

# TRENDS IN THE NUMBERS AND DISTRIBUTION OF COASTAL BIRDS IN WELLINGTON HARBOUR

By HUGH A. ROBERTSON

## ABSTRACT

The Wellington branch of the Ornithological Society of New Zealand counted coastal birds along the shores of Wellington Harbour every month for two years in 1975-77 and again in 1986-88. Between the two surveys, giant petrels and Black-backed Gulls, which feed on offal, showed significant population declines; however, most other key species increased, particularly Little Shags, Little Black Shags and Mallards, presumably as the health of the harbour improved as discharges from abattoirs and sewer outfalls were reduced. The distribution of some species changed markedly between the surveys, away from Ngauranga and Pencarrow Head to Moa Point and Owhiro Bay, where raw sewage continued to be discharged into the sea.

## INTRODUCTION

Wellington Harbour is a large sea-filled basin, 10-30 m deep, at the southern end of the North Island (Figure 1). It is roughly circular, with the Hutt River flowing in at the northeast and the exit to Cook Strait at the southeast. Most of the coastline has been modified by urban development of Wellington, Lower Hutt, Petone and Eastbourne. The character of the harbour continues to be modified as new areas are reclaimed or converted into marinas, or sewage and stormwater treatment methods and outfalls are changed. Major sections of the harbour have been reclaimed in the Wellington dockyard area, at Kaiwharawhara, and at Seaview to the east of the Hutt River mouth. Marinas are in the southwest section of Evans Bay and in Oriental Bay. Domestic and industrial waste was discharged into Wellington Harbour at many places up to the 1960s, but the introduction of trunk sewers for the Hutt Valley and Wellington and the closure of two of the three abattoirs have greatly reduced the number of discharge sites. Most waste from the Hutt Valley has been discharged at Pencarrow since 1962, and Wellington waste is mostly discharged at Moa Point on the Wellington south coast.

With growing public interest in the environmental consequences of modifying the Wellington Harbour ecosystem, this study aimed to describe the seasonal and geographical distribution of birdlife in Wellington Harbour and to investigate how modifications to the harbour have affected the numbers and distribution of birds.

The Wellington branch of the Ornithological Society made two series of 24 monthly counts of birds in Wellington Harbour and off the southern coast of Wellington city. The 67 km of coastline from Lake Kohangapiripiri to the end of the public road west of Owhiro Bay was divided into 17 sections based on geographical and habitat features (Figure 1). The first series of counts was made from August 1975 to July 1977 and the second series was from October 1986 to September 1988.

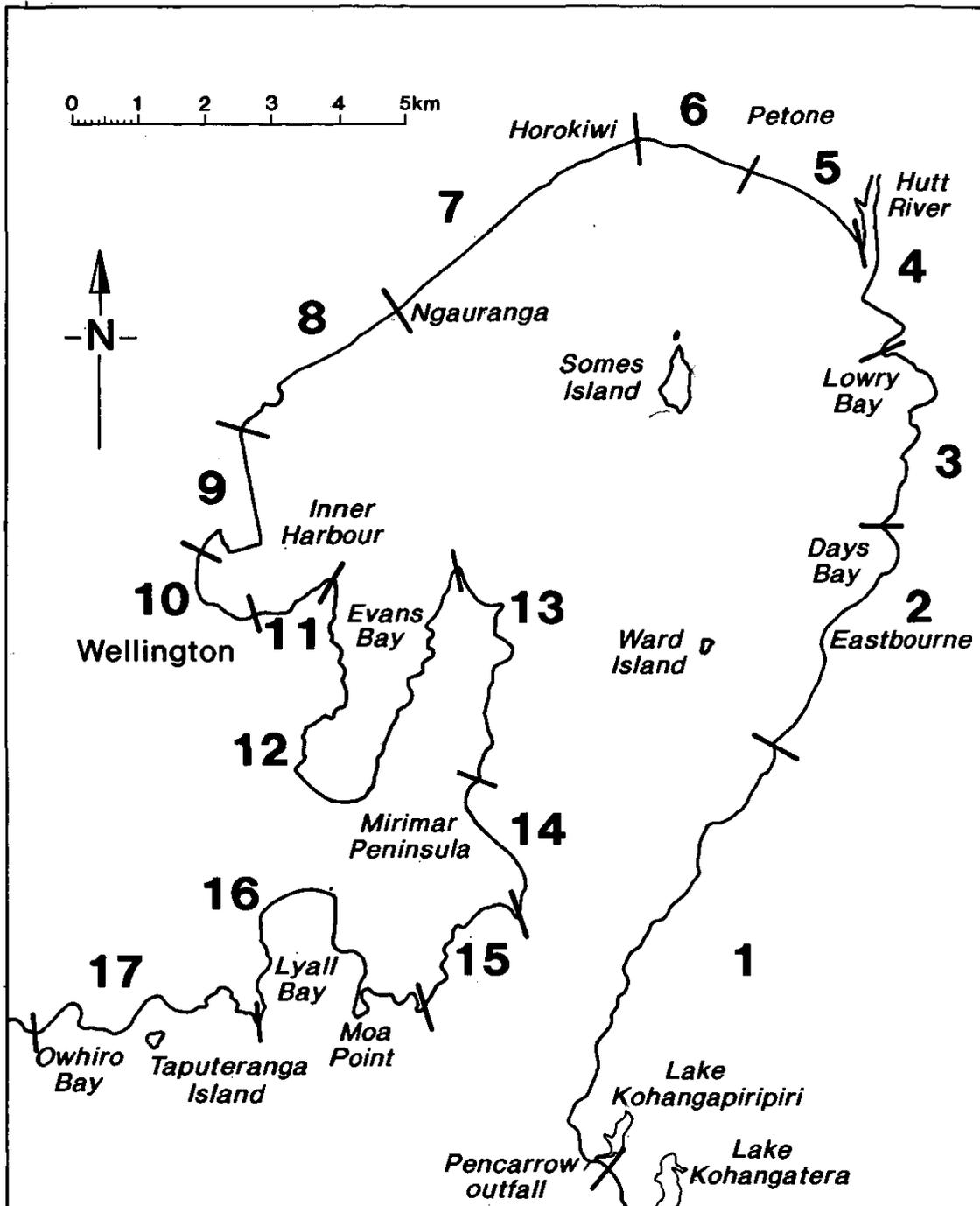


FIGURE 1 — The sections of the Wellington Harbour coastline used in the Ornithological Society Survey

Between these two surveys, the most obvious changes to the Harbour ecosystem were the commissioning of a milliscreening plant to treat sewage from the Hutt Valley, which is discharged at Pencarrow Head, a reduction in the number of sewage outfalls into the harbour, especially around the Eastbourne coast and near central Wellington, and the reduction in the level of biological waste entering the harbour with the closure of two large abattoirs at Ngauranga. No major reclamation work or new marinas were constructed during this decade, and so the shoreline remained reasonably static.

For 13 key species, the seasonal and geographical pattern of occurrence in Wellington Harbour is described (Figures 2 to 14), along with an analysis of changes in numbers and distribution between the two surveys. Brief notes on the other 32 bird species recorded are given.

### METHODS

Observers walked or cycled the entire length of their section between 1300 and 1500 hours on the second Sunday of each month. All birds seaward of the high tide line, and shorebirds roosting above the beach on nearby parks, were counted.

Differences in bird numbers between the two surveys were tested by Wilcoxon matched pairs on monthly totals on the assumption that the seasonal pattern of occurrence would not change over the years. Differences in seasonal occurrence and distribution of birds within the harbour were tested with  $\chi^2$  tests (Siegel 1956).

### RESULTS

#### GIANT PETREL *Macronectes* spp. (Figure 2)

No attempt was made to distinguish between *M. giganteus* and *M. halli*, both of which use the harbour or follow the Cook Strait ferries. Giant petrels were formerly common and conspicuous in Wellington Harbour, especially when feeding on offal entering the sea from the Ngauranga abattoirs (McIlwaine 1964, Secker 1973). During this study most giant petrels were recorded in the harbour from June to November, quite unlike the pattern observed in studies around 1960 (McIlwaine 1964) and 1970 (Secker 1973), when the peak numbers were from November to February.

During the first survey, 35% were recorded in the inner harbour from Ngauranga to Point Jerningham (sections 8-11), whereas during the second survey, none were seen from this area, and 96% were seen off the southern coast (sections 1 and 16-17), usually following the Cook Strait ferries. The change in numbers ( $P < 0.01$ ) and distribution ( $\chi^2 = 137, 3 \text{ df}, P < 0.001$ ) between the surveys are both highly significant. The changes are a continuation of a decline in numbers of giant petrels in Wellington Harbour (especially the inner harbour) since the discharge of effluent from the two Ngauranga abattoirs was partially treated from 1967, and then ceased with the closure of one abattoir and the diversion of the waste from the other into the Wellington sewage system around 1981. Between 1958 and 1962 maximum monthly averages at Ngauranga exceeded 100 birds each summer (McIlwaine 1964), but between 1967 and 1972 the peak monthly averages were down to 16-28 birds (Secker 1973). In 1975-77 the peak monthly average at Ngauranga had fallen to six birds. By the 1986-88 survey, giant petrels were only irregular visitors to the inner harbour, and just a single bird was recorded at Ngauranga during the 24 counts.

#### FLUTTERING SHEARWATER *Puffinus gavia* (Figure 3)

Fluttering Shearwaters were common visitors to Wellington Harbour during both sets of counts. Numbers were highly variable from month to month, but most were seen from April to October. The nearest breeding colonies are in the Marlborough Sounds, but the origin of birds visiting the harbour in winter is not known.

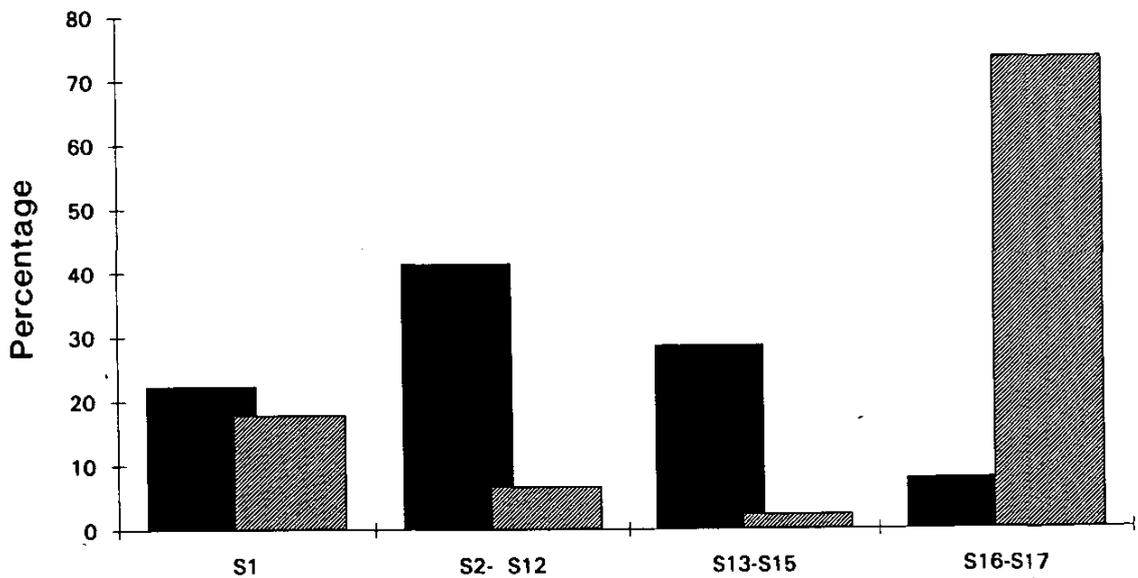
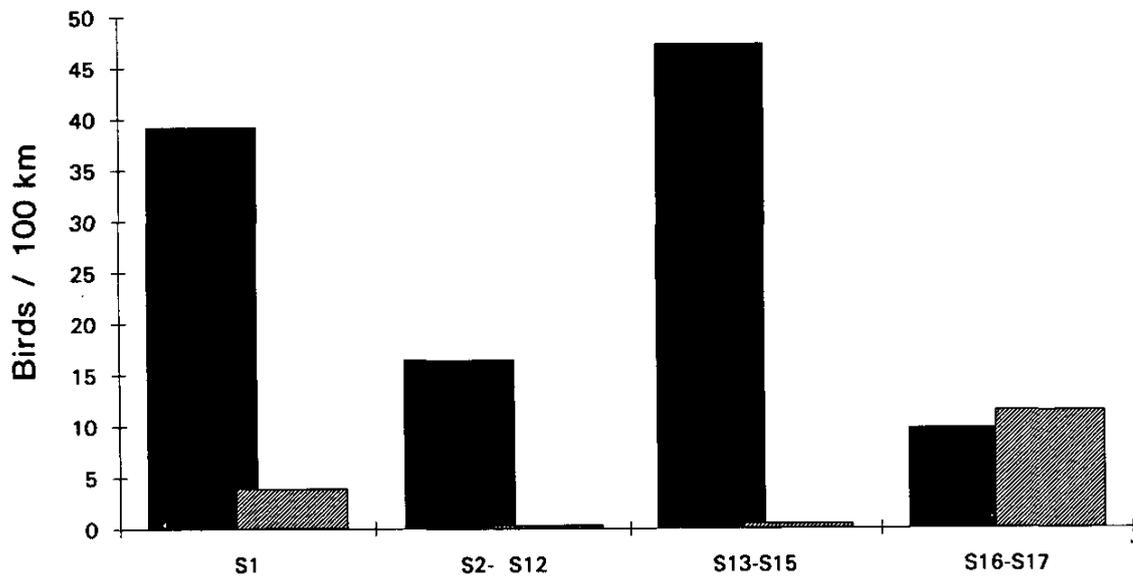
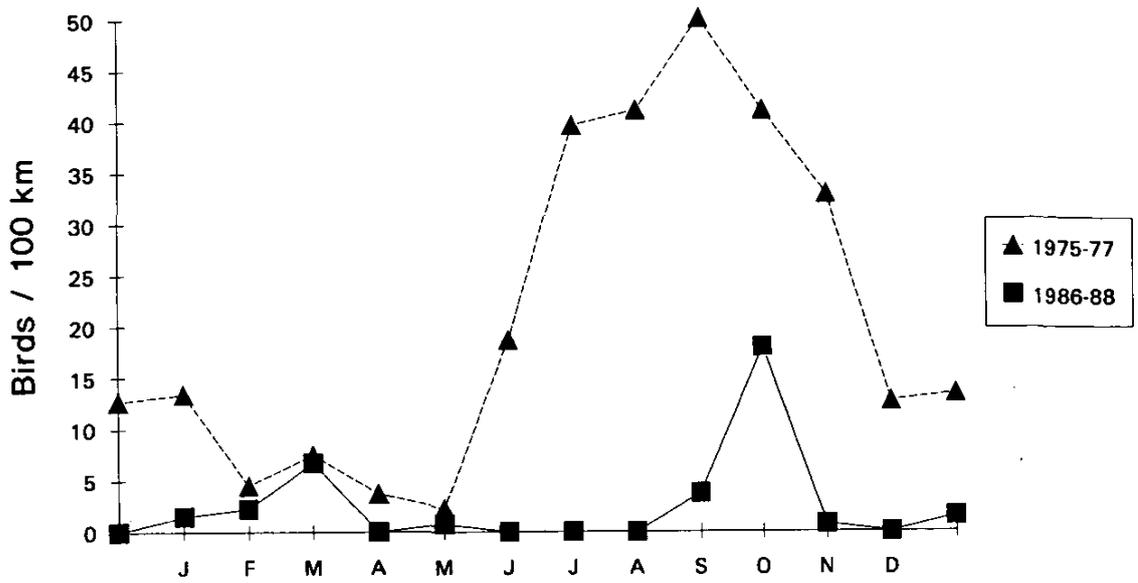


FIGURE 2 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of giant petrels. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

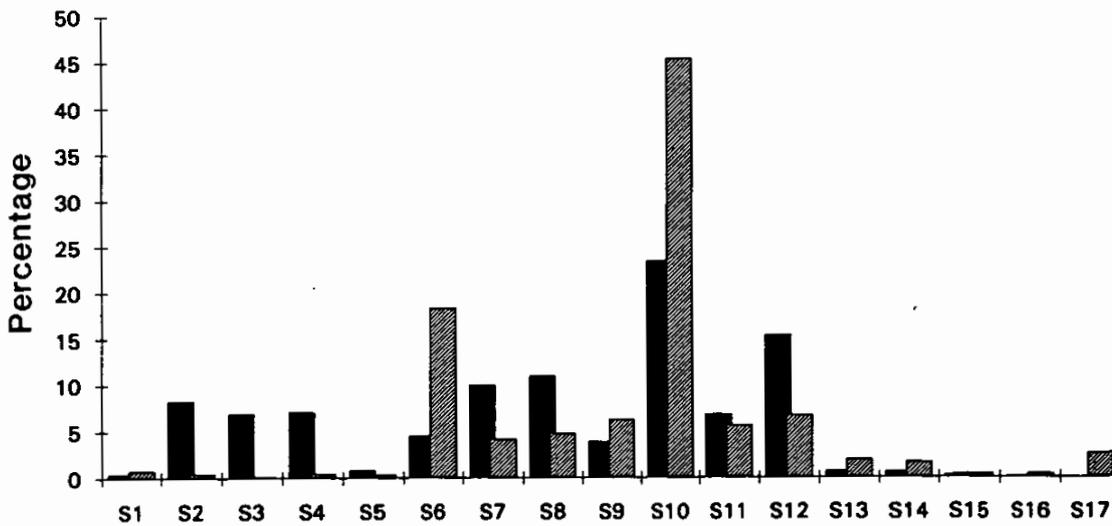
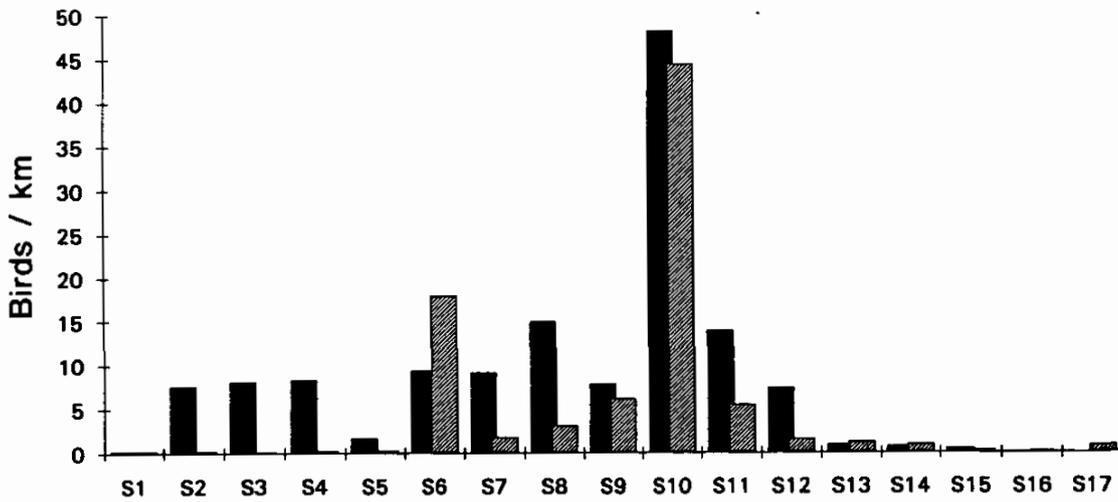
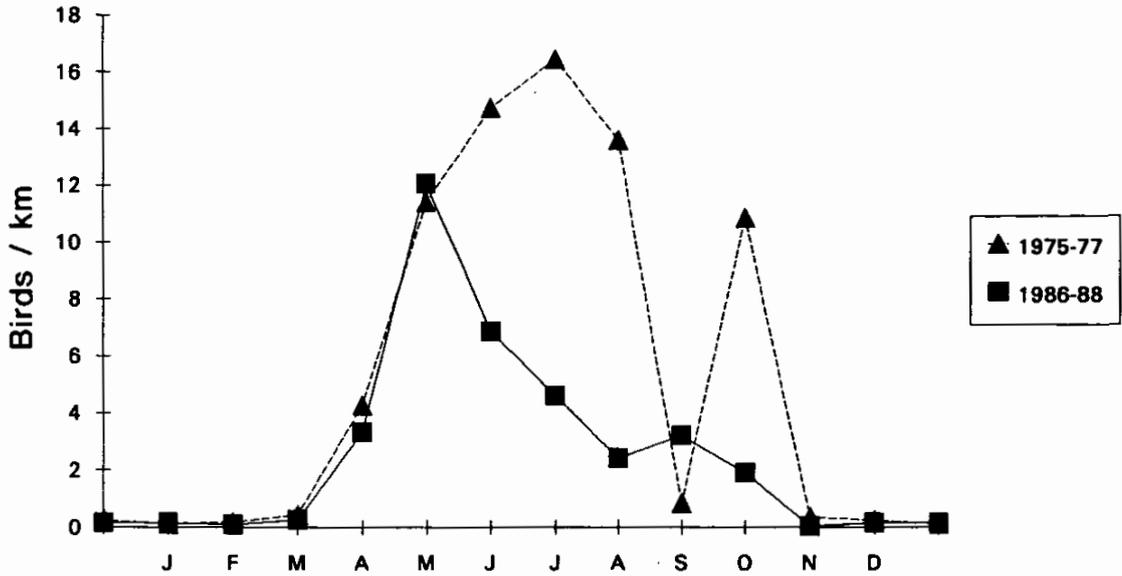


FIGURE 3 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Fluctuating Shearwater. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

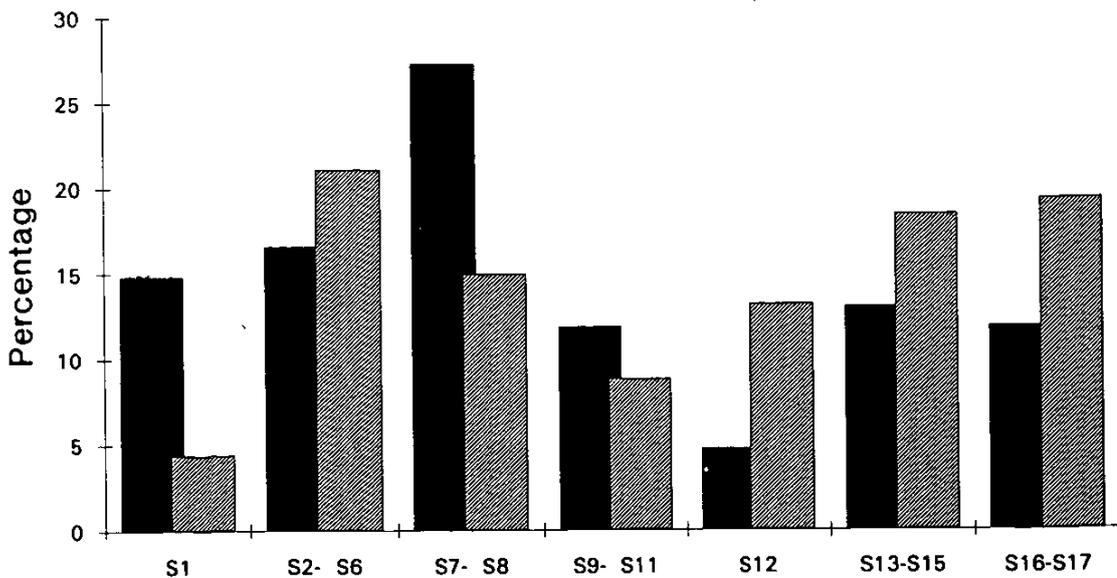
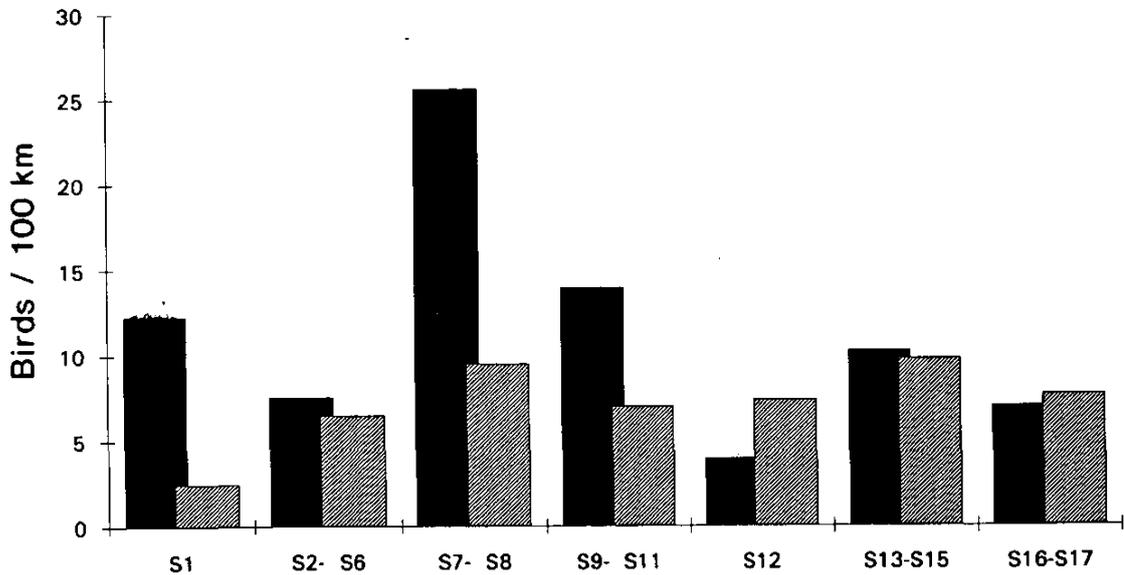
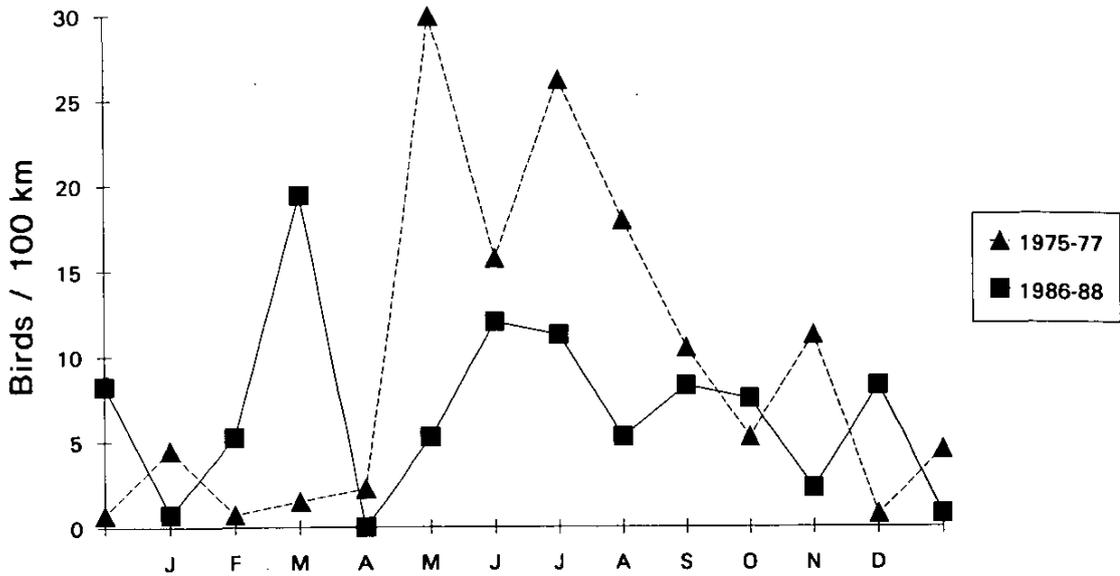


FIGURE 4 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Gannet. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

Between surveys there was a significant decrease in the numbers of Fluttering Shearwaters recorded ( $P < 0.05$ ). In the first survey over 1000 birds were counted five times whereas during the second survey this was exceeded only once. In both surveys, the highest density of Fluttering Shearwaters was off section 10, in the inner harbour. Almost all were in the sheltered waters of the harbour, rather than at the harbour entrance or off the southern coast (sections 1 and 13 to 17). Between surveys there was a significant shift in distribution away from the eastern shore of the harbour (sections 2 to 4) in favour of sections 6 and 10 ( $\chi^2 = 2987$ ,  $P < 0.001$ ).

**AUSTRALASIAN GANNET** *Morus serrator* (Figure 4)

The Gannet is mainly a winter visitor to Wellington Harbour, although some can be seen in any month. The nearest breeding colonies are at Cape Kidnappers in Hawke's Bay, at Waimarua in the Marlborough Sounds, and at Farewell Spit (Turbott 1990). The maximum counts in the two surveys were 33 and 13 respectively, but these are probably overestimates because birds circling the harbour were likely to have been recorded in several sections.

Through both surveys, Gannets were widely distributed within the harbour, with low numbers in only the northeastern parts (sections 2-6) and around the inner harbour (sections 9-12). There was no significant change in numbers between the two surveys, but the distributions were significantly different ( $\chi^2 = 22.7$ , 6 df,  $P < 0.001$ ), with more in section 12 and fewer in sections 1, 7 and 8 in the second survey. This decrease in the number around the Pencarrow sewer outfall and the Ngauranga effluent outfall could have been because, as less waste was discharged, fewer fish were attracted to these sections.

**BLACK SHAG** *Phalacrocorax carbo* (Figure 5)

Black Shags are present in Wellington Harbour all year, with a small influx in autumn, and fewest in winter ( $\chi^2 = 14.2$ , 3 df,  $P < 0.01$ ). The maximum count in both surveys was 73 birds (both in April), and between the two surveys there was no significant change in their numbers, unlike for the other shag species. Many of the birds in the harbour probably breed at a colony in karaka (*Corynocarpus laevigatus*) trees in the valley northeast of Lake Kohangatera (Figure 1).

Through both surveys the distribution of Black Shags was very clumped; however, their distribution in the harbour changed dramatically ( $\chi^2 = 230$ , 9 df,  $P < < 0.001$ ), with Pencarrow Head (section 1) being largely abandoned in favour of the Days Bay to Point Howard area (section 3), Petone to Ngauranga area (sections 6 and 7), the inner harbour (sections 9-11) and Evans Bay (section 12). The milliscreening at Pencarrow has presumably decreased the supply of fish feeding in the vicinity of the outfall, and so birds have had to move elsewhere. The numbers at the Hutt River mouth (section 4) and on the Wellington south coast (sections 16 and 17) hardly changed at all.

**LITTLE BLACK SHAG** *P. sulcirostris* (Figure 6)

Little Black Shags visit Wellington Harbour mainly from May to August, but a few are present in all months ( $\chi^2 = 705$ , 11 df,  $P < < < 0.001$ ). The nearest breeding colony is at Matthews Lagoon, on the eastern shore of Lake

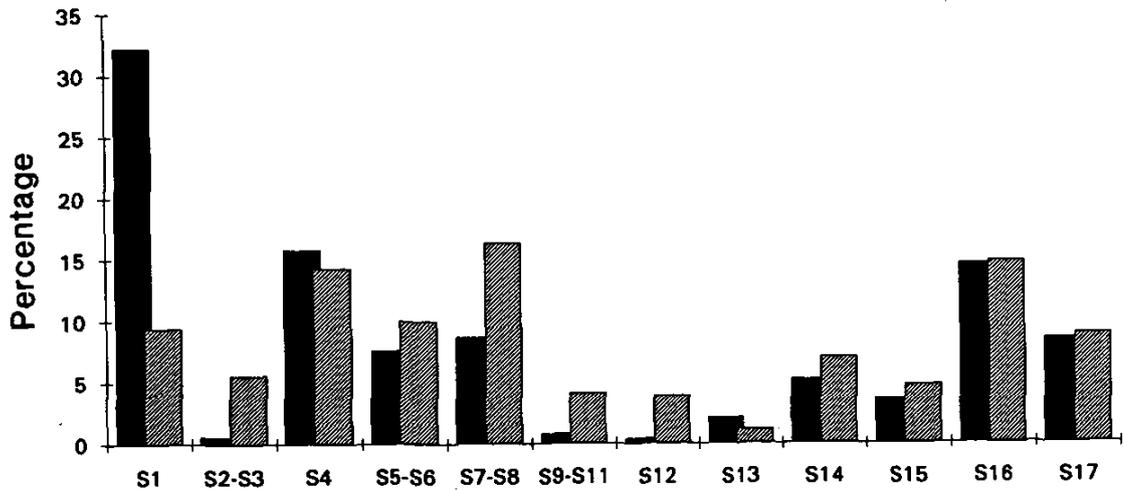
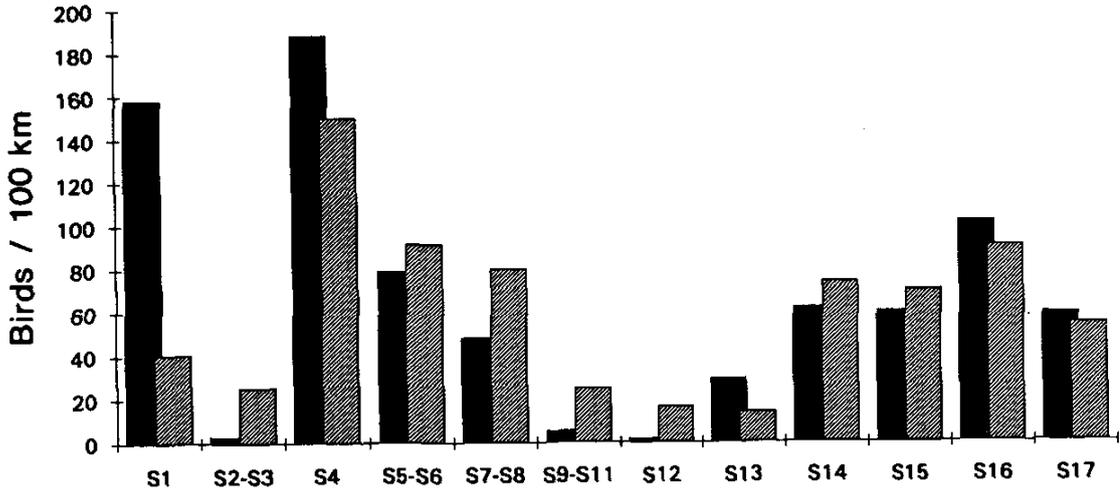
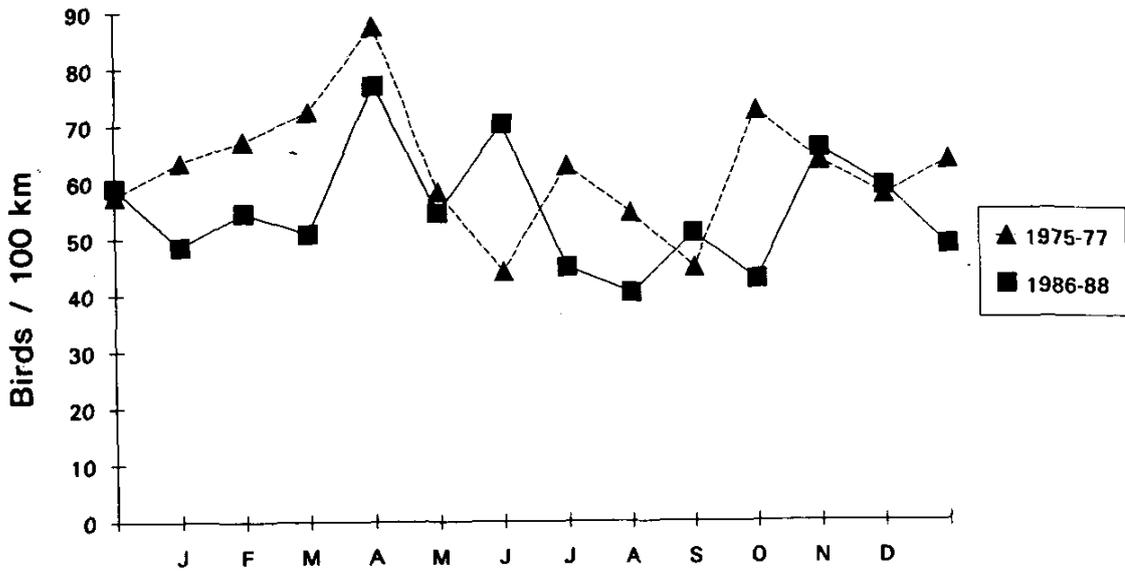


FIGURE 5 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Black Shag. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

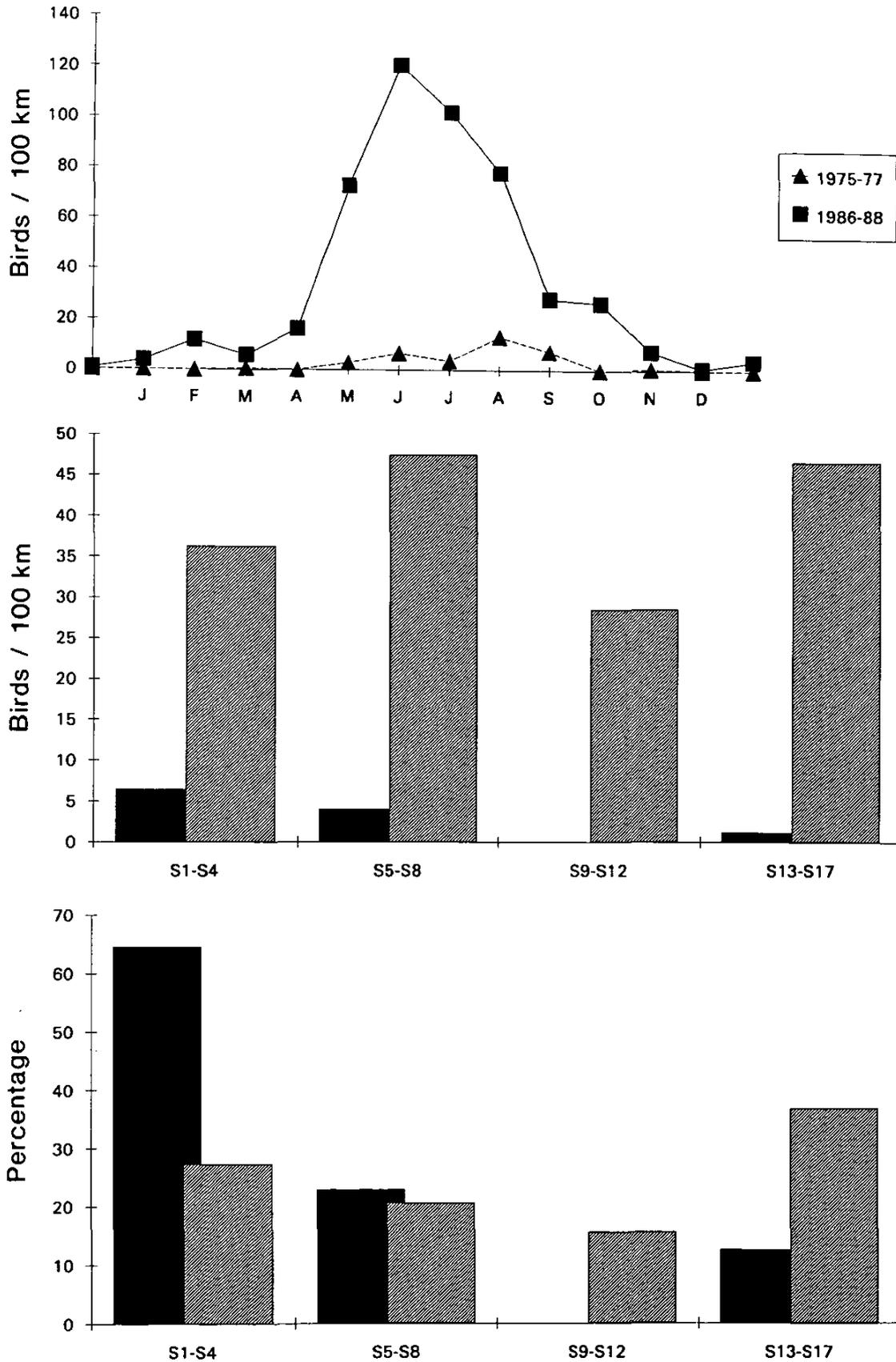


FIGURE 6 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Little Black Shag. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

Wairarapa, but as this is not a large colony (D. Sim, pers. comm.), Little Black Shags are apparently coming from well beyond the Wellington region, perhaps from large colonies in the central North Island (Turbott 1990).

Little Black Shags showed the greatest percentage change (1200%) between surveys; in the first survey they were uncommon, with a total of 48 birds being recorded over the 2-year period, whereas in the second survey 638 were recorded ( $P < 0.001$ ). The maximum count during the first survey was just 10 birds, whereas 10 years later the maximum was 134 birds, including a flock of 74 birds. Although several large flocks were recorded, most sightings were of small groups of fewer than 10 birds.

Little Black Shags were mainly found from Days Bay to the Hutt River (sections 3 & 4), between Horokiwi and Ngauranga (section 7) and between Point Halswell and Point Dorset (sections 13 & 14). Between the two surveys, their distribution changed significantly ( $\chi^2 = 35.8$ , 3 df,  $P < 0.001$ ); in 1975-77, 65% were between Pencarrow and the Hutt River (sections 1 to 4), compared with 27% in 1986-88.

#### LITTLE SHAG *P. melanoleucos* (Figure 7)

Like the Little Black Shag, the Little Shag is mainly a winter visitor to Wellington Harbour, numbers building up from March to a peak between May and August. The origin of the Little Shags that visit Wellington Harbour is not known. The nearest colony is at Matthews Lagoon, Lake Wairarapa, but this is not large enough to supply all the birds that now visit the harbour, and so Little Shags are presumably coming from outside the Wellington region.

There was a marked increase in Little Shags between the two surveys ( $P < 0.001$ ): the maximum count in the first survey was 80 birds, but 10 years later, the peak count was 294 birds. In both surveys, over 20% of the Little Shags were found in section 16, generally near Moa Point; however, the importance of this area declined from 33% in 1975-77 to 22% in 1986-88. The other area that contributed most to a significant change in distribution between surveys ( $\chi^2 = 177$ , 13 df,  $P < 0.001$ ) was the Hutt River mouth (section 4), where only 1% of Little Shags were recorded in the first survey but 14% in the second survey.

#### SPOTTED SHAG *Stictocarbo punctatus* (Figure 8)

The Spotted Shag is resident in Wellington Harbour, breeding from June to February. Most nest on the western cliffs of Somes Island, some breed on Shag Rock off the northwestern corner of Somes Island, and a few are on nearby Mokopuna Island (R.O. Cossee, pers. comm.). Breeding was first recorded in 1972, when 7 nests were discovered (Kendrick 1973) and the colony grew quickly (Miskelly & Benfell 1981) so that there are now about 150 breeding pairs each year (R.O. Cossee, pers. comm.). During the first survey, most Spotted Shags were recorded on the shores of Wellington Harbour in May and September, which was just before each of the two main periods of breeding recorded by Miskelly & Benfell (1981). During the second survey, the pattern was much less clear with fewest being recorded in September and October.

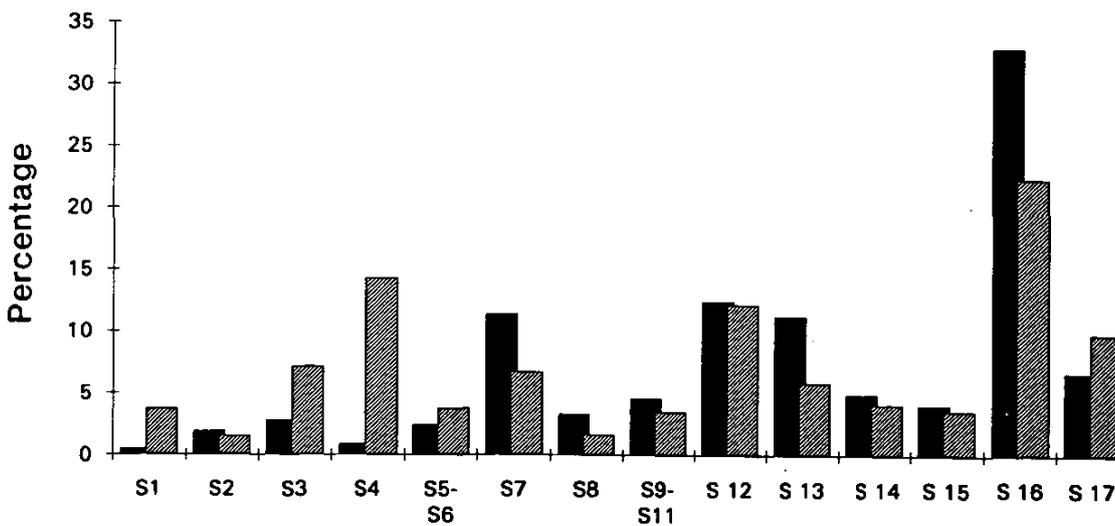
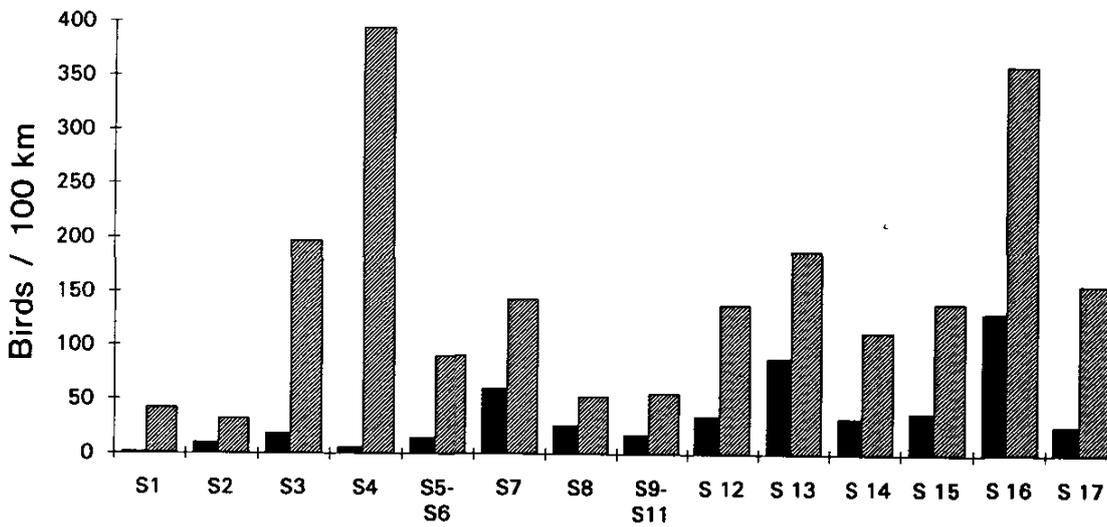
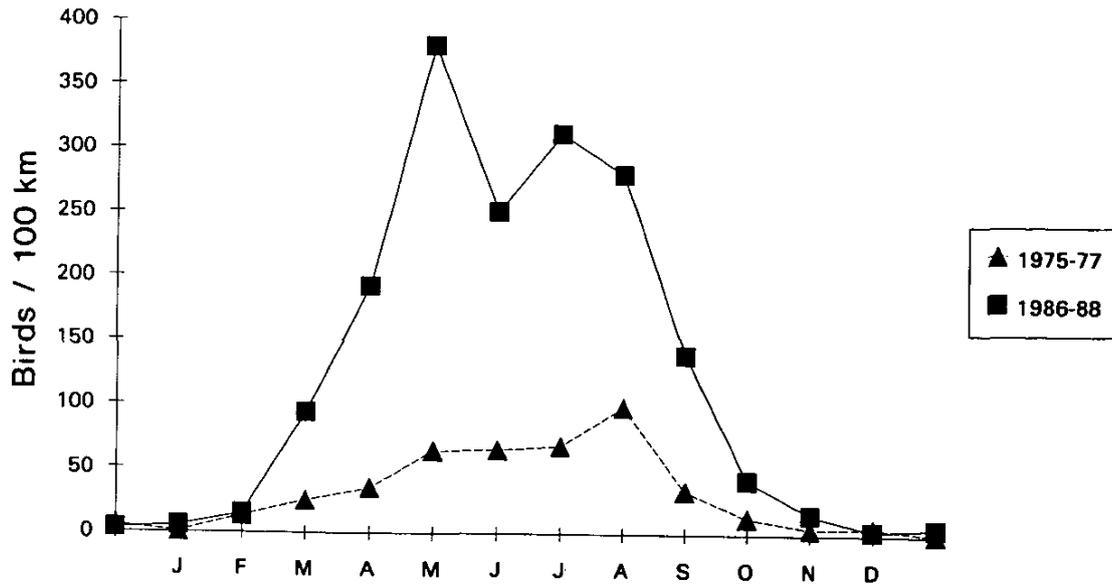


FIGURE 7 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Little Shag. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

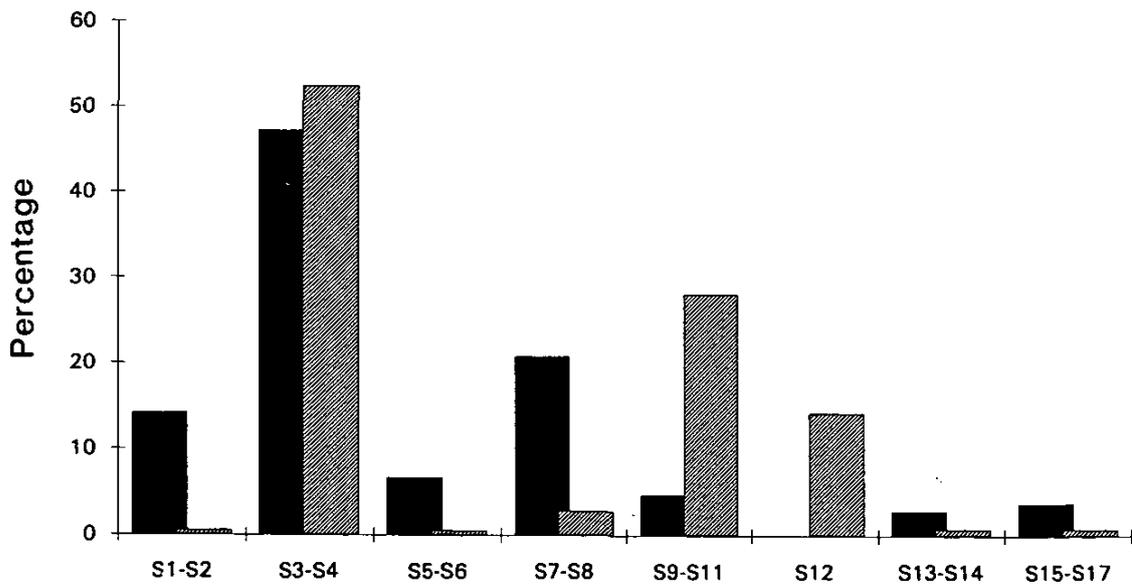
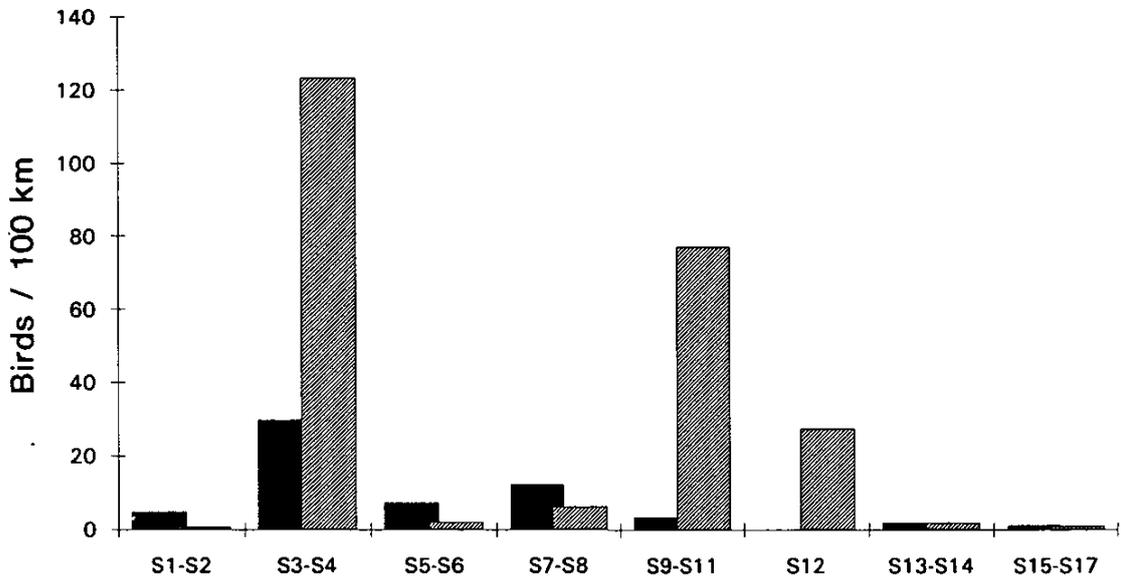
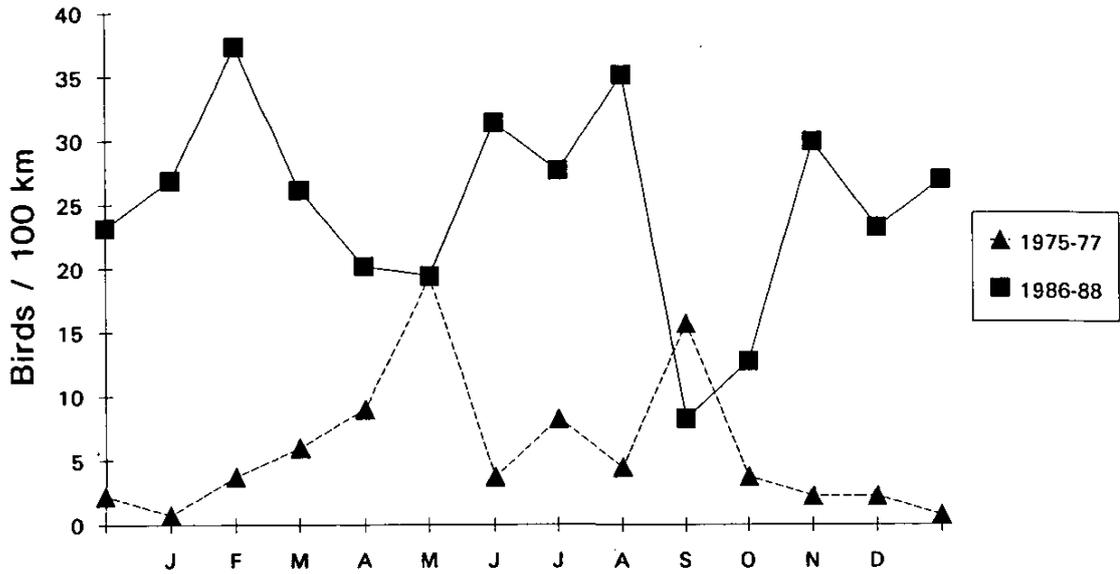


FIGURE 8 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Spotted Shag. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

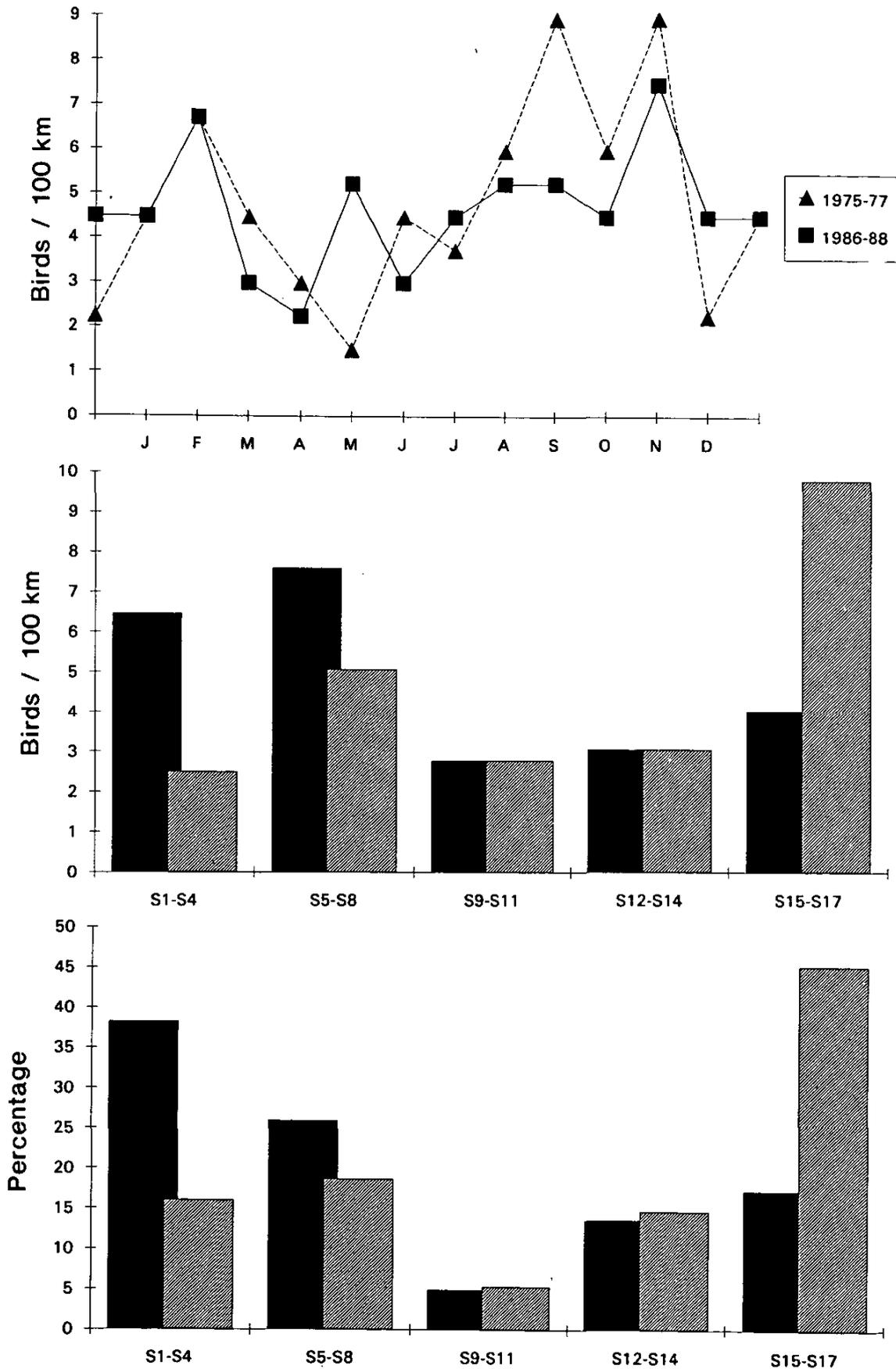


FIGURE 9 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Reef Heron. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

With the growth of the breeding colony there was a marked increase in the number of Spotted Shags recorded ( $P < < 0.001$ ). The maximum count of 17 in the first survey was exceeded on 10 of the 24 counts on the second survey, with a maximum count of 33 birds. In both surveys about 50% were recorded from sections 3 & 4, often roosting on the northern wing of the Point Howard wharf. During the second survey, Spotted Shags also roosted regularly in section 9 on piers near the Picton Ferry Terminal, and in section 12 at the Evans Bay marina; few were recorded elsewhere in the harbour.

**REEF HERON** *Egretta sacra* (Figure 9)

The few Reef Herons around Wellington Harbour attract considerable attention because of their threatened status in New Zealand. A small population is apparently resident in the harbour, but the number seen rose slightly ( $\chi^2 = 11.1$ ,  $P < 0.05$ ) in spring. One banded chick, produced by one of the two pairs that regularly nest on Somes Island (R.O. Cossee, pers. comm.), was recovered at Invercargill, indicating that at least some young disperse widely.

There was a slight and insignificant decrease between surveys; however, the relatively stable population suggested by these data may be incorrect because some Reef Herons may have been missed in section 17 during the first survey. None was recorded in section 17, whereas 19 were recorded there in the second survey; most of these birds were on Taputeranga Island in Island Bay, where they were difficult to see. Perhaps a few Reef Herons became resident on the island between the surveys, in the same way that birds disappeared from section 1 between surveys. Reef Herons were recorded widely around the harbour, but especially in section 3 in Lowry and York Bays, section 15 at Breaker Bay in the first survey, and section 17 during the second survey.

**MALLARD** *Anas platyrhynchos* (Figure 10)

Mallards have become permanent, but probably mainly non-breeding, residents of Wellington Harbour. They were recorded in all months, but there was a huge influx during the duckshooting season from May to July 1986-88 ( $\chi^2 = 4443$ ,  $P < < 0.001$ ). Mallards showed the second greatest percentage increase of any species between the two surveys, with over 11 times as many recorded during the second survey ( $P < < 0.001$ ). During the first survey, 47% of Mallards were found at the Hutt River mouth (section 4) and 36% at Ngauranga (section 8), near the outfall from the abattoirs. By the second survey, most Mallards (62%) were at Moa Point (section 16) and 16% were in Evans Bay (section 12). The Hutt River mouth was still popular (11%), but the Ngauranga site was virtually abandoned (0.2%).

**VARIABLE OYSTERCATCHER** *Haematopus unicolor* (Figure 11)

Variable Oystercatchers breed at various isolated spots around Wellington Harbour, but most breed on Somes Island, up to 11 pairs each year (R.O. Cossee, pers. comm.). Birds colour-banded on Somes Island by Ray Benfell were often seen in flocks around the harbour, but rarely as isolated pairs. The movement from Somes Island to the mainland shore of the harbour probably accounts for most of the increase in numbers recorded in autumn and winter ( $\chi^2 = 110$ ,  $P < < 0.001$ ), but there may also be a winter influx

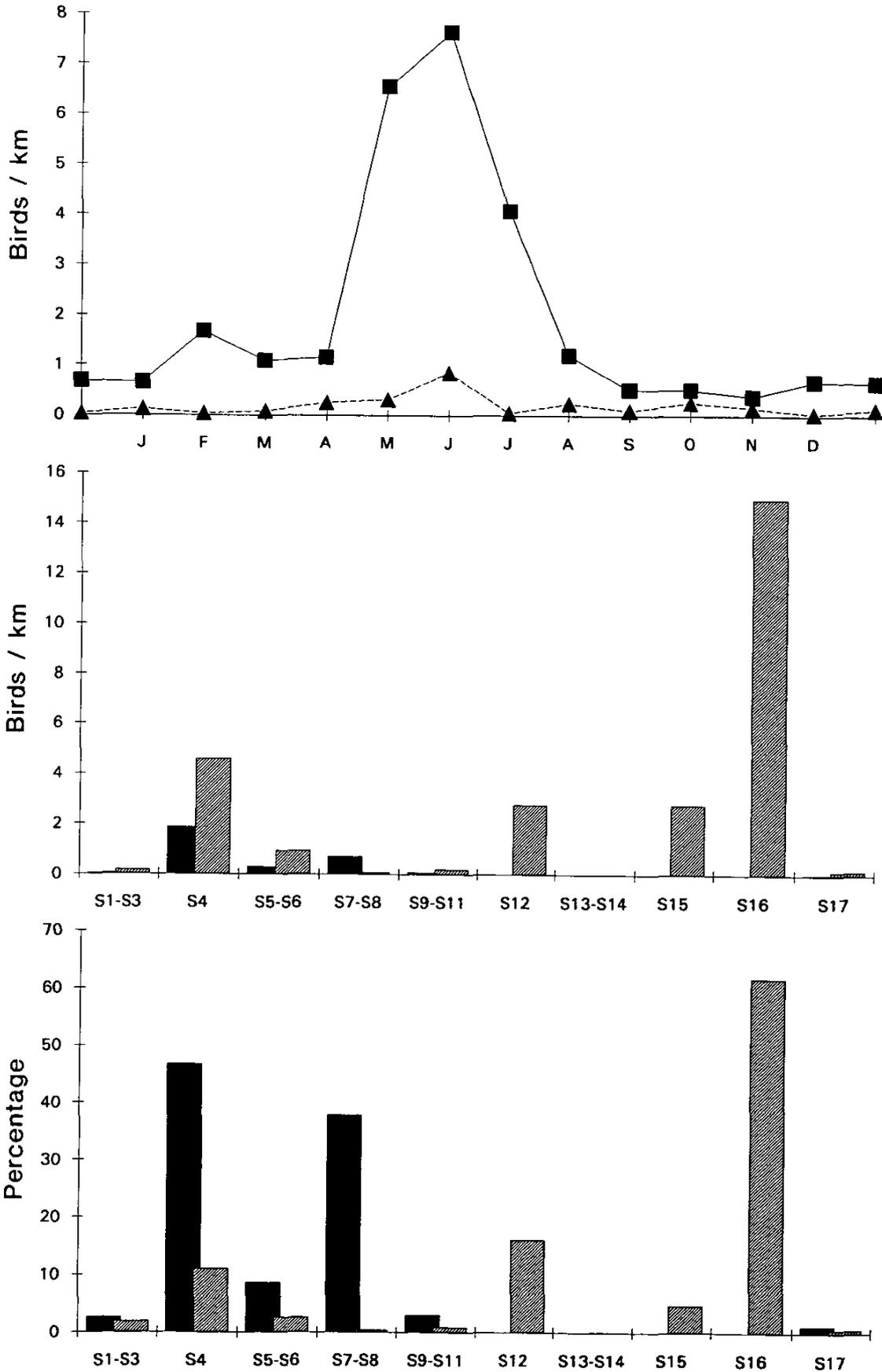


FIGURE 10 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Mallard. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

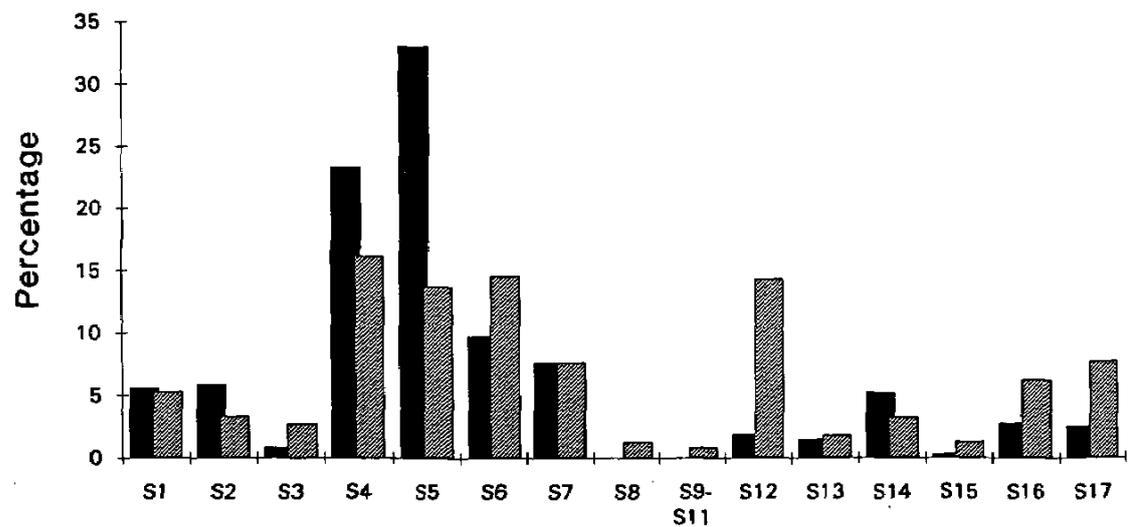
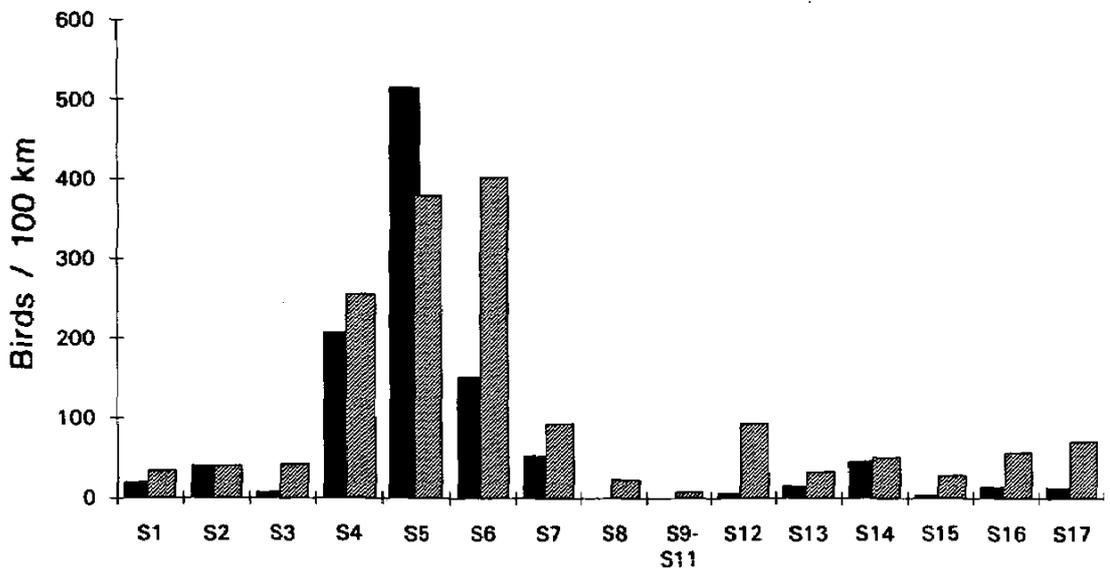
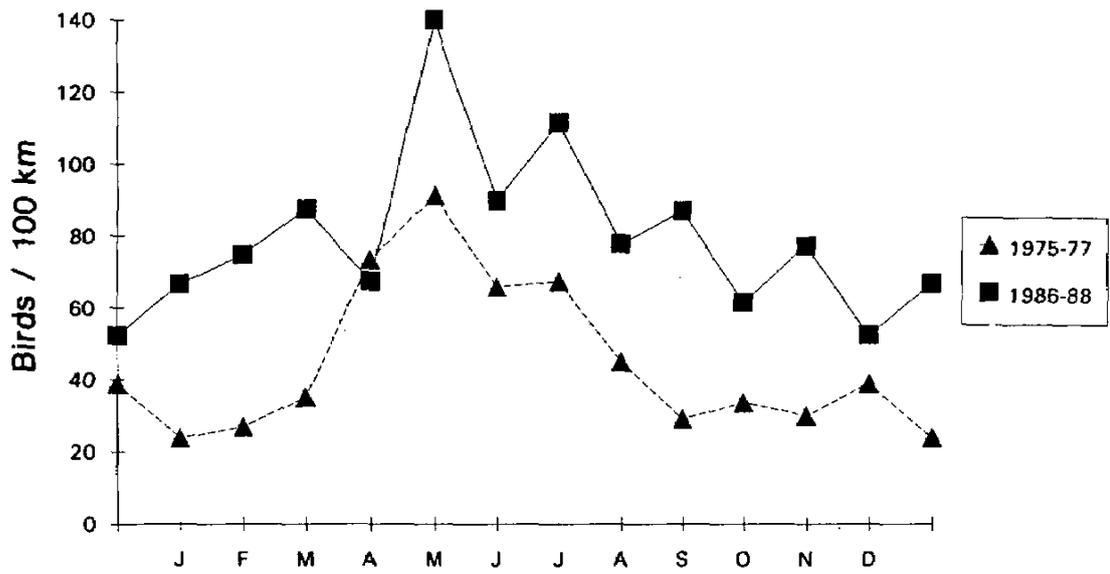


FIGURE 11 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Variable Oystercatcher. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

from nearby rocky coasts such as the Marlborough Sounds; a colour-banding study is required to test this suggestion.

Variable Oystercatchers increased significantly ( $P < < 0.001$ ) between surveys, 78% more being recorded during the second survey. Most birds, and the highest densities, were in sections 4 to 6, around Petone Beach; however, the distribution changed significantly between surveys ( $\chi^2 = 154$ , 11 df,  $P < < 0.001$ ) so that 44% were found near Petone in the second survey compared with 66% in the first survey. Much of the increase was recorded in Evans Bay, especially near Shelly Bay (section 12) and on the south coast from Palmer Head to Owhiro Bay (sections 16 & 17). As for Reef Heron, the increase in section 17, from 19 (2.5%) in the first survey to 102 (7.7%), could have been because Taputeranga Island was checked more thoroughly during the second survey.

#### BLACK-BACKED GULL *Larus dominicanus* (Figure 12)

Black-backed Gulls were the most common and widespread resident species in Wellington Harbour. They were in high numbers all year, but in autumn and early winter their numbers were about 40% greater than during the breeding season ( $\chi^2 = 2452$ , 11 df,  $P < < < 0.001$ ). Somes Island has a very large breeding colony of about 2000 pairs and a winter night-time roost of over 10 000 birds, with smaller colonies and roosts on Ward Island, on Taputeranga Island, and on the mainland cliffs near Moa Point. A few Black-backed Gulls nest at other sites around the harbour and on the roofs of some buildings in Wellington and Lower Hutt. Another large colony of about 400 pairs is just to the southeast of the counting area at Fitzroy Bay, near Baring Head.

Fordham (1968) studied the dispersal of Black-backed Gulls from five colonies in the greater Wellington area, including the Somes Island and Baring Head colonies, and from the Somes Island roost. He found that the gulls were remarkably sedentary, 86% of Somes Island birds and 60% of Baring Head birds being seen in Wellington and Lower Hutt cities. A few birds dispersed to the Manawatu, Wairarapa, and east coast of the South Island; but there was some evidence of immigration to Wellington from colonies in the northern South Island.

In reviewing the historical increase in numbers of Black-backed Gulls around Wellington Harbour from the late 1800s to the early 1960s, Fordham (1967) showed that the increase had been very rapid since about 1940. The two series of harbour counts provide further evidence for this increase continuing into the 1970s, followed by a recent decline. In April 1965, Fordham (1968) recorded 4169 gulls on the coast from Owhiro Bay to Pencarrow Head, whereas the average April count in the first survey was 7781 birds, but only 4939 birds in the second survey.

Between the two Ornithological Society surveys, Black-backed Gull numbers along the coast declined significantly ( $P < < 0.001$ ) from an average of 40.4/km to 31.3/km. The decline was most marked in the autumn and winter counts, suggesting that the gulls had probably been attracted away to the new Silverstream refuse tip, where up to 20 000 birds have been estimated (R.E. Brockie, pers. comm.). Between the two surveys, there was

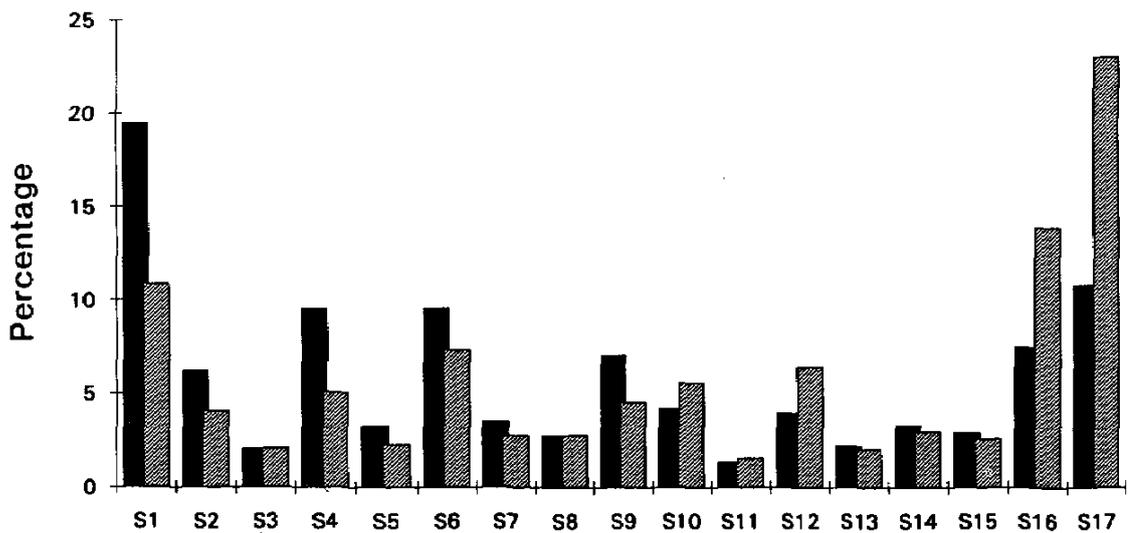
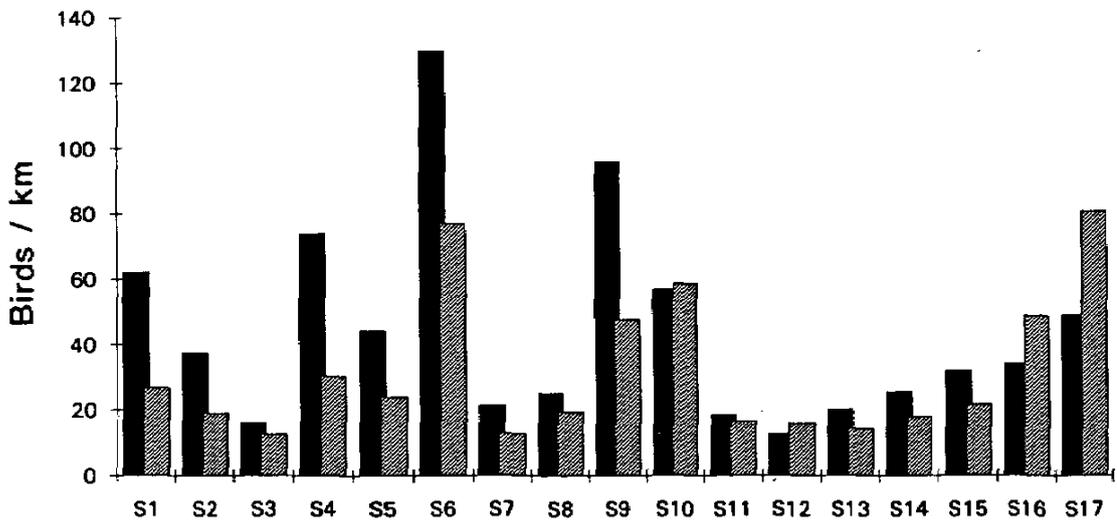
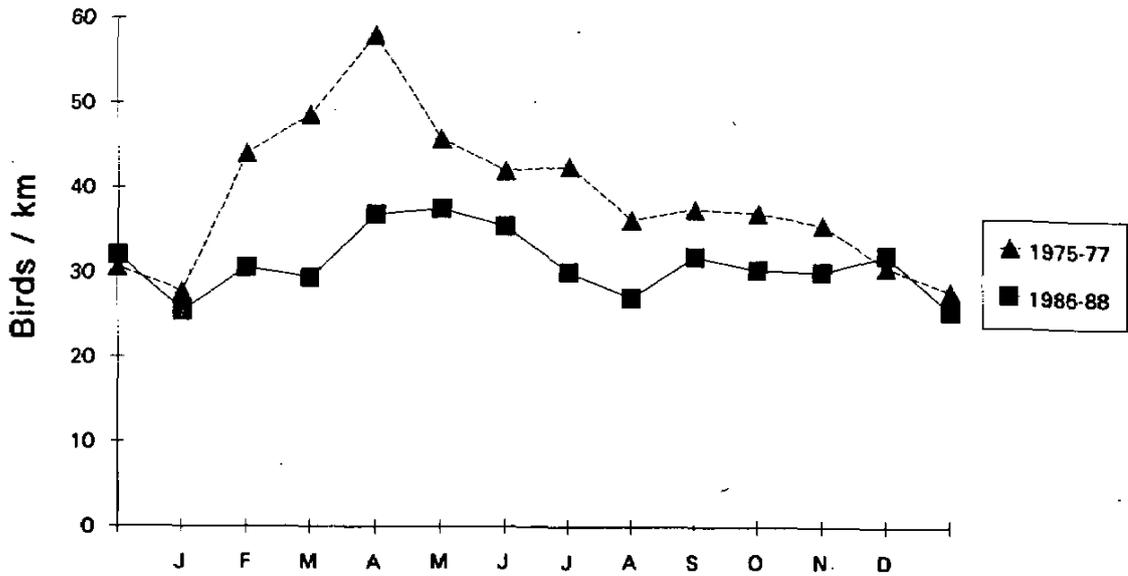


FIGURE 12 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Black-backed Gull. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

a marked shift ( $\chi^2 = 7109$ , 16 df,  $P \ll 0.001$ ) in the distribution of Black-backed Gulls within the harbour; birds declined at section 1 (Pencarrow Head), where sewage had become milliscreened, and increased in sections 16 and 17 (Moa Point to Owhiro Bay), where sewage remained untreated.

**RED-BILLED GULL** *L. novaehollandiae* (Figure 13)

From March to August, the Red-billed Gull was the most common bird in Wellington Harbour, but few were present for the rest of the year ( $\chi^2 = 45353$ ,  $P \ll 0.001$ ). Many birds banded at Kaikoura or Lake Grassmere were seen during the counts, indicating that much of the autumn influx was from South Island breeding colonies. Red-billed Gulls were very unevenly distributed around the harbour ( $\chi^2 = 14486$ ,  $P \ll 0.001$ ), the highest densities being near Moa Point (section 16) and on Petone Beach (section 6).

Some information is available on the numbers of Red-billed Gulls in parts of Wellington Harbour in the early 1950s (Secker 1954a, 1954b), but the geographical boundaries of those studies were not clearly defined; nevertheless Red-billed Gulls seem to have decreased near Petone, where over 1000 birds were recorded between February and May in both 1950 and 1951, with a maximum of 1387 birds on 7 May 1950 (Secker 1954a), whereas the maximum winter count from Petone Beach (sections 5 and 6 combined) was 840 during the first survey and 836 during the second.

Between the first and second surveys there was no noticeable change in overall numbers within the harbour ( $P > 0.05$ ), but there was a marked change in the distribution ( $\chi^2 = 14486$ , 16 df,  $P \ll 0.001$ ), away from Pencarrow Head (section 1) to Moa Point and Owhiro Bay (sections 16 & 17).

**WHITE-FRONTED TERN** *Sterna striata* (Figure 14)

Nearly 60% of White-fronted Terns recorded in the harbour were seen between March and May; outside that period, consistently small numbers were recorded. Up to 50 pairs of White-fronted Terns nested in the harbour, on rocks off Scorching Bay (section 13), but the majority visited immediately before their autumn migration to Australia. Petone Beach (section 6) and Kaiwharawhara reclamation (section 8) were the main sites where White-fronted Terns roosted. Surprisingly few were recorded off the southern coast (sections 1, 15, 16 and 17).

Between the surveys there was no significant change in numbers or distribution, but during both counts, the numbers recorded were highly variable from month to month, depending on where flocks were gathering in the Wellington region.

## OTHER SPECIES

**Wandering Albatross** *Diomedea exulans*

This species was recorded in most months during the first survey (50 birds during 11 counts), especially between Ngauranga and the inner harbour (sections 8 to 10) and off section 16 in September 1975, but Wandering Albatrosses were not recorded at all in the second survey. The decline parallels that for the ecologically similar giant petrels.

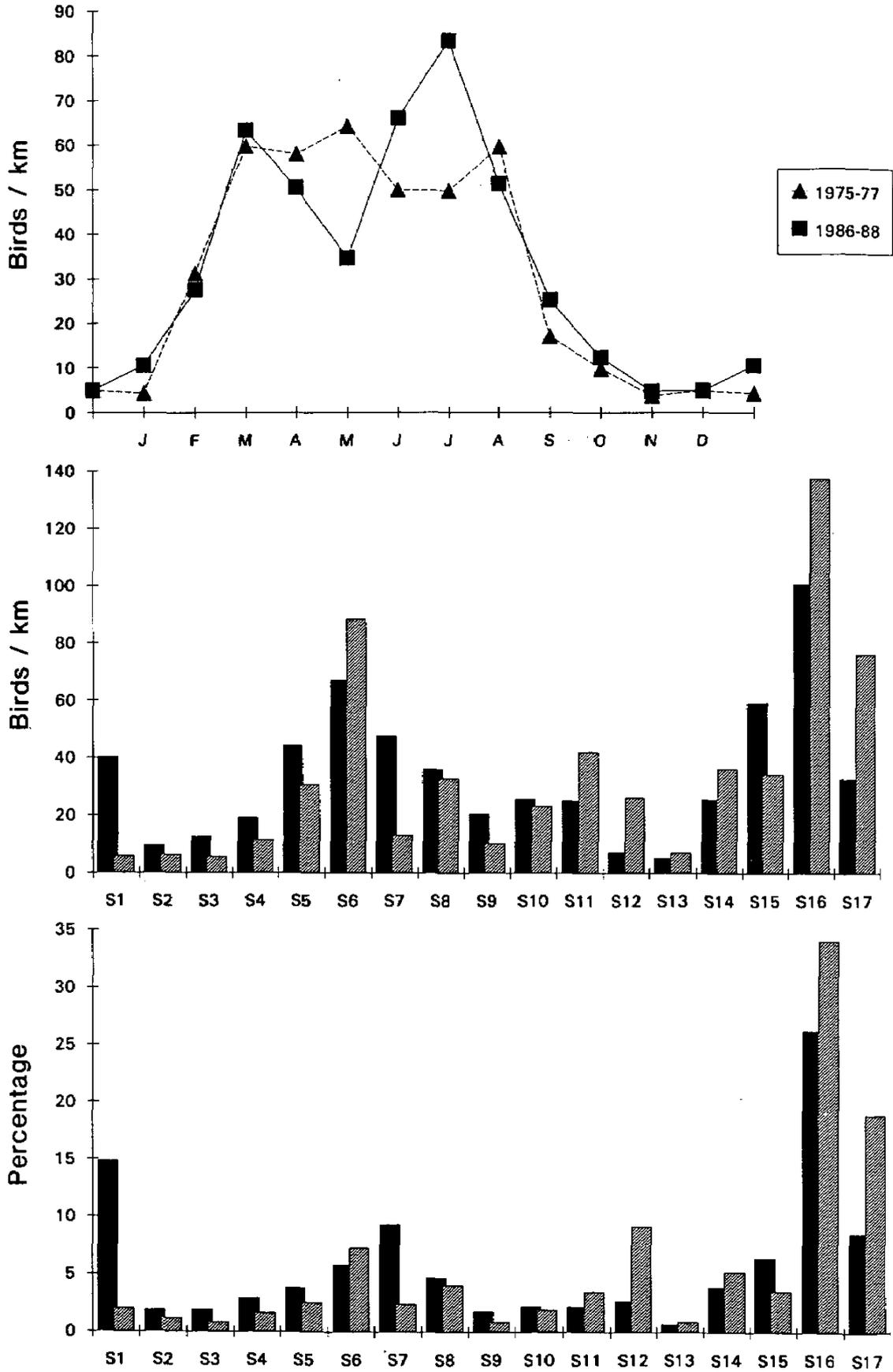


FIGURE 13 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of Red-billed Gull. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

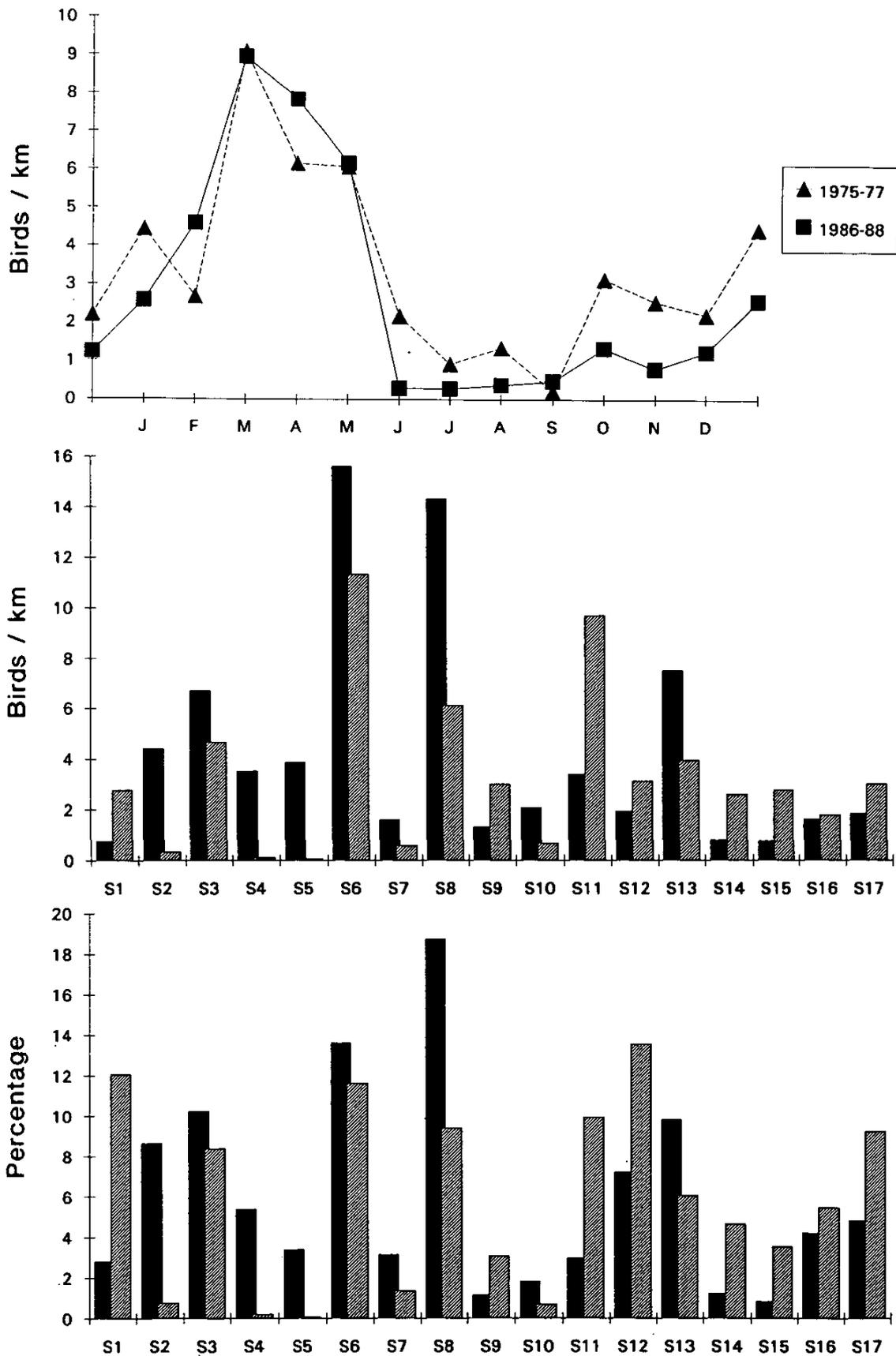


FIGURE 14 — Seasonal pattern of occurrence (top), geographical distribution (middle) and percentage distribution (bottom) of White-fronted Tern. Solid bars, 1975-77; shaded bars, 1986-88. Sections are shown in Figure 1.

Royal Albatross *D. epomophora*

Only one bird was seen, following the Cook Strait ferry *Aratika*, off section 1 in January 1977.

Black-browed Mollymawk *D. melanophrys*

A few were recorded in winter off the southern coast (sections 1 and 15) during the first survey only; some were noted as they followed fishing boats along the coast.

White-capped Mollymawk *D. cauta*

Two birds were seen, one off section 15 in September 1975 and one off section 17 in October 1987.

Grey-headed Mollymawk *D. chrysostoma*

One bird was seen off Ngauranga (section 8) in October 1976.

Buller's Mollymawk *D. bulleri*

One bird was seen, following a fishing boat, off section 15 in July 1976.

Buller's Shearwater *Puffinus bulleri*

Three seen off section 17 in July 1987 were the only recorded.

Sooty Shearwater *P. griseus*

Occasionally seen off the southern coast (sections 16 and 17) and off section 7 in the second survey only.

Cape Pigeon *Daption capense*

About 40 birds were recorded during the first survey, mainly near the harbour entrance and off Moa Point (section 16) in September. During the second survey they were recorded during three of the 24 counts, but when they did turn up, they were often in large flocks: 81 off sections 16 and 17 in October 1987 and 344 off Moa Point in September 1988. Cape Pigeons seem to be attracted to the main sewer outfalls, but were not regularly dependent on waste as a food source.

Antarctic Fulmar *Fulmarus glacialisoides*

Only one bird was recorded, off section 7 in October 1975.

Fairy Prion *Pachyptila turtur*

A prion, presumably of this species, was seen at the entrance of Lyall Bay (section 16) in June 1976, and one was recorded off section 17 in July 1987.

White-headed Petrel *Pterodroma lessonii*

One was seen off section 17 in May 1987.

Little Blue Penguin *Eudyptula minor*

Although many breed around the mainland shore of the harbour and on Somes Island (R.O. Cossee, pers. comm.), they were only occasionally seen during our surveys: 13 records from the first survey (including several birds nesting in section 6) and four records from the second.

Pied Shag *Phalacrocorax varius*

None was recorded during the first survey, but during the second survey, two birds were seen between June and August 1987 and one bird frequented

the harbour from May to September 1988. Most records of these Pied Shags were from around the northern half of Wellington Harbour (sections 2 to 7).

White-faced Heron *Ardea novaehollandiae*

Recorded irregularly in the first survey (10 birds from eight counts), but recorded in every calendar month during the second survey (29 birds from 16 counts). Most sightings were at the Hutt River estuary (section 4) or along the southern coast (sections 15 to 17).

Royal Spoonbill *Platalea regia*

One bird visited the Hutt River estuary in March 1988.

Black Swan *Cygnus atratus*

Birds occasionally stopped in Wellington Harbour, presumably while on passage, but they were nowhere regular. The largest group was of 10 birds off section 2 in July 1977.

Canada Goose *Branta canadensis*

Not seen during the first survey, but a small flock resided on the lower part of the Hutt River during the second survey, and these birds (up to six) occasionally visited the estuary (section 4) and other parts of Wellington Harbour.

Grey Duck *Anas superciliosa*

A few (maximum three) were recorded in both surveys. Most sightings were around the inner harbour (sections 8 to 10).

Grey Teal *A. gracilis*

One was seen at the Hutt River estuary in September 1975.

South Island Pied Oystercatcher *Haematopus ostralegus*

Recorded in all calendar months, but some small flocks (up to 37 birds) stopped while on passage. They were usually associated with flocks of Variable Oystercatchers around the Hutt River estuary and Petone Beach (sections 4 to 6).

Pied Stilt *Himantopus himantopus*

A few birds (maximum 13) regularly visited Wellington Harbour out of the breeding season during both surveys. Almost all records were from the Hutt River estuary (section 4).

Banded Dotterel *Charadrius bicinctus*

During both surveys, Banded Dotterels nested in the small bay near Lake Kohangapiripiri. In the first survey one or two pairs were present from October to January, while in the second survey two or three pairs were present from July to January. A few Banded Dotterels, presumably on passage, were recorded at Wellington Airport.

Black-fronted Dotterel *C. melanops*

Two birds were seen on the beach in section 14 in March 1987, presumably on passage.

Spur-winged Plover *Vanellus miles*

During the first survey one bird was seen on Petone Beach (section 5) and one opposite the Horokiwi quarry (section 7). By the second survey, Spur-

winged Plovers had become more frequent visitors to the harbour shores, 18 being seen during 7 counts; most were seen near Lake Kohangapiripiri (section 1).

Bar-tailed Godwit *Limosa lapponica*

Two were seen at the Hutt River estuary (section 4) in January 1976.

Brown Skua *Catharacta skua*

One bird was seen off section 8 in March 1987.

Arctic Skua *Stercorarius parasiticus*

A few were recorded through summer and autumn, mainly associated with White-fronted Terns near the harbour entrance.

Black-billed Gull *Larus bulleri*

During the first survey, a total of over 300 Black-billed Gulls was recorded during the 24 counts. They were recorded in all calendar months, but mainly from February to June. During the second survey, only 19 birds were recorded. It is not clear whether there has been a significant decrease or whether birds were confused with the much more common Red-billed Gull.

Black-fronted Tern *Sterna albobriata*

One was recorded in September 1976 off section 9. In April 1987 one was off section 6, and three were off section 17 in both April and May 1987.

Caspian Tern *S. caspia*

Through both surveys, a few Caspian Terns were recorded in all parts of the harbour, except the southwestern area (sections 9 to 12). They were recorded in all calendar months, but an exceptional count of 24 was recorded in section 17 in August 1976.

Kingfisher *Halcyon sancta*

Kingfishers visited the harbour shore mainly from April to September. Between surveys there seemed to be an increase from 18 counted in the first survey to 52 in the second survey. Most were seen along the southern coast (sections 15 to 17) and a few from Lowry Bay to the Hutt River (sections 3 and 4).

#### DISTRIBUTION OF BIRDS WITHIN WELLINGTON HARBOUR

Each year two or three pairs of Banded Dotterels and a pair of Variable Oystercatchers nested on the wide shingle beach near Lake Kohangapiripiri, and a flock of Black-backed Gulls usually roosted at the eastern end of the bay which is at the southeastern end of section 1. In the first survey, many birds fed offshore from the Pencarrow sewer outfall, but this was not seen in the second survey. Relatively few birds were seen on the rocky shore of the eastern side of the harbour from Pencarrow Lighthouse to Point Howard (sections 1 to 3), but on the coast between Pencarrow Lighthouse and the end of the road at Eastbourne a pair of Variable Oystercatchers usually managed to raise one or two young.

The wharf at Point Howard (section 4) was a favoured roost for Spotted Shags. Few birds were recorded between there and the Hutt River mouth, in an area which has been subsequently transformed into a marina.

The Hutt River mouth is the only estuarine area within Wellington Harbour, and was therefore an important site for wading birds, waterfowl and shags.

The sandy Petone Beach (sections 5 and 6) and adjacent playing fields were favoured feeding or roosting sites for Variable Oystercatchers in both surveys, and the gravel bank at the western end of the beach was a key roost for Black-backed Gulls, Red-billed Gulls and White-fronted Terns.

The rocky shore between Horokiwi and Ngauranga was used mainly by small shags and Variable Oystercatchers, but the oystercatchers were not known to attempt to breed on the small gravel beaches in this section. Around the abattoir outfall at Ngauranga (section 8) large numbers of gulls, Gannets, giant petrels and Mallards congregated during the first survey, but by the second survey, when such waste was not available, few birds other than shags were recorded there.

In the inner harbour (sections 9 to 11), which had been extensively modified by reclamations, wharves and marinas before the first survey, little of the original shoreline remains and densities of most birds was low, except for Fluttering Shearwaters, which seemed to like the sheltered waters available, Black-backed Gulls, which roosted on the wharves, especially at the container terminal, and White-fronted Terns, which often roosted on the breakwater of the Port Nicholson Yacht Club marina (section 11).

The varied shoreline of Evans Bay (section 12) and the eastern side of the Mirimar Peninsula (sections 13-15) provided a variety of feeding habitats for birds, and so moderate densities of most species were recorded. Variable Oystercatchers sometimes congregated on the rocky shore near Shelly Bay in section 12, and a small group of White-fronted Terns sometimes nested on rocks off Scorching Bay (section 13).

Many birds congregated in section 16 around the sewer outfall at Moa Point; this was especially so in the second survey. Little Shags, Mallards and Red-billed Gulls reached their highest densities in this section, and Black Shags and Black-backed Gulls were locally abundant around the outfall itself. A few Black-backed Gulls nested on the cliffs overlooking Moa Point

Taputeranga Island, in Island Bay (section 17), was a key site for Reef Herons, and a couple of pairs of Variable Oystercatchers nested there during the second survey. A colony of about 200 pairs of Black-backed Gulls nested on the island and a small islet to the west. Owhiro Bay, at the western end of section 17, was an important roost for Black-backed Gulls and Red-billed Gulls, and the sewer outfall on the eastern side of the bay attracted gulls and shags.

Somes Island (16 ha), together with its associated rock stacks, is a key site for birdlife in Wellington Harbour because many of the birds seen around the mainland shores roost or breed there. Good numbers of Little Blue Penguin, Spotted Shag, Reef Heron, Variable Oystercatcher and Black-backed Gull breed on this island, which is free from large mammalian predators such as cats, dogs and mustelids. The recent removal of rats from the island (R. Cotter, pers. comm.) should enhance the values of the island. The much smaller Ward Island (1.1 ha) provides some opportunities for

birds, such as Variable Oystercatchers, to nest in the absence of large mammalian predators. Continued management of Somes Island in a way which benefits wildlife is important to the numbers and diversity of birds around the shores of Wellington Harbour.

### DISCUSSION

Wellington Harbour has a diverse birdlife of resident species and migratory visitors. Between the mid-1970s and the mid-1980s there were marked changes in the numbers of most of the key species, with more species increasing than decreasing. For most species, the distribution within the harbour changed dramatically between the surveys, or from historical records to the present series of counts.

The changes in overall numbers and distribution were clearly related to changes in the water quality within the harbour. The closure of abattoirs and the treatment of waste discharge have led to a marked decrease in the use of the Ngauranga area by giant petrels, Gannets and Mallards; and Red-billed Gulls have decreased in the vicinity of the former Gear Freezing Works at Petone since the 1950s. The milliscreening of sewage at Pencarrow Head seems to have led to a redistribution of some species within the harbour, in particular, Black-backed Gulls and Red-billed Gulls having shifted to Moa Point and Owhiro Bay, where raw sewage was still being discharged during our studies. Since the second in the series of counts was completed, the sewage at Moa Point has also been milliscreened, and so it will be interesting to see what happens to the numbers and distribution of birds in Wellington Harbour as a result.

The increase in many species is presumably in response to an overall improvement in water quality, not necessarily just from better treatment of sewage and abattoir effluent, but also from a decrease in the levels of toxic chemicals finding their way into the harbour food chains. The number of birds in the harbour is likely to be a good indicator of the health of the harbour, and so the birds should continue to be monitored at approximately 10-year intervals.

### ACKNOWLEDGEMENTS

The following people took part in one (1) or both (2) harbour surveys (E & OE): A. Ballance (1), J.A. Bartle (2), C. Basham (1), D. & R. Batcheler (1), Ben D. Bell (2), Brian D., C. E. & P. Bell (2), A., D., M. & R. Bell (1), A.J. Beauchamp (1), G. & G. Blackwell (1), G. Brown (2), K. & M. Brown (2), D.J. & E.E. Buckett (1), P. C. Bull (1), G. Burgess (1), W. J. Campbell (1), W.F. Cash (1), N. Champion (1), F. Clunie (1), J. F. Cockrem (1), E. Collins (1), J. Collman, B. Cook (1), S. Cook (1), R. Cotter (2), S. Cotter (1), D. Cunningham (1), C. Dawidowski (1), D.G. Dawson (1), P. Daysh (1), M. Douglas (1), B. Dunlop (1), C. Duval (1), M.G. Efford (1), B.A. Ellis (1), M.L. Falconer (2), P. Finlay (1), J.E.C. Flux (1), D.C. & P.D. Gaze (1), P. Gentry (1), E. Gibbons, (1), A.H & I.N. Gollop (1), J.R. Hay (1), L. Hayes (1), B.D. & R. Heather (2), J. & B. Henley (1), R.F. Hodson (1), A. Holt (1), A. Hutson (1), B. James (1), J.L. & K. Kendrick (1), F.C. Kinsky (1), S. Lawrence (1), J. & S. Leary (1), D. Mare, S. Mitchell (1), S.J. Moore (1), A. Morrison (1), A. Munro (1), E. Murphy (1), M. Neil (1), A., J. & P. Notman (1), R. O'Brien (1), M. Parrish (1), S. & D. Payne (1), R. Pickard (1), M.H. & R.G. Powlesland (1), P. Purser (1), P. & R. Rider (2), H.A. & P.E. Roberts (1), L. Roberts (1), H.A. Robertson (1), G. Sherley (1), R. Slack (1), J.-C. Stahl (1), D. Stone (1), B. & G. Suckling

(1), B. & P. Sutherland (1), B.N. & R.N. Thomas (1), G. Tracy (1), S. Triggs (1), D.L. & M. Turner (1), D.J. & J. Wardle (1), A. Warren (1), W.A. Watters (1), C.J. West (1), G.A. Woodward (2).

The Wellington Harbour Board asked for the first survey to be done, Max Falconer organised the first survey and Dr Dave Dawson collated all the data from the first survey and carried out some preliminary analyses. Dr Richard Sadleir suggested the second survey be done, and Dr John Cockrem entered some data from the second survey onto computer, and made those files available to me. Rod Cossee, Barrie Heather and Ralph Powlesland improved the manuscript.

#### LITERATURE CITED

- FORDHAM, R.A. 1967. History and status of the Dominican Gull in Wellington. *Notornis* 14: 144-153.  
 FORDHAM, R.A. 1968. Dispersion and dispersal of the Dominican Gull in Wellington, New Zealand. *Proc. NZ Ecol. Soc.* 15: 40-50.  
 KENDRICK, J.L. 1973. Spotted Shags nest at Wellington. *Notornis* 20: 5.  
 McILWAINE, C.P. 1964. Fluctuations in the numbers of Giant Petrels at Ngauranga, Wellington Harbour, New Zealand. *Emu* 64: 33-38.  
 MISKELLY, C.M.; BENFELL, R.W. 1981. Unusual wandering of a Spotted Shag. *Notornis* 28: 134-135.  
 SECKER, H.L. 1954a. Counts of the Silver Gull in eastern Cook Strait, New Zealand. *Emu* 54: 73.  
 SECKER, H.L. 1954b. Counts of the Silver Gull in eastern Cook Strait, New Zealand. *Emu* 54: 280.  
 SECKER, H.L. 1973. Numbers of Giant Petrels in Wellington Harbour and Cook Strait, NZ. *Emu* 73: 134-135.  
 SIEGEL, S. 1956. *Nonparametric Statistics for the Behavioural Sciences*. Tokyo: McGraw-Hill Kogakusha. 312pp.  
 TURBOTT, E.G. (convener) 1990. *Checklist of the Birds of New Zealand*. 3rd edn. Auckland: Random Century. 247pp.

HUGH A. ROBERTSON, *Science and Research Division, Department of Conservation, P.O. Box 10 420, Wellington*



## SHORT NOTE

### A Chestnut Teal at the Manawatu River estuary – a new bird for New Zealand

Over the past decade increasing numbers of Grey Teal (*Anas gibberifrons*) have used the R. Manawatu estuary as a sanctuary during the duck shooting season. While counting a flock of c.115 Grey Teal there on 3 June 1991, JLM saw a noticeably darker bird feeding with them on the open mudflats with its lower body partly hidden in a shallow channel. From the green gloss on the head and the reddish-brown upper breast it was assumed to be a male Brown Teal (*A. aucklandica*) and was shown to R & S Creswell as such about 20 min later. Although by then disturbance had extended the viewing distance to 200-300 m, the distinctive breast colour and head pattern were still clearly visible.

The bird was still present on 15-16 June and, as many Brown Teal are now captive bred, it was checked by telescope for bands at less than 100 m range. It had no bands, but a number of features were noted which were not consistent with the original identification as a Brown Teal. These included