of Rarotonga on 4 September 1981 (a small shearwater, dark above, white below, with flashing white underwings; other seabirds offshore at this time were Herald Petrels *Pterodroma arminjoniana*, noddies and White Terns).

As races of the Little Shearwater breed in the Austral and Kermadec groups, stragglers to the Cook group could be expected, but records to date suggest that this species (like Audubon's) does not normally disperse far from its breeding islands and that its normal range is south of about 25°S latitude (i.e. well to the south of Rarotonga). However, stragglers of the Little Shearwater are recorded from the Marquesas, Marshall and Hawaiian areas (King 1967).

Finally, further records of seabirds attracted to the lights at Rarotonga airport may be expected as it is close to the north coast of the island where, because the reef is close inshore, the lights may be visible from well out to sea.

I am grateful to J. A. F. Jenkins and T. G. Lovegrove for their comments.

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Snipe in Southland

Single snipe, probably Japanese Snipe (*Gallinago hardwickii*), were seen on a freshwater bog behind Colac Bay, Southland, between 19 December 1984 and 21 March 1985. Two snipe were seen on 22 March 1985. This is the southernmost record of migratory snipe in New Zealand. A summary of previous New Zealand records is given.

The "Henderson Extension" of Lake George Wildlife Management Reserve, Colac Bay, is an extensive freshwater bog with many artificial tarns and canals. The pond nearest the end of the access road held a small group of migrant waders during the 1984-85 summer (Miskelly & Cooper, this issue). Snipe were generally flushed from the edges of this pond.

KM & JVM found the first snipe on 19 December 1984. The bird rose from rushes about 5 m away, flew in wide circles about 20 m above the pond for 3 minutes, before landing abruptly 100 m away. It was flushed twice more and called a gruff *schnape* on each occasion.

WJC was unaware of the previous sighting when he visited the area on 20 December. A snipe flushed from the edge of the pool 20-25 m from him, gave several harsh calls, rose to a maximum height of 25 m, and circled three times before making a long, low approach and pitching at the edge of the same pool, 40-50 m further north. When approached, the bird flushed at 2-3 m with a whirr of wings, giving the same calls, then flew fast and low before landing among rushes 60 m away. It could not be found again.

There was a gap of nearly three months before more sightings.

On 16 March 1985, CMM, WJC & G. J. Eller startled a snipe 500 m north of the pond. This bird flew back past them, 15 m above the swamp, and dropped into an inaccessible area 1 km to the east. On 21 March, CMM & GJE flushed a snipe which rose with a Pectoral Sandpiper (*Calidris melanotos*). The snipe gave five or six harsh calls and flew in wide circles for 2 minutes before pitching 1 km away.

The following afternoon (22 March), CMM flushed two snipe in close succession. One bird continued flying to the east until lost to sight, while the other landed and was flushed a second time.

All five sightings of snipe near Lake George were of birds in flight, and so detailed descriptions could not be made. However, all observers noted the long straight bill, short neck and stock body. The tail was short with a rounded tip and the wings were long and pointed. The legs did not project beyond the tail. KM & JVM considered it to be larger than Common Snipe (*G. gallinago*), with which they are familiar. The snipe flew with fast wing beats, rolling the body as it flew away.

The upperparts were rich brown with two pale longitudinal stripes on the scapulars. The breast was buffish and the belly off-white with four or five strong brown bars on the flank near the axilla. The underwing appeared dark at a distance, but was noted as being dusky white with fine dark barring. The flight feathers were dark. No wing bar was seen.

Japanese (Latham's) Snipe breeds in Japan and summers in southern Australia, arriving in Queensland from August on, and then moving south. They are highly mobile, probably moving in response to rainfall. Single birds or small groups occupy muddy edges of fresh, and sometimes saline, swamps and pools (Blakers *et al.* 1984).

Japanese Snipe are the commonest snipe in eastern Australia. However, Swinhoe's Snipe (*G. megala*) and Pin-tailed Snipe (*G. stenura*) have been recorded from northern Australia (Blakers *et al.* 1984, Simpson & Day 1984). Both these species breed in Siberia and migrate to Africa, Asia and Australia, although *G. stenura* has a more westerly distribution than *G. megala*. Swinhoe's Snipe is probably the main snipe species summering in the Top End and Kimberley regions of Australia, where it occurs around freshwater swamps and pools (Blakers *et al.* 1984), but they also occur in Papua-New Guinea east to New Ireland (J. L. McKean *in litt.*).

Identifying migratory snipe by sight in New Zealand will continue to be difficult because few snipe occur and few observers are familiar with Asian snipe. The birds we saw were unlikely to have been *G. stenura* because of the locality, habitat, and large size. Large size and the loud, harsh call also suggest *G. hardwickii* rather than *G. megala*.

The only confirmed Japanese Snipe from New Zealand were shot at Arch Hill, Auckland, in March 1898 and at Castlecliff, Wanganui, in October 1914 (Oliver 1955, Kinsky 1970). Sight records of snipe assumed to be *G. hardwickii* were made at Taieri Beach, Otago, in January 1941 & 1942 ((Oliver 1955); Ahuriri Lagoon, Napier, on 13 April 1952 (Brathwaite 1955); Taieri Lake, Otago, in January 1969 (Edgar *et al.* 1969); Waitohu Stream, Otaki, in November 1972 (P. C. Bull *in* Edgar 1973); two birds at Cooper's Lagoon, Lake Ellesmere, in January 1973 (R. J. Pierce *in* Edgar 1973); and one also seen by R. J. Pierce at Lake Tekapo on 31 December 1983 & 1 January 1984.

Japanese Snipe have been confirmed from Norfolk Island (Moore 1981) and Lord Howe Island (J. L. McKean *in litt.*). Probable sightings on Macquarie Island were reported by Gwynne (1953) and Warham (1969).

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A Ruff in Southland

A Ruff (*Philomachus pugnax*) was present on a freshwater bog behind Colac Bay, Southland, between 9 December 1984 and 16 March 1985. The first report of a Ruff in New Zealand (Mackenzie & McKenzie 1965) was not accepted by the Checklist Committee (Kinsky 1970). Up to two Ruffs were present at Lake Ellesmere, Canterbury, during the period of the Southland sightings (Harrison *et al.* 1985; John Fennell, pers. comm.), and so at least three Ruffs were in New Zealand during the summer of 1984-85.

The "Henderson Extension" of Lake George Wildlife Management Reserve, Colac Bay (see Miskelly *et al.* this issue) was visited by a number of observers between 9 December 1984 and 22 March 1985. A large unidentified sandpiper was first seen by WJC and seven other Southland OSNZ members on 9 December. Subsequent sightings were made on 11 December (WJC) and 20 January (WJC & L. M. Cooper) before the bird's identity was confirmed on 16 March (WJC, CMM & G.J. Eller).

Observationse were made as close as 15 m, but usually at 20-30 m, with 20X telescope and 8X binoculars. The following description is based on notes taken on all four dates.

Although generally solitary, the Ruff was seen among feeding stilts (*Himantopus himantopus*) on 16 March and flew to join an Asiatic Black-tailed Godwit (*Limosa limosa melanuroides*) when flushed. It was always alert and was not seen feeding. The bird was about half the size of the stilts and godwit and of similar size to a Knot (*Calidris canutus*). Indirect comparisons were made on 16 March with a Pectoral Sandpiper (*C. melanotos*), which was observed among stilts 5 minutes after the Ruff had flown off.

The Ruff had the appearance of a large calidrine sandpiper, with long legs, slender neck and comparatively small head. The bill was shorter in relation to the head than in *C. melanotus*, though of similar shape, and was dark with a yellowish base. The bird had no obvious markings on the head, although it had a faint supercilium and fine streaking on the crown. The face and throat were yellowish white. The back feathers were brown with buff edges, giving a scaled appearance. The underparts were whitish buff but with more buff on the upper breast, where a faint gorget was formed by dark feather shafts.

The wings and tail were of similar length when the bird was standing. The legs were long and yellowish, but their length could not be estimated because the bird was always standing in shallow water.

In flight, the Ruff showed a dark rump and tail, conspicuous white lateral tail-coverts, and a narrow white wingbar. The underwing was white, and the legs extended beyond the tail. Its flight was fast and level.

The short, sturdy bill and the lack of a pale blaze on the rump or lower back distinguished this bird from the *Tringa* sandpipers. Upland Sandpiper (*Bartramia longicauda*) was discounted because of the straight bill, short tail, and white underwing (cf. heavily barred in *Bartramia*). The similarly sized knots, *C. canutus* and *C. tenuirostris*, were eliminated owing to their bulkier, short-necked appearance and their rump pattern.

Smaller species with which a Ruff might be confused were discounted for the following reasons apart from size: Buff-breasted Sandpiper (*Tryngites subruficollis*) because of the longer bill, whitish underparts and white sides to rump; Sharp-tailed Sandpiper (*C. acuminata*) because of the long, yellowish legs, different proportions of head and bill, and the absence of a rufous cap. Compared with the Pectoral Sandpiper, the Ruff was larger and more upright with a comparatively shorter bill. Also, the gorget on the breast was much paler on the Ruff, being formed only by feather shafts.

This bird was probably a juvenile because it had a yellowish rather than white fore-face, the latter being typical of adults (Cramp & Simmons 1983). By the yellowish base to its bill, the bird may have been a male.

Ruff breed in northern Asia and Europe, mainly migrating to India and eastern Africa. As a few are recorded from Australia in most summers (Blakers *et al.* 1984), more New Zealand records are to be expected.

We thank John Fennell and Paul Sagar for criticising this note.

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Pursuit Diving by Northern Giant Petrels at the Chatham Islands

On 29 November 1984, while we were working on the west coast of South East Island, we saw a Northern Giant Petrel (*Macronectes halli*) on the sea surface 80-100 metres offshore struggling with a long (60-70 cm) animate object. Given a flat sea, excellent weather conditions and an elevated viewing position some 150 metres a.s.l., we were able to follow the contest fairly well with binoculars. A second giant petrel was also on the surface nearby, and the activity attracted a Southern Great Skua (*Stercorarius skua lonnbergi*), Black-backed Gull (*Larus dominicanus*) and Sooty Shearwater (*Puffinus griseus*).

The giant petrel had great difficulty retaining the animal and, in an apparent attempt to lift it completely clear of the water, beat its wings on several occasions. When it lost its hold on the animal and it 'sank' — we were not sure whether it actively swam away or merely sank when released — the giant petrel dived after it from the surface and completely disappeared underwater. We could see the bird make several beats with half-folded wings to propel itself underwater, and we estimated that it went down about 2 metres to retrieve the animal. We are unable to see whether it used its feet.

After some further struggling with the animal on the surface by the first bird, the second giant petrel moved in. The first bird released the animal, which promptly 'sank' again. The second bird dived after it in exactly the same manner as the first — surface dive, beats with half-opened wings underwater — and retrieved it. Over the next 15 minutes or so, the birds contested the prize on several more occasions and each bird was involved in several dives of this sort to recover the prey, all to about 2 metres in depth, before the prey finally sank or escaped.

We believe the prey to have been a hagfish (family Eptatretidae) from its size, shape and behaviour. The copious production of mucus usual with hagfish would have made it a slippery customer indeed and may account for the difficulty both giant petrels had in handling it. Hagfishes are common around the Chathams and often foul fishing gear. We considered the possibility that the giant petrels had picked up an animal discarded by a fisherman clearing his tackle. However, we had been on that side of the island all day without seeing any fishing vessels and believe, therefore, that this was a natural encounter.

Giant petrels are usually characterised as 'surface seizers' and 'scavengers' at sea (Ashmole 1971, Johnstone 1977, Croxall & Prince 1980). How giant petrels and albatrosses catch active prey such as fish and squid has not been determined, although it has been assumed that this might happen at night when these animals have migrated to the surface. Diving after prey in the manner we observed, termed 'pursuit diving' by Ashmole (1971), has not been reported for giant petrels, as far as we are aware. Voisin & Shaughnessy (1980) reported *M. halli* diving and swimming underwater to avoid capture and *M. giganteus* diving through incoming waves near the shore, although the birds used their feet rather than wings for propulsion. However, wing-propelled underwater swimming has been recorded in albatrosses (Nicholls 1979, Oatley 1979). Some albatrosses have been seen 'plunge diving' (Prince 1980) ('surface plunging' of Ashmole 1971), but without swimming underwater, the birds being taken below the surface by the momentum of their aerial dive alone.

Our observations show that giant petrels can, at least under some circumstances, make shallow dives in pursuit of prey.

We thank J.P. Croxall for drawing our attention to the paper by Voisin & Shaughnessy.

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Ruff *(Philomachus pugnax)* at Lake Ellesmere

After controls to the water level and a period of low rainfall in Canterbury, many of the areas of Lake Ellesmere favoured by migrant and local waders had dried up by January 1985. The waders therefore moved to new feeding areas.

An area of ideal mudflat was located by KCH in company with Shiela Petch and Peter Wilson at the mouth of the L II River.

During a visit there on 10 January, they noted an unfamiliar wader with a resting flock of Knot (*Calidris canutus*). The bird was larger than the Knot and its plumage on the back was more boldly marked. Although it occasionally lifted its head from the resting position, the observers could not see the bird well enough for a full description to be made. As the observers approached, the flock took flight, too far away for the wing and tail pattern to be seen.

The bird was later found feeding with a mixed flock of Knot, Bar-tailed Godwit and Pied Stilt. It was approached to within 20 metres and further details of plumage and behaviour were noted.

The bird was provisionally identified as a Ruff or Reeve.

On 20 January, JFMF and JSF found it at the same place again in a group of 26 Knot. It was approached to within 50 metres and the species identification was confirmed, the observers being previously familiar with the species.

The bird was estimated to be 4-5 cm taller than the Knot with it. Its general shape was more elongated, and it had a longer neck. Its plumage was buffish brown and grey brown compared with the general grey of the Knot.

The crown was finely streaked, but the feathers just over the bill, on the cheeks and on the neck were buff and unstreaked. The back feathers were brown with broad light margins, giving a bold scaly appearance. The underparts were buffish with white on the belly and undertail, but the breast had extensive scalloping of light brown.

The tail was dark with white patches on either side of the tail coverts.

In flight, the white patches were noticeable and separated by a central dark stripe. The wings were brown with a narrow pale wingbar. The secondaries were paler brown than the greater coverts and primaries, resulting in a noticeable lighter trailing edge to the wing.

The bill was the same length as the head and downcurved very slightly at the tip. The bill was dark but appeared to have some pinkish brown at the base. The legs were longer than those of the Knot and were yellowish.

It fed quite differently from the Knots, moving quickly and darting at food items on the surface of the mud. During the period of observation, it did not feed by probing and was not heard to call. Occasionally, it ran at the Knots in turn, showing mild aggression. The Knots moved aside but otherwise took little notice. On several occasions the bird made fluttering leaps of about 30 cm into the air.

The Ruff is sexually dimorphic for size. Cramp & Simmons (1983) quote the size range for male Ruff as 26-30 cm, whereas the female Reeve is smaller with a range of 20-24 cm. The Knot has a size range of 23-25 cm.

As this bird was larger than the Knot, we believe that it was a male.

This record, which was accepted by the OSNZ Rare Birds Committee, is the first positive record for New Zealand. The first possible record was of a bird at the Manukau Harbour in April 1964 (Mackenzie & McKenzie) but this was only admitted to the Suspense List in the New Zealand checklist (OSNZ 1970).

We later learned that this bird had been seen nearby by Colin O'Donnell on 30 December 1984, which would be the first actual sighting. On 14 January, two birds, possibly a Ruff and a Reeve, were seen by Ken Hughey but since then only single birds have been seen.

The Ruff has occurred in Australia in most summers since 1962 but from widely scattered localities (Blakers *et al.* 1984).

This recent sighting confirms the addition of Ruff to the New Zealand list.

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Some foods of Hutton's Shearwater (*Puffinus huttoni*)

Hutton's Shearwaters (*Puffinus huttoni*) breed on steep, tussock-covered slopes of the Seaward Kaikoura Mountains (42° 15'S, 173°38'W) in the north-east of the South Island (Harrow 1965). They migrate to seas off the north-west coast of Australia during autumn (Halse 1981).

Little is known about the foods of this species. Harrow (1976) reported that Kaikoura residents saw up to 20 000 in the bay on 20 and 21 September 1967 feeding on "shoals of unidentified silver fish about 35-40 mm long". Tarburton (1981) examined nine drowned on 28 August 1980: all had stomachs full of very small fish, one shearwater (fresh weight 466.5 g) having 42.5 g of stomach contents.

MATERIALS AND METHODS

The data for this note are from 25 shearwaters drowned in nets at South Bay, Kaikoura, on 20 October 1984. The collector, D.W. Tattle of the University of Canterbury, reported that many thousands of shearwaters were feeding in the bay and numerous small nekton were visible in the calm water. A net of 108-mm mesh set by a local fisherman ensnared at least 50 Hutton's Shearwaters. Although the net was probably set overnight, the birds were

almost certainly caught in the morning because, if they had been in the net all night, nocturnally scavenging isopods may have reduced the carcasses to skeletons by daybreak (W. Davison, pers. comm.). The 25 specimens were collected at 0800 hours and frozen. In November 1984 their stomach contents were removed, and later the birds were deposited at the National Museum. All but one were males.

The stomach and gizzard contents of each bird were carefully washed through a 0.8-mm-mesh sieve. All food items were initially assigned to the following classes: fish skeletons, otoliths, crustaceans, and squid beaks. Fish backbones (up to 10 from each sample), with part of the skull still present and the last vertebra obvious, were measured with vernier calipers, and whole skulls and tail fins were also measured to give an estimate of fish length.

RESULTS

Only two fish samples were intact enough for tentative identification. Almost all these remains were of a small pelagic clupeid, probably *Sprattus antipodum*. All were juveniles, possibly part of a large shoal of a single age-group. Another fish was tentatively identified as a larval wrasse (*Pseudolabrus* sp.). The measurements of the backbones, skulls, and tails (Table 1) give an average fish length of approximately 40 mm. The female had apparently been feeding on the same-sized prey as the males. Fish counts (Table 2) were based on the number of backbone sections longer than 20 mm.

Very few crustaceans were intact. Counts (Table 2) were made of pairs of eyes, which are more resistant to digestion than the rest of the body. Some samples contained enough broken parts of bodies for identifications to be made.

The squid beaks found in six samples (Table 2) were all very small. Only the most heavily darkened area around the rostrum remained, indicating that they were from juveniles.

When the birds were caught, the flocks were drifting southwards, feeding in the typical shearwater manner. As fishing nets are set at least 0.6 m below the surface and are usually 1.8 m deep (D.W. Tattle, pers. comm.), the shearwaters must have been diving to depths of at least 0.6-2.4 m.

DISCUSSION

Work by Griffiths (1975) on the rates at which small fish fed to European perch (*Perca fluviatilis*) were digested showed that, after 24 hours, only 4-5% of their dry weight remained in the perch's stomach. Duffy & Laurenson (1983) found that captive Cape Cormorants (*Phalacrocorax capensis*) retained fish otoliths in the stomach for only one day and that, when regurgitated in pellets, the otoliths were severely eroded. Uspenski (1956) had similar results from Thick-billed Murres (*Uria lomvia*). Wilson *et al.* (1985) fed fish and squid to captive Jackass Penguins (*Spheniscus demersus*) and stomach-pumped them to analyse digestion rates. Otoliths were present 4-18 hours after ingestion, but all other parts of fish were completely digested 10-14 hours after a meal; squid took a little longer (18-22 hours). A captive Shy Albatross (*Diomedea cauta*) fed daily on fish and once on squid had no otoliths in its digestive

TABLE 1 — Measurements (mm) of fish skeletons from the stomachs of 25 Hutton's Shearwaters drowned in Kaikoura Bay on 20 October 1984

	All samples			Female only		
	N	Mean	Range	N	Mean	Range
Length of backbone	162	26.2	18.6-37.7	9	26.9	23.3-30.5
Skull length	9	7.0				
Tail length	8	6.4				
Estimated length of fish		39.6				

TABLE 2 — Prey items from the stomachs of 25 Hutton's Shearwaters drowned in Kaikoura Bay on 20 October 1984

Class Order Family Species	Samples with prey item	Number of prey items Total	Mean per 25 samples	Range
Osteichthyes (fish) (intact or backbones)				
Clupeidae ?*Sprattus antipodum*	25	1330	53.2	8-116
Labridae *Pseudolabrus* sp.	1(+)	1(+)		
(Otoliths only)	3	21	0.85	0-10
Myctophidae *Symbolophorus* sp. Unidentified		12 9		
Crustacea (intact or pairs of eyes)				
Euphausiacea *Nyctiphanes australis*	23	2830	113.2	0-447
Mysidacea *Tenagomysis* sp.	2	3		
Cephalopoda (beaks only)				
Teuthoidea	6	11	0.4	0-5
Nototodarus sp. Unidentified		9 2		

tract after death, although it had eaten fish the previous day; however, squid beaks were present 38 days after ingestion and some must have been present for at least 50 days (Furness *et al.* 1984).

The fish remains from the Hutton's Shearwaters were well digested, mostly with only backbones and a few otoliths intact.

Thus, most of the fish had probably been eaten some hours before the birds died. The myctophids could have been captured about dusk the previous day, but the squids may have been caught days before. The crustaceans, however, were more complete than the fish and possibly pursuit of these had led the birds into the net. Continued digestion after death may account for the general absence of whole animals swallowed just before drowning.

In late October, many male Hutton's Shearwaters would be preparing and defending their burrows in preparation for incubation. They fly into the colony at nightfall and may leave at dawn to feed; many may stay near the coast throughout the day. Most of the females are probably further out at sea at this time. Thus, the birds in this sample could have fed on small fish at dusk, flown into the nesting areas at night and returned at dawn to feed mainly on euphausiids.

These and the earlier findings show that small fish and euphausiids are a major part of the diet of this species, at least from August to October. Examination of more samples collected at other times of the year will provide valuable additional information.

ACKNOWLEDGEMENTS

We thank W. Davison for the identification of fishes, and J. Warham, L.H. Field, M.C. Crawley and P.J. Moors for helpful comments on the manuscript.

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REVIEWS

The Atlas of Australian Birds, by M. Blakers, S.J.J.F. Davies and P.N. Reilly. 1984. Melbourne University Press for the RAOU. 738 pages, 782 maps. Pre-devaluation price Aus $49.

A large, well-illustrated atlas showing the distributions of 648 of the species on the Australian list in two-colour maps which summarise over 2½ million records. The coverage is for Australia, Tasmania and their inshore islands, offshore ones like Lord Howe and Macquarie being excluded.

There is one species to a page (slightly smaller than A4 size), about half the space being given to the map, the rest to a small sketch (mostly very accurate) of the bird and a summary of its world distribution, movements, changes within Australia and brief information on breeding and feeding habits. For some species there are also historical maps recording distribution changes since European settlement.

The methods of compilation from the records of 3000 field observers are fully explained, as are the biases involved and the weak places in the data bases. There is an up-to-date reference list of 1929 titles and several pages listing books and other major works consulted.

This is a major production and a credit to the RAOU and all the members concerned in the venture. Although quite expensive it will be a big help to those planning to watch or study birds in Australia, and OSNZ members should encourage their local libraries to add the work to their reference collections even if they don't purchase their own.

John Warham

Bibliography of the Genera **Calidris** and **Limicola**, by Sven Blomquist. 1983. Special report from Ottenby Bird Observatory, No. 3.

Bibliography of the Genus **Phalaropus**, by Sven Blomquist. 1983. Special report from Ottenby Bird Observatory No. 4.

From the Ottenby Bird Observatory, Sweden, come two publications which should be of interest to any serious student of the genera mentioned.

No. 3 (**Calidris** and **Limicola**) contains 1364 listed references from a wide selection of the ornithological journals of the world (including Australia, New Zealand and the Pacific) and in several languages, including English, Swedish, German, Finnish, Danish, Dutch and French, and at least one in Russian. However, English seems to be the language of most papers.

Report No. 4 (**Phalaropus**) seems to be equally exhaustive with 394 listed references.

The reports may be obtained from Ottenby Bird Observatory, Pl. 1500, S-380 65 Degerhamn, Sweden. No. 3 costs $US 7.00, and No. 4 $US 4.00, both include surface mail postage; for airmail postage add $US 1.00.

D. H. Brathwaite

Field guide to the birds of North America. Published by the National Geographic Society. 1983.

This addition to the various field guides to American birds features 220 full-colour plates of the 800-odd species from Canada to the Mexican border, showing more than 2400 plumages. For carrying in the pocket, I would still prefer the Peterson guides, where a greater number of confusible species can be shown on one plate with diagnostic differences indicated. But anybody planning a bird tour of North America would find this book worth acquiring to pour over before leaving home, and for the wader enthusiast the illustrations are a delight. In the introduction it is stated that average lengths of each species (and each sex where they differ) are quoted, based on measurements from skins, which is an improvement on the apparently haphazard measurements criticised by Eric Jones (**Aust. Bird Watcher**, 1983, 10:28-32). However, it seems that an error has crept in in one case, where the length quoted for the Long-billed Curlew (**Numenius americanus**) is 23ins (58 cm) and for the Far-eastern Curlew 17ins (43 cm). Prater *et al.* (*Guide to the identification and aging of Holarctic Waders* BTO Guide 17) give wing lengths of 28 **N. americanus** as 257-296 mm and of 45 **N. madagascariensis** as 281-333. shortest wing-length recorded there for **americanus** is actually 1mm less than the largest wing-length given for 19 **N. hudsonicus**. **N. americanus** has a relatively longer bill, but I doubt whether this would make the species look nearly one-third larger than **madagascariensis**. That, however, is the only thing I have been able to criticise. The book is obtainable from National Geographic Society, Dept.100, Washington, D.C. 20036. Price $US 13.95 plus $US 3.00 for postage and handling.

D. H. Brathwaite

Australian birds with a sense of humour.

This excellent cassette recorded, narrated and produced by Dr Paul White gives the calls of six species, including two usually regarded rather as master mimics. Side 1 of this cassette, which runs for 9 min 15s, introduces the following species with informed comment: Kookaburra, Blue-winged Kookaburra, Eastern Whipbird, Noisy Frairbird, Red Wattlebird, Little Wattlebird, Aust Crow, with mimicry and song from Superb Lyrebirds and the Satin Bowerbird. Side 2 introduces the same species without the spoken identification.

I found the second side of the tape most useful in checking my identification of Australian species by sound alone. This is not easy and would repay a greater effort many times over.

As far as I am aware some of the species presented on this tape, which is one of a series of six, have rarely been available commercially before. One minor criticism is the lack of dates and times of recording along with the location data. For the scientist, such information, along with that on behaviouir, can be of critical importance. For the informed layman the data are still useful but perhaps not essential.

This high-quality cassette is number three in a series that includes *Bird song from O'Reilly's* (a nature park in Queensland), *Lyrebird, Rhapsody in black and white spring song*, and *Bells in the Australian bush.* These are available

from R.A. & M.J. Ashton, 89 Woronora Parade, Oatley, New South Wales 2223, Australia for $A5.80 plus packing and postage.

Recommended for beginners or those interested in a particular area or group of Australian birds.

Les McPherson

Wildlife and wildlife habitat of American Samoa, 2 volumes (soft covers)
Volume 1, 120 pages, Environment and Ecology
Volume 2, 151 pages, Accounts of Flora and Fauna

Edited by Richard C. Banks, U.S. Fish and Wildlife Service, from material gathered by A. Binion Amerson Jr., W. Arthur Whistler and Terry D. Schwaner, Environment Consultants, Ind., Dallas, Texas, from 15 June 1975 to 21 December 1976.

Volume 1 covers physical environment, biological environment, community relationships and recommendations on resource management.

Most of the numerous figures and tables and 23 photographs show plant communities, some reptiles, but no birds.

The section on birds includes ornithological history, faunal composition, biogeographical affinities, ecological distribution and a summary of the avifaunal distribution on the five islands and two atolls.

At the end of the book Tables 16-25 deal with birds — Table 16 a checklist; Table 17 distribution summary; Table 18 Status; Table 19 Endemic species; Table 20 Occurrence of bird species in various vegetation communities; Table 21 Habitat utilization by seabirds; Table 22 Habitat preference and food of waterfowl, marsh and land birds; Table 24 Densities and rounded population estimates of waterfowl, marsh and land birds on the five main islands.

Volume 2 covers climate, soils, plants and vertebrate animals. Twenty pages are given to birds, this being a coverage species by species of the 57 birds recorded from American Samoa. Several waders and seabirds occurring in New Zealand are discussed, as is the migratory Long-tailed Cuckoo. Each species, except for the three on the list regarded as errors, are treated as follows: Samoan name; status (resident or migrant etc.) discussion, mostly breeding data but with migratory waders interesting observations such as a Ruddy Turnstone breaking and eating tern eggs are mentioned; specimens (museum specimens known to exist).

At the conclusion of Vol. 2 Tables 55-72 deal with birds, including such aspects as mean densities of birds in study areas; population estimates and counts of seabirds summarised from colony observations; birds observed at sea between islands.

There are extensive acknowledgements, including two New Zealand sources, and a comprehensive list of references, including early notes from a *Notornis* article.

With a growing New Zealand interest in birds of the Pacific region, these two excellent and thoroughly prepared volumes are highly recommended to New Zealand ornithologists wanting to keep abreast of Pacific bird literature, even though much of the data presented in these volumes covers other aspects of American Samoan wildlife.

Unlike most publications, these books are available free of charge simply on request from the U.S. Fish & Wildlife Service, Region 1, 500 N.E. Multnomah Street, Suite 1692, Portland, Oregon 97232, USA.

Don Hadden