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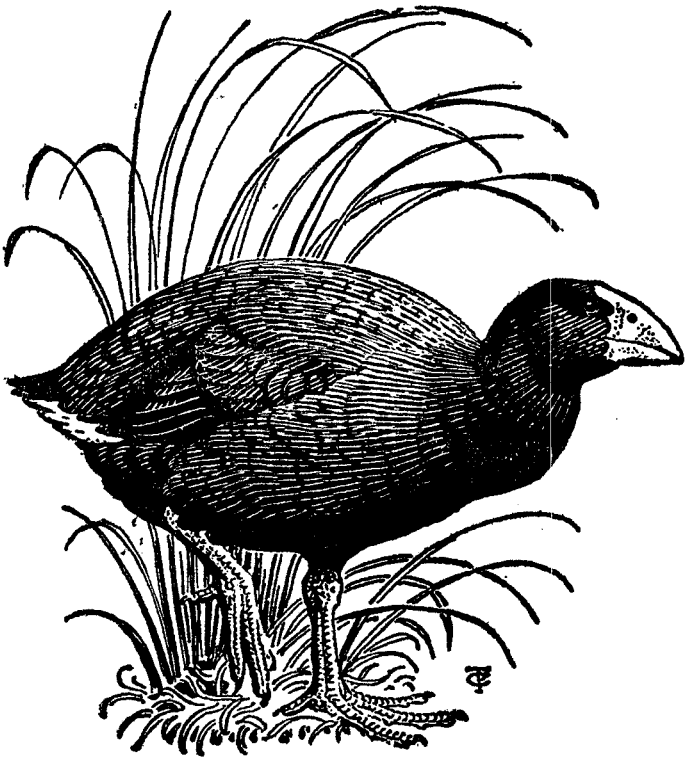
Journal of the Ornithological Society of New Zealand



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SEASONAL DIFFERENCES IN BIRD COUNTS IN FORESTS NEAR REEFTON, SOUTH ISLAND, NEW ZEALAND

By D. G. DAWSON, P. J. DILKS, P. D. GAZE, J. G. R. McBURNEY and P. R. WILSON

ABSTRACT

Birds were counted in four forest areas every second month of a year to determine broad habitat preferences of the different species and the factors affecting the numbers counted. Most species showed marked seasonal changes in conspicuousness. The differences between the numbers of birds counted by different observers were generally small compared with the differences between areas and seasons. Many species were more abundant in the valley-bottom forest than in the two hill-country forests; only a few species preferred high-altitude forest. The preferred habitat of some species changed with season. The implications of these findings for bird conservation in Westland forests are discussed.

INTRODUCTION

Conservation issues, such as those raised by proposals to exploit South Island beech forests commercially (Thomson 1971), require information on the kinds and numbers of birds living in different forested areas. Dawson & Bull (1975) described what seemed a practical technique for counting birds in forests, and this paper reports the use of the technique to compare the bird populations of four forests near Reefton every second month for a year. The study had two main aims: to document broad habitat preferences and the seasonal distribution of each species of bird, and to examine the various factors influencing the numbers counted. This paper compares the areas and examines the effects of season and different observers on the numbers counted. A preliminary examination indicates that weather, noise (produced by running water, traffic, cicadas, etc.) and hour of day were not significant in the differences that occurred.

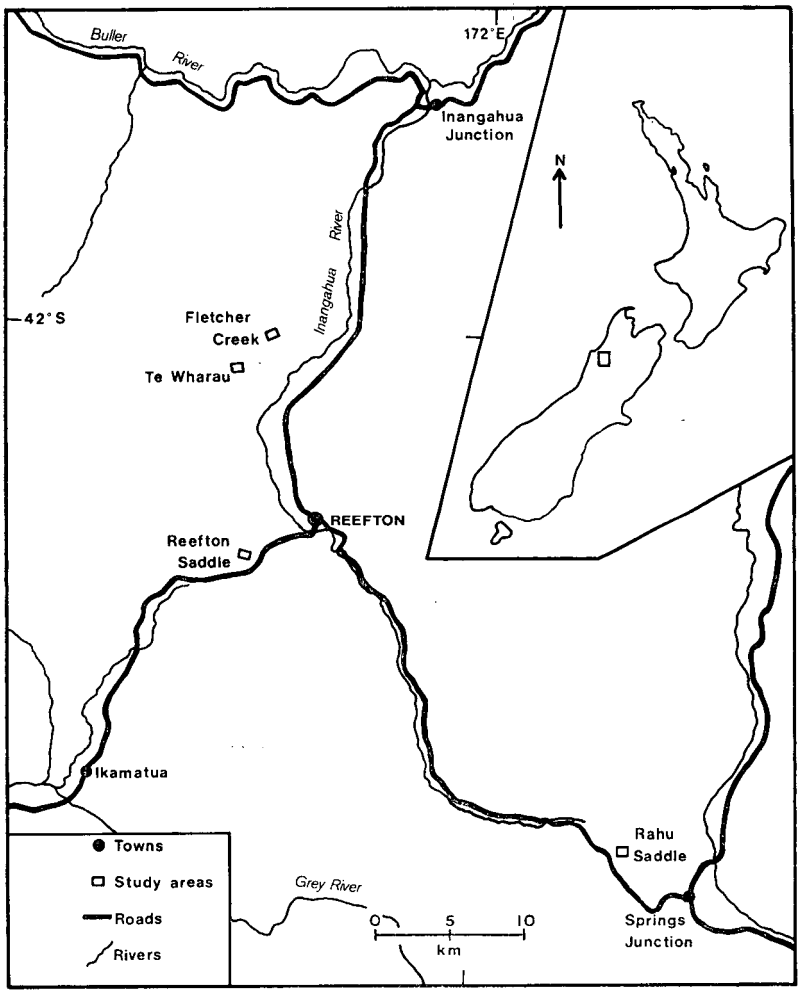

FIGURE 1 — The location of the four study areas.

STUDY AREAS AND METHODS

Four study areas were selected (Fig. 1). Two represent the main hill-country "types" (as mapped by the National Forest Survey, Masters *et al.* 1957) of the forests proposed for conversion to exotics or beech management in the West Coast Beech Utilisation Scheme (Thomson 1971; N.Z. Forest Service staff, Reefton, pers. comm.). These were at Reefton Saddle (type PB5: 310-430 m a.s.l.) and at Te Wharau (type PB15: 300-420 m a.s.l.). The third area, type PB1, sampled at Fletcher Creek (230 m a.s.l.), is a remnant of the type of

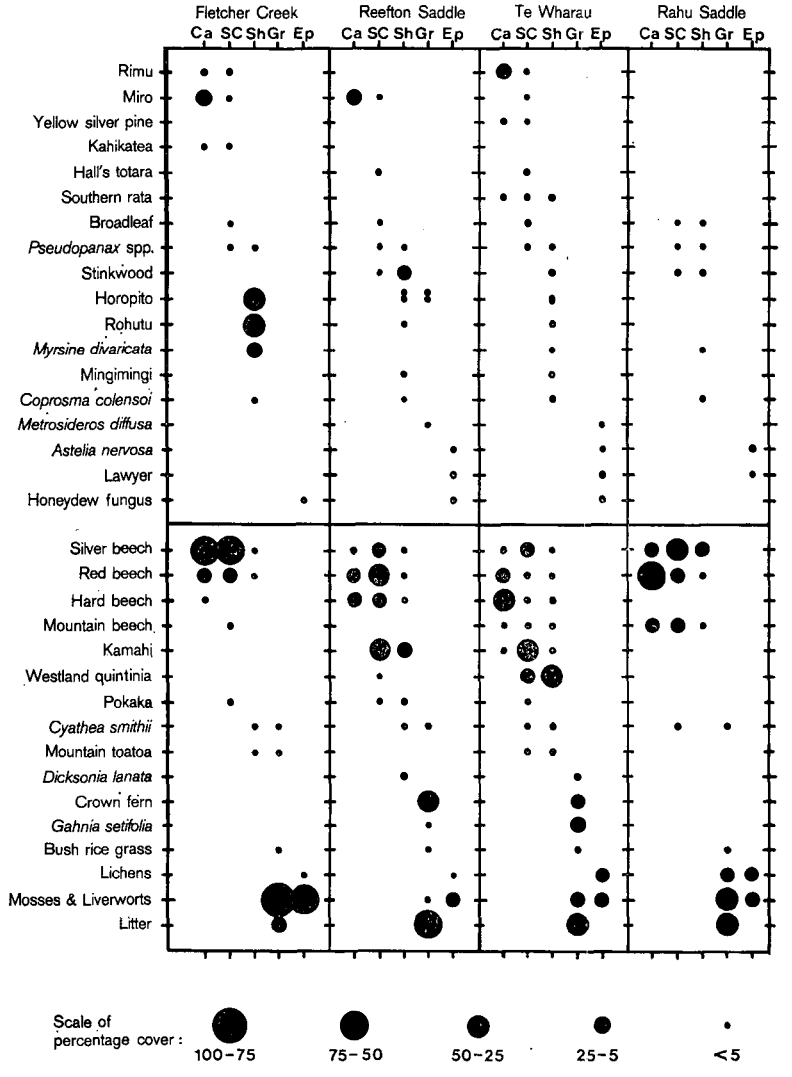

FIGURE 2 — The structure and composition of the vegetation in each study area. Species known to provide fruit or nectar for birds are grouped together at the top. The method used to estimate the ground cover provided by each species in each layer is given in Appendix III. (Ca = canopy & emergents; SC = subcanopy and tall understorey; Sh = shrubs; Gr = ground cover; and Ep = epiphytes). For scientific names see Appendix I.

TABLE 1 — The weather and noise recorded in the four study areas (average values).
Air temperature was recorded in each area at 0930, 1200 and 1500 hours each day; the other variables were recorded on an arbitrary scale (Dawson & Bull 1975) at every counting point.

	Fletcher	Reefton	Te Wharau	Rahu	Average
Air temperature (°C):	12.3	12.2	12.7	10.4	11.9
Sun (0-5):	2.0	2.5	2.1	1.8	2.1
Wind (0-3):	0.15	0.33	0.16	0.44	0.27
Rain (0-5):	0.22	0.20	0.33	0.24	0.25
Noise (0-2):	0.21	0.20	0.15	0.42	0.25

forest once common on alluvial flats and terraces; most of what is left could be logged under current New Zealand Forest Service proposals. The fourth study area is in " protection forest " at Rahu Saddle (820-1070 m a.s.l.) and represents the high-altitude areas that are to remain untouched.

Table 1 gives the average weather and noise levels recorded in the four study areas, and Figures 2 and 3 summarise the vegetation as described by G. N. Park and G. Y. Walls of Botany Division, DSIR. The major features of each area are described below; scientific plant names are given in Appendix I.

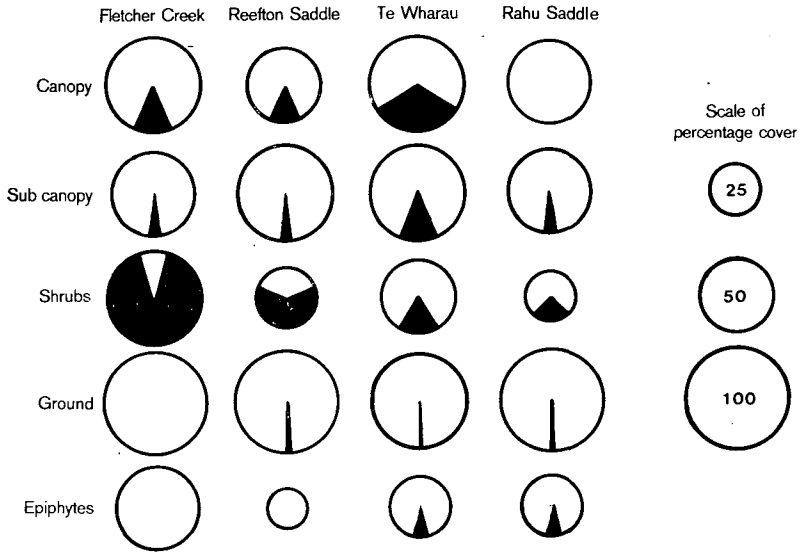

FIGURE 3 — The average cover provided by each of the layers of vegetation in Fig. 2. The areas of the circles indicate the ground cover provided by the layers. The proportion attributable to species known to provide fruit or nectar is shaded.

1. *Fletcher Creek (map ref. NZMS 18 S57 2942): silver beech, red beech forest, with emergent podocarps*

Despite its low altitude this area was no warmer (Table 1) than Te Wharau and Reefton Saddle, suggesting that cold air drained on to it from the surrounding hills. Silver beech predominated in the canopy and subcanopy, with few podocarps, but this was the only area with any kahikatea. The area was notable for a dense layer of the fruit-bearing shrubs horopito, rohutu, *Myrsine divaricata* and *Coprosma colensoi*. Mosses and liverworts covered the ground and tree trunks. Figure 3 shows that Fletcher Creek, in contrast to the other areas, had full representation of each layer.

2. *Reefton Saddle (map ref, S57 2826): hard beech forest and red beech, silver beech forest*

This area was appreciably windier than Fletcher Creek or Te Wharau. The ridges had hard beech forest over kamahi, quintinia and Hall's totara, but the slopes and gullies had red and silver beech, with some miro in the canopy, over kamahi. The shrubs were fewer than at Fletcher Creek, with stinkwood, rohutu and mingimingi the predominant fruiting species. Mosses and liverworts were scarce, and crown fern and litter predominated on the ground. The canopy and shrub layers were sparse and there were few epiphytes.

3. *Te Wharau (map ref. S57 2739): rimu, hard beech forest*

This area experienced a little more rain and slightly higher temperatures than the other three. Emergent rimu were prominent, but miro were practically absent. The canopy was mainly of hard beech, with some red beech in gullies, and poorly drained sites had yellow-silver pine and mountain beech. Kamahi, quintinia and silver beech were abundant below the canopy and there were few fruiting shrubs. The ground cover was varied, with much litter and *Gahnia setifolia* but with some mosses, liverworts and crown fern. Mosses, liverworts and lichens were the major epiphytes.

4. *Rahu Saddle (map ref. S57 5605): red beech, silver beech forest*

This area contrasted markedly with the three lower sites in many respects. It was colder, had less sun and more wind, and was noisier. There were no podocarps, the canopy being of red beech over silver beech. The shrub layer was very thin, though stinkwood and a few vines of lawyer provided some fruit. The ground was covered with litter, mosses, liverworts and lichens. The last three were also important as epiphytes.

The study areas were visited on 18-21 April, 19-22 June, 27-30 August, 21-24 October, 14-17 December 1974 and 17-20 February 1975; and 22-25 April 1976. On each visit, each of the four observers counted in all four areas, one per day; and on each of the four days, all four areas were counted simultaneously.

In each area a 2-km loop walking track was permanently marked at 200-m intervals, and 5-minute counts (Dawson & Bull 1975) were made from each of these 10 points twice each day: once between 0930 and 1200 hours N.Z. standard time and once between 1300 and 1530 hours. Thus 20 counts were made by each observer per day, 320 were made by the team in each four-day visit and 1920 in the year.

All differences were tested with chi-squared tests but, for two main reasons, the test results provide only a pointer to the real pattern. First, the chi-squared test assumes each observation to be statistically independent of the others, but we know that some species of birds flock, while others defend territories and are thus respectively more or less likely to be seen together than would be so by chance. The tests produce too many " significant " results for flocking species and too few for territorial ones. Second, though each observer counted in each area, some differences were found between the observers and between the four successive days. Thus the counts could be affected by a combination of particular observers and days.

The histograms and Appendix II give the numbers of each species counted. These are indices of abundance, not censuses; for example, Bellbirds are more conspicuous than Riflemen so that their numbers are not directly comparable, nor would Bellbird counts in summer be directly comparable with those in winter when they may be less conspicuous. Even when comparing areas at the same time of the year differences between counts can be caused by levels of song or activity rather than by real difference in numbers. With abundant species, fewer birds may be recorded than were actually seen or heard, because, when many birds are being seen or heard, it is difficult to discriminate new birds from ones already recorded; rarely were more then eight individuals of any species recorded in one count.

RESULTS

DIFFERENCES BETWEEN OBSERVERS

Figure 4 illustrates differences between the counts of the four observers. Most of the differences were statistically significant but only a few (Tit, Chaffinch, and Song Thrush especially) were large. These three species were the only ones for which a higher chi-squared value was obtained when testing observer differences than when testing area differences (both tests with three degrees of freedom). Most differences seemed to reflect differing judgement of a bird's distance or of whether a new call represented a new bird or one previously counted.

As the same four observers counted in each area on each visit, such differences were of minor importance, but they would be of more concern if counts made by observers who had never worked together were to be compared. However, our four observers rarely differed more than twofold (usually much less).

The possibility that our judgement or ability improved or deteriorated as time went on was investigated with a six (visits) by four (observers) chi-squared test for each species. Figure 5 illustrates this for the Blackbird. Though a quarter of the counts of all the species differed significantly from the mathematically expected value, for no species did any of the observers find a seasonal trend which differed appreciably from the average.

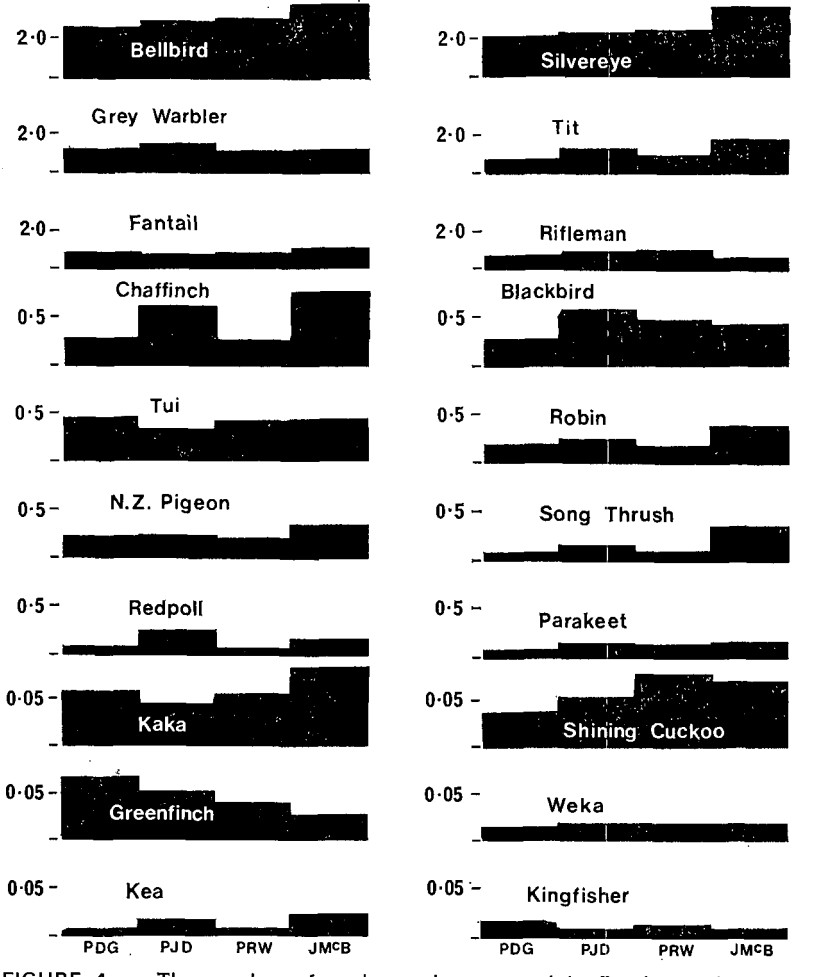

FIGURE 4 — The number of each species counted in 5 minutes by each of the four observers, averaged over the whole study. Note the different scales. The differences between observers were highly significant ($P<0.01$) for all species except Shining Cuckoo and Greenfinch, which were significant ($0.01<P<0.05$), and Weka and Kea, which were not significant.

DIFFERENCES BETWEEN AREAS

Figure 6 shows that many species had marked preferences for certain areas. Fantails, Tuis, New Zealand Pigeons and Song Thrushes were common in the low-terrace forest at Fletcher Creek, less so in the hill-country forests of Reefton Saddle and Te Wharau, and least common in the high-altitude forest at Rahu Saddle. Conversely, Riflemen and Keas were commonest at Rahu Saddle. Bellbirds, Kakas and Dunnocks preferred hill-country forests. Blackbirds and Robins favoured the low-terrace and high-altitude forest. Redpolls, Silvereyes, Shining Cuckoos, Greenfinches and Wekas were commonest at Reefton Saddle and were next most abundant at Fletcher Creek, and less abundant at Te Wharau, the other hill-country forest. Parakeets and Chaffinches were found mainly at Fletcher Creek and Te Wharau. No clear preference was shown by Grey Warblers or Tits.

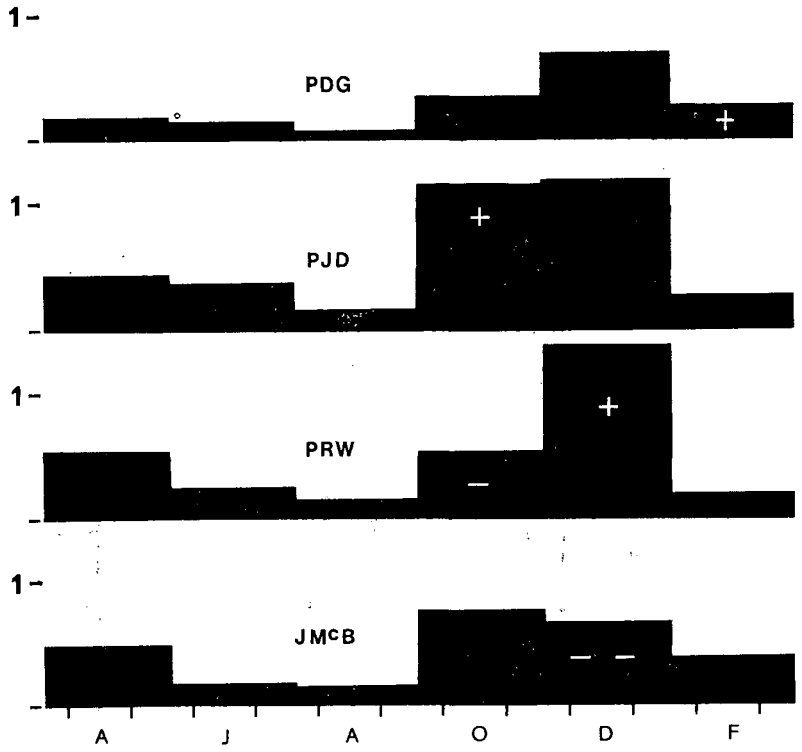

FIGURE 5 — The average number of Blackbirds counted in 5 minutes by each observer on each of the six visits. Statistically significant (+ or −) and highly significant (++ or −−) departures from expected are marked; the expected count was based on each observer's and each month's average.

Thus while all the areas were used by most of the common species, the high-altitude forest (Rahu Saddle) was favoured by fewest birds, with only Riflemen, Robins and Keas preferring it; by contrast, the now much diminished low-terrace forest (Fletcher Creek) held numerous Fantails, Blackbirds, Tuis, Robins, Pigeons and Song Thrushes. Seasonal changes in this generalised picture are described below.

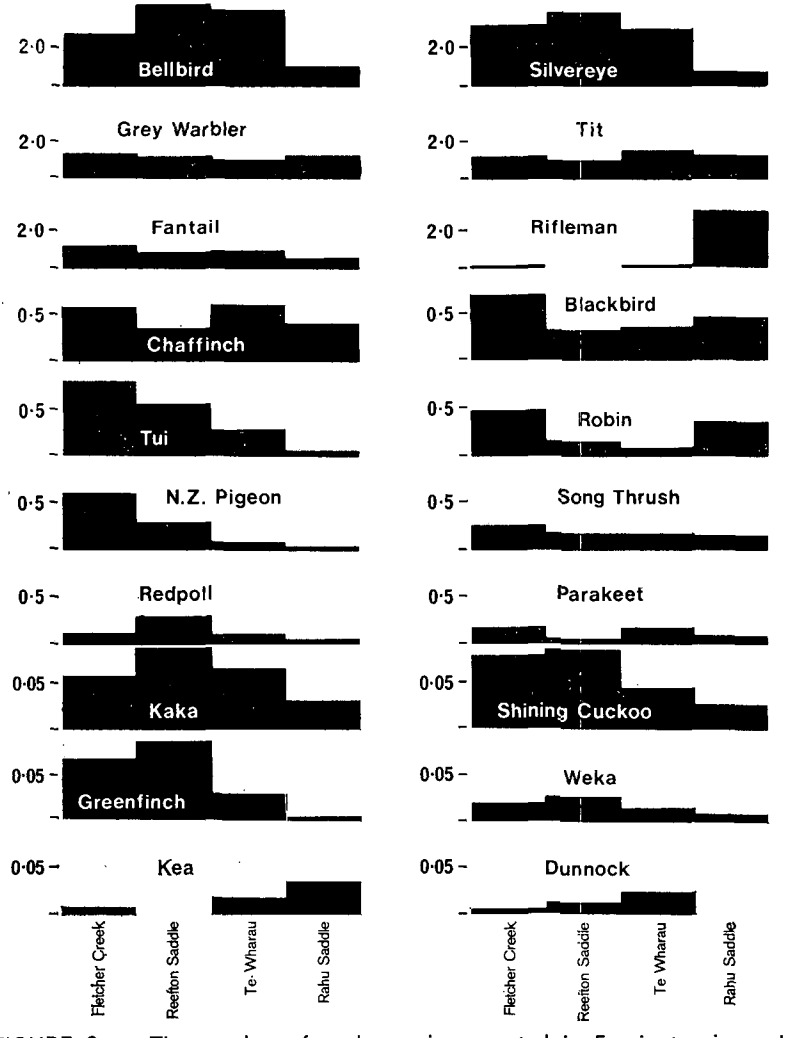

FIGURE 6 — The number of each species counted in 5 minutes in each of the four study areas, averaged over the whole year. The count was significantly different ($P<0.01$) between areas for all species except Weka. Other species are given in Appendix II.

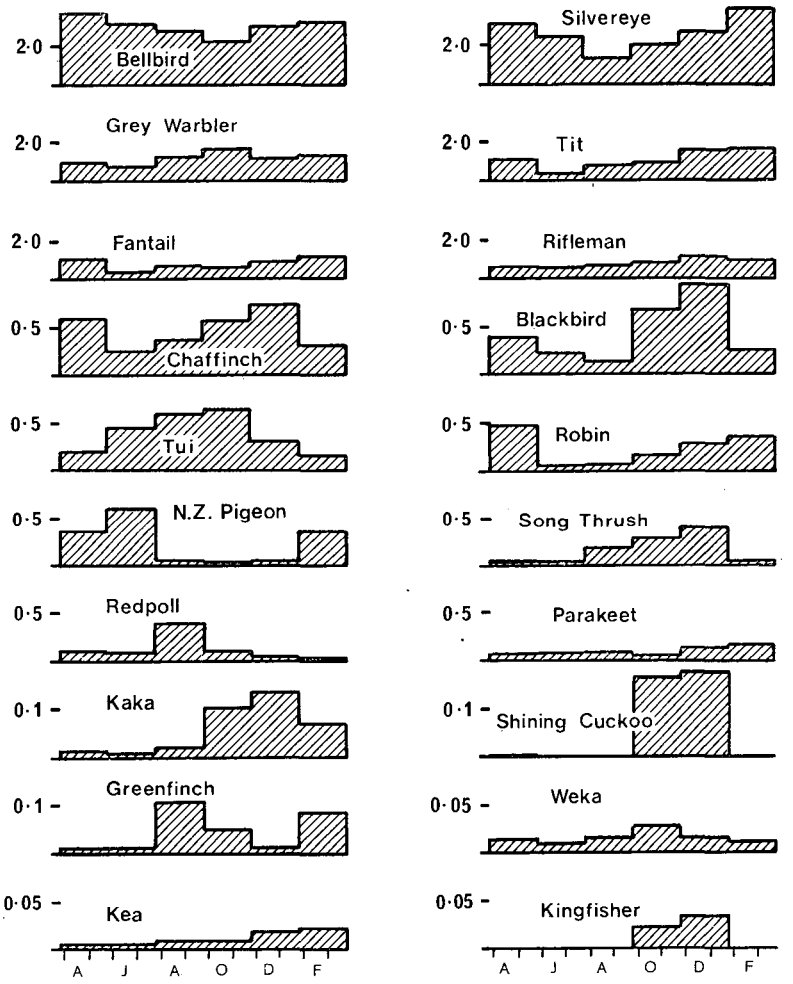

FIGURE 7 — Average 5-minute count of each species on each of the six visits; April 1974 to February 1975. Note the different scales. The count differed significantly ($P<0.01$) between months for all species except Weka, Kea and Kingfisher. Other species are given in Appendix II.

SEASONAL DIFFERENCES

Figure 7 shows that for many species the number counted rose from early winter till December, remained high till May, and then declined rapidly back to the winter minimum. This may reflect changes in numbers brought about by movement in and out, and by breeding and mortality, or in the conspicuousness of the birds through

changes in their behaviour (e.g. song) and through the direct influence of the weather on the observers' acuity.

If birds did not move from an area, the combined effect of the other processes could be allowed for when comparing counts made at different times of the year. Thus, with the Robin, a count made in late June would need to be multiplied by 121/15 = 8.07 (Appendix II) to be comparable with one made in February, if this factor sums up the net effects of mortality and changes in conspicuousness between February and June. Such reasoning obviously does not apply to species such as the Shining Cuckoo and Kingfisher which certainly leave the area for winter, and others (Silvereye, Pigeon) which may move out of the forests or to forest types not represented in our study. Nevertheless this is the best correction factor to use until further work in other habitats can improve it.

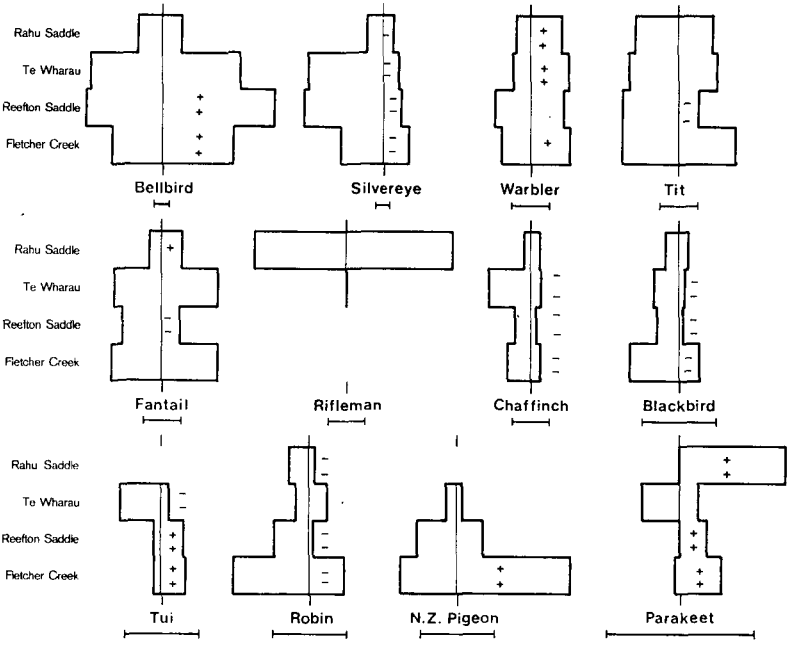

FIGURE 8 — A comparison of counts in April 1974 (left) and April 1976 (right), for 12 species. Significant differences between the two years are marked as in Fig. 5. One scale unit equals one bird.

COMPARISON OF APRIL COUNTS

The April counts were repeated in 1976 to measure the combined effect of learning by the observers, differences in conspicuousness, and real differences in bird abundance. For the 12 most abundant species the two years differed about twofold or less (Fig. 8). Chance probably

affects the counts not only of scarce species such as the Blackbird and Robin, but also of those that flock such as the Silvereye, Chaffinch and Parakeet.

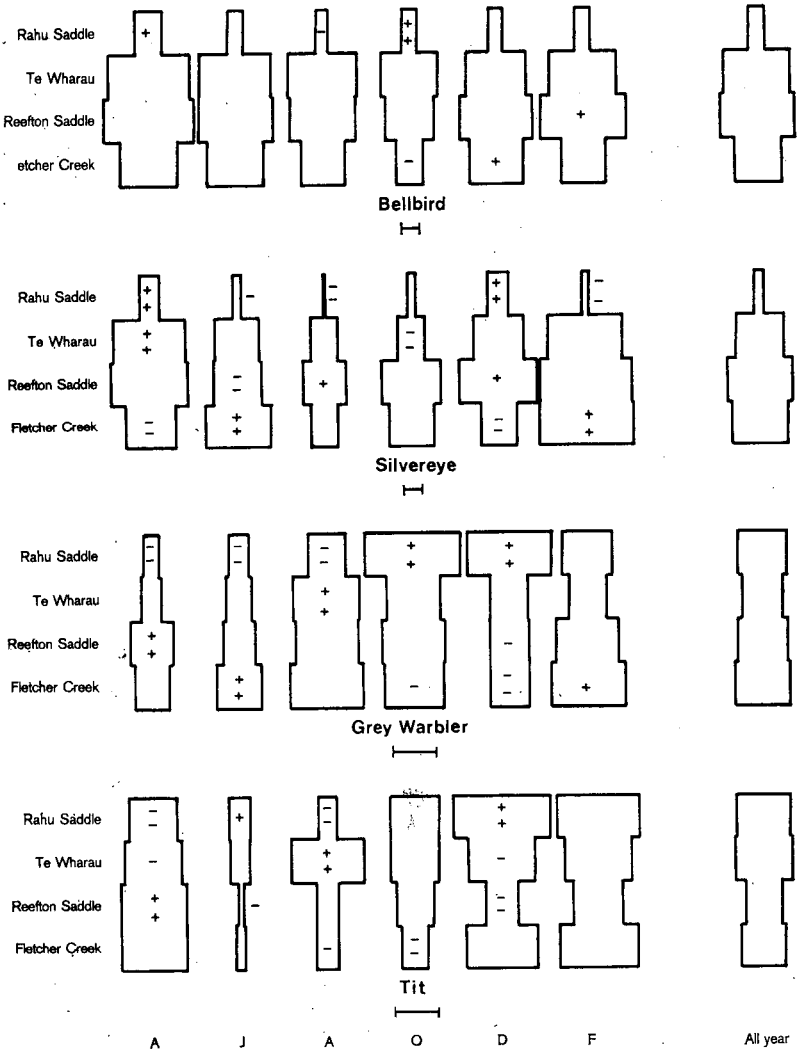

FIGURE 9A — Average 5-minute count of each species in each area on each of the six visits. Statistically significant differences from the proportion of each species counted in each area over the whole year (extreme right) are marked as in Fig. 5. The Rifleman and Pigeon showed no significant changes and so are not illustrated. One scale unit equals one bird.

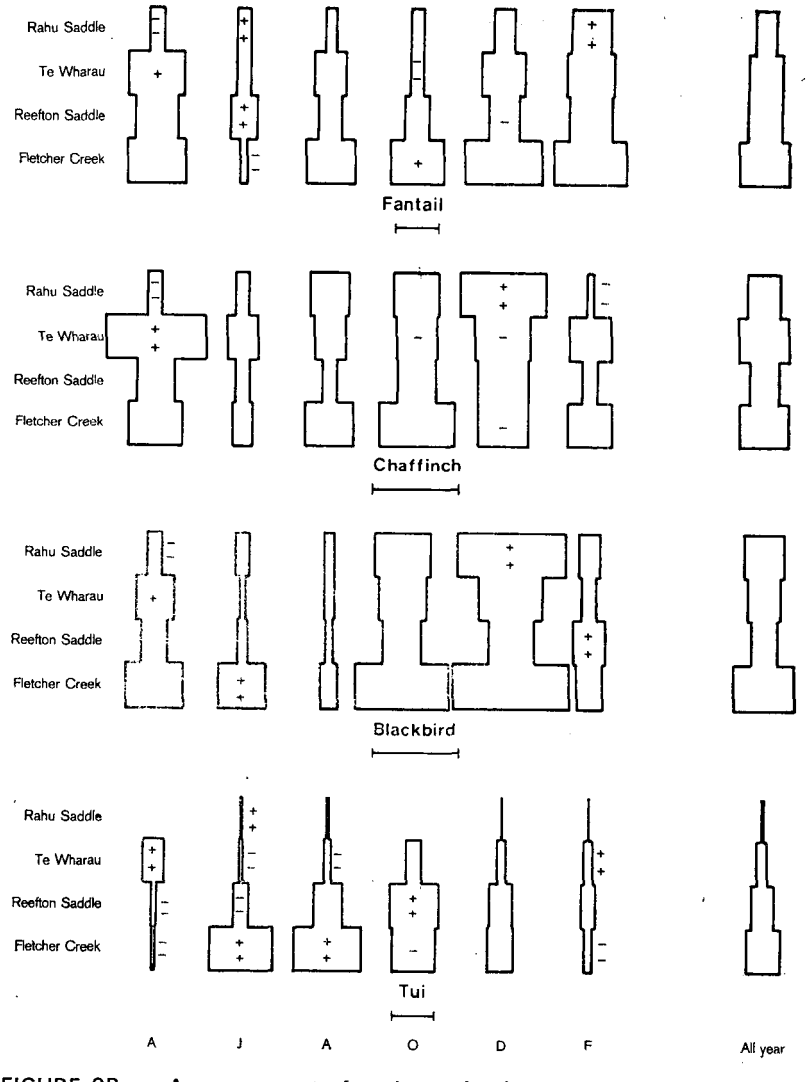

FIGURE 9B — Average count of each species in each area on each of six visits (continued).

SPECIES COUNTS

In this section we examine the seasonal changes in the apparent preferences of the 14 most commonly encountered species (Figs. 6 & 7) for each of the four study areas. This was done by comparing the proportion of each species counted in each area over the whole year,

with the proportion counted in each area, each month. For example, for Grey Warbler (Fig. 9A), though there was little difference between the annual average count for each area there were large differences between areas in some months: more than the expected numbers of

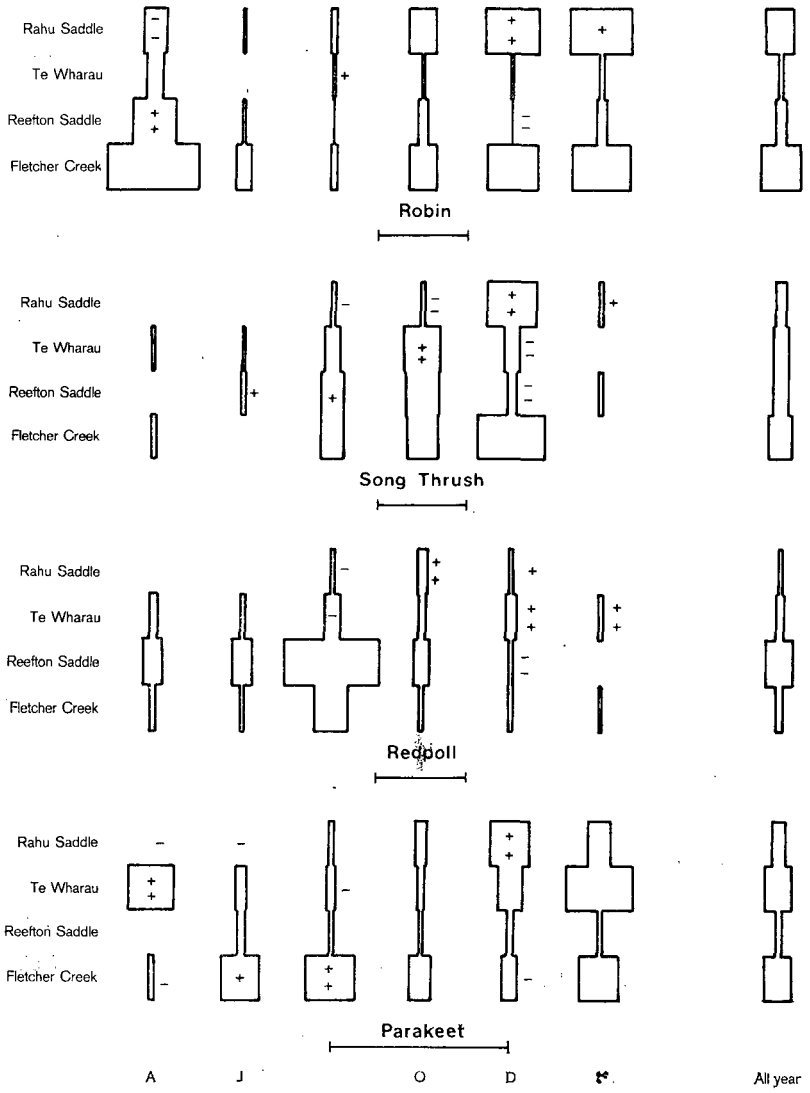

FIGURE 9C — Average count of each species in each area on each of six visits (continued).

warblers were found at Rahu Saddle in October and December, at Te Wharau in August, at Reefton Saddle in April and at Fletcher Creek in June and February. Conversely, fewer warblers than expected were counted at Rahu Saddle in April, June and August, at Reefton Saddle in December and at Fletcher Creek in October and December. Such departures from expected figures suggest either that birds moved between forest types or that they were more conspicuous in one place than another. For instance, the peak of song may be specially late at high altitude or on south-facing slopes, or birds may sing more vigorously after a nest failure as they revert to early stages of the breeding cycle.

In Figure 9, and below, the species are listed in descending order of the total number counted.

BELLBIRD *Anthornis melanura*

Unlike Tuis (see below), Bellbirds favoured hill-country forests throughout the year (Fig. 9A).

SILVEREYE *Zosterops lateralis*

We counted fewest Silvereyes in winter (Fig. 7), probably because some leave the forest then (Kikkawa 1962) rather than because they become less conspicuous. We do not know why so few Silvereyes were counted at high altitude in February. Fewer Silvereyes were counted in April 1976 than in April 1974 in all four areas, suggesting the difference was real.

GREY WARBLER *Gerygone igata*

Though, on average, warblers were distributed quite evenly through the forests (Fig. 6), comparatively many were recorded in the low-terrace and hill-country forests from February till August and at Rahu during October and December (Fig. 9A). Warblers are frequently double-brooded and breed from August to January at lower altitudes (Oliver 1955), but probably for a shorter period at higher altitudes. This may explain why we counted so many warblers at Rahu Saddle in summer. Alternatively, perhaps some warblers move to high altitude by October to avoid parasitism by Shining Cuckoos, which appear to move up later (see below).

PIED TIT *Petroica macrocephala*

Tits were found in similar numbers in all four study areas but they were inconspicuous in June and August except at Te Wharau, where singing may have begun early. Increasing numbers were counted in all areas through to February probably because there were more young about. Fleming (1950: 26) reviewed the evidence that tits are sedentary but our counts (Fig. 9A) suggest movements do occur although in no simple pattern.

FANTAIL *Rhipidura fuliginosa*

With only minor exceptions (Fig. 9B), Fantails seemed to prefer the lower-altitude forests, especially the low-terrace forest at Fletcher Creek (Fig. 6). The increasing numbers counted from June to February (Fig. 7) probably reflect the long breeding season (Blackburn 1965).

RIFLEMAN *Acanthisitta chloris*

Riflemen clearly always preferred the high-altitude protection forest (Fig. 6). Kikkawa (1966) considered that Riflemen preferred drier forests, as they become scarcer towards the West Coast. We have no reason to believe Rahu Saddle was drier than the other areas, but it is further east. Altitude *per se* seems not to explain their distribution as Riflemen are common near sea level near Dunedin (Gray 1969) and Kaikoura (pers. obs. D.G.D. & P.R.W.). The high numbers recorded in December and February (Fig. 7) were probably the result of breeding.

CHAFFINCH *Fringilla coelebs*

Chaffinches were more abundant at Fletcher Creek and Te Wharau than at the other two areas (Fig. 6), except that more were counted at Rahu Saddle in December (Fig. 9B). Increasing numbers were counted in all areas from August to October or December (Figs. 7 and 9B) probably because they increased during the breeding season. Flocks of Chaffinches outside the breeding season made counts of them very variable.

BLACKBIRD *Turdus merula*

Throughout the year, on average, the distribution of Blackbirds conformed to the pattern in Figure 6 except that unexpectedly many were recorded at Rahu Saddle in December (Fig. 9B). Either they had moved to high-altitude forest in summer or they had bred very successfully there. Some may also have moved into lower-altitude terrace forests for the winter. Blackbirds were counted most commonly in the middle of their song period, i.e. in October and December.

TUI *Prosthemadera novaeseelandiae*

Tuis favoured the low-terrace forest of Fletcher Creek, especially during winter, but were also quite common in the hill-country forests of Reefton Saddle and Te Wharau (Figs. 6 and 9B). By October, they had spread more into the hill-country forests, probably to breed there as well as in the low-terrace areas. This dispersion persisted until April, after which Tuis returned to their preferred over-wintering habitat. Most were counted in winter and spring, when noisy flocks fed at low altitude.

ROBIN *Petroica australis*

Robins favoured the protection forest at Rahu Saddle and the low-terrace forest at Fletcher Creek, and their increase and decrease through the year (Fig. 7) reflected the breeding cycle; first, singing adults became more conspicuous, then young birds swelled the population between October and April. The highly significant increase in numbers at Reefton Saddle during April 1974 (Fig. 9C) may have reflected a movement of young birds, but it did not recur in 1976.

NEW ZEALAND PIGEON *Hemiphaga novaeseelandiae*

Pigeons were distributed very similarly to Tuis (Fig. 6), specially preferring forests with kahikatea and/or miro as at Fletcher Creek, but

also the hill-country forest at Reefton Saddle which has some miro in the gullies. Pigeons were rarely seen in late winter and spring, probably because they were then in lowland habitats outside our study areas, e.g. feeding on kowhai foliage until September, then on new shoots of willows until October (pers. obs.). Oliver (1955) recorded that most eggs are laid in November and December and that the young fledge about 70 days later. Pigeons were virtually absent from Fletcher Creek in December but were present during the February counts, suggesting they may have bred early elsewhere.

SONG THRUSH *Turdus philomelos*

Though Song Thrushes were distributed throughout, they were usually commonest at Fletcher Creek. Few were counted except in the breeding season (August till December) when they were singing strongly. As with Blackbirds, the sudden reduction in numbers counted in both of the hill-country forest types and the marked increase in the protection forest between October and December (Fig. 9C) may indicate an upward movement, or they may begin to sing later at higher than at lower altitudes.

REDPOLL *Acanthis flammea*

Redpolls were most often encountered at Reefton Saddle, especially in winter. However, only few were seen and the differences in Figure 9C may well be due to chance.

PARAKEET *Cyanoramphus* spp.

Only a few parakeets were identified to species and all of these were Yellow-crowned *(Cyanoramphus auriceps)*. Parakeets were commonly found at Fletcher Creek and Te Wharau (Fig. 6). Figure 9C suggests that they move to higher altitudes for the summer and down for the winter, but the large difference between the two April counts (Fig. 8) throws some doubt on this.

KAKA *Nestor meridionalis*

Kakas were found mainly below the protection forest (Fig. 6) and were most often recorded from October to February (Fig. 7); noisy birds flying overhead at this time may be family parties (Jackson 1963a).

SHINING CUCKOO *Chrysococcyx lucidus*

Although Shining Cuckoos may arrive as early as August and leave as late as April (Oliver 1955), we recorded them only during their peak song period (Fig. 7). The shift of peak numbers from Fletcher Creek to higher forests between October and December (Appendix II) was highly significant ($P<0.005$ in a chi-squared test) and may reflect a movement in search of warblers' nests to parasitise.

GREENFINCH *Carduelis chloris*

Greenfinches were often heard at Fletcher Creek and Reefton Saddle and, like Redpolls, were common in late winter and again in February. These changes could reflect either movement or conspicuousness.

WEKA *Gallirallus australis*

A few Wekas were encountered at all seasons and in all four areas, but no significant differences were detected.

KEA *Nestor notabilis*

Like Kakas, Keas were normally noticed flying overhead and calling more frequently in December and February (Fig. 7), when possibly in family parties (Jackson 1963b), than at other seasons. They were most numerous at Rahu Saddle, whereas Kakas favoured low and mid-altitude forest (Fig. 6).

KINGFISHER *Halcyon sancta*

Kingfishers were found only in October and December (Fig. 7) the same seasonal pattern shown by Taylor (1966) for areas near Lake Rotoiti (Nelson) at around 600 m above sea level. We found none at Rahu Saddle, 800 m or more above sea level. Taylor found Kingfishers inconspicuous in January and February while moulting, and we agree that they move out of the forests for the winter, when they are most abundant at the coast (pers. obs. D.G.D., P.R.W.).

DUNNOCK *Prunella modularis*

Dunnocks were recorded only from those study areas with low second-growth vegetation within earshot of at least one counting point. No seasonal variation was shown by the statistical tests.

GOLDFINCH *Carduelis carduelis*

A few Goldfinches were recorded in all four study areas throughout the year (Appendix II).

BROWN CREEPER *Finschia novaeseelandiae*

Our records of Brown Creepers were confined to the protection forest at Rahu Saddle in December and February (Appendix II). This species occurs at coastal forest margins at Punakaiki, Westland, only in winter (D. J. Onley, pers. comm.), perhaps having then moved down from high altitudes on the Paparoa Range.

OTHER SPECIES

Too few Yellowhammers *(Emberiza citrinella)*, Harriers *(Circus approximans)*, New Zealand Falcons *(Falco novaeseelandiae)*, Long-tailed Cuckoos *(Eudynamis taitensis)*, Paradise Ducks *(Tadorna variegata)* and Moreporks *(Ninox novaeseelandiae)* were recorded for detailed analysis (Appendix II). The three Falcons, Long-tailed Cuckoo and Morepork were recorded at Rahu Saddle, and the other three species were flying over the forest at one or more localities.

Occasional observation at night revealed the presence of Moreporks and Great Spotted Kiwis (Appendix II). A Great Spotted Kiwi *(Apteryx haasti)* was captured at Fletcher Creek, and others were heard nearby and at Te Wharau.

DISCUSSION

The study was confined to diurnal birds in four forest types. Three were important inland, North Westland forest types included in the Beech Forest Utilisation Scheme (Thomson 1971) and classified by the New Zealand Forest Service as PB1, PB5 and PB15; the fourth was high-altitude 'protection' forest.

Some general patterns emerge from the details in Figures 6 and 9, summarised in Figure 10. The low-terrace forest (Fletcher Creek) was preferred by more species than were the other three areas (Fig. 10, average). Though many species were found in all four areas throughout the year, Figure 9 suggests that a varying proportion of the population of many species in all areas moved seasonally. Warblers and parakeets used the high-altitude forest (Rahu Saddle) principally in spring and summer.

The maintenance of complete populations of forest birds thus probably depends upon preserving a full, balanced range of forest types adjacent to one another, so that birds may move seasonally from one to another to avoid bad weather or food shortage — as suggested by Falla (1939). The need for large and representative reserves also follows from the general observation that small isolated areas support few species (Diamond 1975).

Of the forests studied, Fletcher Creek had the richest bird fauna, but is only a small remnant of a forest type once widespread, i.e. the podocarp-beech forests of the valley bottom. The present rarity of these low-lying forests may have reduced the numbers of birds and of species in the surrounding hill-country forests.

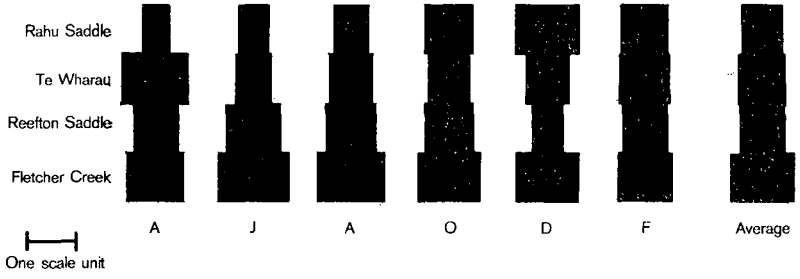

FIGURE 10 — The relative abundance of birds (pooling the 14 most numerous species) in each area during each of the six visits. The average 5-minute count of each species for each of the six visits was arbitrarily assigned a scale value of one and the counts in each area expressed on this scale. For example, the average count of Silvereyes in October in each area was 2.76, 3.32, 1.54 and 0.51 (Appendix II), averaging 2.03, so the scale values were 2.76/2.03 = 1.4, 3.32/2.03 = 1.6, 1.54/2.03 = 0.8, and 0.51/2.03 = 0.3. The values in the figure are the average of the 14 such scaled counts for each area each visit.

Birds are indicators of general habitat diversity: bird numbers (Fig. 10) and diversity of species correlate with the structural diversity of the vegetation (Fig. 3), with the abundance of flowers and fruits, and with the numbers of invertebrates (McColl 1974) in the forests studied. Thus the preservation of representative samples of the forest communities may preserve the birds and invertebrates as well, but very large areas of forests may be needed to preserve the full range of bird species.

ACKNOWLEDGEMENTS

Dr P. C. Bull and R. H. Taylor advised on all stages of this work, criticised earlier drafts of the manuscript, and with Dr J. E. C. Flux and B. W. Thomas, helped to establish the four 2-km-long walking tracks from which the birds were counted. We are also indebted to staff of the New Zealand Forest Service at Reefton for advice in choosing our study areas. Dr G. N. Park and G. Y. Walls of Botany Division, DSIR, described the vegetation of the study areas. We thank Dr J. A. Gibb and many other colleagues in Ecology Division, DSIR, for helpful criticism of the manuscript.

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D. G. DAWSON, *Ecology Division, DSIR, Private Bag, Lower Hutt;* P. J. DILKS, P. D. GAZE, J. G. R. McBURNEY & P. R. WILSON, *Ecology Division, DSIR, Private Bag, Nelson.*

APPENDIX I

Glossary of plant names

Broadleaf	**Griselinia littoralis**	Mountain beech	**Nothofagus solandri** var. ***cliffortioides***
Bush rice grass	***Microlaena avenacea***	Mountain toatoa	**Phyllocladus alpinus**
Crown fern	**Blechnum discolor**	Pokaka	**Elaeocarpus hookerianus**
Cutty grass	**Gahnia setifolia**	Red beech	**Nothofagus fusca**
Hall's totara	**Podocarpus hallii**	Rimu	**Dacrydium cupressinum**
Hard beech	**Nothofagus truncata**	Rohutu	**Neomyrtus pendunculata**
Horopito	**Pseudowintera colorata**	Silver beech	**Nothofagus menziesii**
Kahikatea	**Dacrycarpus dacrydioides**	Southern rata	**Metrosideros umbellata**
Kamahi	**Weimannia racemosa**	Stinkwood	**Coprosma foetidissima**
Lancewood	**Pseudopanax crassifolium**	Westland quintinia	**Quintinia acutifolia**
Lawyer	**Rubus australis**	Yellow-silver pine	**Dacrydium intermedium**
Mingimingi	**Cyathodes fasciculata**		
Miro	**Podocarpus ferrugineus**		

	Fletcher Creek						Reefton Saddle						Te Wharau						Rahu Saddle					
	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun	Aug	Oct	Dec	Feb
Bellbird	267	250	197	135	244	211	407	342	308	234	337	397	378	333	319	255	282	313	123	73	55	78	67	76
Silvereye	231	305	121	221	165	434	345	226	184	266	361	432	328	210	113	123	236	337	88	29	5	41	93	21
Grey warbler	62	82	129	111	75	139	77	58	115	116	76	116	34	47	118	101	70	69	31	33	68	178	157	92
Tit	121	16	38	48	135	149	121	10	40	65	63	92	107	35	130	92	125	141	91	39	32	91	180	157
Fantail	110	13	89	82	137	130	87	48	43	43	55	82	103	22	53	23	82	88	27	26	21	23	38	73
Rifleman	1	1											3	5	8	8	23	5	202	172	202	232	302	285
Chaffinch	49	20	45	71	48	40	34	15	15	34	47	14	93	30	27	39	54	39	14	12	34	43	80	6
Blackbird	53	43	16	89	108	22	24	9	7	34	41	129	34	7	8	44	58	12	15	11	8	53	101	20
Tui	8	107	125	80	43	13	8	29	51	95	41	26	44	4	12	27	13	15		7	4		2	1
Robin	82	12	6	23	44	54	38	2	1	7	1	8	14		3	2	2	4	21	1	6	23	48	55
New Zealand pigeon	61	137	2	4	5	75	41	46	5	1	1	36	11	8	1	3	1	4		1	2		2	1
Song thrush	4		19	27	60			4	21	27	9	4	4	2	15	32	14				3	3	45	5
Redpoll	6	2	28	5	3	1	17	20	85	13	1		8	4	13	6	9	4			1	8	3	
Parakeet	2	17	23	9	7	17		3	1	1	2	1	20	5	3	3	11	30			1	5	17	10
Kaka	3	1	3	7	7	5	1	1	1	16	20	2			1	7	10	11			1	2	7	4
Shining cuckoo				30	7					19	20					2	19					1	11	
Greenfinch		1	5	8		17	3	3	23	3	3	5	1		5	3		4				1		
Weka	1		1	5	2		2	2	4	1	2	1	1	1		1	1	2				2		1
Kea			1										2	1	2	2				1		1	6	7
Kingfisher				2	1				4	8						1	2							
Dunnock		1			1					5			1	7	1	2								
Goldfinch			3				3		3	1	2		1								1	1		
Brown creeper																				1		2	6	5
Yellowhammer			1							2						1								
Harrier										2												1		
New Zealand falcon																						3		
Paradise duck										2														
Morepork			+							+						+						1		
Long-tailed cuckoo																						1		
Great spotted kiwi			+													+								

APPENDIX II

The total of the 80 counts for each species in each area each visit. Because of their value for comparisons with other work, these figures (on which Figures 6 - 10 were based) are given in full. The visits are not distinguished for the last seven species.

+ = species not represented in count but presence confirmed.

APPENDIX III

Method of describing the vegetation

The vegetation was described using a method modified from Druce (1959). The technique is described here as it provided a quick semi-quantitative assessment and so may be useful to others with similar needs.

Up to seven structural layers were described from the area within about 30 metres of each counting point: upper canopy (usually emergent), lower canopy (usually semi-continuous), subcanopy, upper shrub understorey, lower shrub understorey, ground layer, and epiphytes. The percentage ground cover (for epiphytes the percentage cover of trunks and branches) provided by each layer, and the percentage of each layer's total cover provided by each species, were estimated and categorised into one of five classes. These categories were noted with a shorthand consisting of various line rulings, as follows:

over 75%; 50-75%; 25-50%; 5-25%; and less then 5%

The appropriate line symbolising each layer's percentage cover was placed vertically beside its species list, and each species name was also underlined to indicate its percentage contribution to the layer's total. For example:

Canopy	Red beech
	miro
	hard beech
	silver beech
Subcanopy	Silver beech
	hard beech
	kamahi

To summarise the data, we considered the average ground cover provided by each canopy layer and by each species in each layer. For example, if the canopy gave 50-75% (average 62.5%) ground cover and miro was estimated to comprise 25-50% (average 37.5%) of the canopy, we estimated the ground cover provided by canopy miro as 37.5% of 62.5%, which is 23%. The data for Figure 2 were obtained by averaging such percentages over the 10 counting points in each area and grouping two pairs of structural layers — the upper and lower canopy, and the subcanopy and upper understorey. The data for Figure 3 were the totals of those used for Figure 2.

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SHORT NOTE

LEACH'S FORK-TAILED STORM PETREL

A specimen of Leach's Fork-tailed Storm Petrel *(Oceanodroma leucorhoa)* was found in a farm paddock at Turangaomoana, near Waharoa, Waikato, after a storm on 19 April 1978, and is now in the collection of the Auckland War Memorial Museum (A.M. No. AV 1283.3).

The plumage is normal for this species but there are faded pale brown feathers on the forehead and secondaries. The rump is white, almost completely divided by dark feathering, the only white in the central area being supplied by a 4 mm fringe on two dark feathers. The only previous record for New Zealand was in 1922.

PATRICIA FOOKS, *3/91 Campbell Road, Onehunga, Auckland 6*

FIELD STUDY COURSE, BAY OF PLENTY, JANUARY 1978

By A. T. EDGAR

ABSTRACT

Activities during the Bay of Plenty Study Course of 8-15 January 1978 are described. 94 species seen during the course are listed, with notes on 27 other species not recorded during the course, but known to have occurred along this coastline in recent years.

INTRODUCTION

Planning the course was a joint effort by Roy Weston and Paddy Latham (Bay of Plenty), Ray Jackson (Volcanic Plateau), Beth Brown (South Auckland) and Betty Seddon (Waikato). Most of the visitors stayed at Papamoa Domain camping ground, not far from Papamoa Beach Play Centre where evening meetings were held for discussion, talks and slides and where excellent evening meals were provided. A final social gathering was held at the residence of Rosemary and Paddy Latham, where members enjoyed a barbecue, prepared by Bryony Veitch and Hazel Harty, with Richard Veitch in his best form as chef.

Fair weather throughout the week enabled completion of the work plan, which provided for a census of Tauranga Harbour (11 January) and of Ohiwa Harbour and Whakatane Heads (13 January). On 14 January members travelled inland to Otanewainuku Bush Reserve. On other days members split into three groups, each of which had one day at each of three predominantly coastal localities — Kaituna Cut-Maketu; Little Waihi-Kaikokopu Swamp; Matata-Tarawera estuary-Awaiti Reserve-Thornton. Beach patrols for seabird wrecks were conducted during the course as opportunity permitted.

Checklist sheets were provided for recording observations and from these 38 mapping cards were completed, covering 25 map squares. Two results sheets of waders and water birds were compiled and sent to all who took part.

The following field observers were present for all or part of the course — A. T. Edgar, J. Hawken (Northland); S. Chamberlin, R., P. & J. Hooper (North Auckland); P. Fooks, G. & C. Schischka, R. B. Sibson, E. Spragg, M. J. Taylor (Auckland); J. A. & B. Brown, H. Harty, C. R. Veitch (South Auckland); M. A. Barnes, J. F. Cockrem, R. Mayhill, M. Rossiter, S. M. Timmins, L. Wilson (Waikato); H. Anderson, P. Densem, K. Fletcher, B. Goffin, P. C. M. Latham, A. McCutchan, R. V. McLintock, R. M. Weston (Bay of Plenty); A. Palliser (Volcanic Plateau); C. Scadden (Wairarapa); G. A. Brown, A. Dorman, T. P. Fisher, E. Gibbons, D. Goodale, A. Husson, M. M. Neill, P. Rider, J. Young (Wellington); P. Jenkins (Marlborough); M. Feaver, D. Rorke (UK). (E. & O. E.)

NOTORNIS 25: 279-290 (1978)

OTANEWAINUKU BUSH RESERVE

This remnant of native forest, 15 km south of Te Puke, was visited on 14 January, the last day of the course. Parties worked over the bush reserve and adjoining open country and recorded: N.Z. Pigeon (24), Shining Cuckoo (1), Long-tailed Cuckoo (11), Kingfisher (7), Rifleman (1), Pipit (1), Whitehead (6+), Grey Warbler (71), Fantail (61), Pied Tit (19), Robin (19), Silvereye (40), Bellbird (33), Tui (25) and a probable Kokako (since confirmed). Also noted were Harrier, California Quail, Black-backed Gull (1), Skylark, Thrush, Blackbird, Yellowhammer (12), Chaffinch (12), Greenfinch (2), Goldfinch (6), Sparrow, Myna and White-backed Magpie.

These results are not repeated in the species list below.

AWAITI WILDLIFE MANAGEMENT RESERVE

This lies south of Tarawera river mouth and is a series of lagoons with raupo and willow swamp, surrounded by farmland. On 12 January, there were 32 Little Black, 14 Black and 4 Little Shags, but of 20 nests in two willows only one was occupied, by a Little Black Shag. Up to 50 Little Shags were counted on 10 January, plus White-faced Heron, Bittern, Mallard (150), Grey Duck (4), Shoveler (8), Pukeko (9). Other species recorded in and around the reserve were Black Swan, Pheasant, Harrier, Pied Stilt, Black-backed Gull, Kingfisher, Skylark, Swallow, Fantail, Thrush, Blackbird, Silvereye, Yellowhammer, Chaffinch, Goldfinch, Sparrow, Starling and Myna.

SEABIRDS

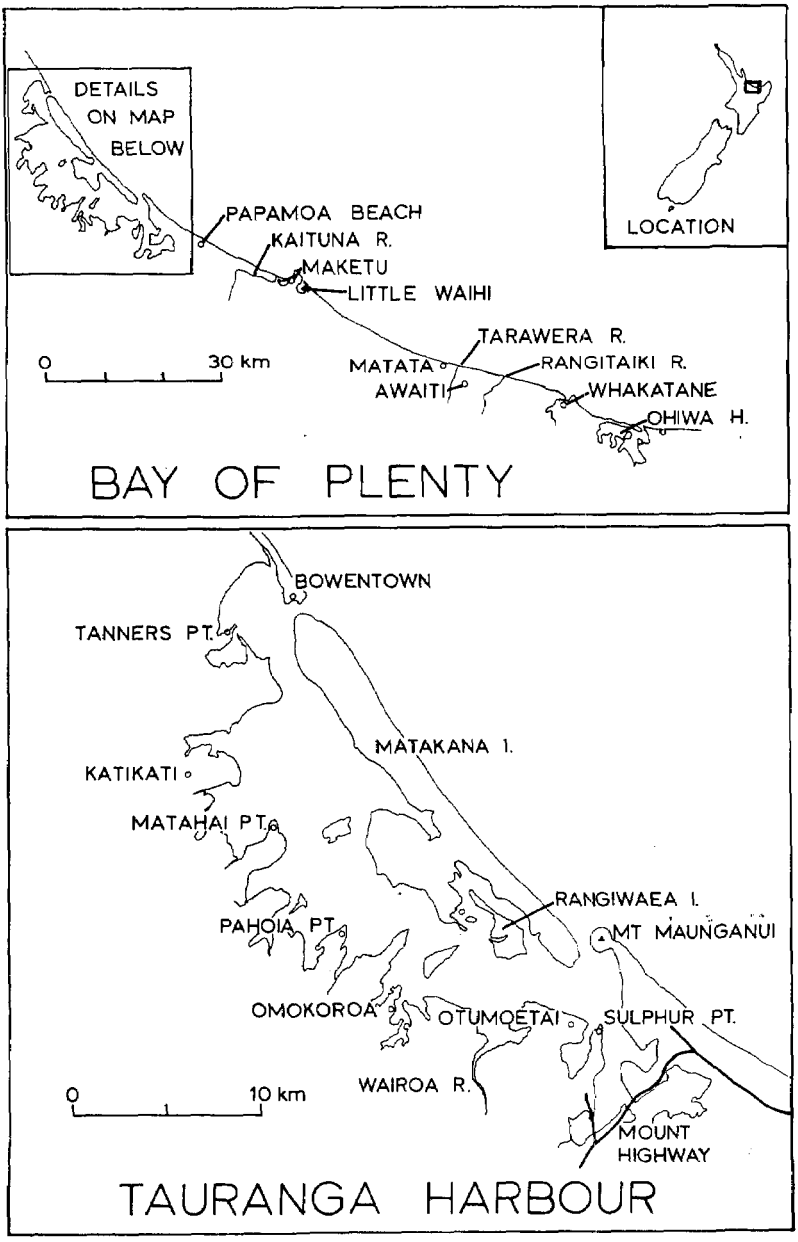
Beach patrols between Matakana and Whakatane produced 99 specimens including Blue Penguin (3), Cape Pigeon (1), Grey-faced Petrel (3), Prion sp. (2); Shearwaters: Flesh-footed (2), Buller's (2), Sooty (4), Short-tailed (46), Fluttering (12), Hutton's (1); Diving Petrel (9), White-faced Storm Petrel (2) and miscellaneous (12).

On 12 January observers at Maketu-Little Waihi had a bonus when strong winds brought close inshore flocks of free-flying Shearwaters — Flesh-footed (50), Buller's (10), Sooty (6), Fluttering (c. 300) and also Diving Petrels (10).

One Gannet was recorded inside Tauranga Harbour, and one or two birds offshore at Maketu, Little Waihi, Tarawera estuary and Whakatane.

COASTAL COUNTS: LAND, SHORE AND FRESHWATER BIRDS

Tauranga Harbour count was done at the top of a spring tide (3.6 m). Parties or individuals worked ten localities around the harbour, Tanner's Point-Bowentown, Matakana, Matahai Point, Katikati, Pahoia, Omokoroa, Wairoa estuary, Otumoetai, Sulphur Point, and the area east of the Mount highway (Welcome Bay etc.). Rangiwaea and other islands were covered by a boat party, and boats were also used in the Tanner's Point-Bowentown area.


DETAILS ON MAP BELOW
LOCATION
PAPAMOA BEACH
KAITUNA R.
MAKETU
LITTLE WAIHI
TARAWERA R.
RANGITAIKI R.
WHAKATANE
OHIWA H.
MATATA
AWAITI
0
30 km
BAY OF PLENTY
BOWENTOWN
TANNERS PT.
MATAKANA I.
KATIKATI
MATAHAI PT.
RANGIWAEA I.
MT MAUNGANUI
PAHOIA PT.
OMOKOROA
OTUMOETAI
SULPHUR PT.
WAIROA R.
0
10 km
MOUNT HIGHWAY
TAURANGA HARBOUR

Ohiwa Harbour was covered by one party on Ohiwa Spit, other parties working around the harbour, and a boat party. A brief visit was paid to Whakatane Heads and Ohope oxidation ponds.

Each of the other localities (Kaituna cut-Maketu, Little Waihi-Kaikokopu swamp and Matata-Tarawera estuary-Thornton) was visited on each of three days by different parties.

The information from the census sheets is presented in the form of an annotated list, which also includes species not observed during the course but known to have occurred along Bay of Plenty coastline during recent years. It is hoped that this will be useful to observers, as it provides a better picture of birdlife in the Bay than could be obtained from tabulated records for one week in midsummer 1978.

SPECIES LIST (COASTAL AREAS)

Locality names are abbreviated thus — Tauranga Harbour, TH; Kaituna cut-Maketu, KM; Little Waihi, LW; Matata, M; Tarawera estuary, T; Rangitaiki estuary (Thornton), R; Whakatane, W; Ohiwa Harbour and Ohope, OH.

For species recorded during coastal counts, the species name is followed by the course record — locality abbreviation and number of birds counted; where appropriate this is followed by a short note on previous sightings, etc.

Species not recorded in January 1978 are marked with an asterisk; their inclusion is supported by a brief reference to a local observer or published material.

Names of observers are omitted from course records, but for other records are given in full, or identified by initials if they were on the course.

DABCHICK *(Podiceps rufopectus)* R, one at lagoon. A previous sighting at Maketu, May 1976 (PCML).

BLACK SHAG *(Phalacrocorax carbo)* TH, 18; KM, 29; LW, 14; M/T/R, 23; OH, 8; total 92.

PIED SHAG *(P. varius)* TH, 35; KM, 33; LW, 4; M/T/R, 43; W, 35; total 150.

LITTLE BLACK SHAG *(P. sulcirostris)* TH, 7; LW, 4; T, 25; R, 10; OH, 5; total 51. Seasonal in the eastern end of TH, scarce or absent September-February; winter flocks, each of c. 100 birds, at Wairoa estuary, Waimapu estuary and Welcome Bay (KF). June 1977, c. 200 on a pylon opposite Matapihi bridge (Mount highway) and 90 on sandbanks in the channel to the east (J. H. Seddon). Numbers are augmented in autumn and winter elsewhere along the Bay, e.g., LW, 32 in July 1975; R, 40 in April 1977 (PCML); known to have occurred at M since 1940 (RBS).

LITTLE SHAG *(P. melanoleucos)* TH, 165; KM, 27; LW, 24; T, 25; R, 4; W, 6; OH, 51; total 302. Probably an undercount (see under White-faced Heron). Plentiful and obvious around TH, March-August (KF).

WHITE-FACED HERON *(Ardea novaehollandiae)* TH, 637; KM, 53; LW, 73; M/T/R, 14; W, 5; OH, 177; total 959. It has been suggested that even the large number recorded at TH may be an undercount. In harbour and estuary surveys where the principal objective is a count of waders, birds are counted when waders will be on their high tide roosts, and it is therefore not always practicable at the same time to inspect every location where herons and shags may have congregated in mangroves, pines or other trees, or where Pied Stilts, displaced by a high tide, may be in paddocks well back from the count area. It may be of interest to note that regular counts in Manukau Harbour usually give a total of about 350 White-faced Herons; once, in December 1969, 689 were recorded.

*WHITE HERON *(Egretta alba)* Autumn and winter visitor (March-September) to estuaries and lagoons from TH to OH, in small numbers.

*LITTLE EGRET *(E. garzetta)* Recorded as a winter visitor since 1957 (RBS). LW, July-October 1975, two, later one (PCML); 1976, T, one, June; M, one, July (RMW, AP).

REEF HERON *(E. sacra)* TH, 4 (Matakana, Wairoa estuary, Sulphur Point); KM, one. At a high tide count some would have been missed. Reef Herons are present around Tanner's Point (JFC); up to 7 have recently been recorded in Tauranga city/Sulphur Point area (KF), and others are reported from LW, W and OH.

*CATTLE EGRET *(Bubulcus ibis)* LW, January 1976, one; 1977, KM, one June-July; 7 between Thornton and Matata, August (PCML, AP).

BITTERN *(Botaurus stellaris)* TH, one (Matakana); KM, 3; LW, 1; M, 2; OH, 2; total 9. No special search; has been observed in Tanner's Point area (JFC) and around the southern end of TH (KF); widespread, in suitable localities.

*GLOSSY IBIS *(Plegadis falcinellus)* October 1975, LW, 2 (PCML).

*WHITE IBIS *(Threskiornis molucca)* Single birds at KM and LW, 1975 July, October; 1976 May; 1977 May (PCML).

*ROYAL SPOONBILL *(Platalea leucorodia)* KM, single birds 1975 July; 1976 May, October; and at M, 1975 July, one (PCML, AP).

BLACK SWAN *(Cygnus atratus)* TH, 1058; M, c. 100; R. 30; total 1188.

*CANADA GOOSE *(Branta canadensis)* TH, Tanner's Point, one with Black Swans, January 1978 (JFC). KF informs me that Mr Turner, Pahoia, has a semi-domesticated flock of 65, some of which tend to go wild in the summer months.

PARADISE DUCK *(Tadorna variegata)* R, 4; W, 3; total 7. KM, September 1976, one (AP); M, April-May 1977, up to 120 (PCML).

MALLARD *(Anas platyrhynchus)* TH, 622; KM, c. 100; LW, c. 200; M, c. 100; T, 12; R, c. 650; W, 35; OH, 56; total 1775.

GREY DUCK *(A. superciliosa)* TH, 251; KM, 1; LW, 20; M, 6; R, 100; W, 1; total 379.

GREY TEAL *(A. gibberifrons)* TH, 6; KM, 12; M, 5; total 23. May 1977, M, c. 100 (PCML).

N.Z. SHOVELER *(A. rhynchotis)* LW, 2; M, 50; R, 12; total 64. July 1974, KM, 15; July 1977, M, c. 300 (PCML).

N.Z. SCAUP *(Aythya novaeseelandiae)* M, 5; T, 8; R, 1; total 14.

HARRIER *(Circus approximans)* Generally distributed.

*N.Z. FALCON *(Falco novaeseelandiae)* No recent records. One reported at Matata, October 1961 (J. M. Hamilton); five sightings around Tauranga Domain gates, Cameron Road, Welcome Bay, in June 1963 (D. C. Smith).

BROWN QUAIL *(Synoicus ypsiliphorus)* TH (Omokoroa), KM, M. Earlier records from other areas around TH, and from W and OH. Apparently not very common but may be increasing round Maketu (AP).

CALIFORNIA QUAIL *(Lophortyx californicus)* TH, three localities; KM, LW, R, OH. Apparently widely distributed.

PHEASANT *(Phasianus colchicus)* Recorded at eight localities, TH to OH.

BANDED RAIL *(Rallus philippensis)* LW, 1. Known to breed around Tauranga Harbour (RVMcL *et al*); recorded KM, 1975 and 1976 (PCML, AP); M, 1975-77 (AP); OH, 1972 (RMW) and 1974 (G. Foreman).

*WEKA *(Gallirallus australis)* In 1967, the caretaker of the hot pool at the foot of Mount Maunganui reported that two came out of the scrub behind the baths (RVMcL). Apparently some birds were illegally liberated in this area (RMW).

*MARSH CRAKE *(Porzana pusilla)* April 1975, Matata (AP).

*SPOTLESS CRAKE *(P. tabuensis)* 1975, TH, Te Puna Inlet (RVMcL); formerly bred in a swamp at Papamoa Beach (PCML); present in small numbers in raupo swamps, 1975 sightings at LW and M (AP).

PUKEKO *(Porphyrio melanotus)* TH (five localities), LW, M. T. R, W, OH. Widespread.

S.I. PIED OYSTERCATCHER *(Haematopus ostralegus finschi)* TH, 89; KM, 2; LW, 2; OH, 51; total 144. No recent records of large winter flocks.

VARIABLE OYSTERCATCHER *(H. unicolor)* TH, 84; KM, 40+; LW, 26; T, 1; R, 2; W, 7; OH, 37; total 147.

*SPUR-WINGED PLOVER *(Lobibyx novaehollandiae)* October 1975, a single straggler at Matata (H. R. McKenzie, *Notornis* 7: 196).

GOLDEN PLOVER *(Pluvialis dominica fulva)* TH (Matahai Point) 3; KM, 11; LW, 16; OH, 32; total 59. 1968, October, 44 at Matahai Point, TH; 1975, January, 45 at KM (J. H. Seddon); 1976, November, LW, 24; KM, 30; OH, 34; total 88 (AP). December, OH, 51 (RMW). 1977, January, KM, 104, one of which over-wintered (AP); TH, April, 16 at Sulphur Point (KF); November, 14 at north-east end of Welcome Bay, near Mount highway (BG) and a similar flock present in the same general area on 12 March 1978 (KF).

N.Z. DOTTEREL *(Charadrius obscurus)* TH, 34 (Matakana 22, Sulphur Point 12); KM, 8; LW, 13; R, 1; OH, 13; total 69. Autumn flocks at OH, March 1972, 42; March 1978, 43 (RMW). Five or six pairs breed at Sulphur Point, August-December, leaving the area about February. In September 1976 four very pale birds arrived; they had a lemon-yellow wash on their breasts (KF). One such bird was seen on 7 January 1978. It was actively "bobbing" and appeared to be loosely attached to three normal young birds of the year. Except on its face, the white parts of its plumage were suffused with pale yellow and the red patch on its belly also had a yellow tinge (J. H. Seddon, ATE).

BANDED DOTTEREL *(C. bicinctus)* TH, 78; KM, 26; LW, 2; R, 3; OH, 107; total 216. Breeds regularly at Sulphur Point, arriving late August and leaving when the chicks are ready to fly (KF).

*BLACK-FRONTED DOTTEREL *(C. melanops)* 1977, May, R, 2 adults and 2 juveniles; July, KM, 7 (PCML, AP).

WRYBILL *(Anarhynchus frontalis)* TH (Sulphur Point) 36; KM, 8; OH, 1; total 45. Wrybill were apparently on the move; only 23 were counted at Sulphur Point on 7 January, 36 on 11 January; numbers had built up to 100 in February (KF). In 1977, 99 were counted in March (PCML), peak numbers till May, some reduction thereafter, odd birds present until early November (KF).

Curlew *(Numenius madagascariensis)* KM, 5; OH, 1; total 6. In 1976, 6 were present at KM in January, 7 in December (AP).

ASIATIC WHIMBREL *(N. phaeopus variegatus)* TH (Omokoroa), 1; KM, 1; OH, 9; total 11.

*AMERICAN WHIMBREL *(N. p. hudsonicus)* H. R. McKenzie recorded one at Ohiwa in June and December 1949 (Oliver, 1955).

*LITTLE WHIMBREL *(N. minutus)* KM, one on 6 January 1976 (AP).

*ASIATIC BLACK-TAILED GODWIT *(Limosa limosa melanuroides)* Bowentown Heads, 19 December 1974, 15 January 1975 (G. L. N. Arnold, *Notornis* 23: 257).

BAR-TAILED GODWIT *(L. lapponica)* TH, 7469; KM, c. 1000; LW, 20; OH, 3595; W, 3; total 12087. The TH high tide count gave 3500 at Tanner's Point-Bowentown in the north and 3500 at Sulphur Point in the south; 305 at Matahai Point and small numbers (47, 71, 4, 42) at four other localities. Up to 450 godwits were recorded at Little Waihi but it appears that on a very high tide most of them fly to Kaituna for lack of roosting space on the Little Waihi side. For this record I have therefore shown the highest number recorded at KM and the lowest number at LW.

GREENSHANK *(Tringa nebularia)* TH (Matahai Point) one, which had been in the area since late November (PCML, BG). A doubtful record from KM was not confirmed.

*MARSH SANDPIPER *(T. stagnatilis)* January-February 1970, KM, 4 (J. H. Seddon, *Notornis* 18: 132).

SIBERIAN TATTLER *(T. brevipes)* KM, 1. 1977, May, one at Mount Maunganui (PCML). TH, Sulphur Point, January-March 1967, 3 tattlers, probably this species (RVMcL). T, September 1966, a single bird, not certainly identified but thought to be a Wandering Tattler *(T. incana)* because of its general dark colour, including underparts (H. R. McKenzie, *Notornis* 15: 38).

*TEREK SANDPIPER *(Xenus cinereus)* OH, Port Ohope Spit, one on 16 October 1977, the first Bay of Plenty record (RMW).

TURNSTONE *(Arenaria interpres)* TH, 260; KM, 7; OH, 4; total 271. Has also been recorded at KM/LW (AP).

KNOT *(Calidris canutus)* KM, 7. A rare bird in Bay of Plenty; 22 at KM/LW, January 1976 (AP); a single bird at Bowentown shellbank on 26 March 1978 was the first noted in this area in several years of observation (JFC).

SHARP-TAILED SANDPIPER *(C. acuminata)* TH (Sulphur Point), 7; KM, 7; total 14. 1976, November, KM, 14 (PCML).

*PECTORAL SANDPIPER *(C. melanotos)* 1972 March, KM, one (J. H. Seddon).

*CURLEW SANDPIPER *(C. ferruginea)* 1976 records, Sulphur Point, TH (RVMcL) and up to 13 at KM (PCML).

RED-NECKED STINT *(C. ruficollis)* KM, 6. 1975, November, T, 1 (R. W. Jackson).

*SANDERLING *(C. alba)* 1967, December, KM, 5 (R. W. Jackson, *Notornis* 15: 122).

PIED STILT *(Himantopus h. leucocephalus)* TH, 1233; KM, 400; LW, 150; M, 10; T, 20; R, 6; W, 4; OH, 492; total 2315.

*GREY PHALAROPE *(Phalaropus fulicarius)* 1977, 19-26 June, Kaituna lagoon, one bird (BB, PCML, AP, RMW).

ARCTIC SKUA *(Stercorarius parasiticus)* KM, 1; LW, 5; M/T/R, 1; total 7. Frequent sightings of up to six birds at a time, along the coastline from Mount Maunganui to Ohope, in season (PCML, AP, *et al*).

POMARINE SKUA *(S. pomarinus)* LW, 1.

BLACK-BACKED GULL *(Larus dominicanus)* TH, 4479; KM, 155; LW, 190; M/T/R, 138; W, 90; OH, 282; total 5334. The figure for TH includes a large concentration (4289) at Matakana, but does not include the large numbers which frequent town areas, docks and rubbish dumps, where no count was made. The same would apply to other centres of population in the Bay.

RED-BILLED GULL *(L. novaehollandiae)* TH, 377; KM, 228; LW, 360; M/T/R, 84; W, 209; OH, 84; total 1342. Here again the recorded count is no more than a fraction of the total population; no attempt was made to count birds in town areas, at dumps, or in paddocks except those adjacent to estuaries and lagoons.

BLACK-BILLED GULL *(L. bulleri)* OH, 32. Mainly a winter visitor, usually in small numbers, but R. W. Jackson recorded c. 1000 on a Kaituna paddock in June 1966. P. Densem recorded nesting at Matakana in 1967; AP found 14 pairs on eggs at a White-fronted Tern colony at Ohiwa in 1975; J. H. Seddon noted 11 adults and 3 immatures at Sulphur Point, June 1977.

*BLACK-FRONTED TERN *(Chlidonias hybrida)* A winter visitor, April-August, e.g. T, May 1976, 8 (PCML); R, 1975, 3 (AP); June 1977, 32 (RMW).

*WHITE-WINGED BLACK TERN *(C. leucopterus)* Singles, and occasionally two birds, have visited Bowentown, KM and R at intervals over the period 1960-1977 (various observers).

CASPIAN TERN *(Hydroprogne caspia)* TH, 191; KM, 4; LW, 6; M/T/R, 4; W, 2; OH, 42; total 249. Has bred on a sandbank at Bowentown for some years; on 2 January 1978 80 adults were present, with eggs and chicks; by 11 January the colony had been washed out (JFC). 130 birds were counted at Sulphur Point in late February 1978 (KF).

FAIRY TERN *(Sterna nereis)* A lone bird at Sulphur Point, offering fish to Little Terns (various observers) and once to a New Zealand Dotterel (J. H. Seddon).

LITTLE TERN *(S. albifrons)* TH (Sulphur Point) 7; R, 1; OH, 5; total 13. Single birds at KM, May and November 1976 (AP). Up to 12 present at Sulphur Point, January-March 1977. They tend to wander, as KF found 9 on a sandbank at Rotary Park, Maungatapu (Mount highway) at high tide on 29 January 1977; a single bird was present there on 7 January 1978 (ATE).

WHITE-FRONTED TERN *(S. striata)* TH, 11 January, 147; 13 January, W, 300; OH, 624. Counts at other localities on 9, 10 and 12 January were — KM, 5, 65, 49; LW, 57, 23, 120; M/T/R, 435, 470, 3300; total c. 4500. Apparently considerable movement, and a big influx on 12 January. Nesting colonies at Mount Maunganui on offshore rocks and on Motuotau Island, were still occupied in January 1978 (KF).

*SOOTY TERN *(S. fuscata)* Tauranga, February 1936, after a heavy storm (Oliver 1955).

*GREY TERNLET *(Procelsterna cerulea)* February 1974, 3 at Astrolabe Reef, north of Motiti Island (PCML). Unconfirmed reports in 1976, Matata (January) and Whakatane River (October) per AP.

N.Z. PIGEON *(Hemiphaga novaeseelandiae)* OH, 1.

FERAL PIGEON *(Columba livia)* Mt Maunganui, large numbers in dock area, flying to roost on Motuotau Island (KF) where they are reported to nest in shearwater burrows (CRV); also recorded at LW; M, 30; R, 20; W.

*BARBARY DOVE *(Streptopelia risoria)* Port Ohope, January 1975 (RMW).

SHINING CUCKOO *(Chrysococcyx lucidus* LW, 1.

*LONG-TAILED CUCKOO *(Eudynamis taitensis)* Mt Maunganui, December 1974, one (PCML).

MOREPORK *(Ninox novaeseelandiae)*.

KINGFISHER *(Halcyon sancta)* TH, 9; KM, 2; LW, 2; M, 2; OH/W, c. 40. More generally distributed around TH than the figure for that area would suggest (JFC, KF). Population along KM/LW/M coastline increases in winter, e.g. 10 at KM in June 1977 (RMW).

SKYLARK *(Alauda arvensis)* Generally distributed.

*TREE MARTIN *(Hylochelidon nigricans)* T, January 1977, one with a flock of 40 Welcome Swallows (PCML).

WELCOME SWALLOW *(Hirundo neoxena)* Plentiful throughout.

N.Z. PIPIT *(Anthus novaeseelandiae)* KM, W, OH.

HEDGE SPARROW *(Prunella modularis)* LW, T, OH.

FERNBIRD *(Bowdleria punctata)* Plentiful around TH; LW, M, T. Also recorded at OH (AP).

GREY WARBLER *(Gerygone igata)* TH, LW, R, W, OH; probably generally distributed.

FANTAIL *(Rhipidura fuliginosa)*; SONG THRUSH *(Turdus philomelos)*; BLACKBIRD *(T. merula)*; SILVEREYE *(Zosterops lateralis)* Recorded in all count areas.

TUI *(Prosthemadera novaeseelandiae)* TH, W. Much of the coastal strip is not "tui country." Tuis come into Tauranga city areas in fair numbers in winter and spring (KF).

YELLOWHAMMER *(Emberiza citrinella);* CHAFFINCH *(Fringilla coelebs);* GREENFINCH *(Carduelis chloris);* GOLDFINCH *(C. carduelis)* Recorded in all count areas.

REDPOLL *(Acanthis flammea)* Recorded only at Mount Maunganui and KM. Breeds at KM (AP). On Papamoa paddocks in winter 1973 PCML noted large mixed finch flocks in which Redpolls were the dominant species.

HOUSE SPARROW *(Passer domesticus)* Throughout.

STARLING *(Sturnus vulgaris)* All count areas. Large flocks roost on Motuotau island off Mt Maunganui; further large numbers breed and roost in Tauranga town area and around Matapihi, Mount highway (KF).

MYNA *(Acridotheres tristis)* Plentiful throughout.

WHITE-BACKED MAGPIE *(Gymnorhina tibicen hypoleuca)* TH, 4; Papamoa, 1; LW, 1; OH, 8. Also recorded at TM (AP). Not plentiful on the coastal strip but commoner inland (KF).

ROOK *(Corvus frugilegus)* KM, October 1976, a juvenile, being chased by gulls, terns and stilts (AP). During the course, one at Omokoroa, TH; 2 flying over paddocks near LW.

ACKNOWLEDGEMENTS

Thanks are due to the organisers of a highly successful operation, to those who planned and executed the catering arrangements and to landowners who permitted access through their properties. Many of the visitors had little or no previous knowledge of the area, and were most grateful for the help and guidance of local members and others already well acquainted with Bay of Plenty and its birdlife. Wildlife Service officers Peter Fisher and Richard Veitch made notable contributions to the success of the exercise and Wayne Price was also most helpful.

I am grateful to members who sent notes on the species sheets and particularly to those who read and commented on the draft of this paper, and to CRV for the maps. It is hoped that publication of course results will encourage members from other regions to visit this fruitful area and will stimulate local observers to continue their work. It is suggested that an important part of this, in the short term, should be completion of mapping cards. The Provisional Atlas shows gaps which, with diligent search and recording, can be filled before publication of the final atlas.

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

FEEDING METHODS OF AN ORIENTAL PRATINCOLE

Wide gape, deeply forked tail and long angular wings distinguish pratincoles (*Glareola* spp.) as an aberrant genus of the suborder Charadrii. For at least five days in the 1977 autumn, an Oriental Pratincole *(Glareola maldivarum)* frequented the muddy shores of Lake Wainono, South Canterbury. The bird was first noticed on 28 March 1977 at which time the lake had been low for several weeks, exposing extensive drying mudflats — conditions favoured by glareolids in other countries (e.g. Guggisberg 1970, *in* Gooders, J. (ed.), *Birds of the World* 3 (12): 981-982).

While I was watching a flock of about 100 Pied Stilts *(Himantopus h. leucocephalus)* feeding at a drying-up pool during the mid-morning, a bird with proportions and actions of a giant swallow circled overhead. The forked tail, chestnut underwing coverts and striking facial pattern were quickly recognised as being diagnostic of *G. maldivarum* so that closer attention could then be given to the bird's behaviour. The pratincole continued to fly in wide circles, interrupted several times each minute by rapid (usually upward) changes in flight direction to capture an insect. Most insects were captured 10-20 m above the mudflat. Adult chironomids were sometimes seen to be taken at lower heights, but they may not have been the main prey, as larger insects (possibly muscid flies and/or bees) were regularly taken, particularly at greater heights.

According to Guggisberg (1970), glareolids catch most of their prey in the air. This bird fed mostly in the air, but on 1 April between 0700 h and 0820 h it was feeding differently. It was watched walking over the dried mudflat snapping up adult shoreflies *(Ephydrella aquaria)* from the ground. These flies are particularly slow-moving at low air temperatures, making them easy prey early in the morning. Later in the same day almost all foraging was aerial, and ground-feeding occurred for only a few minutes at a time.

During the middle of each day the pratincole appeared to spend most of its time roosting on the dried mudflats (often beside small pools), although it was not watched continuously. While visiting the lake on 29 March, Ian McVinnie of Oamaru also found that the bird roosted for a long period in the middle of the day, interrupted by a few short periods of ground feeding. Between 28 March and 1 April the lake level gradually rose, flooding the mudflats and perhaps causing the pratincole to leave (some time after 1 April). The bird was photographed by Mr McVinnie and by myself, one photograph later being sent to the OSNZ recording scheme.

R. J. PIERCE, *Department of Zoology, University of Otago*

SEABIRD OBSERVATIONS BETWEEN NEW ZEALAND AND FIJI

By T. G. LOVEGROVE

ABSTRACT

Seabirds seen during a yacht voyage from Auckland, New Zealand, to Lautoka, Fiji, between 30 April and 7 May 1977, and during the return voyage to Whangarei between 22 May and 1 June are listed. Field characters of *Pterodromas* and Storm Petrels are illustrated.

INTRODUCTION

The following notes have been extracted from a seabird log made during the yacht race from Auckland to Lautoka on the Whangarei sloop *Amoureuse*. Weather and sea conditions were unpleasant, with a gale for the first few days of the race, and more gales on the return voyage. Some seabirds flew close to the boat, so that their diagnostic features were clearly seen, while other fast-moving or distant petrels were difficult to identify.

SPECIES OBSERVED

WANDERING ALBATROSS *Diomedea exulans*

Birds in a variety of plumages were logged from the outer Hauraki Gulf to about 33°00'S on the outward voyage, and from 27°00'S, on the homeward voyage. Many albatrosses were too distant for certain identification.

BLACK-BROWED MOLLYMAWK *Diomedea melanophris*

Quite common, being noted from the Gulf to about 30°40'S on the outward voyage, and from 27°00'S on the return voyage. Often there would be several following in the wake at once. They readily took food scraps tossed overboard.

Diomedea sp.

A mollymawk with the rather odd combination of a pale head, dusky bill and darkish underparts was seen on 29 May at 28°35'S 174°48'E, where the sea temperature was 19.5°C. The plumage reminded me somewhat of that of a juvenile Wandering Albatross, but the bird was smaller, and had the dark back of a mollymawk. Dr W. R. P. Bourne (pers. comm.) thinks this bird may have been an aberrant, possibly melanistic juvenile Black-brow, rather than a straggler of north Pacific origin.

LIGHT-MANTLED SOOTY ALBATROSS *Phoebetria palpebrata*

One circled the boat at dawn on 31 May, at 33°14'S 174°48'E, sea temperature 18.2°C. John Jenkins tells me he has also noted this species in these latitudes.

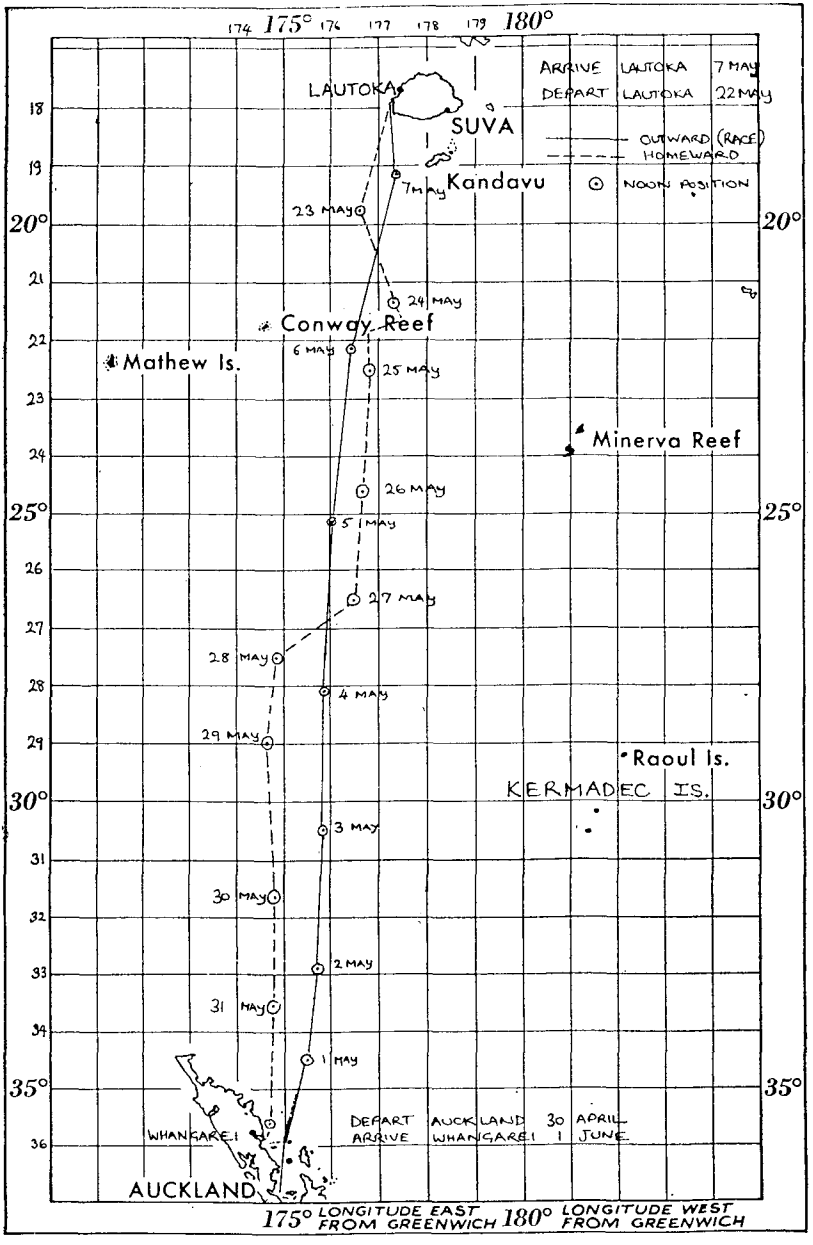


FIGURE 1 — Yacht's tracks over which observations were made.

GIANT PETREL *Macronectes giganteus*

Logged on the return voyage, from 33°19'S onwards.

CAPE PIGEON *Daption capense*

Seen on the return voyage, the first at 31°17'S on 30 May. Odd ones recorded from there on, following astern.

FAIRY PRION *Pachyptila turtur*

First seen on the return voyage at 31°37'S on 30 May, sea temperature 18.9°C. Small flocks were logged regularly from there to Bream Head.

WEDGE-TAILED SHEARWATER *Puffinus pacificus*

Groups of these shearwaters were seen west of Kadavu Island on 7 May, sea temperature 26°C. On the return voyage they were noted as far as 21°00'S, on 24 May, sea temperature 25.5°C.

BULLER'S SHEARWATER *Puffinus bulleri*

Odd ones noted on 1 May, when leaving the New Zealand coast. They were also seen in Fijian waters; on 23 May, one logged moving north at 19°30'S 176°45'E, sea temperature 26°C. At 27°35'S 175°47'E on 28 May one seen heading north-east, sea temperature 21°C. It may reasonably be assumed that these birds are part of the northward migration of Buller's from N.Z. during winter. Records of Buller's from Fiji are few (Clunie, Kinsky & Jenkins 1978). The bird seen at 19°30'S 176°45'E, was probably on the very western edge of the migration path, the centre of which may pass near Rarotonga and Tahiti (John Jenkins, pers. comm.).

SOOTY SHEARWATER *Puffinus griseus*

Birds were noted over a wide latitudinal range from the outer Hauraki Gulf at 36°00'S to 21°53'S, on both voyages between 30 April and 1 June.

AUDUBON'S SHEARWATER *Puffinus lherminieri*

A small seabird with dark upperparts, broad, dark underwing margins, and nearly all-dark head, seen at 19°35'S 177°15'E on 7 May, could have been this species. This bird has been illustrated in a previous issue of Notornis (Jenkins 1973). Another was logged on 25 May at 22°55'S 177°02'E, sea temperature 23.8°C.

GREY-FACED PETREL *Pterodroma macroptera*

None was logged in Fijian waters, but this was the most common species at sea further south towards New Zealand. On the homeward voyage, the first birds were noted at about 20°S on 27 May, sea temperature 22°C. They would often approach from astern, flying close to the boat, following for a while before veering off and vanishing.

BLACK-CAPPED PETREL *Pterodroma externa cervicalis*

Several of these handsome large gadflies were seen from 22°45'S, sea temperature 24°C, to 27°30'S, sea temperature 21°C, between 25 and 28 May. This area is not far north of the Kermadecs, the breeding ground for this species (Fig. 1). A *Pterodroma externa*-type petrel seen at 33°00'S 175°40'E, sea temperature 19.5°C, on 2 May showed

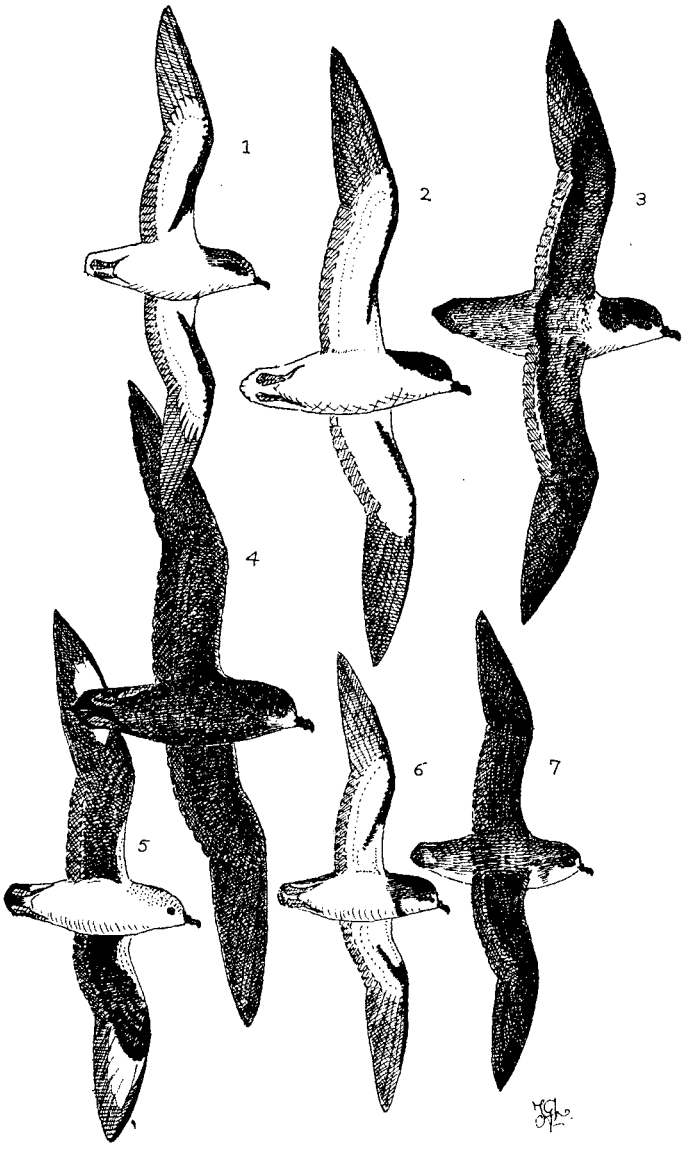


FIGURE 2 — Pterodromas. 1. Black-winged Petrel. 2. & 3. Black-capped Petrel. 4. Grey-faced Petrel. 5. Kermadec Petrel. 6. & 7. Collared Petrel.

some diagnostic features, such as dark upperparts and shoulder markings, and dark leading underwing margins. However, it lacked the definite white collar of the Black-capped Petrel. *Pterodroma e. externa,* the Juan Fernandez Petrel may best fit this description.

KERMADEC PETREL *Pterodroma neglecta*

A medium-sized petrel, with diagnostic white underwing patches, pale head and belly, swept past the boat heading north-east at 26°55'S 176°25'E, sea temperature 21.5°C, on 27 May. It was probably a light-phased bird of this species. Compare the size and plumage of *P. neglecta* with other *Pterodroma* species in Figure 2.

COOKILARIA PETRELS

Numerous unidentified and distant Cookilarias were seen both near New Zealand and near Fiji. Near New Zealand, birds may have been Cook's *(Pterodroma cooki),* Pycroft's *(P. pycrofti),* or Black-winged Petrels *(P. nigripennis),* and near Fiji, Collared Petrels *(P. leucoptera brevipes).*

COLLARED PETREL *Pterodroma leucoptera brevipes*

These were quite easily identified with their distinctive grey collars and wide black leading under-wing margins (Fig. 2). The last Collared Petrel logged on the return voyage was at 22°35'S 176°55'E, sea temperature 23.5°C, on 25 May. This species is sometimes taken by the Fiji Peregrine *(Falco peregrinus),* as shown by remains collected from the G.P.O. roof in Suva (Clunie 1976).

BLACK-WINGED PETREL *Pterodroma hypoleuca nigripennis*

These were logged from some distance off the New Zealand coast to about 30°S, sea temperature 20.5°C, on the outward voyage. A *joie de vivre* chase between two birds was seen. Unlike Collared Petrels, the Black-winged flies with high wheeling arcs. Compare these species in Figure 2.

WILSON'S STORM PETREL *Oceanites oceanicus*

A very dark storm petrel was seen closely at 30°00'S 175°55'E, sea temperature 20.5°C, on 3 May. The bird was all-black except for the characteristic white rump and flank patches. The only other species which fits this description is the dark phase of the White-bellied Storm Petrel from Lord Howe Island, which differs from the former species by having a slightly notched tail instead of a square one.

WHITE-BELLIED STORM PETREL *Fregetta grallaria*

One was logged on 5 May at 25°41'S 176°00'E, sea temperature 22.6°C. Its conspicuous white belly contrasted with the black head. The white rump and broad, dark underwing margins were clearly visible at close range. These birds breed during the winter on Macaulay Island in the Kermadecs, and at Lord Howe (Harper & Kinsky 1974), so are to be expected in these waters at that time of year. The two *Fregetta* species are compared in Figure 3.

BLACK-BELLIED STORM PETREL *Fregetta tropica*

Several of these distinctive storm petrels were logged on the homeward voyage between 22°45'S 177°02'E, sea temperature 23.8°C. on 25 May, and 29°09'S 174°37'E, sea temperature 19.5°C, on 29 May. The last birds recorded were seen closely as they flitted round the boat for several minutes, clearly displaying the black line down their bellies. This pair later flew off to the north-west.

WHITE-FACED STORM PETREL *Pelagodroma marina*

A number of these birds were seen during the morning of 1 June, soon after landfall about 25 miles north-east of Cape Brett. Falla, Sibson & Turbott (1966) state that this species is apparently absent from New Zealand waters during the winter. Perhaps some of them just move further off the coast for the winter and are thus less likely to be seen.

WHITE-TAILED TROPIC BIRD *Phaethon lepturus*

None was logged during the race from Auckland to Lautoka, but several were seen on the return voyage. The first was logged soon after clearing the Navula Passage, south of Nadi, on 22 May, sea temperature 27.5°C. More were recorded as far as 21°19'S 177°37'E, where the sea temperature was 25°C. Usually they flew over to have a close look at the boat, approaching with characteristic rapid, shallow wing beats. Sometimes they would soar at the masthead for several minutes. Jenkins (1973) noted similar behaviour of tropic birds at masts and wireless aerials on ships.

GANNET *Sula serrator*

Apart from those seen along the New Zealand coast, one was sighted at 31°55'S 174°54'E on 30 May, sea temperature 18.9°C.

BROWN BOOBY *Sula leucogaster*

Boobies were noted as far as 19°50'S on 23 May, sea temperature 26°C. They were very numerous near the Navula Light, and on the channel beacons at Malololailai Island. Groups of these birds often accompanied feeding noddy flocks. No definite Red-footed *(S. sula)* or Blue-faced Boobies *(S. dactylatra)* were seen. However there seemed to be many variably coloured birds among the distant booby flocks. These might well have been the Red-footed Booby, a species which has various plumage phases, as noted by Hindwood, Keith & Serventy (1963).

LESSER FRIGATE BIRD *Fregata ariel*

Two male Lessers showing distinct white flank patches were seen overhead at Malololailai, south-west of Nadi, on 20 May, sea temperature 27.5°C.

FRIGATE BIRD sp.

One seen flying high, heading west on 23 May at 19°40' 176°42'E, sea temperature 26°C. Observations by Clunie, Kinsky & Jenkins (1978) indicate both Lesser and Greater Frigates occur in Fijian waters. They add that separating these two in the field is not easy unless sure diagnostic features are seen.

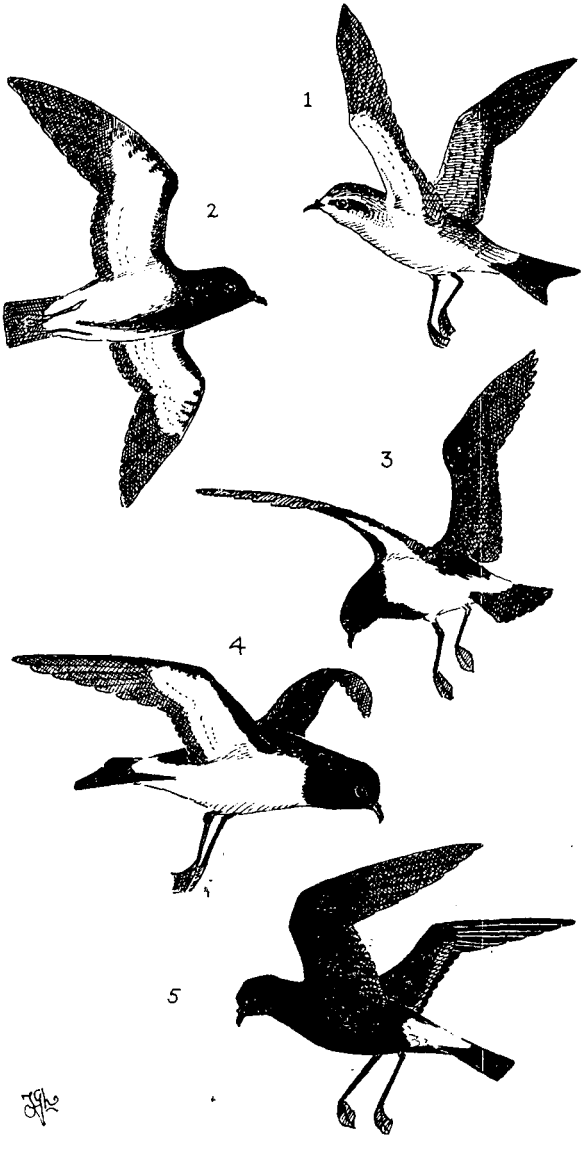


FIGURE 3 — Storm Petrels. 1. White-faced Storm Petrel. 2. & 3. Black-bellied Storm Petrel. 4. White-bellied Storm Petrel. 5. Wilson's Storm Petrel.

POMARINE SKUA *Stercorarius pomarinus*

A robust skua with paler areas on the undersides of its wings, pale rump, short tail and generally pale underparts, was probably this species. It was seen near the remains of a small petrel in the water on 23 May, at 19°43'S 176°41'E, sea temperature 26°C. This is the second record for Fijian waters, following that of Clunie, Kinsky & Jenkins (1978).

CRESTED TERN *Sterna bergii*

Often logged off Nadi and along the coast of Viti Levu, but not outside the main reef.

BLACK-NAPED TERN *Sterna sumatrana*

A small flock of five was noted resting on the beach at Savala Islet about three miles west of Lautoka, on 14 May.

SOOTY TERN *Sterna fuscata*

Flocks of about 50 birds were recorded as the boat neared the Fiji coast on 7 May; sea temperature 26°C. These terns were flying buoyantly, wheeling about and swooping low over the sea. There were boobies feeding among them. The last Sooty Tern logged on the return voyage was sighted at 19°20'S 176°45'E, sea temperature 26°C, on 23 May.

COMMON NODDY *Anous stolidus*

Mixed flocks of noddies, boobies and small white terns were logged on 7 May from 19°30'S onwards, on the way to Lautoka.

WHITE-CAPPED NODDY *Anous minutus*

Flocks were seen near the Navula Light at the main reef entrance on 22 May, sea temperature 27.5°C. Unlike the Common Noddy, this species occurs mainly near the coast.

WHITE TERN *Gygis alba*

Well out to sea at 19°30'S were distant, pale shapes in the noddy flocks, which may have been this species, as they were small compared with the noddies.

ACKNOWLEDGEMENTS

I am grateful to J. A. F. Jenkins and R. B. Sibson for stimulating criticism of the original draft of this paper, also to Dr W. R. P. Bourne for his thoughts on the unusual mollymawk discussed in the text.

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TIM LOVEGROVE, *P.O. Box 56, Waipu, Northland.*

STATUS OF THE PIED TIT (*Petroica macrocephala toitoi*) IN THE WAITAKERE RANGE, AUCKLAND

Interim Report

By JEAN F. SKINNER

The Waitakere Range, which rises to 460 m (1500 ft) above sea level, is a plateau dissected by streams running out to the West Coast and south to the Manukau Harbour. Its fringes exhibit typical ridge and valley characteristics, but its central portion includes extensive plateau remnants. The annual rainfall is about 1200 mm on the margins and up to 2000 mm in the higher central parts (Mead 1972). It forms an island of bush bounded on two sides by the sea, by farmland to the north, and by Auckland City to the east.

The study has been confined to the Parks and Water Catchment, an area of about 6300 hectares (15,700 acres), the bulk administered by the Auckland Regional Authority, the remainder by Auckland City Council.

The forest was extensively milled until the 1930s. One third was heavily milled but not burnt over. Most of the coastal land was cleared and burnt for farming, and farms were also established on the Scenic Drive, the Piha Road, around Lower Nihotupu Dam and the head of Anawhata Catchment. Some areas of virgin bush, as well as milled-over land, were burnt in attempts to farm them. There are estimated to be more than 2400 hectares (6000 acres) of abandoned farmland in the Range. Land behind Cornwallis beach was burnt for gumdigging, and in 1924 the area on the north side of the Huia Road was planted with *Pinus radiata.*

There is almost virgin bush in some parts of the Water Catchment, young forest is regenerating well in areas which were heavily milled but not burnt, and *Leptospermum* scrub has taken over the former farmland.

These changes in the vegetation must have affected the populations, including the Pied Tit *(Petroica macrocephala toitoi).* In 1975 I began work on its present status. It had previously been reported as few (Oliver 1955) and " existing in small but established populations " (Turbott 1974). There were eleven records in *Notornis* between 1950 and 1972 — random sightings on day trips to the area.

My husband and I found the territories recorded between 1975 and 1978 by walking the tracks and recording birds on a map. Our observations indicate that this species is highly territorial, staying in the same place throughout the year, a conclusion reached by Wilkinson (1930). We believe that our records do represent established territories of separate pairs, and we were able to check this, particularly when we heard males countersinging. We have rechecked about 40% of

NOTORNIS 25: 299-302 (1978)

the territories, some of them many times, and in all seasons, and have consistently relocated them.

In 1976, with co-operation of the Regional Representative, Mrs Sylvia Reed, I began organising twice-yearly surveys of all species within the Centennial Park area, and up to 40 members of the Ornithological Society took part. This enabled some Pied Tit territories to be checked, and additional territories found were later checked by us before inclusion on the territorial map. The A.R.A. rangers too have been most helpful in reporting sightings.

The distribution of vegetation in the Range clearly has an important bearing on Pied Tit distribution. This was substantiated when I superimposed on my own map the map prepared by J. T. Diamond (Esler & Astridge 1974) which indicated where forest had been burnt to clear land for farming and gumdigging. It could be seen that Pied Tits are not present in the *Leptospermum* scrub now covering areas burnt for farmland or gumdigging, but there are a few where *Leptospermum* and *Pinus radiata* merge on the old gumdigging land (see Fig. 1).

Most territories have been found in least modified areas, that is, virgin bush (Mead 1972) and regrowth in unburnt areas where the larger trees are predominantly Rimu *(Dacrydium cupressinum)*. Pied Tits show a marked association with these trees. They tend to perch, sing and hunt insects high in the branches — unlike their behaviour in other parts of New Zealand. They will come down to investigate an intruder, are attracted to a *tsst* call through the teeth, squeak grass *(Dianella intermedia)* and, at certain times, particularly in spring or in the juvenile stage, to taped call and squeak bottle, but they soon return to the tree tops.

During the early spring they are comparatively easy to locate by their territorial song but, later in the year when they give only the *tsst* call or are silent, they can easily be overlooked if one is not familiar with their habits.

In the breeding season many juveniles have been found, some of these with their parents. On one track with a flourishing population conventional nest boxes were introduced but not used, indicating no lack of natural sites.

Recently we have concentrated our efforts on one block, crashing bush to do transects between tracks. Here, territories in rimu-dominated bush appear to have an area of about 1.2 hectares (3 acres). Where birds did not at first appear in a likely area, we found that when we sat and periodically gave the *tssting* call through the teeth, the male would investigate after about five or ten minutes.

While this investigation has been spread over much of the Waitakeres, we have intensively covered only a limited area. So far, we have located 117 territories. Depending on the type of bush, these territories probably average about 2.5 hectares (6 acres). With intensive study of further areas we expect to find more.

Finally, it should be emphasised that this is an interim report.

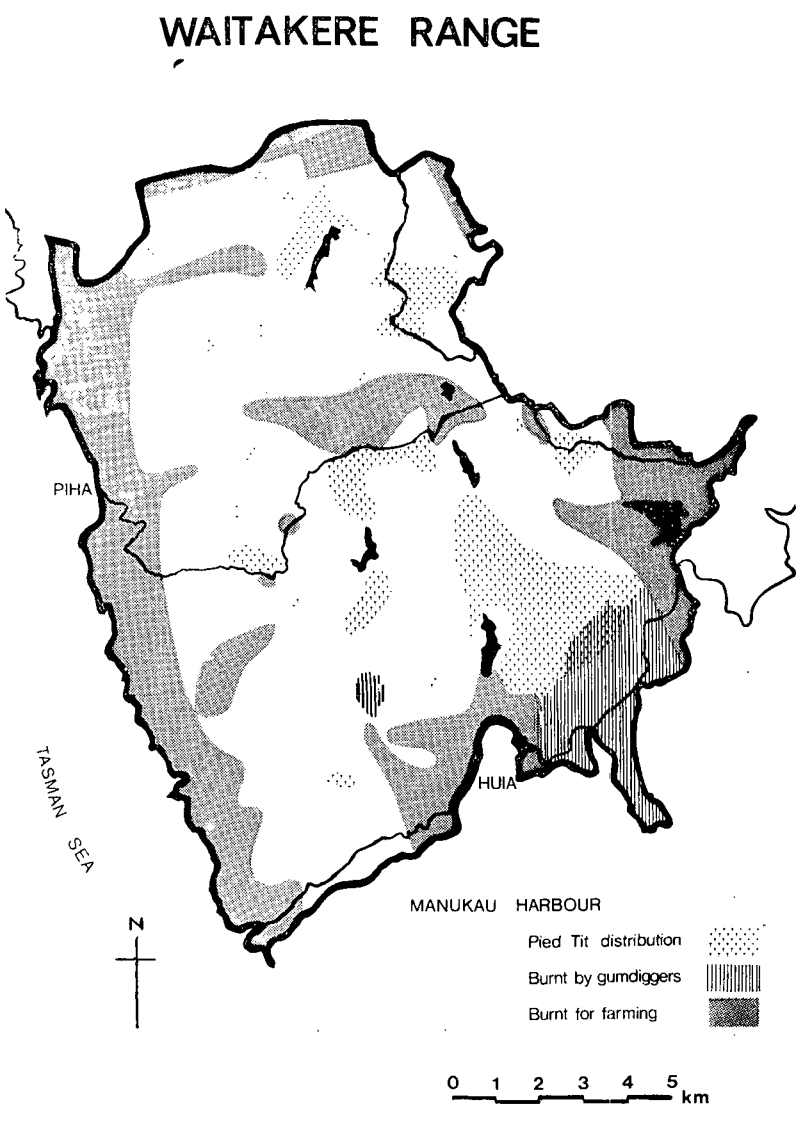

FIGURE 1 — Pied Tit distribution related to the vegetation history.

DISCUSSION

Two interesting points are raised. Firstly, the tendency of Pied Tits in the Waitakeres to keep to the canopy of the higher trees for much of the time contrasts markedly with behaviour in other parts of New Zealand. For example, Fleming (1950) stated "*Petroica macrocephala* customarily feeds by darting from a watching perch to

pick up insects on the bark or limbs of trees, or, particularly, on the forest floor." Oliver (1955: 479-480) stated, " It is much in evidence in forest clearings and manuka scrub." In southern Fiordland, Turbott (1959) found that it was " generally distributed from the valley floor through the forest, but was occasionally seen in the subalpine scrub. It was the most conspicuous forest bird, especially as the males were singing, and being rather evenly distributed was recorded in more observation periods than any other species; though it was probably no more numerous than gregarious species like silvereyes and redpolls which were encountered less frequently. Tomtits were present at all levels in the forest, singing and possibly also feeding in the canopy and in the second tier, and feeding in the shrub layer on the ground. Birds were more easily seen at the lower levels and this may give a biased impression of their feeding behaviour. In addition to the ripe small-leaved coprosma fruits in the underscrub, the feeding birds were taking insects off the ground or from branches and trunks of the trees and bushes, often flying up and capturing an insect without alighting, and occasionaly taking one in the air."

Elsewhere, for example Little Barrier and Central Plateau of North Island, we too have found a similar behaviour pattern, completely different from that in the Waitakeres. Observations are needed in various forest types in other districts for a full comparison with our findings to be made.

Secondly, in our future studies we hope to establish whether the Pied Tit population is thriving and increasing, as present observations suggest, and whether earlier sightings were so few merely because of the birds' different behaviour in the Waitakeres.

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Mrs JEAN F. SKINNER, *P.O. Box 60083, Titirangi, Auckland 7.*

SOME RECENT OBSERVATIONS ON SEABIRDS BREEDING IN FIJI

By M. K. TARBURTON

ABSTRACT

Descriptions, distribution, banding data and details of nesting seabirds are given for various islands within the Fiji group visited during 1974, 1975 and 1976. These include Vatu-i-Ra, Vatu Lami, Yabu Is., Mabulau, Nuku-i-Cikobia, Sovu, Cikobia-i-Lau, Qilaqila, Lakeba, Nanuku Levu, Nanuku Lailai and Nasautabu. Species found nesting were Red-footed, Masked and Brown Boobies, Lesser Frigate Bird, White-tailed Tropic Bird, Reef Heron, Black-naped, Sooty, Bridled and Crested Terns, Common and White-capped Noddies.

INTRODUCTION

The seabird breeding situation in Fiji before European contact will never be fully known. The introduction of the cat and the mongoose to the major islands Viti Levu and Vanua Levu presumably ended the breeding of large numbers of petrels and shearwaters on them. The early literature recording seabird nesting is incomplete. Many nesting sites were misnamed or not named at all and several of the scientific names used can no longer be associated confidently with a particular bird.

W. B. King (1967), working with the Smithsonian Institution, summarised much of the literature, but without giving Fiji breeding locations. King (1974), being concerned with the findings of the Pacific Ocean Biological Survey Program 1963-1968, could give little information on Fiji. J. B. Smart tried to gather as much published breeding data as possible referring to Fiji and then to locate what nesting he could in 1969-1970. To my knowledge, his findings have not been published. This paper records my 1974-1976 observations, to provide some basis for future work.

The following terms are used to define the ages of birds. A pull is a nestling incapable of leaving the nest. A runner is a nestling capable of moving or which has moved a short distance away from its nest. Juveniles can fly but because of colour, size or the presence of down can be recognised as having fledged during the current breeding season.

VATU-I-RA

The higher north-east side and each end of this island are composed of volcanic rock. The rest of the island consists of flat coral sand, not far above spring high tide level. Most of the island is covered by vegetation, with taller *Pisonia* trees in the centre and on the outside

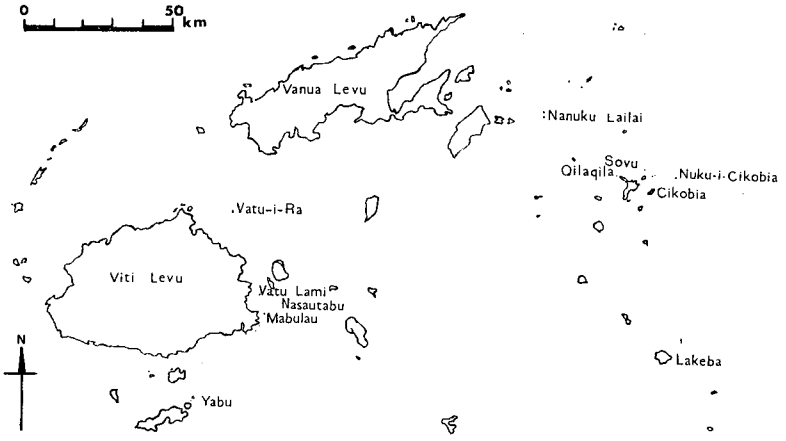

FIGURE 1 — Fiji Islands — locality of islands visited.

shorter shrub-like trees of two species: the yellow-flowering Vau (possibly *Hibiscus tiliaceus*) and an unknown species. Several exposed areas become covered with couch-grass after sufficient rain. Four visits were made on 12-14 July 1974, 2-6 December 1974, 2-5 October 1975, 14-15 November 1976.

RED-FOOTED BOOBY *Sula sula*

It was estimated on 12-14 July 1974 that there were 400 nests, a figure matching an estimate of 300-500 made by Morris (unpub. MS.) in June 1963. Of the accessible nests examined, 41 held pulls old enough to be banded and 28 contained eggs. 15 sitting birds handled were of the intermediate colour phase, two of the dark phase and only three had reached the white phase.

Nests were all on branches of *Pisonia* trees at heights between 2.5 and 6 metres. Some of the larger trees contained up to ten nests but two nests per tree were more usual. The nests were substantial stick structures 35-45 cm across, with occasional pieces of nylon rope, plastic and leaves also used. Egg chambers were 12-18 cm across and not lined. Strong winds and interference by humans seemed to have almost totally destroyed some nests. Only 5-10 nests remained from one breeding season to the next. White-capped Noddies *(Anous minutus)* and Lesser Frigate Birds *(Fregata ariel)* shared the same trees for nesting. Smaller trees, whether *Pisonia* or the yellow flowering Vau, were not used by boobies but were extensively used by the White-capped Noddy. Five eggs ranged 58-65.5 mm by 39-43 mm, average 62.7 x 40.9 mm. They were off-white in colour, becoming more brown and less smooth with age.

The visit of 2-6 December 1974 was obviously much nearer the end of the breeding season as there were only 20-30 adults attending

nests. Ten adults, 116 runners and 11 pulls were banded. Only five eggs were found.

The visits of October 1975 and November 1976 were timed for the period between the previous visits of July and December and confirmed breeding for the same period in similar numbers for 1975 and 1976.

303 Red-footed Boobies were banded on Vatu-i-Ra: 127 as runners, 122 as adults and 54 as pulls. To date, seven band recoveries have been made, all on Vatu-i-Ra and all had been banded as adults. Three were found dead after a storm by a Royal Fiji Navy patrol, 32 months after banding, and one of the four live recoveries was found 13 months later, having lost its intermediate colour phase. The dark feet, primaries and bill had been replaced by red feet, white plumage and light coloured bill.

The dark phase of this species probably lasts only to the first moult and then several moults gradually change the birds into the final all-white phase (except for black primaries and secondaries), when the pink and blue hues on the bill are diagnostic of the completed plumage change. The grey or black edges to the skin beneath the lower mandible seem to be associated with either age or individual character, but not with sex, as breeding pairs were sometimes observed to be both grey or both black.

LESSER FRIGATE BIRD *Fregata ariel*

60 birds were counted overhead on 12 July 1974, 200 over the island on the 13th, and an estimate of 250 nests was made on 14 July. Birds not occupied on nests were overhead all night whenever we were banding right through the night. Even when we were not active, only those building nests or incubating would land.

In December 1974 no eggs or pulls were found but 27 runners were banded and most of the 70 birds in the air were immature. In October 1975 only five or six young were in nests and in November 1976 only 115 birds were counted altogether on the island. Together these observations suggest an early nesting season for this species. A decrease in the breeding population cannot be discounted as Morris (unpub. MS.) found between 500 and 700 pairs breeding here in June 1963.

Their stick nests were much less bulky than those of the Red-footed Booby from which they commonly steal material.

Juveniles are liable to damage themselves when approached in the tree tops and both they and adults may break their wings while being handled. Because of this and the soft nature of the feathered tarsus which swells considerably just before the juveniles leave the nest, we discontinued banding after the first season. I found several birds on the ground with their wings broken after fishermen had come ashore to collect chicks for pets.

Locality	Date	Booby			Lesser Frigate Bird	White-Tailed Tropic	Reef Heron	Tern				Noddy	
		Red-Footed	Masked	Brown				Black-Naped	Sooty	Bridled	Crested	Common	White-Capped
VATU-I-RA	July 1974	400	-	(16)	250	-	(1)	-	-	-	-	(5)	(5960)
	Dec 1974	50 (500)	-	-	10 (70)	-	1	-	-	16	-	15 (70)	4050 (1200)
	Oct 1975	200 (500)	-	(5)	5 (60)	1 (1)	-	-	-	-	-	80 (50)	(10000-15000)
	Nov 1976	100 (400)	-	-	(115)	-	-	-	-	-	-	20 (40)	(10000-15000)
VATU-LANI	Jan 1974	-	-	-	(4)	-	(4)	(50)	-	(3)	-	-	(75)
	Aug 1974	-	-	-	-	-	1 (10)	1 (80)	-	-	16	-	(200)
	Oct 1974	-	-	-	-	-	(6)	11 (48)	-	-	-	-	(1)
	July 1975	-	-	-	-	-	(3)	-	-	-	-	-	-
YABU	June 1975	100+ (500)	-	(6)	(200)	-	-	-	-	-	-	-	-
MABULAU	June 1975	270	-	(6)	(70)	-	(28)	-	-	-		(1)	(2500)
	July 1975	(350)	-	-	-	-	2 (10)	-	-	-		-	(40)
NUKU-I-CIKOBIA	Jan 1976	(50)	1 (2)	(40-50)	(3)	- -	-	? (10)	580 (90)	-	380	450 (40)	-
SOVU	Jan 1976	350 (50)	-	(10)	(30)	-	-	-	-	-	-	-	-
CIKOBIA-I-LAU	Jan 1976	(25)	-	-	(1)	2+3?	(3)	-	(8)	-	(45)	-	-
QILAQILA	Jan 1976	-	-	-	-	3?	-	-	-	-	-	-	-
LAKEBA	Dec 1975	-	-	-	-	6? (15)	-	-	-	-	-	-	-
NANUKU LAILAI NANUKU LEVU	Aug 1976	(12)	-	(1)	(4)	-	-	(16)	-	-	-	(70)	-

TABLE 1 — Number of occupied nests and (in brackets) unoccupied birds.

WHITE-TAILED TROPIC BIRD *Phaethon lepturus*

In October 1975 one bird was found on an egg in a crevice right on top of the northern end. Another was seen making passes over the south end of the island but no nest was found. The nest site was overgrown in November 1976. The egg measured 54 x 40 mm. The nesting bird had only one of its extended rectrices, as did a nesting bird seen at Lakeba by Clunie (pers. comm.).

REEF HERON *Egretta sacra*

Seen occasionally. Only one nest was found, in December 1974, fairly high up under scrub at the north end of the island. The pair was of the grey form. The first of the blue coloured eggs hatched on 3 December 1974. Egg sizes were 48.2 x 32 mm, 48.5 x 34 mm and 49 x 31.6 mm.

BRIDLED TERN *Sterna anaetheta*

A very difficult bird to catch. I was unable to band any, largely because of their small numbers. In December 1974 I found 14 eggs higher up than the Common Noddy eggs on the rocks of the north-east

corner of the island. There were two very young chicks. Six eggs averaged 46.8 x 32.97 mm, range 46-48 x 32-33 mm. They were straw-coloured with brownish and grey blotches.

COMMON NODDY *Anous stolidus*

This larger, browner noddy is not in large numbers on this island. None were seen by Morris (unpub. MS.) in June 1963 nor by myself in July 1974 until two were caught at night. A search the following morning revealed few birds. In December 1974 some 90 birds were present. Five pulls, one runner and two adults were banded. The highest estimate was 200 made in October 1975 when 70 eggs were counted, seven runners and one adult banded. The latter was not moulting. Unlike the White-capped Noddy this species is apparently largely absent from Vatu-i-Ra when not breeding.

The eggs and chicks were found on exposed rock ledges at each end of the island and along the eastern side at heights of 1-5 m above high tide level. No nests were constructed and 12 eggs averaged 52.7 x 35.8 mm, range 50-56.8 x 34-37.2 mm. They are larger and darker than the eggs of the Bridled Tern which lays in similar sites. The chicks are very agile but may be killed by rats.

Because of this bird's occasional habit of swooping at persons near its nest, it falls foul of visiting fishermen who strike it with sticks. I saw one killed in this manner and on the first trip found a grounded bird with one wing missing, possibly from a similar incident.

WHITE-CAPPED NODDY *Anous minutus*

Easily the most common species on Vatu-i-Ra. It appears to roost there at night throughout the year, which is contrary to my findings on the islands and sand bars in the Bau Waters where roosting is sporadic or at best seasonal.

As the sky darkened on the night of 12 July 1974, thousands of these birds gathered into flocks and rafts 200-400 m offshore. On the western side of the island counts were made of the groups of birds that broke from the offshore flocks to pass over on their way to roost. This seemed satisfactory, provided no one was moving about on the island, which would send large flocks back out to sea. We counted 5960 noddies arriving from the western side and the next day made a less accurate count of 6000. These arrivals were spectacular because there was only one derelict nest on the island and no noddies at all during the day.

As the trip of December 1974 was in the midst of nesting and it was hard to count all the birds within the tree canopy of a given area, I decided to do a nest count. Birds were coming and going at all hours of the day and the use of a light to count them at night sent large numbers back out to sea, making counting very inaccurate. A nest count along adjacent transects for about a quarter of the island totalled 1010 nests. By climbing to the lighthouse and

superimposing the counted portion over the rest of the island I estimated some 4550 nests on the island. The figure of 9,000 adult birds attained by this method seemed reasonable while viewing the whole island from the lighthouse.

The start of breeding may vary from year to year, as Morris (unpub. MS) found between 1000 and 2000 pairs reoccupying and rebuilding nests in trees on Vatu-i-Ra in June 1963.

Although this noddy has nested sometimes on rocks (Mayr 1968), all nests on this island were in *Pisonia* shrubs or Vau trees. The nests, 100-180 mm across with very shallow egg chambers (12-20 mm), were placed in horizontal and vertical forks or on the upper side of larger horizontal branches. They were composed mostly of dried leaves and excreta, sited 1-4.5 m from the ground, below the canopy. Many nests were empty but as there were numerous juveniles in flight and runners moving amongst the branches it was assumed that the peak of nesting had just passed. 410 of the 1177 White-capped Noddies banded were juveniles, readily separated by their light weight (86-100 g), shorter bill (32-40 mm) and smaller white cap streaked with black. Over 200 eggs were counted but there would have been many more as most nests were seen only from below. Ten eggs averaged 44.45 x 31.53 mm, range 40-48 x 30.8-33 mm. They were off-white with an even spread of reddish-purple and brown blotches. 27 pulls were large enough to band.

The rats that had been very numerous and quite a nuisance at the tent during the first visit in July 1974, were scarce on this visit, only two being found together with their young. This rat is a good climber and was seen running up the trees with great agility. Although we saw them eating only dead birds, they may well prey on noddies caught up in the *Pisonia* fruits. The early nesters seemed to be most readily trapped by the *Pisonia* fruits that had fallen to the ground. About 20 birds were freed from *Pisonia* in October 1975; of these only 8 were considered strong enough to be worth banding. About eight *Pisonia*-covered birds were found dead. This problem did not exist on the other three trips.

The visit of December 1974 was the only time when anything other than small fish was found in the regurgitated crop contents. Eight young sea snakes (White-banded Sea Kraits, *Laticauda* sp.) measuring about 90-150 mm were found in the regurgitated material in the bottom of the holding bag.

In December 1974, 13 of the 809 noddies banded in July 1974 were retrapped among the 1190 birds handled. In October 1975, 15 retraps were among the 664 handled; five having been banded in July 1974 and ten in December 1974. In November 1976, 48 retraps were among the 818 birds handled; six had been banded in July 1974 (28 months previously), 20 in December 1974 (23 months previously), and 22 in October 1975 (13 months previously). Four bands to date have been returned from locations away from Vatu-i-Ra. The first

was a juvenile from December 1974 found ten months later at Yandina in the Russell group of the Solomon Islands, 2900 km WNW. The second, one which I had freed from *Pisonia* berries, was found 14 days later at Sigatoka, 150 km SW on the opposite side of Viti Levu. The third had been banded in November 1976 and was found four months later at Toberua Island, off south-east Viti Levu. The fourth had been banded in December 1974 and was found 32 months later at Lautoka, western Viti Levu. The first return surprised me because I had followed the general belief (Serventy *et al.* 1971) that this species, unlike the Common Noddy, was sedentary.

No moult was observed on the three visits (Oct.-Dec.) during the breeding season, but on the July visit about 75% of the birds were moulting their last or second to last primaries. This correlates with the moult data from Mabulau in June 1975.

NON-BREEDING SPECIES

The Brown Booby *(Sula leucogaster)* is a very timid visitor to this island from late afternoon to evening. All birds landed in the trees atop the cliff at the south-east corner. Six were seen on 13 July, 16 on 14 July 1974 and five in October 1975. Up to six have been seen resting on reef marker posts (as is typical of this species) along the Ra coast south-west of this island (12 Dec. 1974). Groups of two and four Crested Terns *(Sterna bergii)* were seen in December 1974. Groups of seven and 21 Black-naped Terns *(S. sumatrana)* were seen in July 1974, and larger flocks in December 1974, the most being 70 on 3 December.

VATU LAMI

Vatu Lami consists of three rocks at 178°40'E 17°48'S. The tops are about 3-4 metres above reef level and are covered with low succulent plants and ferns amongst which White-banded Sea Snakes (*Laticauda* sp.) are always to be found resting. Visits were made 27 January 1974, 25 August 1974, 28 August 1974, 10 October 1974, 15 June 1975.

BLACK-NAPED TERN *Sterna sumatrana*

Vatu Lami is much visited and this species loses a large number of eggs through repeated disturbance. 1974 records indicate that they may lay at two peaks or that they are persistent replacement layers. On 27 January, 50 birds were present but there were no eggs or other signs of nesting. On 25 August, 80 birds were present with many old nesting scrapes on two of the rocks. There was one abandoned egg and only one juvenile flying with the adults. Lots of young people had been seen running over the rocks 2-3 weeks earlier (W. Sachs, pers. comm.). This almost total failure was apparently followed by another laying for, by 10 October, when 48 birds were present, 11 addled eggs were found. W. Sachs informed me that the birds nested again in the first week of May 1975 but I was unable to get there to confirm it.

The 11 eggs averaged 29 x 39 mm, range 28-30 x 37-41 mm. Their ground colour was either light or moderate brown, evenly covered by three types of marking: the largest blue-grey, the smallest almost black and the other chocolate brown.

REEF HERON *Egretta sacra*

On 25 August 1974 ten birds were in trees and on the reef and one egg was found among the ferns. What was possibly a very old nest constructed of fern mid-ribs was found nearby. The egg measured 53 x 35mm, a large example. There are always several birds at Vatu-Lami, with a ratio as high as 2:1 for dark and white phases.

NON-BREEDING SPECIES

Other birds often rest on or fish near Vatu Lami. For example, 4 Lesser Frigate Birds on 28 August 1974, 3 Bridled Terns on 27 January 1974 and 16 Crested Terns on 25 August 1974. The most common bird resting on the sand bar was the White-capped Noddy; 75 on 27 January 1974, 200 on 25 August 1974 and one on 10 October 1974. The only other species seen have been waders.

YABU ISLAND

Yabu Island is in the Astrolabe Lagoon just north of Ono Island at 178°30'E 18°51'S. It is thickly vegetated despite its numerous cliffs. Many of the trees are 20-22 m high, so that most Red-footed Boobies can roost and nest and Lesser Frigate Birds can roost safely. Because of this we could reach and band only one booby after covering 75% of the island. Only two visits were made, on 13 and 17 May 1975.

RED-FOOTED BOOBY *Sula sula*

On 13 May about 500 birds were present and on 17 May we counted 100 nests, an under-estimate for in the same week F. Clunie counted 300-400 occupied nests. This was probably early in the nesting season so that more nests were yet to be built. The number of unoccupied birds also suggested this. The one egg reached measured 58 x 39.8 mm.

NON-BREEDING SPECIES

Only 60 Lesser Frigate Birds were counted on the 13th but 200, both perched and flying, were present on 17 May. Kinsky and Clunie (pers. comm.) estimated that one in five of the frigate birds in the Astrolabe Lagoon at this time were Greater Frigate Birds *(Fregata minor)*, confirming this by collecting two specimens.

Crested Terns constantly fished the surrounding waters in small numbers. A few were in full breeding plumage and Kinsky and Clunie (pers. comm.) found a runner on nearby Tagua rocks. Black-naped Terns were found on nearby Yanu-i-sau and Vurolevu by Kinsky and Clunie (pers. comm.); some were breeding. On several evenings moderate numbers of Common Noddies were seen on a flight line past the north-west of Ono and seemed to pass by Yabu as they flew north-eastwards. A few nights later, Kinsky and Clunie found them roosting

on Tagua Rocks. Two Brown Boobies were seen on 13 May and 30 on 17 May. Clunie (pers. comm.) found some roosting on Yabu. Wedge-tailed Shearwaters *(Puffinus pacificus)*, which seem to move through Fiji waters at this time of year, were seen in a flight line with boobies off eastern Ono where I collected one dead and saw a very weak bird inshore on 18 May. Kinsky and Clunie collected one on 16 May and another on 17 May. On dissection, all three proved to be emaciated juveniles, apparently just off the nest (Clunie, pers comm.). In June 1975, a bird was found on Suva foreshore. The species has been found breeding on Kadavu in the past.

MABULAU ISLAND

Mabulau is near the edge of the reef on the south-eastern end of Bau Waters at 178°46'E 17°58'S. There is only one small beach on the north-western corner, all other sides having 2-4 m wave-cut walls breached at intervals by eroded clefts. The limestone surface is very eroded, for the most part making movement across the island difficult. Vegetation is low and wind-pruned on the eastern side but rises to a maximum of 20 m on the north-western side.

Two visits were made on 12-15 June 1975 and 29-30 July 1976. On both trips several hundred Banded Sea Snakes (*Laticauda* sp.) were resident, a small number almost constantly coming and going at all hours of the day and night.

RED-FOOTED BOOBY *Sula sula*

In June, 270 nests were counted. Most of the 63 birds banded were non-breeders of intermediate colour phase, roosting on the lower trees of the eastern side. 13 of the banded birds were pulls, one of which was on the ground. Few eggs were found.

The eastward side that had in June been well populated with sleeping birds low down, was almost deserted in July. Several dead birds, including one caught in a tree-fork, and wind-stripped trees were evidence of storms. 300-400 birds were present and 21 were banded.

REEF HERON *Egretta sacra*

In June, 28 birds were seen, mainly on the southern end. In July, two nests were found, one with a clutch of four, the other with two which measured 49.5 x 34 mm and 51 x 33.5 mm.

NON-BREEDING SPECIES

One Collared Petrel *(Pterodroma leucoptera brevipes)* flew by the island on the mainland side during the June visit. 2-6 Brown Boobies were observed each day in June. They roosted in a tall dead tree on the western side each night and for more of the day than those at Vatu-i-Ra. 70 Lesser Frigate Birds were overhead at sunset on 12 June. None was seen to land after having harassed the boobies and only 16 were present the next day. The only Common Noddy seen was one caught in June among the White-capped Noddies.

At sunset on 12 June 1975, White-capped Noddies amassed offshore and some 2600 were counted as they came in to roost. Only

27 could be banded on the first evening because of the rugged terrain and the height of the roosting trees. 71 were banded on the third night and six on the fourth.

The birds were moulting and not breeding. In a sample of 12 birds, one had 4 primaries yet to moult on each wing, two had 3 primaries, three had 2 primaries, five had 1 primary and one had completed moult.

In July 1976 the trees on the east, after four weeks of high winds, had lost most leaves. We saw only about 40 birds and caught nine.

NUKU-I-CIKOBIA

Nuku-i-Cikobia is a roughly circular sand cay upon a reef at 178°39'W 17°12'S, scarcely above high water level and without vegetation. Only one visit was made, from the afternoon of 4 January to the morning of 5 January 1976. Breeding of several species was well under way for, although there were no pulls on the cay, there were 1500 eggs. During the evening two very large turtles came ashore and laid. I was told that both turtle eggs and bird eggs are used at times by the local folk for Christmas cooking.

MASKED BOOBY *Sula dactylatra*

Two pairs were present. One pair had two eggs and the other none. One of the latter was in moult. Three of its tail feathers, two secondaries and the eighth (third last) primary were being replaced. The sitting bird allowed itself to be picked up and two of the others were caught soon after dark. The former returned to its nest soon after being released. The nest was a slight scrape, with no nesting material. The clutch measured 61 x 42 mm and 68 x 45 mm. The smaller egg was chalky white with a tinge of blue and the larger was slightly brownish.

BROWN BOOBY *Sula leucogaster*

40-50 were on the island when we arrived but were as timid as usual and departed as we landed or soon after. Most returned to roost a few hours later and we banded ten. One bird only was nesting and was brooding two eggs . These were a dirty dull green-blue but where scratches had exposed the inner layers it was a deeper blue. They measured 69 x 44 and 64 x 42 mm.

BLACK-NAPED TERN *Sterna sumatrana*

Up to 20 birds were seen around the shores. Seven eggs were found, two measuring 28 x 40 mm and 29 x 39 mm. No chicks or juveniles were present. These birds were almost as hard as the Crested Tern to capture at night; only one was caught for banding.

SOOTY TERN *Sterna fuscata*

Three nesting areas totalled 580 sitting birds, each with an egg in a shallow scrape. As the sun set, the sitting birds were joined by their mates. There were 90 recently fledged juveniles as well as 20-30 dead juveniles at high-water level on the south-western side.

Five eggs averaged 54.8 x 36 mm, range 51-57 x 35-37 mm.

Ground colour was brownish and blotches of variable purplish-brown were evenly distributed.

CRESTED TERN *Sterna bergii*

There were 390 birds by day and almost all were incubating their one egg. None could be caught at night. Ten eggs averaged 61.3 x 41.1 mm, range 58-64 x 39-43 mm. The ground colour and both the shape and colour of the splotches varied widely. In general the markings were much more linear than on other tern eggs. One, 60 x 42 mm was a definite pear shape. All eggs lay in shallow scrapes and no nesting material was used. No eggs had hatched and the few unoccupied birds seemed about to lay.

COMMON NODDY *Anous stolidus*

Of the 495 birds sitting during the day well over three-quarters were brooding an egg. The brownish-white eggs were only lightly patterned by blue-grey and darker brown splotches. The markings were concentrated around the large end and on some to a lesser extent around the pointed end. This was the only species on the cay that arranged any nesting material. Larger pieces of coral were loosely arranged to form a nesting perimeter. Quite a number of primary wing feathers lay between the nests. Five runners and 70 adults were banded.

NON-BREEDING SPECIES

There was an erratic stream of Red-footed Boobies passing overhead from the south-east, several of which paused to circle before continuing on to roost on Sovu. Three Lesser Frigate Birds circled the island for a short time near sunset.

SOVU ISLANDS

The Sovu Islands consist of three islands and a rock, at 179°49'W 17°10'S. The afternoon and evening of 5 January 1976 were spent on the second largest island. A small number of unidentified birds landed near the summit of the largest island. At the same time scores of fruit bats were leaving the smallest island and flying to Cikobia and a few to Vanua Balavu. The rock was occupied by a few Black-naped Terns. On the second largest island Red-footed Boobies were nesting in the trees. On the ground were numbers of Banded Rail *(Rallus philippensis)*.

RED-FOOTED BOOBY *Sula sula*

The only nesting sea-bird. It was late in their breeding season and the few remaining nests in the fairly high trees were occupied mostly by runners. Some immatures (still with some down around their necks) and adults were resting there and in the 2-3 m high trees on the edge of the beach.

16 runners, two immatures and 76 adults were banded by 11 p.m. when rising wind and waves, almost covering the island's little beach, forced us to leave. 300-400 pairs were on the island.

At dusk the adults returned with a strong tail wind from the direction of Tonga. Their speed was thought to be at least 110 km

per hour. Many, with feet extended, overshot the island by a considerable distance. Perhaps they had been fishing in Tongan waters, an idea supported by the recovery of a banded bird six months later from Niua Fo'ou, Tonga, 700 km east of Sovu.

NON-BREEDING SPECIES

Ten Brown Boobies were present but whether they normally roosted or had moved because we had been on Nuku-i-Cikobia the previous night is uncertain. Probably Sovu is used as a roost whenever Nuku-i-Cikobia is awash in bad weather.

30 Lesser Frigate Birds were present at sunset but were not seen after they had finished harassing the boobies. It was fairly dark but the frigate birds were still marauding when I noticed one to have much broader wings than the others. It was overhead for only a minute but I am sure that it was *F. minor*, the Greater Frigate Bird.

CIKOBIA-I-LAU

A mountainous island at 178°47'W 17°17'S, with one village, some forest, caves, gardens and cliffs. I was there on 2-3 and 5-6 January 1976.

WHITE-TAILED TROPIC BIRD *Phaethon lepturus*

Six were seen on 2 January, all on the western and south-western cliff area. One entered the vegetation and was not seen to emerge. The tail feathers of another jutted out from a ledge some 12 m up a cliff and the others were displaying over the water adjacent to the cliffs. The following day two birds were seen doing aerial displays over the cliffs nearest the village. On 6 January several birds were seen along the south side where there are no real cliffs on the shoreline. We looked in vain for nests in an area a little inland where the birds went periodically. One bird entered a hollow horizontal branch about 5 m over the beach. It was caught and banded but its egg was not handled.

NON-BREEDING SPECIES

On 2 January, 25 Red-footed Boobies, two Black-naped Terns, eight Bridled Terns and 28 White-capped Noddies were offshore; 45 Crested Terns were onshore; one Lesser Frigate Bird, two grey and one white Reef Heron were inshore.

QILAQILA

A precipitous rocky island close to the north-west end of Vanua Balavu at 179°02'W 17°10'S. We sailed around it on 1 January 1976.

WHITE-TAILED TROPIC BIRD *Phaethon lepturus*

Five birds were flying close to the cliffs. Two were attempting to land and one seemed to succeed. Although we did not land (it would be extremely hard to climb the cliffs even with ropes), their behaviour indicated attempts to nest. A few minutes after seeing these birds, three more were seen flying along cliffs on Vanua Balavu. One bird flew in among the trees, again indicating probable nesting. Villagers from Vanua Balavu say sea-birds nest on this island, but

most refer to the Lesser Frigate Bird after which the island is named and which they say are often flying over the island.

LAKEBA

WHITE-TAILED TROPIC BIRD *Phaethon lepturus*

This island was visited for five days in December 1975. 9 December was devoted to finding these birds at the three cliff areas on the western side where Clunie (pers. comm.) had observed their nesting in November 1974. We found 15 birds either close offshore or moving in over the land and near the northernmost cliff, among the trees. However, no nests were found. Some broken egg pieces under a cliff face belonged to this species. My guide and friend said they had eaten this bird in earlier years. The land tenants nearby said they had presented five or six tail feathers to the Prime Minister (the paramount chief of the island) a month or so previously. They denied knowing of nests.

NANUKU LEVU and NANUKU LAILAI

These islands at 179°60′W 16°41′S were said to be covered with seabirds. So, after checking Raranitiga and finding only one Red-footed Booby and three Lesser Frigate Birds there, we went over to them on 22 August 1976. Both are flat sandy islands. Nanuku Levu was covered in vegetation including coconut trees whereas Nanuku Lailai was bare except for sprouting coconuts.

We visited Nanuku Levu first and noted 10-12 Red-footed Boobies coming in and roosting in the coconut trees. Four were still there when darkness came and a few Lesser Frigate Birds had finished circling the island. At dark we moved over to Nanuku Lailai where we had observed one Brown Booby, 70 Common Noddies and 16 Black-naped Terns. Few of these birds could be picked up by torch when we arrived. We caught and banded five Common Noddies and one Black-naped Tern before a tropical storm hit us and blew a wader net away. Nanuku Lailai is probably a breeding sand cay and temporary roosting site similar to Nasautabu.

NASAUTABU

Nasautabu is a sand cay at 178°46′E 17°49′S. It has some very low vegetation near one end. Its size and shape change from month to month and storm to storm. Friends have described two species which nest on the sand and I have seen two chicks taken from the cay which appeared to be Common Noddies. I was unable to visit the island. Both species of noddy as well as terns roost on the cay periodically but, as it is exposed to wave action, nesting is probably sporadic.

OTHER LIKELY PLACES

Through various individuals I have learnt of other places that may be worth visiting. Aiwa is a small island off Lakeba which the local people visit in punts periodically and where from their descriptions at least one of the noddies may breed. A rock on the western side

of Viwa is said to have breeding boobies. Some small islands in the Ono-i-Lau group according to one of my students has breeding boobies and " many smaller birds." Nukusimanu, both by its name and according to the owners, who live on Taveuni, is a low island with hundreds of birds nesting on it.

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M. K. TARBURTON, *Biology Dept., Longburn College, P.O. Box 1, Longburn*

APPENDIX — Table of measurements.

SPECIES	Length	Culmen	Wing Span	Wing	Tarsus	Mid Toe	Tail	Weight	Sample	Location
Puffinus pacificus	450-454	39.4-42.1	1 010-1 044	282-293	51.6-53.5	56.6-64.6	117-127	222-236	3	Ono
Phaethon lepturus	550	45, 51		259, 266	21		288 (103)		2	Cikobia, Vatu-i-Ra
S.sula	692-755	83.5-92	1 390-1 580	365-412	35-45		211-272	773-1 041	10	Vatu-i-Ra
	780	88	1 454	402	45		230	915	1	Yabu
S.leucogaster	778	104	1 546	423	50.3	83.4	208	1 450	1	Yabu
	736-746	95-103	1 431	399-431	53		180		4	Nuku-i-Cikobia
S.dactylatra	840-890	104-111	1 622-1 720	442-457	58-60		180-183		3	Nuku-i-Cikobia
F.ariel	F720 723	90-90	1 744-1 838	495-551	25		298	1 021-1 133	2	Vatu-i-Ra
	F	103.8		593	22.2	69.5	359	1 100	1	Ono
	M734-762		1 692-1 740						3	Vatu-i-Ra
E.sacra	669-690	85-95	1 130	313-318	84.4 89.8	70.6-73	103-106	620-685	3	Yabu
S.sumatrana	338-360	33.8-41.5	670-672	224-236	19.6-22.1	19.4-22.8	126-143	105-120	9	Vuro
	336	38	640	229					1	Nuku-i-Cikobia
		39							1	Vatu Lami
		39		223					1	Nanuku Lailai
S.berrii	461-504	58.7-62	1 017-1 058	325-353	28.2-30.1	28 33.2	149-168	315-350	3	Ono
S.fuscata	403-461	42-46	878	297-304	26		150		3	Nuku-i-Cikobia
A.stolidus	418-461	37-44	812-885	262-297	27-30		140-170	198-285	6	Vatu-i-Ra
	428	42		275					1	Nuku-i-Cikobia
A.minutus	337-363	42-49	646-717	223-241	22-27		118-126	92-105	15	Vatu-i-Ra
	354	45	682	227	26		111		1	Mabulau

THE DISTRIBUTION AND NUMBERS OF NEW ZEALAND FALCONS (*Falco novaeseelandiae*)

By N. C. FOX

ABSTRACT

Data on the distribution of the New Zealand Falcon were collected from all likely sources and from field studies in five areas. The known status of the falcon is given and is summarised in two distribution maps. The entire population is estimated using known densities in study areas. About 3100-3200 pairs of "Eastern Falcons," 450-850 pairs of "Bush Falcons" and 140-280 pairs of "Southern Falcons" (total about 3700-4350 pairs) may exist. Probably 3000-4500 pairs is a realistic estimate of the falcon population; 2000 pairs at the least.

INTRODUCTION

No estimate of the New Zealand Falcon population has been published. Only fragmentary, local information exists, which is combined in this paper with more recent data to produce national distribution maps. When estimating breeding ranges, it is important to differentiate between records of transients and of breeders but at the same time to realise that the regular presence of juveniles in certain districts indicates the presence of a reasonable breeding population in adjacent ranges.

METHODS

Data on falcons were obtained from the annual Classified Summarised Notes of the Ornithological Society of New Zealand since 1950, from McKenzie (1972), and from the Bird Mapping Scheme (P. Gaze, pers. comm.). Written enquiries were made to the secretaries of branches of OSNZ and the Royal Forest and Bird Protection Society, and articles were placed in *Outdoor* magazine, the Deerstalkers' Association magazine and the Tussock Grasslands and Mountain Lands Institute magazine. Short items were given on Radio New Zealand and Television One. Letters were sent to people, such as National Park and Forest Service personnel, known to have had contact with falcons or who knew a certain area well. Field work on falcon densities in five study areas containing 142 pairs (Fox 1977) gave useful comparisons between reported sightings and probable densities.

From many sightings the problem was to eliminate those referring to drifting, non-breeding juveniles. Descriptive atlases (McLintock 1959, Wards 1975) were used to eliminate all areas, such as cities, cultivated farmlands and orchards, permanent snow and glaciers, in which it would be unlikely that falcons are breeding. Reports from these areas, e.g. Gill (1976), were considered to refer to non-breeders.

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The remaining areas were then evaluated block by block, using the information available and historical records. Large, uninhabited areas and the low density of observers made more detailed census methods (e.g. Prestt & Bell 1966), or road-counts not feasible.

RESULTS

The results are summarised in two maps (Figs 1 & 2). Meridian squares are described by their northern latitude and western longitude, and concise data for each square are shown below. Abbreviated sources: HRMcK = McKenzie (1972), OSNZ = Ornithological Society's Classified Summarised Notes, BMS = Bird Mapping Scheme. Unspecified data are mine.

NORTH ISLAND

34° x 172°, 34° x 173°, 35° x 173°, and 35° x 174°.

Rare or absent in Northland; Watt (1974) saw only one falcon in 32 years. One or two unconfirmed sightings (1970 OSNZ) were probably of juveniles. The presence of a falcon in Omahuta State Forest (D. Bartram, pers. comm.) may indicate occasional breeding. Skegg (1964) considered that falcons became extinct on the Hen and Chickens by 1914, but these islands could barely support more than one pair.

36° x 175° and 36° x 174°

No sightings on mainland.

36° x 175°

Great Barrier Island: visited occasionally by falcons (1960 OSNZ) but no nest records. Bell & Brathwaite (1964) did not record it, nor did Turbott (1974) on Little Barrier.

Coromandel Range: odd birds have been recorded (1974 BMS) and probably a few pairs still breed.

37° x 174°

South Auckland: very rare, not resident (OSNZ; S. Reed, pers. comm.). Occasional sightings (1968 OSNZ) are probably of immatures. One bird was seen at Waikato Heads estuary (1974 BMS).

37° x 175°

Moumoukai: a pair at Bombay (1963 OSNZ), growing scarcer but often seen (1964 OSNZ) and one bird seen (1970 OSNZ).

Mt Pirongia: usually seen (1964 OSNZ); fairly common (1976 L. A. Hedley, pers. comm.), possibly an isolated population of 5-6 pairs. One seen at Raglan Harbour (1974 BSM) may have come from Mt Pirongia.

Kaimai Range: one seen at Whakamaramara (1963 OSNZ) and one present at aviaries at Tauranga in June (1963 OSNZ). One sighting South Kaimais (1974 BMS) and three sightings North Kaimais (1974-5 OSNZ). Falcons are still present in the Kaimais (Mrs R. V. McLintock 1975, pers. comm.) and presumably still breeding.

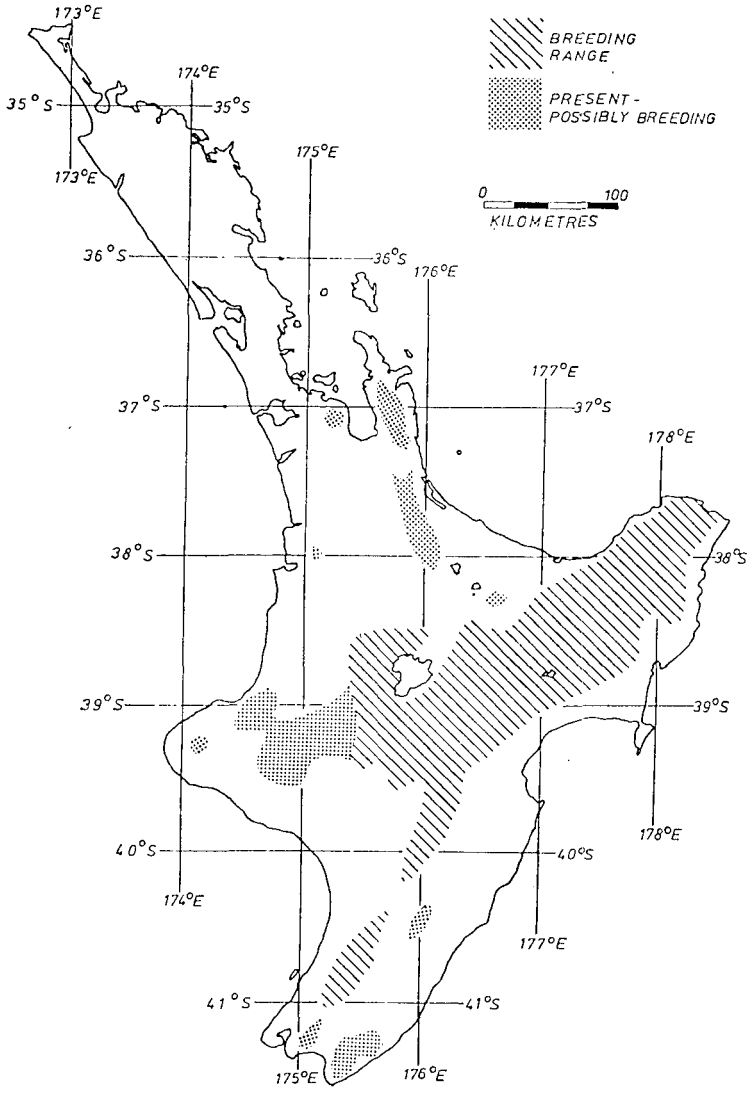

FIGURE 1 — The range of the New Zealand Falcon in North Island.

37° x 176°

Occasional sightings in farming districts between Tauranga, Whakatane, Matata (1961 OSNZ) and Kawerau (1956-64 OSNZ) were probably of juveniles which had strayed from the main ranges further south. A dead falcon was found on Mt Maunganui Beach 22 June 1969 (Davenhill OSNZ).

37° x 177° and 37° x 178°

The bush-clad Raukumara Range of East Cape is probably one of the major breeding areas in the North Island. HRMcK classified falcons as common there and reports in OSNZ and BMS are too numerous to detail.

38° x 174°

A pair at Kawhia Harbour (1966 OSNZ) probably came from Mt Pirongia but may breed, as a pair was also seen there in 1976 (P. Bradfield, pers. comm.).

North Taranaki: three records in the Waitaanga area (1967-8 OSNZ) indicate that there are probably scattered breeding pairs.

38° x 175°

HRMcK considered that falcons were disappearing in the Hauhungaroas due to clear felling, but odd sightings (Te Kuiti 1960 OSNZ) indicate that a few may still breed. At Pureora, West Taupo, they were seen almost daily (1964 OSNZ) and an old inhabitant had killed 20 in one year since the war (OSNZ). Falcons are still present (1974 BMS) but the area is rather inaccessible and more information is required.

38° x 176°

Relatively frequent sightings of falcons at Rotorua, Mamaku, Kawerau, Taupo, Kaingaroa, Lake Rotoiti, Galatea and Wairapukao (1960-75 OSNZ and 1974 BMS) indicate a low density breeding population in the Kaingaroa State Forest area. The range may well be more extensive than shown in Figure 1.

38° x 177° and 38° x 178°

Numerous observations show that falcons may be rather common in the Huiarau and South Raukumara Ranges, extending as far as the cultivated country around Gisborne. Juveniles are frequently seen in Gisborne and a pair lived for at least two years in exotic forest at Patunamu (M. Orchard, pers. comm.). Falcons breed in the Urewera National Park and are seen or heard frequently (W. Berger, pers. comm.).

39° x 174°

Mt Egmont: Falcons are seen occasionally in the National Park (K. A. Mawhinney, pers. comm.) and may still breed.

Taranaki: odd birds seen along bush ridges near Marco (OSNZ), and settlers state the species is quite common in and around the dense bush (OSNZ). A pair was present at the Tangarakau Gorge, Taumarunui (1975 R. Weston, pers. comm.) and falcons probably nest in all bush areas from the Matemateonga Range to Tongariro National Park.

39° x 175°

Five records (1974 BMS) in Tongariro National Park and OSNZ records from the adjacent bush ranges, as well as a number of specimens collected from the Raetihi area, indicate that falcons may be commoner here than at Kaingaroa but less so than at East Cape.

39° x 176°

Numerous records from the Kaimanawa, Ahimanawa, Kaweka and Ruahine Ranges show that a substantial breeding population is present. Juveniles stray annually to Napier and Hastings (W. J. Powell, pers. comm.) and one or two pairs may possibly breed at Maraetotara.

39° x 177°

There is no suitable nesting habitat here, so any records are probably of juveniles.

40° x 174°

Falcons were frequently seen on Kapiti Island but were not known to nest (Wilkinson 1952).

40° x 175°

Numerous records indicate a substantial number breeding in the Tararua Range. Pairs probably breed in the Otaki (1941 OSNZ), Akatarawa, Hutt (1972 J. A. Fowler, pers. comm.) and Kaiparoro (1973 R. White, pers. comm.) Valleys. Juveniles from the Tararuas are probably responsible for reports from Kapiti, Pukerua Bay (1962 OSNZ) and Wellington.

40° x 176°

A sighting of three falcons in the Makuri Gorge (1972 E. Dear, pers. comm.) indicates that a few pairs may exist in the Puketoi Range. Generally the South Hawke Bay, Dannevirke, Masterton area is now too densely settled and cultivated to support falcons, but they used to nest at Mt Oporae (J. Meacham, pers. comm.).

41° x 174°

Frequent sightings from Wellington, Upper and Lower Hutt are almost all attributable to stray juveniles from the Tararuas or Rimutakas. It is possible that one or two unreported pairs of falcons nest in the hills around Cape Terawhiti.

41° x 175°

The presence of falcons during the breeding months (Sir Robert Falla, pers. comm.) and frequent sightings of juveniles in the Eastbourne area suggest that a few pairs of falcons probably breed in the Rimutaka Range. Despite its proximity to Wellington there is little information for this area.

Falcons are present and probably breeding in the Aorangi Mts (1976 G. Woodward, pers. comm.).

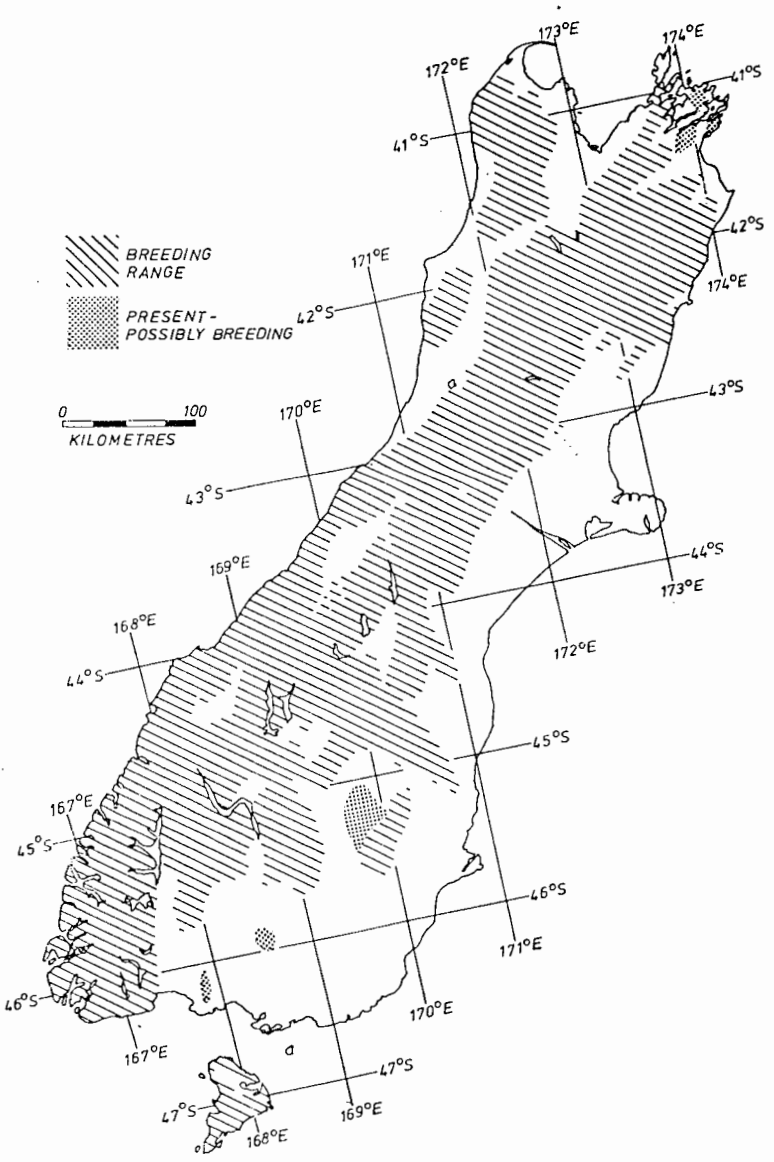

FIGURE 2 — The range of the New Zealand Falcon in South Island.

SOUTH ISLAND

40° x 172°

Wakamarama Range and Tasman Mts: numerous records, mainly in forest areas (OSNZ, BMS). Apparently uncommon now in Abel Tasman National Park (G. Rennison, pers. comm.).

40° x 173°

A falcon was shot on D'Urville Island in 1927 and falcons may breed there. A pair was present on Stephens Island about 1950 (L. Bell, pers. comm.) and falcons were seen occasionally on the Chetwode Islands (D. Flack, pers. comm.).

41° x 171°

Falcons breed in the Paparoa Range (three sightings near Mt Uriah 1974 BMS, and 1976 C. Wynn, pers. comm.).

41° x 172°

Falcons breed in the Mt Arthur Range, Marino Mts, Lyell Range and Nelson Lakes National Park, and reports (BMS, OSNZ, HRMcK) are numerous. Two pairs of falcons nested in the Cobb Valley 1951-2 (G. Davis, pers. comm.) and a well-known pair has nested at Mt Robert in recent years. Although occupying hilly or wooded tracts, the falcon has been eradicated from most marginal agricultural areas by shooting.

41° x 173°

Falcons breed in the Bryant and Richmond Ranges (HRMcK, OSNZ), extending as far as the Marlborough Sounds. Although seen occasionally in the Sounds (1976 A. Shanks, pers. comm.; 1974 BMS) their breeding status is unknown. South of the Wairau River there is a dense, well-documented population (study area A, Fox 1977).

41° x 174°

Although there are imposing sea-cliffs, such as Wellington Head, there are no records of falcons breeding on cliffs which directly overlook water. The status of the falcon in Queen Charlotte Sound seems to be unknown. The most easterly extent of the falcon's breeding range in central Marlborough is Richmond Brook, Seddon.

42° x 170°

Falcons are occasionally seen at Hokitika and Ross (OSNZ) and breed in any areas remote from human activity.

42° x 171°

Probably now eradicated from all flat areas around Greymouth but still seen occasionally (OSNZ). Records are numerous east of Lakes Kaniere, Brunner, Ahaura and Hochstetter, as far north as Reefton and Inangahua Junction, and the breeding range extends across the Canterbury Plains.

42° x 172°

Falcons are present and breeding in all the main ranges east to the Hawarden-Waiau basin but excluding all cultivated areas. Although absent from the Hanmer Springs flats, falcons still breed in the

adjacent hills, including Lochiel Station where Edgar Stead studied them in the 1930s.

42° x 173°

Falcons breed throughout the Kaikouras and in the Hundalee Hills as far south as the Conway River mouth (see study area B, Fox 1977). One or two pairs breed south of the Conway, east of Parnassus (J. West, pers. comm.) and in the Lowry Peaks Range (1976 J. Satterthwaite, pers. comm.).

43° x 168-171°

Falcons breed in all areas between Jackson Bay, Wanganui Bluff, Mt Grey (North Canterbury) and Mt Peel (South Canterbury) — many records — excluding those areas which are permanently snow-bound or involved with human activities. The breeding range extends to within 5 km of the flat Canterbury Plains, usually avoiding the front faces of the hills. Pairs nest up to 1520 m a.s.l. (5000′) in the Craigieburn Range. One or two pairs are also present in the Doctor's Hills, North Canterbury, separated from the main ranges. Stead (1944) considered the falcon uncommon throughout Canterbury back country where he thought numbers had just been maintained between 1920 and 1944. In 1977, falcons were comparatively plentiful in this area but affected by pesticides on the edge of their breeding range.

The falcon probably became extinct on Banks Peninsula around 1900 although one or two pairs may have hung on longer, as P. A. G. Howell (pers. comm.) saw a pair kill a White-backed Magpie *(Gymnorhina tibicen hypoleuca)* near Castle Rock in January 1947. Although occasional single birds and possibly a pair have been seen in Governors Bay (H. Ensor, pers. comm.; B. Calder, pers. comm.) since then, there have been no records of breeding, and runholders in the interior have not seen falcons on Banks Peninsula (W. Aitken, pers. comm.). The falcons probably disappeared because of man but, with increased public tolerance, they may well re-colonise the Peninsula, despite the great reduction in forest.

44° x 167-170°

Numerous records indicate that falcons breed in all areas, excluding alpine barrens and areas of human activity, from Jackson Bay and Caswell Sound to Mt Peel and the Dansey Pass. On the low-lying areas around Wanaka and the Lindis, as well as in the flatter parts of the McKenzie Country, they apparently do not breed, although records indicate that these areas may be occupied by non-breeders. The Hunters Hills, Kirkliston Range and St Mary's Range mark the eastern-most extremity of the breeding range. There are no data on breeding falcons in the Pentland Hills.

44° x 171°

There are no known breeding falcons on the Timaru plains, although juveniles may stray as far as the coast (R. McCully, pers. comm.).

45° x 166-167°

Falcons breed throughout Fiordland National Park (A. Cragg, pers. comm.), Kaherekoau Mts and are common in the Takitimu Mts (1975 R. R. Sutton, pers. comm.; 1975 J. von Tunzelman, pers comm.), but are absent from the low-lying country between Monowai and the eastern shores of Lake Te Anau.

45° x 168°

Falcons breed in the Livingstone Mts, Thompson Mts, Eyre Mts, Remarkables, Hector Mts and Garvie Mts (many records). A breeding pair near Dipton (1955-60 OSNZ) may indicate that falcons still breed in the Hokonui Hills. Breeding falcons are absent from all areas exposed to persistent human disturbance.

45° x 169°

Falcons breed in the Umbrella Mts, Old Man Range and Dunstan Mts (many records), but are absent from the more populated areas of the Clutha and Manuherikia Rivers. There is little information on the presence of falcons in the Knobby Range, Rough Ridge, Rock and Pillar and Lammermoor Ranges, but a pair nesting near Lawrence (1969 OSNZ) and another at North Rough Ridge (J. Mathewson, pers. comm.) suggest that falcons probably breed throughout these hills.

45° x 170°

Falcons are present in the Kakanui Mts (1974 BMS) and breed regularly as far south as Trotters Gorge, Hampden (Prof. P. A. Smithers, pers. comm.). A record from Hindon (1974 BMS) may mean that falcons breed in the hills around Mt Hummock, extending to the Taieri Ridge. There are probably no breeding falcons in the low-lying areas adjacent to Ranfurly and Middlemarch, nor in the cultivated coastal districts.

46° x 166-167°

Falcons breed in southern Fiordland, including Hump Ridge (1974 BMS, 1974 OSNZ). A pair nesting, possibly for several years, just inland from Colac Bay (1956 J. A. Mathieson, pers. comm.) shows that falcons probably still breed in the Longwood Range.

46° x 168°

Falcons are absent as breeding birds from the Southland Plains; reports of single birds at Invercargill and Otatara (1961 OSNZ) were probably of stray juveniles.

46° x 169-170°

It is possible that some falcons breed in the hilly district around Mt Pye but there are no records.

Stewart Island

Information on falcons in Stewart Island is scanty. Sightings include Island Hill, Thompson Ridge and Ackers Point (OSNZ); as these are all near tracks it is logical to assume that falcons are widespread throughout Stewart Island, if at a low density. Wilson's (1959: 75) discovery of two breeding pairs on Codfish Island supports this assumption.

Auckland and Adams Islands

Five or six pairs of falcons were discovered in the 1972/73 expedition to the Auckland Islands, concentrated at the south end, mainly on Adams Island (B. D. Bell, pers. comm.). This may represent a decrease since the war years. Theoretically the Auckland Islands should support at least 12 pairs, but the high pesticide levels in a collected egg (see Bennington *et al.* 1975) may suggest a reason for the decrease.

Macquarie Island

Buller (1888: 221) recorded a specimen collected at Macquarie Island. This appears to be the only record and must be considered dubious.

Chatham Islands

Buller (1888: 224) recorded a falcon egg from the Chatham Islands in the Canterbury Museum collection. The history of this egg and its present location are not known. The falcon probably became extinct in the Chatham Islands before 1892 when Forbes (1893) collected sub-fossil bones, and there have been no further records apart from bones (Scarlett 1955, Dawson 1957).

DISCUSSION

The main problem in this type of analysis is the reliance on a large number of independent observers whose estimates of status, such as "common" or "scarce," vary widely. Because people in New Zealand are used to the unusually high population levels of the Australasian Harrier *(Circus approximans gouldi)*, of which it is common to see 1-10 sightings from one place daily, they tend to measure the falcon by the same yardstick. Thus even scientists working on birds thought that falcon densities of one pair per square mile (2.6 km^2) could be expected in a healthy population.

In Marlborough, where the population density is now known with some accuracy, Handly (1895) considered the falcon "fairly numerous," measured presumably against his knowledge of other falcons overseas. In the OSNZ notes there are scattered records for Marlborough, and S. R. Kennington's estimate "found in small numbers throughout the district, generally avoiding more populated areas" may be considered a fair comment, typical of other OSNZ notes. The Bird Mapping Scheme (1974) had no records for most of this area. There is thus nothing on record to suggest that the Marlborough population is a particularly dense one as, in fact, it is. This same comment also applies to my other four study areas. It therefore seems reasonable to assume that those areas of New Zealand recorded as containing falcons on the distribution maps probably contain similar densities to those study areas of similar ecotype.

Statements are frequently made that the falcon appears to have decreased in numbers in recent years. One of the reasons for this supposed decrease is that farms have become increasingly mechanised

and have better tracks. Horses, being slow, silent and self-steering, were ideal mounts from which to notice falcons. Now that four-wheel drive vehicles are used the noise, restricted vision and concentration on driving, as well as the shortened period of time spent on the hill, greatly diminish the chances of seeing falcons. Many runholders have put this point to me and it is a valid one.

In other areas observers may be gauging the falcon population, unknowingly, on the fortunes of only one pair. If a homestead lies within the territory of a pair, then falcons will be seen reasonably often and the comment will be that falcons are " present " or " common." Should that pair move or die, it is probable that no, or very few, falcons will be seen at the homestead, resulting in the opinion that " falcons have noticeably decreased in this area." As many pairs near homesteads are on marginal territories, this may be a common occurrence.

As observers grow older and less active, far less time is spent in falcon habitat. Thus comparisons made by the same person between numbers of sightings in the 1970s and numbers of sightings in the 1930s or 1940s will differ. One old man in Marlborough had not seen a falcon for 15 years — despite the presence of five pairs within 5 km of his homestead !

The breeding range of the falcon has undoubtedly shrunk in the last 30 years. The study areas which were on the edges of the breeding range contained marginal sites which were no longer active, suggesting a retreat of from 1-8 km. In the Ward area of Marlborough DDT was used between 1950-1972 and the disappearance of some marginal pairs from that area in the early 1950s coincided with the use of DDT (Fox 1978a). There was no persecution of falcons on these stations at that time (T. J. Taylor, pers. comm.). It is possible that, without further pesticides or undue disturbance, falcons will nest in these areas again. In North Canterbury, falcons still nest even on the front faces of Mt Grey and also in the Doctors Hills and the Lowry Peaks Range, both of which are isolated from the main ranges. This indicates that there is a reasonable falcon population in the main hills because population strength generally is lowest at the edges of the breeding range and increases inwards.

Whether or not falcons bred in pre-European times on the flat plains, such as Canterbury, is not known. Although it apparently uses a wide range of nest sites, the falcon has some strict limitations. For example, no nests have been found directly overlooking water; and no nests have been found in flat open country. Perhaps any falcons nesting on the plains used small patches of bush, especially those on higher ground. However, if a falcon such as the Peregrine *(Falco peregrinus)*, which has very conservative nest site requirements, can adapt to flat land and scattered trees (Hickey 1969: Plates 7, 24, 25, 26), probably the New Zealand Falcon could also do so.

If this plains population existed, it seems to have been extinct

by 1882, when Potts mentioned the presence of a pair in Governor's Bay, Banks Peninsula, but did not mention any seen on the plains. M'Lean (1911: 12) specifically stated " in the lower open country the Bush-hawk is seldom seen, and then only in winter. I have never seen a Falcon about the cultivated plains of the coast." Potts also thought that neither falcons nor their prey were so common in 1882 as previously. Why this should have been so is not clear but it appears that the decrease of the falcon was linked to that of the prey (Galushin 1974), rather than to any more direct factor.

Breeding falcons have inevitably been eliminated from the lowland areas of New Zealand by drastic ecological changes, the natural boldness of the species, unsympathetic treatment by man, and by pesticide contamination. In forests, low-pressure logging is unlikely to have affected the falcon but the monoculture of exotic *Pinus*, especially the even canopy formed by stands of one generation, is definitely unsatisfactory for falcons. Hunting conditions are difficult and these forests support only a poor range of prey.

Reischek (1881, 1886) recorded falcons on the Chicken Islands and Little Barrier Island. Oliver (1955: 425) summarised records from the Hen and Chickens, Little and Great Barrier, Kapiti, D'Urville, Stewart Island, Codfish Island, Auckland Islands and Campbell Island. Most of these records gave no positive evidence of breeding; probably the fortunes of pairs on the small off-shore islands, such as Kapiti, D'Urville and those in the Hauraki Gulf, depend on the presence of a strong falcon population and of suitable habitat on the adjacent mainland.

As long as present conditions remain, the falcon should maintain its present numbers. Increasing replacement of indigenous forest by exotic forests, increasing human population, and chemicals in the food chain are probably the main threats. The species can survive well where there is extensive hill sheep and cattle farming and thus has a more encouraging future than have many native birds which depend heavily on indigenous forests.

ESTIMATED POPULATION SIZE

In the North Island the falcon breeding range (Fig. 1) is about 24 986 km², with an additional 6152 km² in which falcons may possibly breed. In the South Island and Stewart Island the falcon breeding range (Fig. 2) is about 83 654 km², with an additional 1682 km² in which falcons may possibly breed.

Apparently three forms of New Zealand Falcon exist (see Fox 1978). In the North Island and north-western South Island there is a small dark form called the " Bush Falcon." In the eastern half of the South Island the falcon inhabits open terrain and this " Eastern Falcon " is a large pale form. In Fiordland and the Auckland Islands is a form intermediate in size and colour between " Bush " and " Eastern Falcon " which I call the " Southern Falcon."

The range of the "Bush Falcon" covers about 24 986 km² in the North Island and about 14 895 km² in the South Island. "Bush Falcons" may also be breeding in a further 6 833 km². Thus the total breeding area for "Bush Falcons" is about 39 881 (+6 833) km².

The range of the "Eastern Falcon" covers about 44 884 km² plus about 10 662 km² of forested terrain in Westland and a further 1 000 km² of open country in which it may possibly be breeding.

The range of the "Southern Falcon" covers about 13 213 km² including Stewart Island but excluding the Auckland Islands. These breeding range estimates are probably accurate to confidence limits of below 20%.

Estimates of falcon numbers depend heavily on estimates of falcon densities in forest habitat. Reports by Guthrie-Smith (1927), John Powell (pers. comm.) and St Paul (1977) indicate that falcon densities in bush areas may reach as high as those found in open terrain in Marlborough and North Canterbury. Therefore a mean home range size of 190 km² for falcons in Westland (Fox 1977) seems an over-estimate and it is likely that only one in 3-5 pairs was actually found. If this was the case, the probable home range size of falcons in wooded areas may be about 40-100 km², perhaps dropping as low as 20 km² in some places. In open country the home range of falcons is about 15 km² (Fox 1977).

If it is assumed that (a) in areas where falcons may only possibly be breeding they are at a density of one pair per 100 km², and (b) that only 10 pairs exist on the Auckland Islands, then two estimates can be made (Table 1).

TABLE 1 — Estimate of total numbers of breeding pairs of each form of the New Zealand Falcon, based on densities of one pair per 15 km² in open country and on one pair per 50 or 100 km² in forest.

	No. prs. in forest	No. prs. in open country	Possible extras	Total
Eastern	107	2 992	10	3 109
Bush	399	0	68	467
Southern	142	0	0	142
Estimated falcon numbers if one pair per 100 km² in forest assumed =				3 718
Eastern	214	2 992	10	3 216
Bush	798	0	68	866
Southern	284	0	0	284
Estimated falcon numbers if one pair per 50 km² in forest assumed =				4 366

Depending on which estimate of density in forest is used it seems likely that there are about 3000-4500 breeding pairs of New Zealand Falcons. Of these, about 3100-3200 pairs are of the " Eastern " form, 450-850 are " Bush Falcons," and 140-280 are " Southern Falcons." Considering the area of falcon habitat in New Zealand, and the absence of specialised avian competitors, these estimates seem reasonable. More accurate estimates will not be possible until better information on the variables is obtained, but at present it seems most unlikely that there are less than 2000 breeding pairs. How many non-breeders exist is not known.

Changes in land use and destruction of forests make the " Bush Falcon " the most vulnerable form. Most of the " Southern Falcons " are contained in the Fiordland National Park and thus are protected, but the Auckland Islands representatives of this form are very exposed to pesticides in the marine ecosystem. The " Eastern Falcon," being adapted to introduced prey and to new types of land use, seems reasonably secure.

ACKNOWLEDGEMENTS

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N. C. FOX, *Department of Zoology, University of Canterbury, Christchurch*

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SHORT NOTE

UNUSUAL FLOCK OF FAIRY TERNS

On 11 May 1978, at Tapora on the eastern side of Kaipara Harbour, I was surprised to find a flock of small terns, 13 of which were Fairy Terns *(Sterna nereis)*. This is the first such flock to be recorded in New Zealand. With me were Richard Hooper from Warkworth, his wife and his son Peter, and my son Geoffrey. The terns were with other roosting birds on the northern end of a sandspit opposite the houses at the end of Beach Road, a piece of shore known locally as Bird's Beach. High tide was at 1210 hrs and we crossed to the spit by dinghy at 1300 hrs in fine, clear weather.

When first seen, the terns were roosting well spaced out in ones, twos and small groups on the sand. At our approach, they flew before we could see them clearly. Some went fishing while the rest flew down the beach. There were 25 small terns altogether. When we returned later, most of the terns were roosting again. After a quiet stalk, I examined them closely through 7 x 50 binoculars. Thirteen were Fairy Terns, one with a red band on its left leg. This was an adult female which had been banded at Mangawhai Spit on the east coast some 40 km away on 3 December 1977. The birds' bills were yellow right to the tip and the black patch on the crown extended only to about the eye. Also in the flock were eight Little Terns *(Sterna albifrons)*; one was in full breeding plumage, two were in the final stages of change into breeding plumage and five, with dark grey, almost black legs and bills, were probably immature. The four other terns seen earlier had not returned.

I am familiar with both these species, having studied the stray Fairy Tern and the Little Terns at Sulphur Point in Tauranga Harbour on many occasions.

From information given by G. J. H. Moon and B. D. Heather, it appears that 13 is the largest flock of Fairy Terns yet seen in New Zealand. Until now, it has not been known where these terns go from their breeding areas in Northland.

R. BRUCE GOFFIN, *133 13th Avenue, Tauranga*

CLASSIFIED SUMMARISED NOTES

Compiled by R. B. SIBSON

Inevitably these notes are patchy and selective. Some districts are more accessible than others; some, which attract great numbers of migratory species, also tend to lure into the field a greater number of observers. In 1978 the large harbours of the north came in for special attention. Not only were the regular censuses of the Firth of Thames, Manukau and Kawhia carried out, but also summer or autumn surveys were made of the Bay of Plenty, Kaipara and Whangarei. These necessitated detailed planning and solid team-work. The results were encouraging and revealing.

A few notes have been gathered in from outside the period 1 July 1977 to 1 July 1978. Notes on the N.Z. Dabchick and the Cattle Egret have been sent to B. D. Heather, who is directing the surveys of these species. I thank all contributors and apologise for any grave omissions.

List of Contributors, 1977-78:—

H. Ayers, M. L. Barlow, J. A. Bartle, B. D. Bell, A. Blackburn, K. Bond, D. F. Booth, B. Brown, B. J. Burch, D. E. Calvert, W. J. Campbell, W. F. Cash, S. P. Chamberlin, S. C. Chambers, J. Charteris, N. Cheshire, J. Chyene, P. Child, R. Child, R. V. J. Clark, J. F. Cockrem, T. Crocker, D. E. Crockett, the late M. Daniel, M. D. Dennison, A. T. Edgar, G. Eller, M. S. Field, K. J. Fisher, C. A. Fleming, K. Fletcher, P. Fooks, E. Frisby, R. Froggatt, P. D. Gaze, B. Goffin, A. Gollop, A. J. Goodwin, A. Habraken, T. R. Harty, T. Hatch, J. M. Hawkins, F. N. Hayes, B. D. Heather, V. H. Hensley, T. Hughes, J. A. F. Jenkins, P. Jenkins, A. B. Jones, E. B. Jones, L. Jones, M. P. Kearns, B. R. Keeley, A. R. Lacey, P. C. Latham, D. A. Lawrie, S. L. Lobb, T. G. Lovegrove, R. Mayhill, J. McCallum, G. K. McKenzie, H. R. McKenzie, R. V. McLintock, P. J. Miller, G. J. H. Moon, J. L. & M. Moore, J. V. Moore, D. Onley, K. L. Owen, A. Palliser, R. J. Pierce, H. Pollock, H. Pullen, S. M. Reed, H. A. Robertson, P. M. Sagar, C. E. Scadden, R. J. Scarlett, C. Schischka, J. H. & B. Seddon, R. B. Sibson, R. H. Sibson, L. Silcock, D. Sim, J. F. Skinner, A. Slade, J. W. St Paul, J. E. Stanisland, R. H. D. Stidolph, R. R. Sutton, E. Taylor, M. J. Taylor, K. V. Todd, J. Trollope, C. R. Veitch, D. M. Walter, R. M. Weston, D. W. White, P. Wilkinson, J. Wootton, C. Wright, G. L. Yockney.

BROWN KIWI *Apteryx australis*

Whangarei, Mt Parahaki, heard on 24/6 (WJC); Urquhart's Bay, several calls on 2/7 (TGL). Hunua Ranges, 1 imm. disturbed by scrub-roller (HRMcK). Rotorua/Tauranga road, 1 killed April '78 (AP). Tongariro State Forest, Taurewa camp, heard March-April '76. Plantation Rd, May and December '76 (CS).

BLUE PENGUIN *Eudyptula minor*

Aorangi, Poor Knights, singles seen ashore on rock platform, 2 & 10/1/78 (PMS).

FIORDLAND CRESTED PENGUIN *Eudyptes pachyrhynchus*
Dargaville west coast, 1 dead, 26/11 (DEC). Murphy's Ck., Westland, 1 pr 13/2 (AP). Taiaroa Hd. 1 moulting on 17/2 (PJ; BB).

ERECT-CRESTED PENGUIN *E. sclateri*
Kaikoura, 1 moulting on 21/2 (AP).

CRESTED GREBE *Podiceps cristatus*
L. Heron, 1 pr + 1 young with 'horns' appearing; Pumphouse Bay, 1 single + 1 pr; L. Emma, 2 on 10/2. L. Alexandrina, 16 — no young seen — on 12/2 (RJP; PJ; BB). L. Macgregor, 9 on 2/2 (ARL); 5 on 13/2 (BB). L. Te Anau, single birds near Terrace midsummer and winter (JVM). Nest c/2 on 13/2 (AP). L. Thomas, 1 pr raised 3 young (RRS).

HOARY-HEADED GREBE *P. poliocephalus*
Aupori Pen., L. Wingy, 2 on 30/1 (PF, SMR) whence they moved to L. Half (VHH). L. Horowhenua, 1 on 4/9, non-breeding dress (WFC, BDH). Wanstead, L. Purimu, 1 in breeding plumage 17/12 (BDH). L. Elterwater, 1, Feb. 78 (AP). Swan Lagoon, Ohau, 1 in breeding plumage 17/12 (BDH). L. Elterwater, 1, Feb. 78 (AP). Swan Lagoon, Ohau, 1 in breeding plumage, several occasions 8-17/12/77 (KLO); on 13/2 (PJ, BB), early March '78 (N. Hellyer, P. Anderson). Southland, 2 prs bred successfully, each pair raising one young, after hatching in mid-Jan. By mid-April all seem to have dispersed (RRS). Redcliff Wetland Reserve, 2 in June (Ian Mathieson).

AUSTRALIAN LITTLE GREBE *P. novaehollandiae*
Aupori Pen., Black Lake, 1 in fine plumage on 12/3 (ATE, VHH); earlier, VHH had seen two. Rahutai near Dargaville, 2 ad. + 2 imm. on 22/4/78 (WJC, CDC, ATE). L. Tarawera, 1 on 24/6 (AP). Westland, 1 pr + 2 chicks on 12/3/78 (S. Lauder). Redcliff Wetland Reserve, 3 in June (Ian Mathieson, per RRS).

WANDERING ALBATROSS *Diomedia exulans*
Near Three Kings, several on 10/5 (TGL).

BLACK-BROWED ALBATROSS *D. melanophris*
Off Tutukaka, 1 on 15/4. Near Three Kings and down Northland coast to C. Brett, several on 11/5 (TGL). Te Awanga, Hastings, 2 resting with Gannets on 21/12 (JL & MM).

GREY-HEADED MOLLYMAWK *D. chrysostoma*
Waingake, juv. 15 miles inland on 6/5 (AB).

BULLER'S MOLLYMAWK *D. bulleri*
Tasman Bay, 3 in June with *D. cauta* (JMH).

SHY MOLLYMAWK *D. cauta*
Three Kings, 1 on 10/5 (TGL). Foxton Beach, 3 passing S on 22/10 (JL & MM). Tasman Bay, c.70 together in June (JMH).

LIGHT-MANTLED SOOTY ALBATROSS *Phoebetria palpebrata*
Miranda, FoT, 1 on 18/7 flying S. (R & K Wrang). Waitakaruru, 1 imm. ashore alive on 11/6 (BB). Foxton Beach, 1 passing S. on 22/10; and later one ashore alive (JL & MM).

NELLY *Macronectes giganteus*
Foxton Beach, odd birds offshore Oct-Jan. Clive, 3 near sewage outfall 22/12 (JL & MM). Bluff, Ocean Beach works outfall, c. 150 in mid-Feb. (BB).

ANTARCTIC PETREL *Thalassoica antarctica*
Manawatu, 1976, 1 ashore (O. Burmeister per JAB). Muriwai, 1 on 6/11/77 (MJT, RNT).

CAPE PIGEON *Daption capense*
Nelson sewer outlet, c. 100 winter '78 (JMH). Snares Is, c. 1750 off east coast on water 18/1 (NC).

GREY-FACED PETREL *Pterodroma macroptera*
Three Kings, some on 10/5 (TGL). BoP, N of Volkner Rocks, 1000+ on 9/7/77 (NC).

WHITE-HEADED PETREL *P. lessoni*
Summit of Old Man Range, 5500 ft, 1 on 22/12, some weeks dead, at base of TV translator tower (PC).

SOFT-PLUMAGED PETREL *P. mollis*
Petone, 1 ashore on 24/6/78 (S. Cotter).

PYCROFT'S PETREL *P. pycrofti*
Aorangi, Poor Knights, up to 3 heard towards dusk, 2-4/1/78 (PMS).

COOK'S PETREL *P. cooki*
Papamoa, 1 alive under a house on 14/4 (BG).

BLACK-WINGED PETREL *P. nigripennis*
c.40 miles NE of North Cape, several on 16/4 (TGL). Aorangi, Poor Knights, up to 4 heard and seen most evenings Jan. '78 (PMS).

BLUE PETREL *Halobaena caerulea*
Mason Bay, Stewart I., 1 dead Aug. '77 (RJS).

FAIRY PRION *Pachyptila turtur*
8 miles ESE from North Cape, 10 000+ along a line of scum and debris where two ocean currents or water masses met (NC). Three Kings, flocks of 20+ on 10/5 and numerous off C. Karikari, 11/5 (TGL). South side of Cook St., c.250 on 18/1 (DWW).

BLACK PETREL *Procellaria parkinsoni*
Dargaville, early June, 1 picked up alive (RF). Another, imm. ashore in Manukau below Titirangi (TGL).

FLESH-FOOTED SHEARWATER *Puffinus carneipes*
A few still off C. Karikari on 11/5 (TGL).

WEDGE-TAILED SHEARWATER *P. pacificus*
Mahuta Gap, W. of Dargaville, 1 dead on 20/4 (WJC).

BULLER'S SHEARWATER *P. bulleri*
N. of Three Kings, small groups on 10/5; off C. Karikari, several on 11/5, but few further south (TGL). 330 miles W. of C. Reinga, 1 on 4/12 (NC). In October, some fed at night just off the jetty at Paihia (DFC).

SOOTY SHEARWATER *P. griseus*
Foxton Beach, between 16/12 and 7/5 max. 14 on 21/1 (JL & MM).

FLUTTERING SHEARWATER *P. gavia*
Clive, c.1000 on 22/12. Foxton Beach, 100+ on 8/4. Wellington, c.200 on 2/6 (JL & MM).

LITTLE SHEARWATER *P. assimilis*
Near Three Kings, some on 10/5. C. Karikari - Whangamumu, several on 11/5; Bream Bay, small groups on 2/7 (TGL).

LEACH'S STORM PETREL *Oceanodroma leucorhoa*
1 ashore 3 km S. of Bayly's Beach on 2/8/78 (WJC).

GREY-BACKED STORM PETREL *Garrodia nereis*
Coast W. of Dargaville, 1 dead on 1/11 (WJC). Mt Aspiring, 3 or 4 dead at 2480 m, June '78 (L. Esler).

WHITE-BELLIED STORM PETREL *Fregetta grallaria*
Ninety-mile Beach, 1 dead on 23/4 (cf. *Notornis* 17: 75-76) (DEC).

RED-TAILED TROPIC BIRD *Phaethon rubricauda*
Far North: 4 sightings summer 77-78. Awanui Hr, 1 exhausted, heavily infested with black ticks (D. McD. Vincent, per ATE). Taupo, 1 alive on 14/5 (M. Hill, per JAB) cf. *Children of Tane:* 207.

AUSTRALIAN PELICAN *Pelecanus conspicillatus*
L. Clearwater, 1 early Feb. (per BB). Washdyke, 2 on 18/2 (AP). Wainono, 2 on 19/3 (PCL). cf. Notornis 25: 89-90.

GANNET *Sula serrator*
On return voyage from Noumea, first logged within sight of Three Kings on 11/5 (TGL). Muriwai, new colony on Pillar Rock, 93 chicks on 23/1 (BDH). Foxton Beach, max. 10 on 22/10. Imms. on 13/11 and 18/6 (JL & MM). Tasman Bay, rafts of 20-30, winter '78 (JMH).

BLACK SHAG *Phalacrocorax carbo*
L. Karapiro, nesting began in June and reached a peak in July, then continuing till November. 25 nests, one being used twice. Incubation c.31 days; fledging 42 days. Usually 3 chicks hatched and 2 reared to flying. L. Ngaroto, 2 small colonies of 3 and 6 nests (JH & BS). Horseshoe Lake, 10 nests on 21/8; L. Purimu, 22 nests on 18/9 (KVT). Foxton, 67 birds on pylons (JL & MM).

PIED SHAG *P. varius*
Kawhia Hr., 1 winter '78, first seen here (JH & BS). Ulva I., 5 roosting in Sydney Cove, 23/2 (BB).

LITTLE BLACK SHAG *P. sulcirostris*
Whangarei, feeding among moored boats on 3/7; wheezy, guttural calls heard from birds feeding at night, L. Rotoiti, on 9/6 (TGL). BoP, abundant, especially in winter (BG, PCL). Awaiti Reserve, c.40 prs nesting (PCL). Purangi est., Coromandal, 29 on 14/5 (DWW). Ahuriri, c.120 on 15/4; Ngaruroro est., c.40 on 24/6 (KVT). Petone, 3 on 1/12; 7 from 29/5 to 11/6 (JL & MM).

LITTLE SHAG *P. melanoleucos brevirostris*
Waipu est., max. 23 on 4/6, of which 9 were w.t., 5 l.p., 8 black imm. and 1 smudgy (TGL). Hobson Bay, colony continuously active from August-April, including w.t., l.p. and smudgy birds (MJT). BoP Awaiti Reserve, 16 prs nesting on 22/10 (PCL). L. Wanaka at Clutha outlet, 16, all w.t., on small boulders (PC).

STEWART ISLAND SHAG *Leucocarbo chalconotus*
Rock off Oban, c.30, half being bronze, on 24/2 (BB).

SPOTTED SHAG *Stictocarbo punctatus*

Vagrants to Far North: 1 at Te Hapua, juv. Feb. '78 (CAF); 1 Opua also Feb. '78 (DEC). Wanganui est., winter visitor, max. 8 on 16/7 (LJ). Large flocks return at end of May to fish in Tasman Bay; x 100 roosting Pepin Is. (JMH).

BLUE SHAG *S. steadi*

Ulva I., c.150 on offshore islet on 26/2 (BB).

WHITE HERON *Egretta alba*

The usual wide scatter, mostly of single birds, with many reports from BoP and Nelson estuaries. Also Kaimaumau, 9 on 23/8/78 (ATE, KB); Jordan's, Kaipara, 5 on 2/11 (BRK, RBS). Weymouth, April-June, 4 (GS, BJB, KF). L. Whangape, 5+ overwintered at Newby's farm (JC). Haumoana, 3 on 22/12 (JL & MM). Rabbit I., 4 on 24/3 (PCL). L. Forsyth, 6 on 14/8 (AH).

LITTLE EGRET *E. garzetta*

Whangateau, again 2 overwintering (GJHM, SPC). Estuary of Clevedon Wairoa, 1 at least from 23/4 - 7/6 (GKMcK). Manukau, Parau, 1 on 16/9 (CS); Waiuku, 1 on 9/9 (WR). Ahuriri, 1 on 10/7 and 1/4. Hurimoana, 1 on 28/7 (KVT). Manawatu est., 1 on 20-21/5 (JL & MM). Ohau & L. Horowhenua, 1 on 4/9 (BDH). Rabbit I., 3 on 24/1 (DWW), 2 on 23/2 (PCL).

CATTLE EGRET *Bubulcus ibis*

Many reports which are being collated elsewhere. An irruption of some hundreds began in the autumn. Flocks have returned to some old areas and seem to have deserted others. They have also appeared in new areas. One flock in the Lower Waikato had built up to 65 by mid-August.

NANKEEN NIGHT HERON *Nycticorax caledonicus*

L. Wairarapa, one reported near SW corner, spring '77 (DS).

BITTERN *Botaurus poiciloptilus*

Aratapu, 2 feeding on grassland among cattle on 11/9 (ATE). Tokaanu, 9 feeding out on open mud on 1/7 (AP, RWJ, GP). Ryburn's Lagoon, 7 feeding out on water weed on 5/1 (DAL).

GLOSSY IBIS *Plegadis falcinellus*

Waipapakauri, L. Ngatu, 3 arrived late April; shy; 2 on 15/5 Mrs McMillan per ATE). L. Wairarapa, 1 on 26/12 (BDH, DS, MDD). Taumutu, 4 on 18/9, 1 on 13/7 (AH).

WHITE IBIS *Threskiornis molucca*

BoP estuaries and lagoons, 1 all winter '77, last seen on 22/10 (PCL, BG). Manawatu est., 1 from at least 30/12 - 6/5 (JL & MM).

ROYAL SPOONBILL *Platalea regia*

A lean year in the North. Unahi, 2 winter '78 (ATE, KB). Kaituna, BoP, 1 in Nov. '77. Waitotara est., none from 28/8 - 16/4 (BDH). Manawatu est., present all months except Sept.; max. 28 on 12/3 (JL & MM). Ahuriri, 4 on 6/8/77 and 10/6/78 (KVT). Appleby marshes 5 on 7/8 (JMH), 16 on 24/3 (PCL). L. Wainono, 1, Feb. '78 (AP).

YELLOW-BILLED SPOONBILL *P. flavipes*

Unahi, 1 on 19/8/78; probably the same bird has now stayed for two years on or near Rangaunu Bay (ATE, KB, A & JP).

MUTE SWAN *Cygnus olor*
L. Poukawa, 16 on 14/8 (KVT).

CANADA GOOSE *Branta canadensis*
L. Waikare, bred in '77; 18 on 25/6 (BB, AH). Ahuriri, 10 on 5/11 (KVT). Southland, Waituna, 34+ on 18/2; Dawson Dam, 63 on 19/2; L. Luxmore, 320+ on 12/4; Kakapo Swamp, 11 on 12/4 (RRS).

PARADISE SHELDUCK *Tadorna variegata*
Widespread now in Northland. Paua, 48 on 18/10 (ARL). Waipu, 30 on 5/7 (TGL). Near Bayly's Beach, c.60 on 29/4 (WJC). Muriwai lakes, 49 on 12/2 (SMR). Jordan's, 1 pr on 5/6. Kidd's Bay, 15 on 24/6 (JRH). Tuakau, 12 on 9/7 (AH). Moehau, 1 pr on 16/7 (JH & BS). Matata, 155 on 6/5 (PCL). Kaituna, 7 on 22/4 (BG). Ngaroto, 22 in April. Oparau, 6 on 20/8 (BB, BS). Marakopa, 36 in Feb. (RM), 1 pr on 13/7 (RBS). Tokaanu, 21 on 24/3 (JC). Ahuriri, c.80 on 10/6; Puketitiri, 16 on 6/3; Hurimoana, 57 on 28/8; L. Poukawa, c.20 on 14/8; Horseshoe Lake, 15 on 21/8; L. Hatuma, 40+ on 17/12 (KVT, JL & MM). L. Wairarapa, 19 on 4/2; Papaitonga, 12 on 28/5 (BDH). Rabbit I. marshes, 26 on 24/1 (DWW), c.300 on 24/3 (PCL). Blenheim sewage ponds, 41 on 6/8 (AH). L. Rotoiti (Nelson), c.80 on 7/3; Hawea, c.80 on 12/3; Tekapo, 30 on 12/3, Kingston, 50 on 16/3; Kakanui, 30 on 17/3; Wainono, c.300 on 19/3 (PCL). Te Anau, Lagoon Creek tarns, 800+ on 12/4; Waimatuku, 40 on 17/3 (RRS).

GREY DUCK *Anas superciliosa*
Pure Greys are distinctly scarce Manukau, Firth of Thames (DAU, BB, HRMcK, RBS) and Hawkes Bay (KVT).

GREY TEAL *A. gibberifrons*
Port Whangarei, 4 on 24/6 (WJC). Waipu, 1 on 14/5 (TGL). Muriwai lakes, 32 on 12/2 (SMR). A.M.D.B. ponds, 40+ on 1/5 (JAFJ, RBS). Miranda, 14 on 12/1 (AH), 12 on 29/5 (ARL). Pokeno Valley, Ryburn's Lagoon, c.100 on 26/11, c.200 on 5/1 (DAL). BoP: flocks appear in autumn; Kaituna max. 40 on 22/4; Matata, 53 on 6/5 (PCL). Manawatu est., 6 on 6/5 (JL & MM). Abundant in Hawkes Bay: c.40 at Hurimoana on 28/8; 9 on L. Oingo on 8/10; c.80 at Ahuriri on 12/3 and c.350 on 10/6; c.100 on L. Hatuma, 25/6 (KVT); L. Purima, 26 on 17/12 (BDH). Barton's Lagoon, Martinborough, 34 on 22/1 (FNH). Swan Lagoon, Ohau, 11 on 8-17/12 (KLO). L. Wainono, c.40 on 19/3. Hooper's Inlet, c.40 on 18/3 (PCL). Te Anau, 31+ at Dawson Dam on 12/4 (RRS). Southland lagoons, 49 on 30/7.

BROWN TEAL *Anas chlorotis*
Gairloch, Fiordland, 2 on 21/3 (JVM).

N.Z. SHOVELER *A. rhynchotis*
Near Bayly's Beach, 20+ on 29/4; Port Whangarei, 13+ on 14/5 (WJC). Muriwai lakes, 34 on 12/2 (SMR). Manukau, a few frequent A.M.D.B. and farm ponds (RBS). Pokeno Valley, Ryburn's Lagoon, c.300 on 24/9; c.200 on 26/11 (DAL). Hamilton Lake, 4 on 9/5 (JC). BoP, visits all suitable waters: Matata, c.150, May '78 (PCL). Manawatu est., c.10 on 7/5 (JL & MM). Foxton No. 2, c.50. Thriving in Hawkes Bay: c.30 on Tutaekuri on 16/7; L. Poukawa, c.40 on 14/8; Horsehoe Lake, 5 on 21/8; L. Oingo, 21 on 8/10;

L. Hatuma, 40 on 25/6 (KVT). L. Horowhenua, c.100 on 6/5; 300+ on 16/6, some white-breasted (EBJ). Papaitonga, 1 white-breasted drake on 10/5 (BDH). L. Heron, young seen (BB). Southland lagoons, few on 30/7 (RRS). Middlemarch, Salt Lake, 11 on 24/9. Te Anau, near Terrace, 1 pr, June '78 (JVM).

BLUE DUCK *Hymenolaimus malacorhynchus*

Kaimai Range, Soldiers' Rd, 1 seen 1977 (J. Cheyne per BB). Mokau Falls, 1 on 14/1; Aniwaniwa bridge, 7 on 15/1 (WJC). Okupata Stream, Tongariro, pr with 3 ducklings on 3/1 (CS). N. of Raetihi, Manganu-a-teau, 3 on 29/1 (FNH). Whangapeka, 3 on Stony Creek; 1 on Taipo on 27/1 (RH). Mikonui R., pr at mouth of Tube River gorge, winter '78 (RHS). Fiordland, seen or heard Pointburn Valley, Kenneth Burn, Kintail Hut (JVM).

N.Z. SCAUP *Aythya novaeseelandiae*

Roundhill Lake, 30+ on 4/7; Kahuparere, Pouto, 6 on 26/3 (WJC). Muriwai lakes, scarce (SMR). BoP, small flocks visit open waters, e.g. Awaiti Reserve, 20 on 25/6 (PCL). L. Tarawera, c.200 on 25/9, Waikareiti, 25 on 19/1 (WJC, P & KM). Karapiro, 32 on 2/10 (DAL). Wanganui, L. Kaitoke, 5 April-June '78 (LJ). Horseshoe Lake, 30 on 21/8; Hurimoana, c. 50 on 28/8; L. Oingo, 28 on 8/10 (KVT). Kaikoura, L. Rotorua, 3 prs with young, Feb. '78 (AP). L. McGregor, 60+ on 2/2 (ARL) and 100+ mid-Feb. with many young (BB). L. Orbell, pr + 3 young on 12/2 (JVM).

HARRIER *Circus approximans*

Papakura, one chased off by a N.Z. Pigeon on 6/7 (BB). Wakapatu Beach, Southland, 10/5, one cruised to sea from sandhills, gained height rapidly, and flew towards Stewart I. at about 750 m (H. & W. M. Jukes).

N.Z. FALCON *Falco novaeseelandiae*

N.I. Urewera Nat. Pk., 1 on 26/1 (P & KM, WJC). Kaingaroa, 1 on 3/1 (PCL). Recorded winter '78, Pirongia (BB) and Waitomo (RBS). *S.I.* Little Wanganui R., 1 on 28/1 (RH). 1 on Mt Arthur above 3000 m (JMH). Middlemarch, Gladbrook, 1 often seen winter '77 (JVM). Blackmount, nest, 3 chicks on 20/12 (RRS). Harihari, 1 chasing small passerines out of bush, winter '78 (RHS).

BROWN QUAIL *Synoicus ypsilophorus*

Manukau, Awhitu, Coromandel, BoP, widely but thinly distributed, e.g. 3 coveys totalling 14; several coveys totalling c.40 (DWW, PCL, BB). L. Rotoiti, Okataina turn-off, 1 pr on 16/7 (AP).

WEKA *Gallirallus australis*

Birds from Rawhiti re-introduction have spread N. to Deepwater Cove and SW to Opua (DEC). Rawhiti, very noisy at 3 a.m. during electrical storm (MPK). Waipu est., increasing; Kawau I., calling on 5/2 (TGL). Ulva I., common; Golden Bay, 2 seen, 23/2 (BB).

MARSH CRAKE *Porzana pusilla*

L. Tiniroto, quite a few on 1/5 (AB). Ngatea, Rotorua, 1 on 15/4 (AP). Awarua Bay, in two places (RRS).

SPOTLESS CRAKE *P. tabuensis*

Aorangi, Poor Knights, widespread and feeding on forest floor (PMS). Tiritiri, thriving as the island reverts (John Craig). L. Rotoiti, several at Waiiti on 9/6 (TGL). Rotorua, Ngatea, 1 on 15/4 (AP). Hawera, 2 on farm pond, 12/12 (BDH). Aotea Hr, 2 prs in causeway swamp (BS, BB).

PUKEKO *Porphyrio melanotus*

Whangaparaca Pen., A.R.A. Seaside Park, up to 160 (RBS). Herne Bay, 2 and 8 flying over at night (TGL). Ahuriri, 88 on 10/7 (KVT).

COOT *Fulica atra*

Scarce north of Hamilton: L. Pupuke, 1 on 28/11 (JFW). Hamilton Lake, at least 3 pairs nested (BS), 21 on 26/5 (JC). Colonising more lakes on Volcanic Plateau: Rotoiti, Okewa Bay to Okere Falls, 108 on 22/7 (AP); L. Tarawera, 20 on 25/9 (PCL) and 20+ on 26/10 (CAF, RBS). Virginia Lake, c. 70 on 28/4; L. Kaitoke, breeding, chicks seen Dec. '76 (LJ). Elterwater, 1 on 4/2 (ARL). L. Heron, 6 on 10/2; L. Emma, 1 (BB). L. McGregor, 12 on 2/2 (ARL). Frankton, 1 on 16/3 (PCL).

S.I. PIED OYSTERCATCHER *Haematopus ostralegus finschi*

Paua, 40, Aug. '77; 22 in November; up to 40 in March '78; 45 in April and still 40 on 23/7 (ATE). Whangarei Hr survey, 1502 on 11/3 (MPK). N. of Roundhill on coast, 59 on 27/3 (WJC). Waipu, 8 on 6/7 (TGL). Kaipara survey on 25/3, c.13 000. Occupying fresh bays and inlets in Waitemata and Manukau in search of new feeding grounds, e.g. Shoal Bay, Parau, Mill Bay, Cornwallis (CS, JFW). Manukau census, 4594 on 13/11; 19 586 on 31/7; F.o.T., 1998 on 30/10; 7506 on 25/6 (BB *et al.*). Reclamation at Thames 1200+ on 25/2 (RBS), c.4500 on 16/5 (DWW). Kawhia, 1678; Aotea Hr, 250 on 25/2 (JH & BS). B.o.P. survey, only 144, 11-13/1/78. Bowentown, 155 on 15/3 (JC). Wanganui est., max.29 April-May '78 (LJ). Manawatu est., max. 75, 11/3 - 8/4 (JL & MM). Ahuriri, 17 on 12/3 (KVT). Waikanae, 17 on 22/5 (CAF, RBS). Heathcote-Avon est., 1000+ in Feb.; Karitane, c.50; Waitati, 1200; Haldane, c.60; Fortrose, c.120 (BB). Southland lagoons, 1056 on 30/7, 1013 on 27/12 (RRS, MLB).

VARIABLE OYSTERCATCHER *H. unicolor*

Te Werahi Beach, nest c/2 on 13/2 (CAF). Paua, between Aug. '77 and March '78 numbers (? sub-adult non-breeders) ranged from 20-35 (ATE). Waipu est., max. 67 on 29/7; 45 on 6/7/78 (TGL). Roundhill, 50+ on 31/12 (WJ, JCC). Mercury Bay, 30 mid-May (DWW). Rangiputa Bank, 7 on 31/10; a nest c/3 (JHS). Whangarei Hr, 64 on 11/3 (WJC). Bowentown, 17 (10 black, 7 smudgy) on 25/3 (JC). Sulphur Pt., max. 47 (KF). Kaituna, 53 on 5/3 (AP). Gisborne, Waikanae Creek, 10 (9 black, 1 smudgy) July '78 (AB). Raglan, 2 prs on 18/3 (RBS). Kawhia, 2 on 25/2 (JHS). Manawatu est. max. c.10 on 31/12 (JL & MM). Port Underwood, 3 on 26/1; Robin Hood Bay, 2 (DWW).

SPUR-WINGED PLOVER *Lobibyx novaehollandiae*

N.I. N. of Parengarenga, Shenstone Farm (3000 acres), W. Wymer reported 2 or more present spring '77 and later 7 or 8, some mobbing a Harrier; 2 on 3/4 (per MPK & ATE). Miranda, 1 from

at least 30/10 to 21/1 (RBS, AH). Near Tokoroa, 2 from at least 7/3 to 23/4 (J. C. Davenport). Rangikura, Waverley, 3; L. Waikato, Waitotara, 2 on 11/12, 3 on 15/4 (BDH). L. Kaitoke, 2 on 15/7 (LJ). Manawatu est., 7 on 2/1; Foxton No. 2, 2 prs on 3/6; Tangimoana, 4 on 12/3 (JL & MM). Ahuriri, 4 on 13/11; L. Hatuma, 2 on 20/11 (BDH) and 25/6 (KVT, CS). Carterton, 4 on 2/4; Waikawa Beach, Manakau, 2 on 12/5 (BDH). *S.I.* Rabbit I., 2 on 24/1 (DWW). L. Pearson, 3 on 7/2 (ARL). L. Tekapo, 10+ on 12/2; L. Waitaki, 15 on 13/2; Wainono and Hook Swamp, 25 (BB). Southland lagoons, 257 on 30/7; 122 on 27/12; Waimatuku, 90+ on 17/3 (RRS, MLB).

More data desirable on post-nuptial flocking.

GREY PLOVER *Pluvialis squatarola*

Paua, 1, Nov. '77 (ATE). Karaka, 1 on 13/8/78 (RC). Farewell Spit, 4 in Feb. '78 (AP, MDD, HAR); perhaps the same as seen a year before, i.e. 4 in Jan. '77.

EASTERN GOLDEN PLOVER *P. dominica fulva*

Paua, 350 during Nov. '77; later c.200; Jan. & Feb. c.100 (ATE). Whangarei, 3 on 11/3. Kaipara survey, c.50 on 25/3. Manukau Hr, only 5 on census 13/11; but 29 at Kidd's Bay on 15/1 (KF); c.40 on 12/2 (RBS, JAFJ) and 37 on 30/3 (MJT, BB). Firth of Thames, 96 on 30/10, mostly at southern end; odd ones seen in late summer at Miranda (BB, RBS). B.o.P., only 62 on summer survey in mid-Jan.: viz. Kaituna 11, Little Waihi 16, Ohiwa 32, Matahui Pt 3 (ATE *et al.*). Welcome Bay, 14 over the summer (KF). Ahuriri, 13 on 12/3 (KVT). Porangahau, 5 on 20/11 (BDH *et al.*). Westshore, c.20 on 19/12; Tangimoana, 1 on 12/3; Manawatu est., max. 2 (JL & MM). Rangitikei est., 4 on 17/1 (BDH). Fortrose, 7 on 25/2 (SLL).

NEW ZEALAND DOTTEREL *Charadrius obscurus*

Te Werahi Beach, c/3, hatching on 13/2 (CAF). Paua, no large flocks found (ATE). Rangiputa Bank, 16 on 31/10 (JHS). Roundhill Stream, occurs both N. & S. 10+ on 17/6 (WJC). Port Whangarei, 15 on 10/3 (MPK); 28 on 24/6 (WJC). Waipu, max. 44 on 14/5 (TGL). Miranda, max. 16 (BB). Manukau winter census, 23 (BB). Bowentown, 8 on 25/3 (JC). Kaituna Cut, 15 on 19/3 (AP). Ohope Spit, 48 on 30/4; 20 on 25/6 (RW). B.o.P. survey, c.70 in mid-Jan. (ATE). Opoutere, c.20 on 9/4 (BB). Kawhia-Aotea summer census, 6 (JH & BS). Farewell Spit, 1 mid-Feb. (AP). Awarua Bay, 5 on 27/12 (RRS).

BANDED DOTTEREL *C. bicinctus*

Paua, 370 in July '77; c.100 August; c.100 Jan.; c.500 Feb.; 200+ March & April; c.100 on 23/7; c.150 on 22/8, finely banded (ATE). Whangarei Hr survey, 355 on 11/3 (MPK). Waipu, 22 on 16/2; 23 on 14/5 (TGL). Roundhill, 12+ on 27/3 (WJC). Whangateau, 16+ on 7/5/77 (RBS). Kaipara survey, c.450 in March (CRV, BB). Manukau, 783 on winter census '78; F.o.T., max. c.100 on 16/3 (BB, RBS). Waikato est., c.50 on 21/5 (JRH). Bowentown, 215 on 25/3 (JC). Ohope, 274 on 30/4; 68 on 25/6 (RW). B.o.P. survey, c.220 in mid-Jan. (ATE). Kawhia, 91 on 25/2; 70 on 8/7 (JH & BS). Hawkes Bay, frequents all riverbeds and most beaches. Tutaekuri est., c.50 on 13/2 (KVT). Wanganui est., max. 27 on 18/3 (LJ). Rangitikei est., 40+ on 17/1 (BDH). Manawatu est., max. c.60 on 25/4

(JL & MM). Waikanae est., 21 on 22/5 (CAF, RBS). Tekapo and Cass River, still common in mid-Feb. A few at Swan Lagoon and L. Waitaki. L. Wainono, 20+ (BB, PJ). Southland lagoons, 32 on 30/7; 131 on 22/5 (RRS, MLB).

More counts of autumn and winter flocks would be welcome.

MONGOLIAN DOTTEREL *C. mongolus*

Kidd's Bay, Karaka, 1 from 13/11 - 22/3. When last seen, it was developing breeding plumage and was trilling and displaying to Banded Dotterels (BB).

LARGE SAND DOTTEREL *C. leschenaulti*

Paua, 1 in Nov. '77; 1 on 26/2 assuming breeding dress (ATE). Waipu, 1 from 2/2 to 16/2 (TGL). Karaka, 2 on 15/1; colouring by 29/3 (KF); and more coloured on 25/4; probably sub-adult (BB). Farewell Spit, 2 mid-Feb. (AP *et al.*).

BLACK-FRONTED DOTTEREL *C. melanops*

Kaituna, B.o.P., 2 on 11/9; 1 on 13/5 (PCL). Waitotara est., 1 on 16/4 (BDH, WFC). Wanganui est., 1 on 22/9/73 (LJ). Manawatu est., 1 on 20/5 (JL & MM). Southland, Waituna, 1 on 28/11 (RRS). Mataura I., 1 on 20/12 (L. Richards).

WRYBILL *Anarhynchus frontalis*

Paua, March '78, 80+; early April, 110; 20 on 23/7 (ATE). Roundhill Stream, 2 on 27/4; coast W. of Dargaville, c.10 on 9/5 (WJC). Port Whangarei, 120 on 11/3 (MPK); 120+ on 24/6 (WJC). Kaipara autumn survey, c.376 on 26/3 (CRV, BB). Manukau Hr, only 25 on summer census 13/11; winter population perhaps 1500, based on three roosting areas (a) Puketutu and A.M.D.B.; 500+ all winter; 602 on census, 23/7; small flocks crossing isthmus to Tamaki est. and upper Waitemata, e.g. c.40 on 2/7/78 (Rod Hay); (b) Wiroa I. and hovercraft ramp, c.80 on 3/9 (DWW); c.650 on 6/2; c.580 on 7/3 (RVJC, JAFJ, RBS); (c) Karaka, 550 on 24/6 (JRH). F.o.T., 289 on 30/10; 3817 on 25/6 (BB *et al.*). Port Waikato, 20 on 26/2 (AH); 24 on 21/5 (JRH). Sulphur Pt, Tauranga, max. 141 winter '78 (KF). Kaituna, 12 on 5/3, 38 on 16/4 (AP); 33 on 13/5 (PCL). B.o.P. survey, 45 in mid-Jan. (ATE). Gisborne, Muriwai Lagoon, 61 on 9/7/78, biggest local tally (AB). Ahuriri, 1 on 1/4; Ngarururo, 3 on 16/7, 2 on 27/5 (KVT). Porangahau est., 8 on 20/11 (BDH, MDD, HAR). Manawatu est., max. 32 on 11/3 (JL & MM). Ohau, 14 on 4/9 & 15/10; 3 on 5/11. L. Wairarapa, 1 on 4/2 (BDH).

FAR-EASTERN CURLEW *Numenius madagascariensis*

Paua, 4 on 15/10; 7 on 18/10 (ARL); 5, 14/11-28/1; 3 on 26/2 (ATE). Jordan's, 1 on 25/3 (RBS). Karaka, 1 overwintering 20/7 (SMR) and throughout summer till 30/3 (BB, MJT). F.o.T., 8 on 17/9, 11 on 14/2 (AH, HRMcK). Kawhia, 4 on 25/2 (JH & BS). Kaituna-Maketu, 2 on 9/10; 4 from 22/10 to 19/2 (PCL); 1 overwintering '78 (AP). Ohiwa, 1 on 13/1 (RBS). Manawatu est., up to 3, 8/10 - 9/4 (JL & MM). Farewell Spit, 13 mid-Feb. (AP). Southland lagoons, 1 on 27/12 (RRS). Fortrose, 1 on 25/2 (SLL).

ASIATIC WHIMBREL *N. phaeopus variegatus*

Paua, 4 on 20/10 (ARL); 9 on 3/11 (JHS); 23 on 28/1; 1 in April (ATE). Kaipara, 20 on 26/3 (AH, BB). Karaka, 2 on 13/11; 4 on 29/1 and 30/3 (BB, MJT). F.o.T., 19 on 30/10 (DAL); 1 overwintering on 25/6. Kawhia, 7 on 25/1 (JH & BS). B.o.P., 11 mid-

Jan., including 9 at Ohiwa (ATE, BB). Kaituna, 1 overwintering '78 (AP); Ohope, 2 on 25/6 (RW). Ahuriri, 2 on 17/12 and over summer (KVT). Farewell Spit, 13+ on 19/3.

AMERICAN WHIMBREL *N. p. hudsonicus*

Paua, 2 on 13/10 (JHS); 1 on 28/11, 2 on 28/1 (ATE). Jordan's, 3 on 12/3 (AH, BJB, BB). Karaka, 1 on 16/10 and probably on 26/11 (BB).

WHIMBREL (subsp. ?)

Miranda, 1 on 29/5 (ARL). Westshore, 1 on 20/12 (KVT). Invercargill est., 2 on 27/12 (RRS).

ASIATIC BLACK-TAILED GODWIT *Limosa melanuroides*

Port Whangarei, 1 on 24 & 25/6 (WJC, MKT). Nelson Haven, 1 suspected on 7/6 (JMH).

HUDSONIAN GODWIT *L. haemastica*

Paua, 1 early April (JRH, RJP). Whangarei, 2 on 11/3 (MPK).

EASTERN BAR-TAILED GODWIT *L. lapponica baueri*

Paua, c.3000 on 3/11; 2750 on 28/1; x 100 end of March-mid-April; c.100 July '78 (ATE). Port Whangarei, 1237 on 11/3 (MPK), c.55 on 24/6 (WJC). Rangiputa, c.3000 on 31/10 (JH & BS). Roundhill, 24 on 27/3 (WJC). Waipu, max. 36 on 16/2; 13 overwintering '78 (TGL). Jordan's, 4000 in Nov. (RBS). Kaipara, c.5200, autumn survey 25-26/3/78. Manukau, summer census, c.19 000 on 13/11; overwintering 1852 on 23/7. F.o.T., 4873 on 30/10; only 520 on 25/6 (BB *et al.*). Kawhia, 2509 on 25/2; c.100 on 8/7 (JH & BS). B.o.P. summer survey in mid-Jan., c.12 500, from Tauranga Hr. c.7450; Ohiwa c.3600; Kaituna c.1000; Little Waihi, 450 (ATE, RW *et al.*). Ohope, c.320 on 25/6 overwintering (RW). Ahuriri, c.50 overwintering '77; c.400 on 12/3. Tutaekuri, c.60 on 24/6 (KVT). Westshore, 550+ on 20/12 (JL & MM). Wanganui est., max. 60 in March (LJ). Manawatu est., max. 420 on 11/3 (JL & MM). Porangahau, 150+ on 19-20/11 (BDH, MDD, HAR). L. Wairarapa, 8 on 4/2, 4 on 8/4. Ohau, max 11 on 15/10 (BDH). Nelson Haven, c.800 during summer; increase in early March; c.100 overwintering (JMH). Appleby marshes, 32 on 24/3. Okarito, 4 on 9/3 (PCL). Waitati est., c.500 on 16/2 (BB). Hooper's Inlet, c.20 on 18/3 (PCL). Southland lagoons, c.870 overwintered '77; 2435 on 27/12 (RRS). Fortrose, 131 on 25/2 (SLL).

GREENSHANK *Tringa nebularia*

Te Werahi stream, just S. of C. Reinga, 1 on 13/2 (CAF). B.o.P., 1 near Matahui Pt on 27/11 and mid-Jan. (AP, PCL, BG). Manawatu est., 1 overwintering 20/4 - 4/6 (JL & MM). L. Wairarapa, 1 on 4/2 (BDH). Southland lagoons, 1 on 15/10 & 9/1 (MLB, RRS). Chatham I., 1 on 1/1/78 (RNT).

SIBERIAN TATTLER *T. brevipes*

Paua, 2 on 14/11 (ATE). Waipu, 1, 16/2 to 14/5 (TGL). Miranda, 2 early April (JRH, RJP). Kaituna, B.o.P., 1 from Dec. to March; later 1 in breeding dress on 28/5 (AP, PCL). Kawhia, 1 overwintering '78 (JHS). Farewell Spit, 1 mid-Feb. '78 (AP). Southland, Awarua Bay, 2 on 15/10 and 3 on 9/1 (?sp.) (MLB).

TEREK SANDPIPER *Xenus cinereus*

Karaka, 1 from 6/2 to 22/4 (BB, MJT, RBS). Wiroa I., 1 on 25/3 (DWW, SMR). F.o.T., 2 overwintered '77 (RBS); 3 on 23/9; 5 on 7/1 (AH); 4 still on 11/4 (BB, BHS). 1 on 12/5 (ARL). Ohope, 1 in spring '77, first B.o.P. record (RW).

TURNSTONE *Arenaria interpres*

Paua, c.600 in Oct., rising 674 on 19/10 (ARL), to 900 in Jan. (ATE). "Tremendous flock" ?3000 on 1/4 (RJP, JRH); c.700 on 11/4 (ATE). Rangiputa, c.550 on 31/10 (JHS). Waipu, usually some, max. 38 on 2/2; 3 on 14/5 (TGL). Kaipara survey, c.320, 25-26/3 (CRV). North Head, Pouto, 3 on 9/5 (WJC). Manukau, 560 on 13/11 but 585 at Kidd's Bay alone on 29/3 (BB); 55 on 23/7/78 winter census. F.o.T., c.300 on 9/10 (DAL); 236 on 30/10, summer census; 24 on 25/6 overwintering (BB *et al.*). B.o.P. summer survey, c.270, mostly near N. end. Bowentown, 255 on 25/3 (JC). Manawatu est., up to 5, from 30/10 to 24/1. Westshore, 1 on 20/12 (JL & MM). Ngaruroro est., up to 4, Nov. 77 (KVT). L. Grassmere, 39; Kaikoura, c.50 on 9/2 (BB, PJ). Southland lagoons, 341 on 30/7, overwintering; 914 on 27/12 (RRS). Fortrose, 84 on 25/2 (SLL).

KNOT *Calidris canutus*

Paua, c.3000 on 3/11, decreasing to only c.200 in Jan. and c.100 Feb.-March; c.140 on 23/7 overwintering (ATE). Rangiputa, c.4000 on 31/10 (JHS). Waipu, regular in summer, max. 167 on 10/3 (TGL). Kaipara autumn survey, 8000+ on 25-26/3 (CRV, BB). Jordan's, 250 on 5/6. Manukau, 5600 on 13/11, summer census, but 12 000 in Kidd's Bay at end of March and 1500 still on 25/4 (BB, RBS); only 704 on winter census '78; but 2000 towards end of July (KF). B.o.P. summer survey, only 7, the usual puzzling story; and they were at Kaituna where there had been 26 on 15/10 and where 6 on 11/6/78 were overwintering (PCL). Bowentown, 1 on 25/3 (JC). F.o.T., 3006 on 30/10; only 37 on winter census on 25/6 (BB *et al.*). Kawhia, 16 on 25/2 (JH & BS). Wanganui est., 2, Nov. '77 (LJ). Manawatu est., present 25/9-23/4, max. c.75 on 4/12 (JL & MM). Ahuriri, 7 on 5/11/77 (KVT). Porangahau, 30 on 19-20/11 (BDH, MDD, HAR). L. Wairarapa, 4 on 4/2. Ohau, 1 on 15/10; 11 on 16/10; 2 on 5/11 (BDH). Southland lagoons, 118 on 27/12; Little Waituna, 110 on 18/2 (MLB, RRS). Fortrose, 94 on 25/2 (SLL).

SHARP-TAILED SANDPIPER *C. acuminata*

Paua, after last year's record tally, only 1 found, on 14/11 (ATE). Whangarei Hr, 4 on 11/3 (MPK). Karaka, 3 from Nov. to Jan.; later 1 (BB). F.o.T., 1 on 23/9; 4 on 30/10 (RBS); 18 on 4/2 (AH); 13 on 16/3 (HRMcK, BB, RBS). Kaituna, max. 9, 26/2 and into March (AP, BG); 1 on 22/4 (PCL). Ahuriri, 14 on 28/11 (KVT). Manawatu est., up to 4, 8/10-9/4 (JL & MM). L. Wairarapa, 6 on 26/12 & 4/2; 4 on 8/4 (BDH, DS, MDD). Farewell Spit, 3 mid-Feb. (AP). Southland lagoons, 16 on 27/12 (RRS).

PECTORAL SANDPIPER *C. melanotos*

Miranda, 1 on 30/1 (BB), 2 on 14/2 (PCL) and possibly 4 (AH). Maketu, 1 dark sandpiper continually harassed by the local Sharptails; but identity not confirmed (AH, PCL). Ahuriri, 1 on 12/3 (KVT). L. Wairarapa, 1 on 26/12 & 4/2 (BDH).

CURLEW SANDPIPER *C. ferruginea*

Paua, c.40 on 1/11 (JHS); 20+ on 28/11, then up to 12 till 11/4 (ATE). Gt. Exhibition Bay, 5 on 29/1 at stream mouth (MPK). Whangarei, 1 on 11/3 (MPK). Kidd's Bay, 1 overwintering on 4/6 (DAL); on 30/9, a flock of c.25, flashing white-rumps, clearly seen (BB, BJB); but evidently moved on. F.o.T., 23 or more overwintered. Influx in Sept., c.50 on 22/9, 50+ on 19/10 (HRMcK, JH & BS); 53 on 7/1; 47 on 4/2 (AH). 33, some well coloured, still on 12/5 (ARL). Manawatu est., 2 on 15/10 (JL & MM).

RED-NECKED STINT *C. ruficollis*

Paua, 14 on 3/11 (JHS). 6+ throughout summer, some on 25/3 being well coloured. 1 on 23/7/78 overwintering (ATE). Rangiputa, 1 on 31/10 (JHS). Kidd's Bay, some overwintered. 12-14 throughout summer, but 2 of these were 'difficult' (BB, RBS, JAFJ); 10 still on 22/4; 6 overwintered (BB). Miranda, 8 on 30/10 and all summer till 11/3 (ARL); 3 on 30/4 (BB). Kaituna, 2 in Jan. AP); 6 on summer survey (ATE). Rangitikei est., 2 on 17/1 (BDH). Farewell Spit, 13 in mid-Feb. '78 (AP). L. Grassmere, 3 on 9/2 (BB).

SANDERLING *C. alba*

Waituna, 1 on 14/2 (AP).

PIED STILT *Himantopus leucocephalus*

Paua: in spring numbers declined from 100 to 31 on 28/11; 250 by 28/1 and 800 by 28/3; 800+ on 23/7/78 (ATE). Whangarei, 632 on 11/3 (MPK). Waipu, max. 30 on 14/5 (TGL). Kaipara autumn survey, c.6100, 25-26/3 (CRV, BB). Manukau, 1344 on 13/11; 2790 on 23/7. F.o.T., 255 on 30/10; 2487 on 25/6 (BB, RBS). Kawhia & Aotea, 260 on 25/2; 102 on 8/7 (JH & BS). Waitomo, prs back in paddocks on 13/7. B.o.P. summer survey, 2345 (ATE). Wanganui est., max. 280, winter '78 (LJ). Manawatu est., max. c.200, 11-25 Feb. (JL & MM). L. Wairarapa, c.650 on northern mudflats, 4/2 (BDH). L. Grassmere, c. 200 Feb. '78; low numbers elsewhere in S.I. in Feb. (BB). Kaituna, L. Ellesmere, 278 on 14/8 (AH). Swan Lagoon, Ohau, 84 on 8-17/12/77 (KLO). Little Waituna, 112+ on 18/2 (MLB).

BLACK STILT *H. novaezealandiae*

Jordan's, 3 smudgies on 12/3 (BB). Wiroa I., 1 on 15/1 (RVJC) and 1 smudgy on 7/3 (RBS). Karaka, 2 on 25/4. Miranda, 1 on 25/6, all smudgy (BB). Kawhia, only 1 all winter '78 (JHS). Tokaanu, 1 smudgy, 1-15/1 (AP). Nelson Haven, 1, Nov. (GQ). Kaituna, L. Ellesmere, 1 on 30/7 (AH). L. McGregor, 1 on 7/2 (ARL). Smudgies seen at Grassmere and Wainono (BB). Lower Waiau, 1 on 28/3 (H. Morris per RRS). Glenmore, 1 on 12/3 (PCL). Swan Lagoon, Ohau, 11, incl. 3 smudgies, on 8-17/12 (KLO).

ORIENTAL PRATINCOLE *Glareola maldivarum*

Raoul I., 1 on 28-31/5//76 (L. Andrews per JAB).

SOUTHERN SKUA *Catharacta lonnbergi*

1 off C. Karikari on 11/5; probably this, possibly *maccormicki* (TGL).

POMARINE SKUA *Stercorarius pomarinus*
Te Awanga, 1 light-phase imm. on 20/12 (JL & MM). Farewell Spit, 2 in Feb. '78 (AP). Off Punakaiki, 1 on 4/2 (DO).

ARCTIC SKUA *S. parasiticus*
Bayly's Beach, 1 on 26/12. Kaipara Heads, 1 on 31/12; 5 on 9/5 (WJC). Foxton Beach, max. 4 on 8/4. Te Awanga, up to 10, 18-21/12 (JL & MM). Napier S., 2 on 19/11 (KVT). Punakaiki R., 3 on 4/2 (DO).

SOUTHERN BLACK-BACKED GULL *Larus dominicanus*
Napier, c.3000 near sewage outfall on 18/2. L. Hatuma, 10 on 25/6 (KVT).

RED-BILLED GULL *L. novaehollandiae scopulinus*
Numerous between Three Kings and mainland on 10/5 (TGL). Rangiputa, c.660 nest-building, 12 nests with eggs on 31/10 (JHS). Hikinui I., Opoutere, a few nesting on 27/12 (BB). East Clive, c.60 on 18/2; Ngarurоro, c.200 on 24/6 (KVT). Otago Hr, x 1000 feeding on krill, 13/3 (PCL).

BLACK-BACKED GULL *L. bulleri*
Manukau, up to 8, 14-26/11 (KF); 1 on 5/6. F.o.T., 81 on 30/10; no nesting confirmed this summer (BB, RBS); 420 on 25/6. B.o.P. summer survey, 32 all at Ohiwa on 13/1 (ATE, PCL). Tarawera est., winter visitor, up to 11 (PCL). Kawhia, 3 on 25/2 (JH & BS). East Clive, c.200 on 18/2. Ngarurоro est., c.600 on 24/6 (KVT). Small numbers all seasons from Turakina to Otaki (JL & MM, BDH). L. Wairarapa, 122 on 4/2 (BDH). L. Wainono outlet, x 100; Waitaki est., x 1000; All Day Bay, 5000, mid-Feb. (BB). Southland, October survey '77, 37 breeding colonies visited, 3 missed on Eglinton R. Est. c. 75 000 breeding pairs (RRS).

BLACK-FRONTED TERN *Chlidonias albostriatus*
B.o.P., 25 on 17/7 at Tarawera est.; 5 on 14/8; then 2 on 12/3; 16 on 25/6 and 27 inland near Awaiti Reserve. Matata, c.40 inland during gale on 18/6 — all told, c.58 wintering in the district (PCL). Ngarurоro est., c.45 on 24/6 (KVT). Manawatu est., 1 on 25/4 (JL & MM). Waikanae est., c.70 on 22/5 (CAF, RBS). Rough I., mid-Feb. up to 16 (JMH, PDG). Motueka, 2 offshore on 13/6 (JMH). Kaikoura, 2 on 9/2. McKenzie country, few; but c.70 on L. Waitaki on 13/2. Wainono, 3 on 14/2; Waitati est., 1 on 16/2 (BB). Mossburn, 132+ coming downstream to roost on Oreti riverbank at 4.35 p.m. on 12/4. Waimatuku, 70+ on 17/3 (MLB).

WHITE-WINGED BLACK TERN *C. leucopterus*
Miranda, 1 on 16/11 (HRMcK, BB). B.o.P., Kaituna, 1 on 9 & 15/10 (AP, PCL). Manawatu est., 1 on 12/3 (JAB). Pauatahanui, 1 on 12/2 (Mrs I. McArthur per JAB). Nelson Haven, 1 on 10/1 (JMH). Waimea est., 2 in mid-Jan. (PDG).

GULL-BILLED TERN *Gelochelidon nilotica*
Jordan's, 3 seen several times between July '77 and June '78 resting with Caspian and Little Terns on edge of wader-pack or feeding over paddocks (DFB, SPC, BRK, RBS, JRH). Waiuku sandspit, 1 on 11/8 (BB). Southland, Awarua Bay, 1 on 11/2 (RRS). Eight-mile Beach, Westland, 1 on 5/8 (DO).

CASPIAN TERN *Hydroprogne caspia*

Rangipita, c.138 — 31 nests c/1-3; some broken eggs; some scrapes on 31/10 (JH & BS). Waipu est. max. 7 on 14/5 (TGL). Roundhill Stream, c.85 on 31/12; 32 on 27/4 (WJC, JCC). Manukau, 78 on 13/11; 158 on 23/7: F.o.T., 23 on 30/10; 80 on 25/6 (SMR, BB). *Waikato* est., 90 in a tight group on 25/9; c.100 nests on 19/11 and c.200 adults in attendance; c.200, including c.100 flying young; also 9 almost flying, 1 chick and 7 nests, each c/2 on 15/1 (DAL). B.o.P. summer survey c.250 (ATE). Sulphur Pt, Tauranga, 131 on 26/2; 80 on 26/6 (KF). Rotorua Silica Flats, 46 on 20/4. Whakamaru 2, Kuratau on 9/7 (AP). Ahuriri, 7 on 1/4 (KVT). Kawhia-Aotea, 103, Feb. '78 (JH & BS). Manawatu est., max. 32 on 11/3 (JL & MM). Kaitorete Spit, 1 pr c/1 on 19/11 (AH). Southland lagoons 30/7/77, 8 (RRS). Woodend, 57 prs breeding; 38 chicks banded (MLB).

ANTARCTIC TERN *Sterna vittata*

Port Pegasus, 1 pr seen western end; 3 prs in Islet Cove; breeding proved on 12/1/78 (NC).

FAIRY TERN *S. nereis*

Waipu est., present at all seasons, 2 on 29/7/77; 3 on 6/7/78 (TGL). Tauranga, SulphurPt, 1 all year, associating with Little Terns but not quite of them and sometimes rebuffed (KF, BG).

LITTLE TERN *Sterna albifrons*

Rangiputa Bank, 43 on 31/10 (JH & BS). Kaipara: Jordan's, up to 7 in Nov. (RBS); autumn survey, 44, 25/26/3 (CRV); Tapora, 8 on 11/5 (BG, RH). Manukau: Kidd's Bay, up to 13, Jan.-March (KF); Yates Dam and Hihi Creek, 7 on 12/4 (JAFJ, RBS). F.o.T., 6 on 30/10 and over summer; 4 on 30/4; 1 on 25/6 (BB). B.o.P.: Sulphur Pt, 8-10, Nov. '77 to May '78 (KF); summer survey in mid-Jan., 13, 5 being at Ohiwa (ATE). Manawatu est., 3 on 24/10; 1 on 6/11 (JL & MM). Pauatahanui, 1, 31/10 - 2/11 (AG, BDH). Motueka spit, 3 on 6/2 (AP). Karamea, 1 dead, 10/9 (N. Stopforth).

WHITE-FRONTED TERN *S. striata*

Rangiputa Bank, 100+ on 31/10, no eggs (JHS). Waipu est., max. c.200 on 14/5 (TGL). Roundhill, c.650 and a colony of c.100 prs on 31/12 (WJC). Mercury Bay, 320 on 15/5 (DWW). F.o.T., E. coast S. of Coromandel Hr, c.70 nests on 10/12 (J. McCallum). Whatipu, 1500+, very excitable on 19/9 (RBS). B.o.P., big feeding flock stretching from Maketu to Little Waihi, with compact groups of Fluttering Shearwaters, on 4/5 (KF). Rotorua, 1 after gale on 20/4 (AP). Ngararoro est., colony of 600 dwindled to 8 and one chick by end of Dec. (KVT). Manawatu est., max. 150 on 4/12 and 25/2 (JL & MM). L. Wainono, Waitaki est., Karitane x 100 in mid-Feb. Stewart I., c.450 feeding off Ackers Pt, as well as 300, including young clamouring for food, on rocks (BB). Woodend, Invercargill est., 30+ nests on 26/12 (MLB).

WHITE TERN *Gygis alba*

Palmerston North, 1, June '72, reported by O. Burmeister, flying round D.I.C. building (per JAB).

GREY TERNLET *Procelsterna cerulea*

2 miles N.W. of Groper Rock, 1 on 25/2 (TGL).

KAKA *Nestor meridionalis*

Whangarei Heads, calling at Peach Cove, 2/7 (TGL). Waiheke, 1 on 17/12 (JES). Urewera, seen and heard daily, Jan. 78 (WJC). Hurakia State Forest, 9, Pureora, 9+ on 18/8 (ET). Coromandel, a few (BB, RC). Strays at Ngatea and Patumahoe feeding on Banksias and flowering gums. Moehau, a small flock on 22/10 (DAL). Milford, 4 on 15/3 (PCL).

RED-CROWNED PARAKEET *Cyanoramphus novaezelandie*

Aorangi, Poor Knights, second commonest land bird (PMS). Bream I., several on 3/7 (TGL). Ulva I., outnumbers Yellow-crowned (BB).

YELLOW-CROWNED PARAKEET *C. auriceps*

Urewera, all positively identified were of this species (WJC). Present in Hurakia and Pureora State Forests (ET). Ketetahi Springs, 1 pr in Miro, Aug. '76 (CS).

SHINING CUCKOO *Chrysococcyx lucidus*

Waipu, well-grown chick fed by Riro between 17/2 & 20/2 (TGL). Mt Somers, 1 heard on 9/2 (BB). W. of Blenheim, 1 imm. on 6/3 (PCL).

LONG-TAILED CUCKOO *Eudynamis taitensis*

Dargaville, 1 chased by Blackbird on 30/9 (RAF). Coromandel Pen., only 1 heard, 24/10 (BB). Otanewainuku, c.10 seen, more heard on 14/1. Franz Josef, juv. fed by pair of Brown Creepers on 10/3 (PCL).

SPINE-TAILED SWIFT *Chaetura caudacuta*

Coast W. of Dargaville, 1 dead on 17/12 (WJC). Bethells Beach, 1 dead on 3/12 (Tina Thomas). Punakaiki, 2 over the bush on 11/11 at dusk (DO).

N.Z. KINGFISHER *Halcyon sancta*

B.o.P., notable increase in winter when "the visitors" are seen all along the sandhills, swamps and coastal areas where they are absent in summer (KF).

KOOKABURRA *Dacelo gigas*

Several reports from Wenderholm, Puhoi, Warkworth (MJT *et al.*).

RIFLEMAN *Acanthisitta chloris*

Moehau on 16/7/78 (JH & BS). Wairapukao forest edge, Kaingaroa, c.10 in native bush on 3/1 (PCL). Rocky Hill Rd, Te Wharau, Wairarapa E. coast (RHDS). Peel Forest, 2 on 11/2 (BB).

ROCK WREN *Xenicus gilviventris*

Mt Oates, 1 above 2000 m (Peter Tucker per BB).

TREE MARTIN *Hylochelidon nigricans*

Punakaiki est., 1 from 5/6 to 3/7 (DO).

WELCOME SWALLOW *Hirundo neoxena*

Kerikeri. A pair which raised three broods in a pumphouse 77/78, roosted nightly in the nest, March-June (ATE). Aorangi, Poor Knights, nest c/4 (PMS). Widespread in winter flocks: Thornton, c.100 on 17/7 (PCL); L. Tiniroto on 1/5, x.100 (AB); Hawkes Bay, 20-60 over any lake (KVT); Hokio Beach, 45 on 26/2 (EBJ); Nelson Haven, 50+ often (JMH). Southland: "The puzzle continues. Many turned up again and in larger numbers than ever before. Where do

they come from? Where do they go in the spring? The very cold weather in June caused a rash of reports from urban areas. One bird was seen feeding over a lagoon with icicles attached to the end of its tail feathers." (RRS).

PIPIT *Anthus novaeseelandiae*

Aorangi, Poor Knights, 1 on 5/1 (PMS). Records in the north now mainly coastal, e.g. Waipu, 1 in flight on 14/5 (TGL); Jordan's, 3 on 25/3 (BJB, RBS). Muriwai cliffs, where a nest c/3 was found by Geoff Moon; Awhitu Pen., Opoutere, Papamoa, Kaituna (BB, PCL). Elusive around Rotorua, but pr nesting in bank at Tarawera, 26/10 (CAF, RBS). Foxton Beach, 2 on 24/1 (JL & MM). Tauranga Bay, C. Foulwind, 4; Hokitika-Kaniere, 12 on 9/3 (PCL). Inland Canterbury and McKenzie country, few (BB). Old Man Range, c.4500 ft on 6/1 and Pisa Range c.6200 ft on 25/2, gleaning invertebrates from surface of snowfields (PC).

HEDGE SPARROW *Prunella modularis*

Waipu, 1 singing on 5/6, first for some time. A marked decline is apparent around Auckland; but persists in coastal scrub, e.g. several singing at Whatipu on 19/9 and at Hamilton's Gap on 19/8 (RBS) and along B.o.P. from Mt Maunganui to Ohiwa; also on Coromandel Pen., nest c/5 on 10/12 (PCL, BB *et al.*). Fox Glacier, 3 on moraine close to snow on 11/3 (PCL). L. Heron and Peel Forest (BB).

FERNBIRD *Bowdleria punctata*

Pouto Pen., widely distributed (WJC, RAF). Awhitu Pen., Aka Aka swamp, Opoutere, persisting and locally doing well (BB, RBS). Ngatea, Rotorua, 2 on 15/4 (AP). Matata, 3 on 6/5 (PCL). L. Ellesmere, 2 along Drain Rd on 12/8 (AH). Awarua Bay in three places on 11/2 (MLB).

BROWN CREEPER *Finschia novaeseelandiae*

Okarito, 6 in manuka scrub on 9/3. Franz Josef, 6+. Milford, c.10 on 14/3 (PCL). Noted at Blue Cliffs, Waitati, Tautuku, Oban; and more common than Fantail on Ulva I. (BB).

WHITEHEAD *Mohoua albicilla*

Urewera, common (WJC). Thinly distributed around Rotorua (RBS). Otanewainuku, c.10 seen and many more heard (PCL). Wairarapa E. coast, Rewa State Forest (beech) in July; Rocky Hill (mixed forest) Nov. '77 (RHDS).

YELLOWHEAD *M. ochrocephala*

Haast Pass, 8+ feeding in crotches of big beeches and sending the detritus raining down. Also singing strongly; 13/3 (PCL). Jan.-March, seen Lower Garnock Burn, Mt Luxmore, Eglinton Valley, Walker Ck (L. Monowai); Hauroko Burn Valley; lower Seaforth and Spey valley: Wilmot Pass (JVM).

FANTAIL *Rhipidura fuliginosa*

Aorangi, Poor Knights, population estimated at 10 (PMS).

PIED TIT *Petroica macrocephala*

Waipoua, reasonably common (WJC). Waitakeres, much more numerous than expected (JFS). Hunua Range, 31 along 4 km of Kohukohunui track on 6/8/77 (TGL). Pirongia, numerous (JH & BS). Coromandel Pen., locally common (BB). Carterton, imm. male on 9/1 in town garden (RHDS).

ROBIN *P. australis*
Otanewainuku, fair population (PCL, BG).

SONG THRUSH *Turdus philomelos*
Levin, anting on lawn, 28/3 (EBJ).

BLACKBIRD *T. merula*
Aorangi, Poor Knights, 4 occupied nests found (PMS). Levin, anting on lawn, 22/4 (EBJ). Rock and Pillar Range, c.1200 m, singing in *Hebe odora* scrub on 16/12 (PC).

SILVEREYE *Zosterops lateralis*
Levin, few seen winter '78 (EBJ). Lincoln College, 28/7, one seen to steal food from a House Sparrow (AH).

BELLBIRD *Anthornis melanura*
Aorangi, Poor Knights, abundant, breeding finished, Jan. '78 (PMS). Coromandel Pen., found to be common by all teams, Labour Weekend surveys '76 & '77 (BB). Otanewainuku (B.o.P.), numerous (PCL). Ulva I., plentiful and feeding on berries of *Coprosma ?australis* (BB).

TUI *Prosthemadera novaeseelandiae*
Red Hill, Papakura, up to 7 in June attracted by flowering gums (GLY). Pokeno Valley, 10/7, 2 feeding on ripe Privet berries. This happens annually, the Tuis leaving before dark and heading back to the hills (DAL).

YELLOWHAMMER *Emberiza citrinella*
Foxton Beach, c.500 near No. 1 lake on 3/6 (JL & MM).

CIRL BUNTING *E. cirlus*
Middlemarch, Gladbrook Station, 1 pr Oct. '77 (JVM).

STARLING *Sturnus vulgaris*
Poor Knights, up to 20, Jan. '78 (PMS).

INDIAN MYNA *Acridotheres tristis*
Poor Knights, up to 26, Jan. '78 (PMS). Opoutere, 9/4, partial albino, with head and part of the neck white, and the body pale grey (BB).

KOKAKO *Callaeas cinerea*
Several reports of small populations in different parts of native forest from Taranaki to Coromandel and Urewera. Pirongia — full song on 3/12 (JH & BS). Kohukohunui on 6/8, one seen feeding parrot-fashion on *Polypodium diversifolium, Asplenium flaccidum* and *Melicytus ramiflorus* (TGL).

BLACK-BACKED MAGPIE *Gymnorhina tibicen*
Kerikeri Inlet, 1 with rather narrow black band across back. Hybrid? (ATE).

WHITE-BACKED MAGPIE *G. hypoleuca*
S. Pisa Range, Mt Dotterel, 5 at c.1800 m (PC).

ROOK *Corvus frugilegus*
Miranda, now up to c.60; sometimes feeding over seaside pastures which a few years ago were intertidal flats dotted with small mangroves (BB, RBS). Bay of Plenty, an occasional straggler (RW, BG). Little River, Banks Pen., 22 on 18/6 (AH).

SHORT NOTES

HELPERS AND SCROUNGERS AT STARLING NESTS

At Belmont (41°10'S 174°54'E) near Lower Hutt, a study of about 400 pairs of Starlings *(Sturnus vulgaris)* began in 1970. 500 nest boxes are arranged in groups about 100 m apart, with 10 or 15 boxes 2-3 m apart in each group. The boxes are on old concrete buildings in the middle of a 1500 ha sheep farm, with very few natural nest sites available within 3 km. All fledglings from the area are banded and carry a colour band to indicate the year they hatched. Practically all adult females, and a few males, are individually colour banded. First clutches are laid from mid-October, and second clutches in early December.

Starling chicks calling in the nest often attract passing adults, especially towards the end of the breeding season when many have no young of their own to look after. Thus, on 26 December 1977 while I was watching from a hide 5 m away, four or five adults in addition to the parents entered a nest box singly between 1800 and 1900 hrs and spent 2-3 minutes inside before flying off. These included a five-year-old male, a one-year-old female which had nested 20 m away earlier in the season, and three visits from at least two (probably three) different unbanded males. None of the visitors fed the nestlings, then nine days old, and the parents showed little aggression towards these strangers, which were allowed to perch 1-2 m from the box. Remarkably, no adult strangers visited this nest box in 17 other hours of observation spread over eight days, from 24 December 1977 to 7 January 1978.

The commonest visitors are young males, which do not normally breed in their first year (Kessel 1957). In the past eight years I have seen at least 30 banded first-year males entering nest boxes containing chicks, at various times during the breeding season. Like De Haven and Guarino (1970), I have not noticed these males helping or hindering in any way, although some have been reported to brood the young (Kluijver 1938), and carry nesting material or food (Schuz 1943; Wallraff 1953). Kluijver (1933) suspected that they might also remove eggs.

Schantz (unpubl. 1938, MS quoted by Kessel 1957) also noted that early-fledged juvenile starlings visited and entered the box while other nestlings were still there. Warden (1975) watched a juvenile from the first brood enter a box and be fed by the parents who were feeding a second brood. He assumed that the juvenile then fed the nestlings, but Johnson and Cowan (1974) suggested a more sinister role: " Often fledgling starlings from other nests parasitised nest cavities already occupied by less developed nestlings. In some instances these

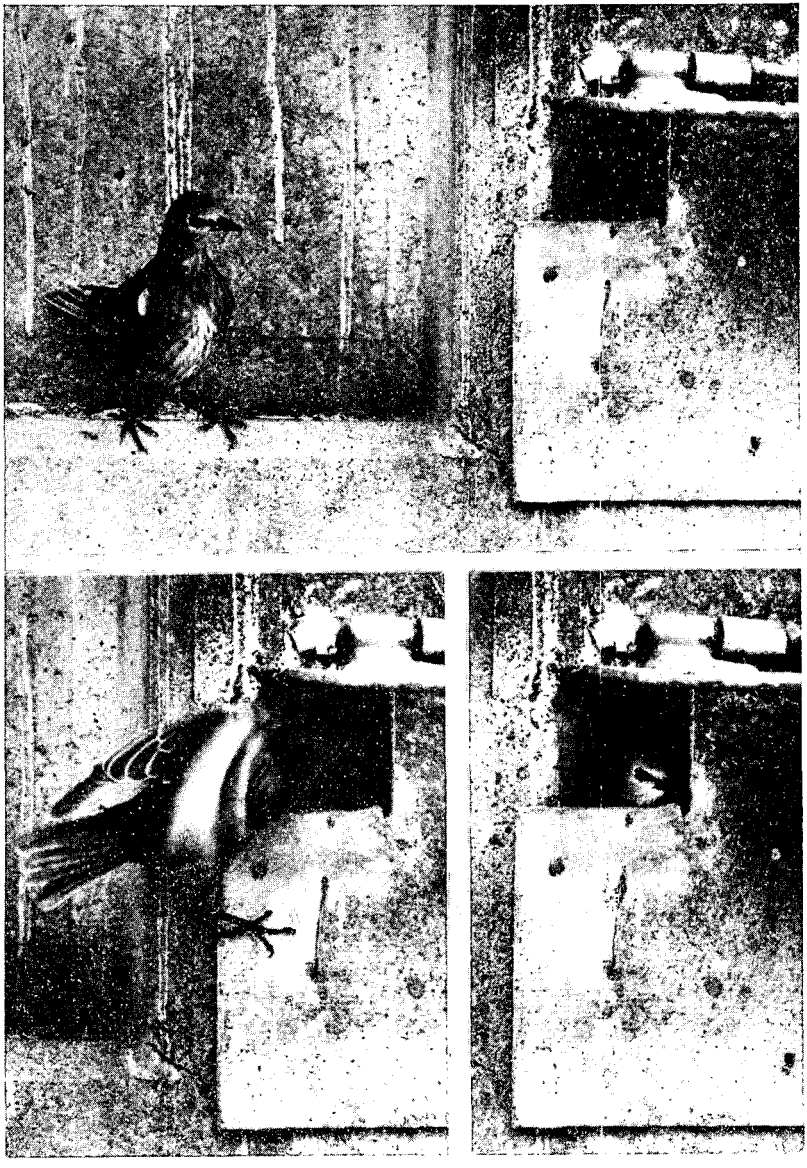

FIGURE 1 — First-brood juvenile Starling (note single dark feather on breast) at nest box containing 3 second-brood chicks 19 days old on 5 January 1978. Top: looking around cautiously after being chased off once by adults. Left: entering box. Right: waiting at entrance to be fed.

nest parasites actually consumed most of the food brought by the parent birds, which resulted in death of the original brood." At 0900 hrs on 5 January 1978 such a juvenile arrived at the nest box, and, although vigorously chased by the parents, returned and entered a few minutes later (Fig. 1). It took up a position at the entrance, but the resident chicks, now 19 days old, attacked from the rear and bundled it out. The same juvenile (unbanded, so not from a local nest box, but recognisable by the single feather of the autumn plumage on its breast) returned almost at once and repeated its entry and ignominious exit. Neither parent arrived with food while the scrounger was at the entrance, but it might well have been fed if the nestlings had been smaller. Similar well-fledged juvenile strangers were seen trying to enter other occupied boxes on 10 and 26 December 1977 but were chased off by the adults. Scrounging may be more effective at isolated, dark nest sites than in my nest boxes, and its incidence in different populations and its evolutionary implications would be a fascinating study.

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JOHN E. C. FLUX, *Ecology Division, DSIR, Private Bag, Lower Hutt*

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GOLFING GULLS

Some years ago, when the only golfer in our district lived nearly 5 km away across a river, I was puzzled to find the occasional golf ball on my farm paddocks. It was only when I became a golfer and began hitting practice balls in the paddocks and not always recovering them, that I discovered that the culprits were Black-backed Gulls *(Larus dominicanus)*.

Several times I have watched these gulls pick up a ball, fly about 40 m above the ground and drop it, repeating this several times. It is not uncommon to find golf balls in the stock water-troughs when I clean them out annually and I presume the gulls have dropped them there. A neighbour 1.5 km away finds balls which the gulls have carried from my practice area to his farm.

So far, the gulls have not obliged by picking up my ball on the golf course and dropping it in the hole !

W. M. JUKES, *Springhills, R.D. 6, Invercargill.*

Corrigendum: **Would members please alter the transposed captions which appeared on pages 207 and 208 of the last issue (Vol. 25, part 3; September 1978). We apologise to Mr Fox for this unfortunate error. — Ed.**

AUSTRALIAN PELICANS IN CANTERBURY

Australian Pelicans *(Pelecanus conspicillatus)* were reported in Canterbury from 18 December 1977 to 4 June 1978. During this period sightings of one and two birds were reported from a number of localities and three birds were reported from one locality.

The first sighting (18 December) was of a single bird on the Opihi River, at Butler's Crossing, Pleasant Point, by P. W. Welch, reported in the *Timaru Herald* of 23 December. A local fisherman reported to me subsequently that a pelican visited the Opihi River mouth daily throughout January and February. On 22 December, a pelican was seen by D. Warren on his farm pond, which is on the north side of the Rangitata River near the Arundel bridge and, at about the same time, two large birds, apparently pelicans, were seen flying farther upstream, near Peel Forest. One was reported from the Rangitata River mouth in early January by S. Robertson. A pelican was seen at Washdyke Lagoon on 3 January by F. B. Ross. This bird stayed in the area and from mid-February was joined by another

FIGURE 1 — Australian Pelicans on the South Canterbury Coast, February, 1978. Photo: **Timaru Herald**

bird. These birds were seen on the lagoon frequently until at least 11 March. During this period they probably commuted the 10 km to the Opihi River mouth where sightings of two pelicans were also reported.

After 11 March the pelicans began moving greater distances. On 19 March two were seen at Lake Wainono, 50 km farther south, by P. C. M. Latham . Two were back at the Opihi River mouth from 24 to 27 March and then from late March to early April local residents reported up to three pelicans together in the Lake Wainono area. They were last seen in this area on 4 April and by 11 April two had returned to Washdyke Lagoon.

A more distant sighting was made on 16 February by G. Guy on the coast at Birdlings Flat, at the northern end of Lake Ellesmere. He saw a pelican flying north, about 200 m offshore. This bird was observed until it disappeared finally into the distance.

On 27 April, following a report in the *Timaru Herald,* I searched the Seadown Beach just north of Washdyke Lagoon and found a dead immature female pelican in moult (det. J. A. Bartle, National Museum, Wellington). It had been shot and had been dead about a week.

The last reported sighting (4 June) was of a single bird on a farm pond in the Morven/Glenavy area of South Canterbury.

These sightings show that pelicans move about from one water body to another over a short period of time. Because of this it is difficult to ascertain the total number of birds in a particular area. Sightings from South Canterbury show that there were at least three pelicans in the area. The Birdlings Flat pelican was probably a fourth bird.

The pelicans were seen mainly on shallow coastal waters and occasionally on the sea, close inshore. When not swimming the birds were resting either on low mud banks or in shallow water.

Before 1976 there had been only one record of this species from New Zealand, on the Wanganui River in 1890 (OSNZ Checklist, 1970). In August/September 1976 one was seen in the Kaipara Harbour (Edgar 1978, *Notornis* 25: 89-90) and one died in Southland in late November 1977. During July and August 1977 there was an apparent influx of Australian Pelicans to mainland New Guinea and its outlying islands (Newsletter 135, New Guinea Bird Society). It was suggested that this influx was related to the drying out of the central Australian 'desert,' which had held pelicans for some years. These latest New Zealand sightings show that Australian Pelicans have moved greater distances in their search for suitable habitat.

I thank Mr F. B. Ross and Mr G. Guy for making their observations and notes available to me.

P. M. SAGAR, *Flat 2, 362 Hereford St, Christchurch 1.*

[See further records of these pelicans in Class. Summ. Notes, this issue. — Ed.]

ASIATIC WHIMBREL CATCHING CRABS

On a visit to the Maketu estuary, Bay of Plenty, on 21 January 1978, B. D. Heather, C. de Lange and I spent half an hour watching an Asiatic Whimbrel *(Numenius phaeopus variegatus)* feeding on the Tunnelling Mud Crab *(Helice crassa)*. Each tunnel was probed gently and slowly after the bird had assumed some awkward-looking positions as it eased its bill down. When an occupant was found at home, it was secured with a quick downward lunge, followed by a screwing motion of the head and bill. On being withdrawn from its burrow, the crab was dropped and the bird took a fresh grip in order to batter its prey on the ground with a few hard sideways and downward swipes. The crab was then swallowed whole with a quick backward toss of the head. During the time, the bird moved about very quietly, feeding within about 1 m^2. By contrast, nearby Bar-tailed Godwit *(Limosa lapponica)* kept moving ahead conspicuously, covering many metres, probing frequently, vigorously and apparently at random.

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

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FERAL BARBARY DOVES SHEDDING RAIN DROPS

A small group of feral Barbary Doves which spend much time in my garden, content to perch in a tree and preen freely, adopt a different posture during periods of steady or heavy rain. Normally they perch in a more or less horizontal position but in rain they assume an almost vertical posture, thereby shedding the rain drops, and occasionally give themselves a good shake. In this way they keep their feathers remarkably dry.

R. STIDOLPH, *Masterton*

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LETTERS

The Editor,
Sir,

THE UNSEXING OF THE CAPE PIGEON

Mr Sibson (Notornis 25: 149) appears not to have done his homework on the correct gender of *Daption* Stephens 1826, for as recently as 1974 G. E. Watson reviewed the matter (Auk 91 (2): 419-421). Apparently the name appears as *Daption capenses, Daption capensis* and *Daption capense* in Stephens' work. Dr Watson's argument that Stephens intended the neuter form to be used seems to have been accepted by procellariiformists. He concluded by quoting the International Code of Zoological Nomenclature (1961, Article 30 (b) (ii)),

that the gender of an anagram is that " expressly attributed to it by its author, or implied by an originally associated species group name." Furthermore *Daption* is actually cited in the Code as an example of a neuter anagram !

JOHN WARHAM

Zoology Dept., University of Canterbury, Christchurch 1. 20 July 1978

The Editor,
Sir,

In his wide-ranging study of the Reef Heron *(Ardea sacra)*, A. T. Edgar (Notornis 25 (1): 25-58, 1978) states that this species " is dimorphic, having a white and a dark phase." This is inaccurate; through parts of the species' range there are three colour morphs — grey, white and mottled (Mayr & Amadon, 1941, Wodzicki & Laird, 1970), but only the grey phase is resident in New Zealand. A single New Zealand record of a white phase bird which remained on the Wairau Bar for at least 18 months (Wodzicki & Eyles, 1945, a and b), was probably a straggler from the north (Fiji?).

KAZIMIERZ WODZICKI

Hon. Lecturer in Zoology, Victoria University of Wellington
19 July 1978

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The Editor,
Sir,

Mr R. B. Sibson's difficulty in accepting the neuter gender of *Daption* will, I am sure, vanish when he reads the Note on this subject published over four years ago by Dr G. E. Watson 1974 (Auk 91: 419-421). The error perpetrated over the last 100 years or so by the use of *capensis* instead of *capense* as the specific epithet associated with *Daption* for the Cape Petrel or Pigeon has now been thoroughly exposed and there is nothing more to be added.

As Mr Sibson rightly points out (though for the wrong reason), the recent Australian checklist (Condon, H. T. 1975. Checklist of the Birds of Australia, I. Non-passerines. Melbourne: RAOU) is in error in listing *Daption capense australis;* it should, of course, be *australe.* This has already been noted in a review by G. M. Storr 1976 (Australian Wildlife Research 3: 91-92) and will no doubt be corrected in any future edition.

G. W. JOHNSTONE

Antarctic Division, Department of Science, 568 St. Kilda Road, Melbourne, 3004, Australia. 15 August 1978