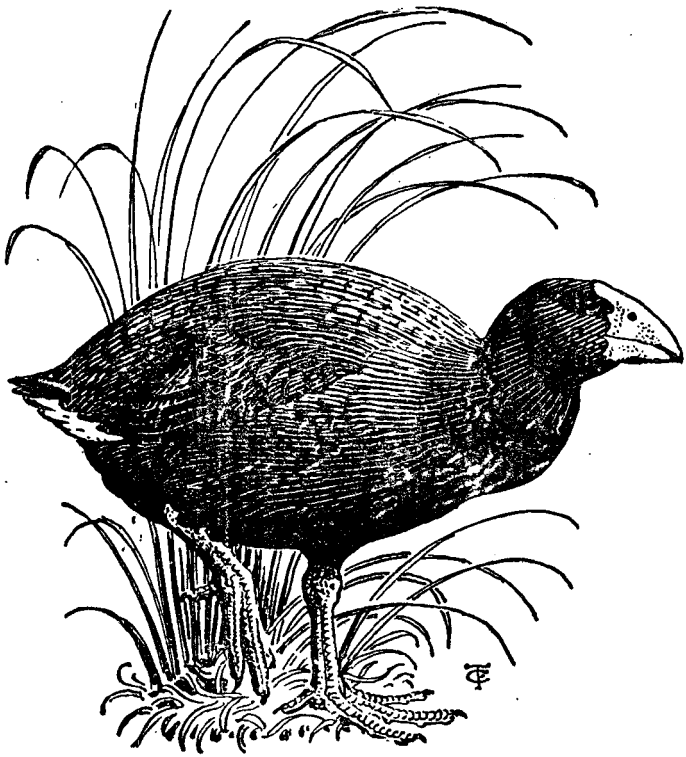
NOTORNIS

Journal of the Ornithological Society of New Zealand



Volume 19 Part 1 March 1972

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CONTENTS

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NOTORNIS

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Editor: E. W. Dawson,
P.O. Box 8009,
WELLINGTON.

VOLUME 19 PART 1 MARCH 1972

EDITORIAL

'What do you read, my lord?'

'Words, words, words.'

W. Shakespeare, 'Hamlet,' Act II, Scene II.

Polonius might well have been asking the question of the editor of *Notornis,* or of any other editor for that matter. Words are an editor's life blood but he likes neither too few nor too many of them. It is comforting to have sufficient in hand for the next issue, but as Jeremy Bentham pointed out some 200 years ago: "The more words there are the more doubts may be entertained about them." A change of editor is an excuse for an editorial which, at least, lets me say a few words about words right at the beginning.

What sort of journal is *Notornis*? Should it be semi-popular or semi-scientific? Or might it be said to be quasi-scientific or even pseudo-scientific? Need it be one thing or the other? I believe that *Notornis,* the journal of a society of over 1,200 members from every walk of life and of every age group, should reflect the interests and activities of that society without restricting itself to either a broadly amateur or narrowly professional approach to ornithology. This, after all, is what brings us together as members of the Ornithological Society of New Zealand. *Notornis* is, therefore, both a journal of ornithology and the journal of an ornithological society. It is a myth that the leading ornithological journals of the world, such as *The Ibis* and *The Auk,* are exclusively scientific; science and quality are not necessarily synonyms. The membership of the BOU and the AOU is perhaps just as varied as our own. It is, in fact, quite fair and not at all immodest to say that through the efforts of my predecessors, Mr R. H. D. Stidolph (10 years as editor) and Mr R. B. Sibson (15 years), *Notornis* has reached an enviable position amongst the world's bird journals, taking its place, in due proportion, with those of Europe and North America which we know and enjoy. The balance of amateur and professional work which characterises New Zealand ornithology at the present time will be maintained in the pages of *Notornis* and no reader or contributor need fear a change. My first experience as an editor was with a university capping magazine and, as well may be imagined, I quickly learned that it was impossible to please everyone. I do not expect to be any more successful with

Notornis in this respect, but every reader should feel that there will be something of interest for him in each issue. Some papers will appear superficial or inconsequential to certain readers; if they serve to stimulate or encourage more profound work, such contributions will earn their place. Other papers, because of their more technical nature, will appeal only to a limited group of readers. I hope, however, that whatever subject matter appears in *Notornis* will be there for sufficient reason. We are, in fact, in our own hands. Contribute the sort of thing you like to read and the balance will be kept.

What is an editor's job ? Surely not to rewrite an author's contribution and yet this is what very often happens even if such was not the intention. There are, it is true, editors who seem to pride themselves that they have a better vocabulary than the author and prefer their words to his. This is an unnecessary demonstration of an editor's talents, destroying not only the author's style, but often his spirit as well. The editor's job, as I see it, is to know the features of a good manuscript and to transform, with the help of both author and printer, whatever is offered to him into an acceptable printed paper worthy of the journal and its readers. This he does by following well-established rules of editorial procedure in assessing it for accuracy, conciseness, clarity, consistency and logic. Because he is neither omniscient nor infallible, he will most often seek advice and criticism from one or more confidential referees. Such referees often go to great trouble to assist both the editor and the author and, contrary to some beliefs, are on the author's side. The Society must be very indebted to them. Referees are not always specialists in the subject of the contribution but may be chosen as intelligent readers able to assess the worth and logic of a contribution, giving a fair judgement on the facts presented and the argument or theory developed from them. Certainly any contribution that is " scientific," that is, one translating an observation into a hypothesis, deserves to be criticised scientifically and rendered intelligible and appealing to the greatest number of its readers. An inflexible system of refereeing, without favour or regard for rank, eminence or age, provides both the author and the journal with what has been called " control by anticipation " of the standards expected of both.

What, then, is the author's job ? Primarily, it is to present his contribution in such a way as to make life as easy as possible for the editor, the referee, and the printer. This means, in effect, following the ' Instructions for Authors ' carefully and submitting the manuscript in a condition that requires the minimum amount of work to turn it into the printed page. Regrettably, contributions are sometimes received in such a state as to cause much extra work for all who subsequently must handle them. Few of us realise, for instance, how much the Society owes to its printers, Te Rau Press Ltd, Gisborne, who, as was very evident to me on my first visit there, have our interests so much at heart that they have never spared themselves, within the technical resources at their disposal, to help the OSNZ achieve and maintain a fine standard of publication. They are not, however, mind readers, any more than is the editor, and they cannot be expected to achieve perfection unless the best is offered to them.

A detailed ' Instructions for Authors ' is given in the final pages of this issue and a shortened version will appear inside the back cover in the future. Please study it carefully and follow it when preparing your next contribution !

Readers of *Notornis* will see some changes in the form and arrangement of this issue and if any of these offend I beg for toleration. Most of the changes have been made for technical reasons, making the printers' task easier and thereby reducing costs for the OSNZ. Other changes bring *Notornis* into line with standard practice for similar publications as given in the " Code of Recommended Practice for the Form and Presentation of Periodicals of Permanent Value " issued by the Standards Association of New Zealand. And who would deny that *Notornis* is a " periodical of permanent value " ? Further changes must be anticipated, in particular a complete change over to the use of metric or SI units for all those Imperial measures so familiar to us. Publishers have been asked to go metric during 1972 and surveys and mapping will change officially early in 1973. This may be a confusing time for many of us but contributors are asked to conform to the new system as best they can.

Finally, I would welcome, and indeed encourage, controversy and discussion in the pages of *Notornis*. Too often a paper is printed and becomes accepted fact even if its readers hold contrary views, reticent though they might be in expressing them. Too many myths have already appeared in New Zealand ornithology about matters that are said to be " well known " or are spoken of but never published. Letters to the Editor and critical reviews will always be welcome.

The Editor's desk is clear. We await a flood of well-presented, clearly-expressed and stimulating contributions, short notes, reviews and letters.

THE LAUGHING OWL SCELOGLAUX ALBIFACIES (GRAY, 1844)

A GENERAL SURVEY OF A NEAR-EXTINCT SPECIES

By G. R. WILLIAMS and M. HARRISON

ABSTRACT

The Laughing Owl *(Sceloglaux albifacies)*, one of the two owls native to New Zealand, was once widely-distributed but is now close to extinction — if not already so. It began to disappear in the North Island in the early 19th century or before, and rapidly became scarce in the South Island after about 1880. It has not been "officially" seen since 1914, though persistent reports of its continued presence in parts of the South Island are still received. The species' appearance, calls, behaviour, food habits and breeding biology are described and speculations made about the reasons for its disappearance.

INTRODUCTION

Two species of owl are native to New Zealand — the Morepork *(Ninox novaeseelandiae)*, which also occurs in Australia and belongs to a widely-distributed genus, and the Laughing Owl *(Sceloglaux albifacies)*, which is the only representative of an endemic genus. Both were originally fairly widespread — the Morepork predominantly in forest, the Laughing Owl predominantly in open country. The Morepork is still common in most areas of suitable habitat, but the Laughing Owl is close to extinction. Although there have been no confirmed recent sightings, circumstantial evidence is in favour of its continued survival, at least in the South Island.

The European Little Owl *(Athene noctua)*, liberated in a number of places in the South Island between 1906 and 1910, is now common in open country in many districts. It has been reported from the southern part of the North Island and from Stewart Island but its continued presence has not been confirmed in either place.

DESCRIPTION

Since there has been no fully-substantiated record of Laughing Owls since 1914 and it was already rare long before then, we have to rely on authors such as Buller (1873, 1883, 1888, 1905), Smith (1884) and Potts (1870) for first-hand accounts of the living bird.

Size: Mounted specimens give the visual impression of being twice as big as those of the Morepork; and a fresh specimen weighs about 21 oz. (0.6 kg) according to Rowley (1876-1878). Falla *et al.* (1966) give the length, apparently "of the flying bird from the tip of the bill to the tip of the tail" (p. 14), as 15 in. (i.e. 37.6 cm),

though this is more likely to be the bill-to-tail measurement of a mounted specimen or study skin. Buller (1905) recorded a female as having a length of 17.5 in. (c. 44 cm) and Potts (1870) gave the following measurements for three specimens, the first of which was fresh and the third Gray's (1844) type specimen:—

	1	2	3
Bill	1.4 in (i.e. 3.6 cm)	—	1.4 (3.6 cm)
Tarsus	2.8 in (7.2 cm)	3⅜ (8.5 cm)	2.5 (6.4 cm)
Wing	13 in (32.5 cm)	10¼ (25.7 cm)	11.0 (27.7 cm)
Length	17.3 in (43.5 cm)	16⅜ (41.2 cm)	15.5 (38.8 cm)

Gurney (1896) reported a tip-to-tip wing span of 28 in. (c. 70 cm) on a fresh specimen. All the above data refer to South Island birds.

Plumage: Potts (1870), Buller (1873, 1888) and Gurney have described the fresh plumage in considerable detail, and more recent descriptions incorporating these and the examination of a series of skins have appeared in Oliver (1955) and Falla *et al.* (1966). To quote the latter:—

> " A large owl with yellowish-brown plumage striped with brown; white stripes on scapulars (sometimes also feathers edged white rather than yellowish-brown on hind-neck and mantle); face white behind and below eyes, greyish towards the centre, the feathers with brown shaft-lines; wings and tail brown with brownish-white bars; tarsus (feathered) yellowish to reddish-buff; toes " fleshy brown " or " pale yellow "."

Smith (*in* Buller 1883) recorded that there is a very full post-nuptial moult between December and February, during which the birds become almost naked — an observation made on captive birds. Newly-hatched young are sparsely covered with coarse yellowish-white down, the abdomen being bare (Buller 1888).

Other Parts: The eyes are " a very dark brown, large and rather prominent; beak and nostrils [are a] . . . gray horn colour; claws, which are not in the least pectinated, are the same, with dark tips. Its toes have long bristly hairs on the upper surface . . . The eyelid is gray, and the toes and soles of the feet are reddish-brown, the latter covered with numerous small spicules." (Gurney 1896).

Distinction from Morepork: Although there is, apparently, only a partial overlap of habitat, there is sufficient for confusion to be possible on this ground alone. In addition, the Morepork is the only species with which the Laughing Owl is likely to be confused if more than a fleeting glance is obtained; for the Little Owl, although occupying much the same habitat as the Laughing Owl, is very much smaller (smaller even than a Morepork), paler and more diurnal. (Fig. 1).

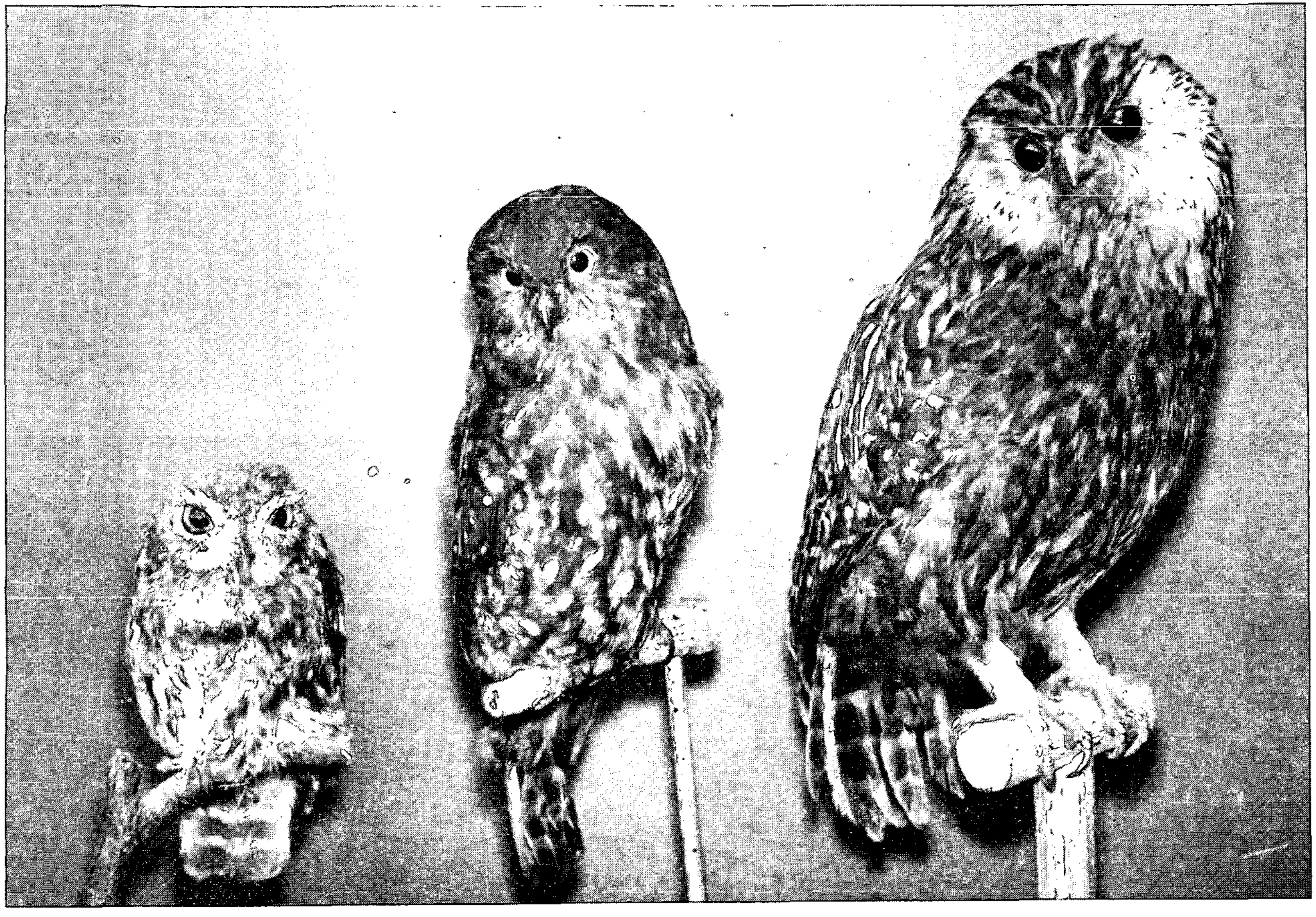

FIGURE 1 — The three New Zealand owls. From left to right: Little Owl, Morepork and Laughing Owl. (Specimens by courtesy of the Dominion Museum).

Apart from its large size, white face and brown (rather than golden) iris, the Laughing Owl is yellower and more clearly streaked and mottled on the back than the Morepork. Its underparts and head are less streaked and mottled and its tail is noticeably proportionately shorter.

Calls: Potts (1870) described a series of " doleful shrieks " similar to, but louder and more strident than, a call of Cook's Petrel. Black (*in litt.* to H. R. McKenzie), who knew the bird well in South Canterbury about 70 years ago, stated that the cry was a " prolonged cack-cack-cack " which could be heard incessantly on rainy nights and which was similar to, but slower and more gutteral than, the call of the Mottled Petrel. Smith (*in* Buller 1883) said calls varied seasonally and that the voice of the male was harsher and louder than that of the female. The evening call of a captive pair was " in waking up . . . precisely the same as two men cooeying to each other from a distance." Buller (1888), also remarking on captive birds, described peculiar barking noises " just like the yelping of a young dog " and miscellaneous mewings and chucklings. It is said that, in the wild, the birds' calls are more frequent at dusk, especially before rain or when drizzle is falling. Since none of the calls described seems similar to those made by the other two owls, petrel-like calls heard after dark in suitable habitat (see below) are now the best indication of the possible presence of Laughing Owls.

TAXONOMY

Australia's only genus of the subfamily Striginae, *Ninox,* is obviously a more recent arrival in New Zealand than *Sceloglaux* — the late Pleistocene (approximately 15,000 years B.P.) as against the Neogene (1 - 25 million years B.P.) according to Fleming (1962).

The genus *Sceloglaux* (Kaup, 1848) is restricted to New Zealand and is provisionally divided into two subspecies — *S. a. albifacies* (Gray, 1844) in South and Stewart Islands and *S. a. rufifacies* Buller, 1904, in the North Island. The origin and affinities of the genus have never been satisfactorily determined.

Although two subspecies are currently accepted (OSNZ Annotated Checklist, 1970) such acceptance rests more on the basis of theory than fact. Only two recent specimens have been taken from the North Island, both of which are now lost, and one of these, the missing type specimen of *S. a. rufifacies,* has been the subject of controversy. It was obtained in the Wairarapa district in 1867 or 1868 and described by Buller (1904). When examined by Rothschild, Hartert and Hellmayr in the Tring Museum the specimen was judged to be immature and to have been fitted with a tail belonging to *Ninox* (Rothschild 1907). Furthermore, Rothschild had specimens of the South Island bird which closely resembled it in colour. However, on account of the rufous face of this single example he was prepared (provisionally no doubt) to accept Buller's claim for a new

subspecies. According to Scarlett (*in litt.* & in prep.), Buller's observation that the North Island subspecies was smaller than that of the South Island is not supported by the comparison of measurements of subfossil bones — " North Island bones are often as long as any from the South."

The type of the South Island subspecies was obtained at Waikouaiti by Earle about 1843 (Gray 1844) and is now in the British Museum (Natural History), London.

Since the distance from the New Zealand mainland to the Chatham Islands is about 400 miles it seems reasonable to suppose that the Laughing Owls once found there (Forbes 1893, Dawson 1960) might constitute yet another subspecies; unless, of course, they were only a temporary, vagrant population.

HABITAT

According to Potts (1870) and Smith (1884), who were the most familiar with the living bird, the species was generally found in and around rocky areas, either in open country or at the margins of scrub or forest. It apparently hunted for its food over open ground, perhaps spending an appreciable amount of time on the ground itself, and roosted and nested in fissures in rocks (having an alternative name of rock owl as well as its common Maori name of whekau). The maps show the distribution of records of the species and of limestone outcrops. Though there is a considerable overlap, it is obvious that the Laughing Owl did occur in other rocky places as well. In European times the main geographical range appears to have been the eastern foothills of the Southern Alps from about Dunedin northwards to inland Marlborough and Nelson — and especially in the central part of this region; though its relative abundance there may be, at least in part, a reflection of the "abundance" of interested observers. Be that as it may, it is from this central part that many of the unconfirmed reports of the continued presence of Laughing Owls still come.

DISTRIBUTION

General: All records plotted on the maps are those of actual sightings, bones or eggs. We have had to use some discretion in mapping the sight records — only those made by " competent ornithologists " have been accepted, and even here a subjective judgment is required. If the reports have reached us second-hand, we have accepted them providing the interviewer has been an ornithologist willing to vouch for the reliability of the original observer. Only reports citing definite localities have been used — obviously, records such as " Fiordland," " Canterbury," " Nelson " have had to be ignored when mapping. Reports based on calls have been disregarded because of the difficulty of assessing their reliability.

There are no acceptable records of Laughing Owls in the North Island north of a line joining Cape Egmont with East Cape

and very few in the South Island west of the Southern Alps. These gaps cannot be taken as accurately reflecting the true range (there are, even now, unconfirmed reports of Laughing Owls in the rough limestone and forested country west of Mt Pirongia and in the Urewera country). But the North Island gap could at least be taken as an indication that the process of extinction was much in advance of that in the South Island. According to Best (1908), there were Maori recollections of Laughing Owls being present in the Urewera country up to about 1855 but the birds had been getting scarcer since about the time European settlement began. Buller (1905) gave the 1840s as the period at which the diminution in numbers first became apparent.

In the South Island there appears to be nothing in Maori tradition to give any idea of early range or abundance; in European times the main falling-away of the species seems to have occurred, generally, during the last quarter of the nineteenth century. The paucity of records from Stewart Island permits of no speculation on the history of the species there, and all that can be said of its extinction on Chatham Island is that it must have pre-dated any European occupation.

North Island: Of the ten records, only one refers to this century, five refer to the period between about 1850 and 1900 and the rest are subfossil or midden material.

Details are as follows (see Fig. 2):—

1. Waikohu, near Te Karaka, 1889, one seen (Buller 1905)
2. Near Mt Egmont, 1854, specimen taken, later lost (Buller 1905)
3. Near Purangi, Waitara R., about 1930, one seen (OSNZ Recording Scheme)
4. Kaimanawa Range, 1890, sight record assumed (Oliver 1955)
5. Dartmoor, subfossil bones (Scarlett, pers. comm.)
6. Hukanui, subfossil bones (Scarlett, pers. comm.)
7. Wairarapa "about 50 miles from Wellington, 1868-9, adult female," N.I. type specimen, lost (Buller 1904)
8. Martinborough, subfossil bones (Stidolph 1921)
9. Paremata, pre-European, bones in midden (Scarlett, pers. comm.)
10. Near Porirua, before 1892, bird nested in hut (Buller 1892)

We have not accepted the Little Barrier Island record (Hutton 1869, Turbott 1961) because of the vagueness of the description and the possibility of confusion with petrels. However, if Laughing Owls did reach the Chathams there is no reason why they should not have been able to reach Little Barrier, though their occurrence there would be far north of any other of which we have record.

South Island: As was found for Kakapo and Takahe (Williams 1956, 1960) records of all kinds are more numerous for the South Island than the North and the species has apparently survived longer there. Of the 40 records for which there are dates 40% refer to

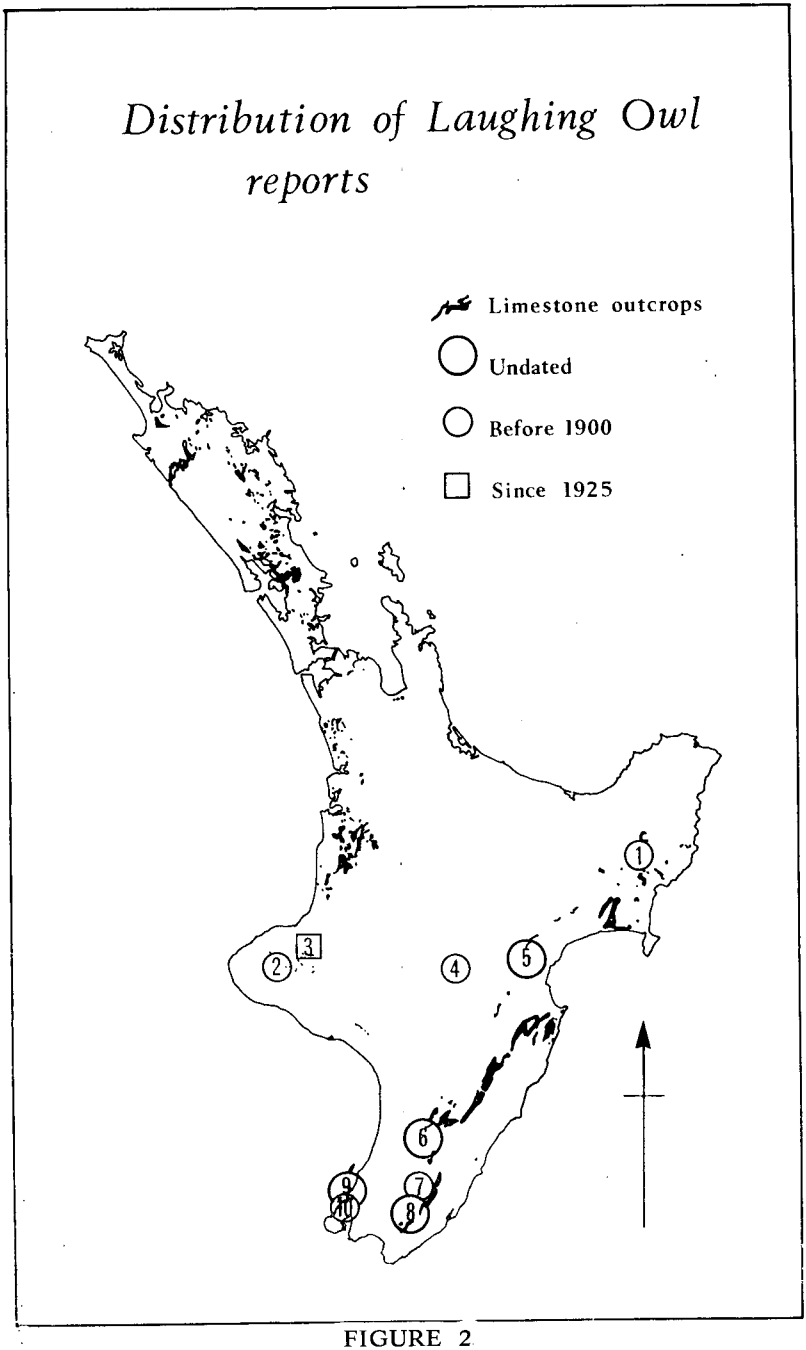
Distribution of Laughing Owl reports
Limestone outcrops
Undated
Before 1900
Since 1925
1
2
3
4
5
6
7
8
9
10

FIGURE 2

the period 1843 - 1875, 25% to the period 1876 - 1900, 22% to 1901 - 1925 and 13% to 1925 - 1960. Though there have been a few reports since, from North Otago and Fiordland, none of these is acceptable, though there is good reason to hope that some may eventually be confirmed, as the informants seem reliable and most of the reports refer to areas known to lie within the species' range.

The distribution of the records for the various periods, including those undated or subfossil, suggests more of a widespread gradual decline in numbers than a shrinkage in geographical distribution, though there have been no reports from Southland or north- or mid-Canterbury for nearly a century. These former areas of distribution are probably those most generally modified by man.

Stewart Island: Only two records are known, neither of which refers to this century. This could imply near- or complete extinction, a lack of suitable observers, or both. Most of the island's 700 sq. mi. are still little modified, but the area of suitable habitat would not be extensive and is probably limited mainly to the north and north-western sectors. Since Stewart Island's avifauna has suffered proportionately less change than those of North, South or Chatham Islands (Williams 1962) its chance of still supporting Laughing Owls must be fair.

Chatham Islands: Acceptance of the species' occurrence on Chatham Island depends solely upon bones identified by Forbes (1893) and their identity confirmed by Dawson (1960).

(A) **Subfossil, midden and undated material** (Fig. 3)

1. Takaka and Golden Bay, subfossil bones, Canterbury Museum
2. Lake Grassmere (Marfell Beach) subfossil bones, Canterbury Museum
3. Rakautara, subfossil bones, Canterbury Museum
4. Kaikoura, subfossil bones, Canterbury Museum
5. Pyramid Valley, subfossil bones, Canterbury Museum
6. Waipara, subfossil bones, Canterbury Museum
7. Redcliffs (Christchurch), subfossil bones, Canterbury Museum
8. Mt Somers, subfossil bones, Canterbury Museum
9. Mt Peel, egg, no date, Canterbury Museum
10. Mackenzie Country (? Lindis Pass) nest and egg fragments (Buller 1875)
11. Lake Ohau, mounted specimen, no date, Otago Museum (Darby, in litt.)
12. Benmore, subfossil bones, Canterbury Museum (Ambrose 1970)
    Shepherd's Creek, subfossil bones, Canterbury Museum
13. Timaru area, subfossil bones, Canterbury Museum
    Waimataitai, midden material, Canterbury Museum (Trotter 1965)
14. Ototara, midden material, Canterbury Museum (Trotter 1965)
15. Earnscleugh, subfossil bones, Canterbury Museum
16. Waikaka, egg, no date, Canterbury Museum
17. Castle Rock, subfossil bones (Hamilton 1892)
18. Forest Hill, subfossil bones, Otago Museum (Forster in litt.)
19. Riverton, male specimens, Otago Museum (Forster in litt.)
20. Invercargill area, female specimen, Buller collection, Canterbury Museum
21. Native Island (Stewart Island), midden material, Canterbury Museum
22. Chatham Island, subfossil bones, British Museum (Nat. Hist.) (Forbes 1893, Dawson 1960)

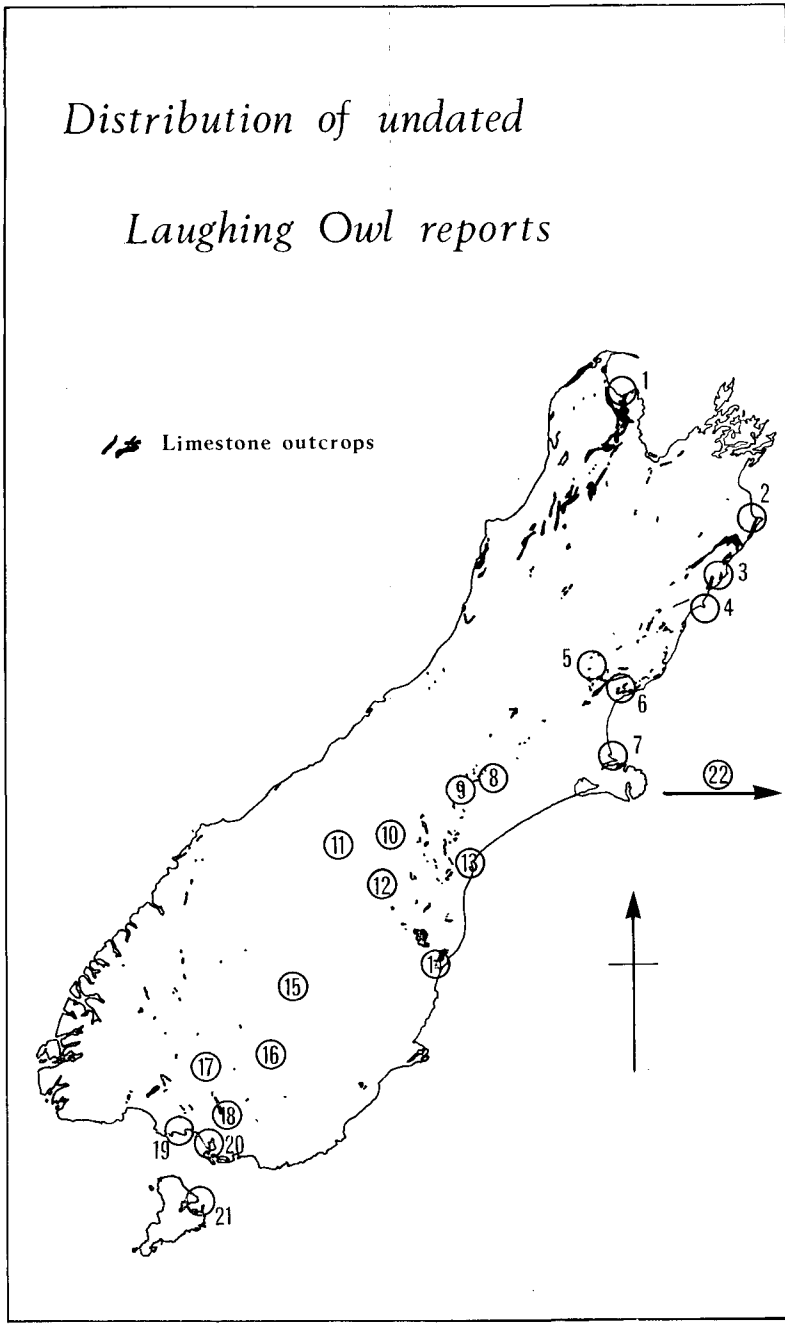
Distribution of undated
Laughing Owl reports
Limestone outcrops
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FIGURE 3

(B) **Recent, before 1900** (Fig. 4)

1. Tadmor, late 1880s, captured and killed (Kingsley 1890)
2. Bealey, before 1873, sight record (Buller 1873)
3. Cass R., 1868, kept in captivity in Christchurch gardens (Potts 1870)
4. Point Station, 1869, killed (light-coloured specimen) (Potts 1870)
   1881, killed (Potts 1882)
5. Mt Hutt, before 1870, sight record (Potts 1870)
6. Rockwood, 1854, captured, killed by dog (Potts 1870)
7. Rangitata R., before 1870, one killed (Potts 1870)
   before 1870, sight record (Potts 1870)
8. Geraldine, 1897, 1898 eggs, Canterbury Museum
9. Kakahu Bush, before 1870, one killed, Canterbury Museum (Potts 1870)
   Opuha, 1894, egg, Canterbury Museum
10. Albury, about 1881, at least 5 kept in captivity (Smith **in** Buller 1888)
11. Levels Station, before 1870, one killed, Canterbury Museum (Potts 1870)
12. Timaru area, 1874, specimen in Buller Collection (Buller 1888)
13. Lake Wanaka, 1886, sight record (Junge in litt.)
14. Lindis Pass, 1867, captured and killed (Potts 1870)
15. Kurow, 1895, specimen, Canterbury Museum
16. Shag Valley, before 1870, sight record (Hector **in** Potts 1870)
17. Waikouaiti, about 1843, type specimen (Gray 1844)
    before 1870, sight record (Hector **in** Potts 1870)
18. Blueskin Bay, 1874, specimen in Buller Collection (Buller 1905)
19. Popotunoa, before 1870, one killed (Hector **in** Potts 1870)
20. Silverstream, 1884, specimen in Reischek Collection (Rikitansky in litt.)
21. Stewart Island, 1881, kept in captivity Amsterdam Zoo 1882-86, Dominion Museum

The Otago Museum has a complete skeleton labelled "Otago, 1883." There are reliable records of calls being heard in the Upper Rangitata (under Mt Potts) in 1861 and in the upper Ashburton Valley in 1857 (Potts 1870); at Kakahu and the Opihi Valley about 1892 (Smith 1893).

(C) **Recent, since 1900** (Fig. 5)

1. Gouland Downs, 1918, sight record (Clouston, Dept. Internal Affairs file Sept. 1919)
2. Mt. Maud (Aniseed Valley), 1939, sight record (Jackson 1957)
3. Conway R., about 1907, sight record (Hope 1927)
4. Albury, about 1901, castings, i.e. pellets (Smith **in** Buller 1905)
5. Hanging Rocks (Pleasant Point), 1903-4, sight record (Black in litt.)
6. Timaru area, 1910, specimen, Canterbury Museum
7. Hazelburn (Castle Rocks), 1904, one killed (Black in litt.)
8. Bluecliffs, 1914, specimen (Woodhouse 1959, Falla et al. 1966)
9. Mt Horrible, 1912-15, sight records (Evans pers. comm.)
10. Waianakarua, 1960, egg fragments (identified J. Kikkawa in litt.)
11. Waitati, 1930s, sight record (Roderick pers. comm.)
12. Dunedin area, 1903, eggs, Canterbury Museum
13. Manapouri - Te Anau area, sight record (Orbell 1950)
14. Lake Thomson, 1930, sight record (Bull & Falla 1951)

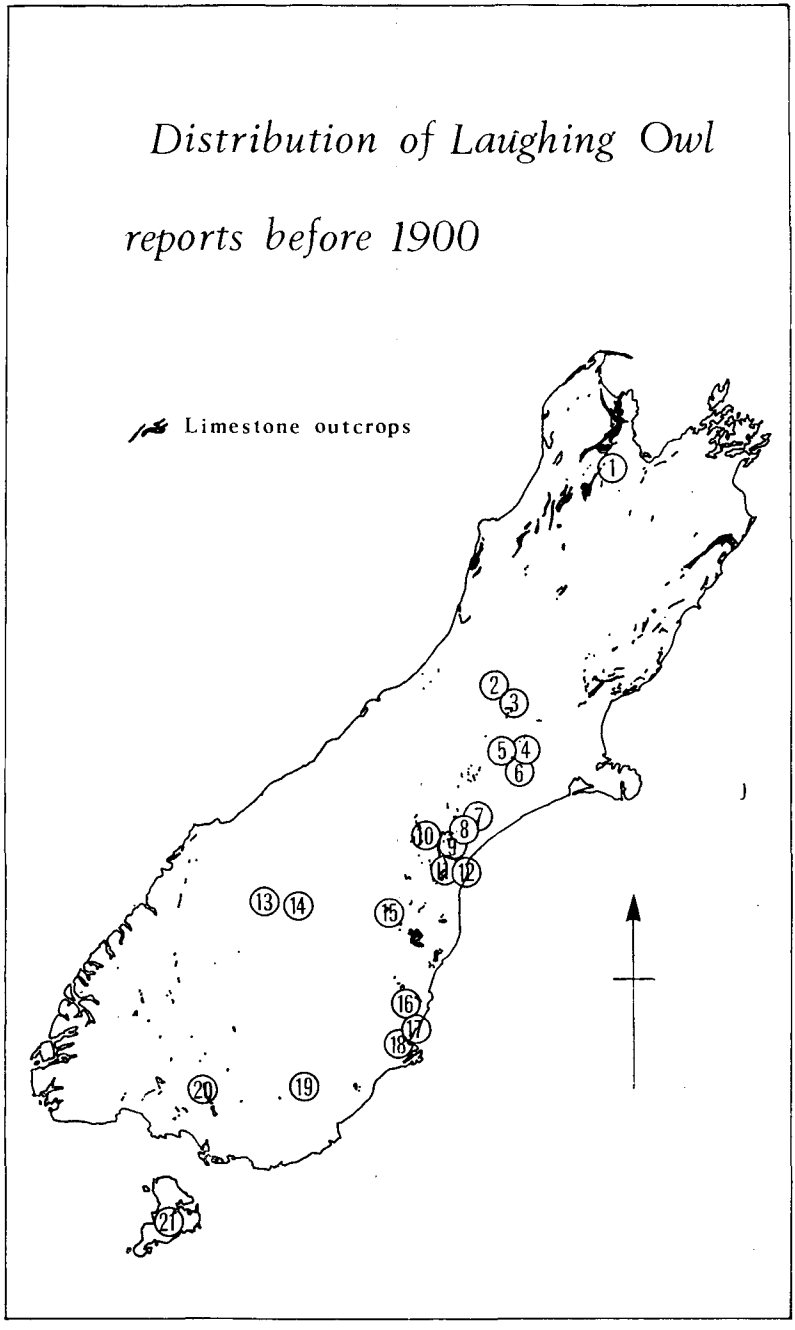
Distribution of Laughing Owl reports before 1900
Limestone outcrops
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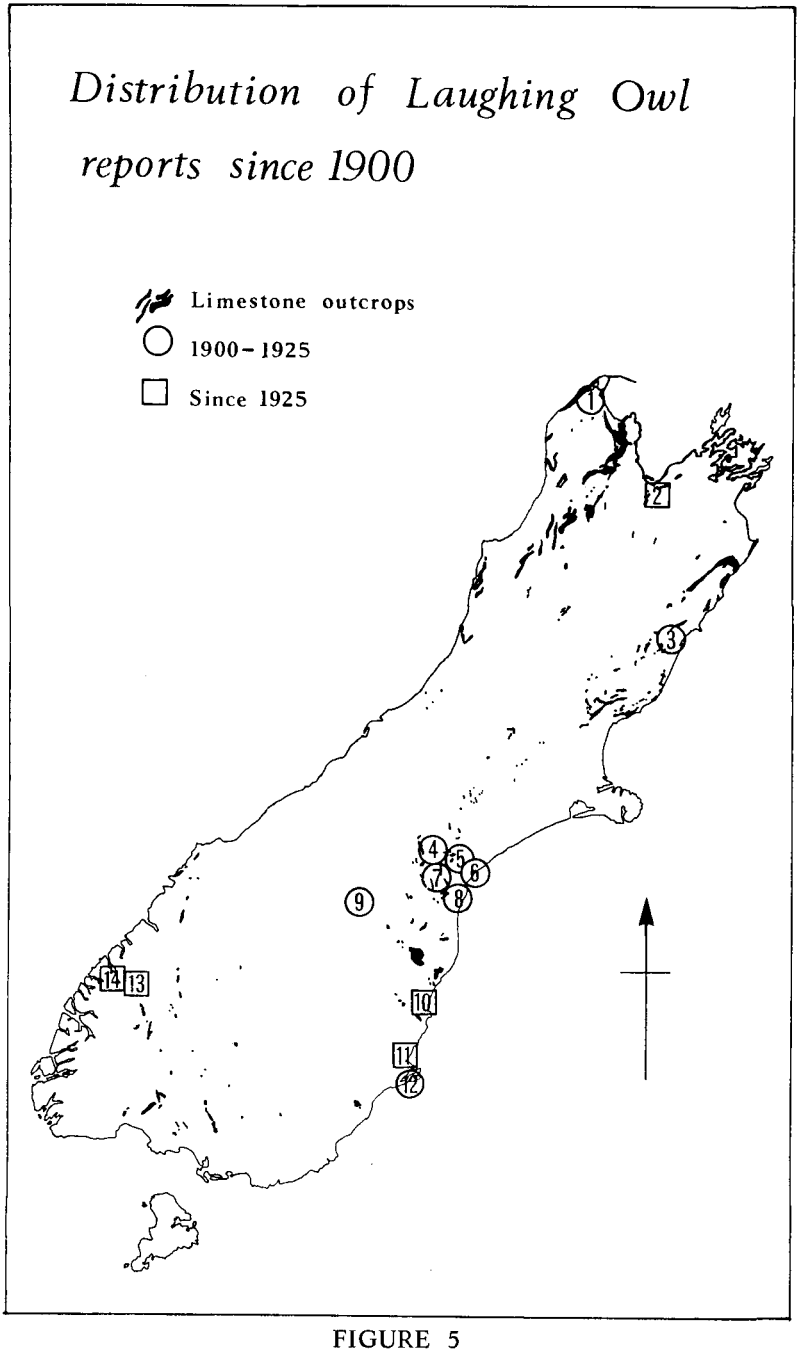
FIGURE 4


Distribution of Laughing Owl reports since 1900
Limestone outcrops
1900–1925
Since 1925
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12
13
14

FIGURE 5

BREEDING AND NESTING BEHAVIOUR

Nests are made under boulders or in fissures among rocks and consist of dry grass on bare ground. According to Smith (1884) breeding begins in September-October and young are reared in October-November. There is a record of eggs being laid in late August (Buller 1888), but this was in captivity. Of the eggs in the Canterbury Museum, one, from the wild, is dated 1 August 1894. The rest (apart from one of those laid in captivity in the Christchurch Gardens in August 1886) are dated September and October. The usual clutch is two, though one captive pair laid one of three and a clutch of one has been reported. (As is so obvious with other owls, clutch size may be determined to a considerable extent by food supply before egg formation begins). The incubation period is about 25 days. The female probably does most of the sitting and is fed on the nest by the male.

Smith (*in* Buller 1888) reported, in one instance a gap of a month and, in another, of three weeks between desertion of a clutch and the laying of a second; but, again, this was in captivity.

The dimensions of two eggs measured by Buller (1888) were 1.70 x 1.55 in. (c. 43 x 39 mm) and 1.90 x 1.50 in. (c. 49 x 38 mm). We have measured the eleven eggs in the Canterbury Museum with the following results: mean length 47.4 mm (range 44.5 - 49.1, mean width 38.5 mm (range 37.2 - 39.8). The colour is white and the surface bears papillae.

FOOD

Members of the Strigidae regurgitate pellets of undigested material and it is from the rough analysis of deposits of such pellets found in rock crevices that the information on Laughing Owls' diet has been obtained. The items identified (Buller 1888) include remains of earthworms, insects, lizards, small birds and mammals, including fur said to be that of mice *(Mus musculus)* and Polynesian rats *(Rattus exulans)*. It was even Buller's opinion (1873) — echoed by others — that the disappearance of the owl was correlated with that of *R. exulans* which had given way before the other two introduced species, *R. rattus* and *R. norvegicus*. The hypothesis is not acceptable for two reasons: (1) It is not clear how precisely the fur was identified in any instance, so native bats may have figured in the owl's diet, and (2) it seems unlikely that an introduced mammal would become an essential item of diet. In any event, how did the owls manage before the arrival of the Polynesian rat about 1,000 years ago? The taking of rats and other small mammals, as is so with many predators, was probably very much a matter of opportunity even if rats were an unfamiliar item. For example, captive Takahe *(Notornis mantelli)*, regarded as wholly herbivorous as adults, have caught and eaten pheasant chicks and young white rats which had accidentally strayed into their enclosure, and they will readily accept young mice.

If *Sceloglaux* was primarily a ground feeder in open country it is easy to imagine how serious the consequences of burning and

oversowing of much of its feeding range could be, even if the physical qualities of the habitat were not greatly altered as a result.

Smith (1884) reported that young owls were fed by their parents on large blackish worms obtained from the edges of swamps.

THE NEAR-EXTINCTION OF THE LAUGHING OWL

As discussed in the papers on Kakapo and Takahe referred to earlier, five major factors, severally or collectively, could have played a part in causing the dwindling of the species: (i) predation by introduced mammals, (ii) diseases caused by introduced parasites or micro-organisms; (iii) alteration of habitat — either naturally or by man, (iv) destruction of food supplies — really a special case of (iii), and (v) competition.

If the species' disappearance did begin, in the North Island and Chatham Island at least, before European settlement was fully under way; and if, as seems likely, Maori predation on the species was not important (its remains have, so far, been identified from very few middens), then the most likely causes of the initial decline seem to be reduced to predation by the introduced rats (prehaps, to some extent, *Rattus exulans* but, more likely, *R. rattus* and especially *R. norvegicus*) and, more latterly, by destruction of its food supply, especially in the South Island, where native grasslands were frequently burned and replaced and their faunas at least temporarily obliterated. Though habitat alteration or destruction in itself may have had some influence — especially on Chatham Island — it is probable that it would be less than usually crucial in a predominantly rock-roosting and rock-nesting species hunting over open ground.

Parasites and micro-organisms have apparently not seriously affected the Morepork and there is no good reason to believe that the Laughing Owl was affected either (though this must remain a possibility). Predators, other than those already mentioned, arrived too late to explain the early reductions and the same can be said for potential competitors — if any.

As usual, *a posteriori* speculations on extinction or near-extinction must always remain a largely unproductive exercise.

CONSERVATION

As the species is probably not yet extinct, a determined effort must be made to establish the whereabouts of survivors. Should any be found, everything practical must be done to prevent any further change in their environment (except, perhaps, for the destruction of potential predators) until the species' ecology is more fully understood. Since captive pairs are known to have laid fertile eggs and one bird has lived for as long as 18 years in captivity and at least five others have survived a journey to Europe last century (Rowley 1876 - 1878, Buller 1888); and since there is no reason to believe that the trend towards extinction has been halted, at least two pairs should be taken into captivity. These, preferably, should be naturally-mated pairs, as some owls will not breed unless they have chosen their own mates — e.g. the Powerful Owl *(Ninox strenua)* (D. Fleay, pers. comm.).

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PIPITS, SKYLARKS AND RAINFALL

By JILL HAMEL

ABSTRACT

A preliminary analysis of bird lists from Otago suggests that during the breeding season Pipits *(Anthus novaeseelandiae)* are absent from areas with a mean annual rainfall of under 30 inches (767mm). Skylarks *(Alauda arvensis)* seem less affected by low rainfall and are abundant even where the mean annual rainfall is as low as 13 in. (330mm). Some factors possibly influencing these correlations are discussed.

INTRODUCTION

During an Otago field day (29 November 1970) for the Ornithological Society's bird mapping scheme it was noticed that Pipits *(Anthus novaeseelandiae)* were absent from the drier inland areas around Middlemarch and Macraes Flat. These tussock ridges and valley flats did, however, support a vigorous population of Skylarks *(Alauda arvensis)* and the vegetation appeared similar to that found in Pipit areas. It seemed worthwhile even at this early stage of the mapping scheme to attempt an analysis of rainfall figures and Pipit/Skylark distribution so as to bring this point to the notice of observers doing further mapping. This analysis applies to distribution from August to mid-January only and uses data collected between August 1969 and January 1971.

ANALYSIS OF DISTRIBUTION

Skylarks were recorded in 85 of the 92 Otago squares for which adequate lists had been made by January 1971 (Table 1), but Pipits were recorded in only 34 of those squares (see Bull 1970, for method of recording).

TABLE 1 — Presence and absence of Pipits and Skylarks in squares for which adequate lists have been received.

	Pipits present	Pipits absent	Totals
Skylarks present	32	53	85
Skylarks absent	2	5	7
Totals	34	58	92

Pipits were observed in the following areas:—

(1) Around the Dunedin-Silver Peaks hills and down the coastal hills to Akatore (see Fig. 1); along the hills north and west of the Taieri Plain as far inland as Hindon and Lake Mahinerangi; around Lake Onslow and Mt Teviot at about 2000′ (609.6 m); in the Catlins area south and west of Owaka; around Queenstown and Arrowtown above about 2000′; eastern side of Lake Wakatipu north of Mt Crichton; in the lower Dart Valley and through most of the Rees Valley.

(2) Isolated squares at Timaru Creek and Lake Alexandrina (Canterbury).

(3) Sporadic occurrences in areas otherwise lacking Pipits,
Sutton — one bird, 29 Nov. 1970, and
Middlemarch — one bird, 25 Oct. 1970.

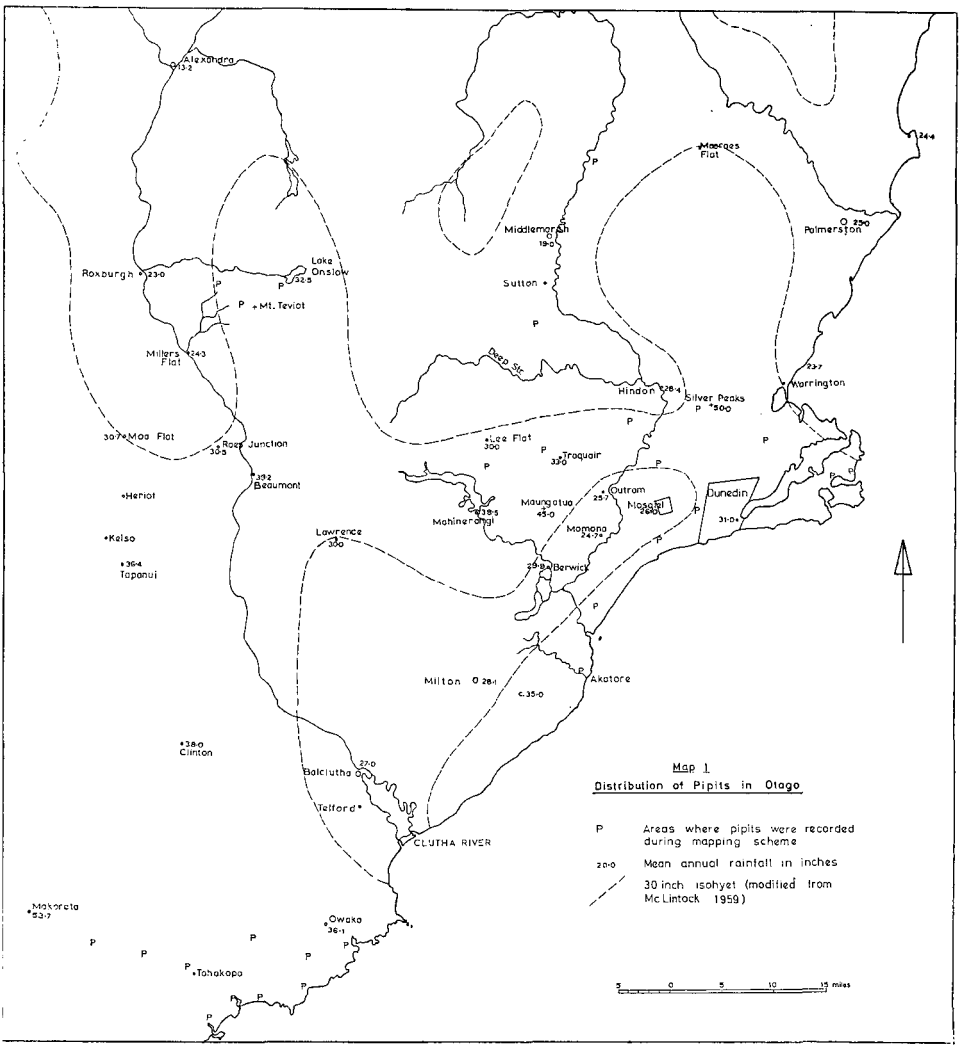

FIGURE 1 — Distribution of Pipits in Otago, showing areas where Pipits were recorded during OSNZ mapping scheme, also annual rainfall and 30 in. (762 mm) isohyet.

Pipits were *not* observed in the following areas:—

(1) North of Warrington up the coast and up the Shag Valley; around Macraes, Middlemarch and south to Deep Stream (except for two birds as above); the Taieri Plain; Milton to Balclutha and Telford; around Kelso, Heriot, Moa Flat, Ettrick and up to 800′ (244 m) a.s.l. in the Tima Burn north-east of Millers Flat; around Alexandra; around Wanaka, Albertown and Tarras.

(2) Isolated squares in the lower Clutha Catchment.

These are the only areas of Otago for which lists have been received so far.

RAINFALL

Rainfall figures were taken from the New Zealand Meteorological Service publications, McLintock (1959), Maunder (1965), Wardle and Mark (1956) and some Dunedin Soil Bureau sources. Some of these figures are means derived from 50 years and more of records but others, especially those for higher altitudes cover only a few years.

McLintock's rainfall map (Map 8) suggested that Pipits occur only in country with more than 30 in. (762 mm) mean annual rainfall. Skylarks, however, extend into the less-than-30in. zone. Lists have been made for 35 squares in the under-30 in. zone and Skylarks were recorded in 31 of those squares. Pipits occured in this zone only at the two places mentioned above, Sutton and Middlemarch.

The Meteorological Service figures for areas with Pipits range from 28.4 in. (721 mm) mean annual rainfall at Hindon to 53 in. (1346 mm) in the Rees Valley. Only Lake Alexandrina near Lake Tekapo may fall outside this range. The mean annual rainfall for Lake Tekapo is recorded as 22.2 in. (564 mm) but rainfall at this station varies greatly from year to year and may rise to 41.0 in. (1041 mm) for the year. In areas where Pipits were not recorded but there were Skylarks the mean annual rainfall ranges from 31.2 in. (335 mm) at Alexandra to 27.0 in. (686 mm) at Balclutha.

Where hills over 1000′ (304.8m) occur in low rainfall areas the rainfall may rise on the tops of the ranges to over 30 in. (762 mm) per annum. The Taieri Plain has rainfalls of 24-26 in. (610-661 mm) but the surrounding hills have rainfalls of 30-45 in (762-1143 mm). There are Pipits on the surrounding hills but not on the Taieri Plain during summer. In winter, however, Mr G. Grant at Outram reports (pers. comm.) that Pipits are numerous on his farm. Outram has a rainfall of 25.7 in (653 mm). Pipit distribution in winter may be quite different from that of summer and not correlated with the 30 in. (762 mm) isohyet.

At Millers Flat in the Clutha Valley the annual rainfall is 24.3 in (618 mm) and at 800′ (244 m) up the Tima Burn the rainfall is little more and probably rarely above 28.0 in. Mr J. Watt reports that on several visits up the Tima Burn he has seen no Pipits

at 800′ but numerous Skylarks. However, at 2200′ (670.6 m) on the range north-east of the Tima Burn and around Lake Onslow Pipits are common. The rainfall at Lake Onslow is recorded as 32.5 in. (826 mm).

DISCUSSION

Since it is unlikely that Pipits are responding directly to rainfall, intermediate factors will have to be considered. Dr P. C. Bull points out (pers. comm.) that Pipits seem to like some shrubby vegetation in their territories, and this scrub may be present only under higher rainfalls. However, at the Tima Burn (24 in. (610 mm)) it is very noticeable that the unploughed ridges and gullies on the lower slopes of the Clutha Valley carry an open scrub of manuka *(Leptospermum scoparium)* and native broom (*Carmichaelia* sp.). At 2000′ (609.6 m) above sea level where Pipits enter the habitat scrub is entirely lacking even in the gullies probably because of the very low winter temperatures of this area. The ridges and gullies are evenly covered with tall tussock *(Chionochloa rigida* and *C. rubra)*. Again at Queenstown the only known Pipit habitat in the low rolling country between Queenstown Hill and Arrowtown is on a consolidated gravel flat beside the Shotover River where the vegetation consists of low cushions of *Raoulia* spp., various small weedy species and scattered tussocks of *Festuca novaezelandiae*. The more scrubby country on the terraces and hills behind the beach carries Skylarks but no Pipits. If scrub is an important factor in Pipit territory, obviously there is some other more desirable factor which Pipits have selected in the above two areas.

Food supply may be the critical factor. It would be unwise to presume that Skylarks consume even roughly the same range of insects as Pipits, but the abundance of small passerines and Skylarks in the lower rainfall areas does suggest an ample insect supply around the size range taken by Pipits. It may be that Skylarks or other small passerines have some competitive advantage over Pipits in the low rainfall areas and it is not the simple absence or presence of a particular factor which determines Pipit distribution.

On the other hand, the controlling factor may be something as simple as the effect of low relative humidities on the hatching success of Pipits' eggs. The eggs of some species will not hatch under relative humidities below a certain level presumably because the eggs dry out. It is worth noting at this point that the closely related Richard's Pipit *(A. richardi)* of Europe is a bird of ' wet grasslands, marshy steppes and ricefield.' (Peterson *et al.* 1954: 26). If humidity in the nest is important, mean annual rainfall may not be a suitable measure to use in carrying out a more complete analysis of Pipit distribution. It may be more effective to use mean monthly rainfall figures from August to about December along with some measure of variation from year to year.

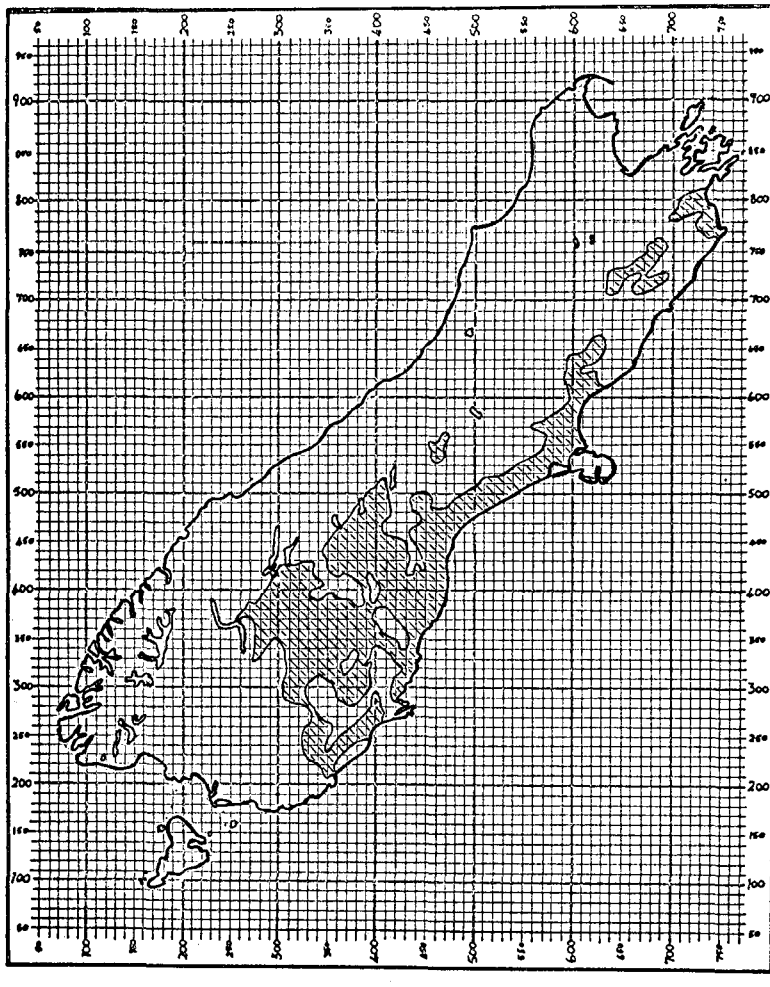

FIGURE 2 — South Island of New Zealand showing the position of the 30 in. (762 mm) isohyet in relation to the 10,000 yard grid squares. (Modified from the New Zealand Meteorological Service map of mean annual rainfall 1921-1950 (in.), issued 1961).

The 30 in. (762 mm) isohyet follows the foothills of the main ranges of the Southern Alps from Queenstown through Wanaka, Ohau and Pukaki to Tekapo with higher rainfall areas extending eastward on the tops of the eastern hill blocks of Otago and South Canterbury. The isohyet then runs roughly parallel to the east coast of central and northern Canterbury and out to the coast at Motunau (see Fig. 2). Elsewhere in New Zealand there is a small area of below 30 in. around Blenheim and another in Hawkes Bay. The temperature regime is very different in the more northerly areas and the correlation of Pipit distribution and rainfall may differ in these areas in such a way as to reveal the nature of the direct controlling factors.

CONCLUSIONS

It seems, therefore, that during the breeding season Pipits are absent from areas with a mean annual rainfall under 30 in. (762 mm). Skylarks, on the other hand, appear less affected by low rainfall and are abundant even where the mean annual rainfall is as low as 13 in. (330 mm). However, the factors influencing these apparent correlations have yet to be elucidated.

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SOME ANATOMICAL NOTES ON THE WRYBILL

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ABSTRACT

Head and neck anatomy in the Wrybill *(Anarhynchus frontalis)* are described from a spirit specimen and a skeleton. In most respects, the Wrybill closely resembles plovers of the genus *Charadrius.* Careful examination has failed to reveal any asymmetry other than that of the bill. Apart from the bill shape, and a gape situated unusually far forward, the main peculiarity of the Wrybill is a bony bridge between the two ventral bars of the upper jaw, mentioned by Lowe (1931). The significance of this structure in relation to bill asymmetry is discussed. An analysis of the stomach contents of the spirit specimen is given.

INTRODUCTION

The laterally curved bill of *Anarhynchus frontalis,* the Wrybill, is unique among birds. Despite this, there have been few studies made of this species, and only recently (Turbott 1970) has any convincing account been given as to the manner in which its bill is used. The anatomy of *Anarhynchus* has remained virtually unstudied, apart from a brief note in a review of the waders by Lowe (1931). This paper presents the findings of an investigation on the anatomy of the Wrybill's head and neck, made possible by Mr. E. G. Turbott's generous gift of a spirit specimen of this bird. This specimen has provided the necessary complement to a skeleton, already in the collections of the British Museum (Natural History). Details of the two specimens are as follows:

Spirit specimen, Reg. No. A/1971.21.1., Auckland, New Zealand, 1 April 1970.

Skeleton specimen, Reg. No. S/1961.11.2, No data. (Rothschild Bequest).

Observations and dissections were made using a stereoscopic dissecting microscope. Careful attention was paid to comparisons of left and right sides, in view of speculations (Bock 1958; Turbott 1970) that anatomical study might reveal further asymmetry linked with that of the bill.

BILL

Most descriptions of *Anarhynchus,* including the original one by Quoy and Gaimard (1830), mention the deflection of the bill tip to the right, and the sharp tip of the bill. Oliver (1955) noted the deflection as about 12°. Some additional details have been noted from the spirit specimen. This bill of this specimen is 33.5 mm long, measured from the junction of nasal and jugal bars. Relative to the

skull (24.0 mm from junction of nasal and jugal bars), this is unusually long for a plover. The portion which is bent to the right is approximately 11.5 mm long. The tomium of both upper and lower jaws is curved inward on the right side, so that the tips of the jaws appear almost cylindrical seen from this side. On the left, the tomia are more normal, but the upper overlaps the lower slightly in the proximal part of the deflected portion. The ventral surface of the upper jaw bears one median and a pair of lateral rows of backwardly directed papillae, starting about 15 mm from the tip of the jaw. These are similar to those of other plovers, and show no sign of asymmetry. An unusual feature, however, is the position of the angle of the gape, which lies about 2 mm anterior to the junction of nasal and jugal bars. In all other plovers (Charadriidae) and many sandpipers (Scolopacidae) examined in an earlier study by Burton (1969; and in press) the angle of the gape lies posterior to this junction. A position anterior to it is found mainly in waders with a highly rhynchokinetic upper jaw (i.e. those with a narrow bending zone situated far forward in the jaw), but as explained below, *Anarhynchus* does not fall into this category.

TONGUE

The tongue extends just into the bent portion of the bill, and is itself bent to the right for about 4.5 mm from the tip. The length of the tongue from anterior tip to the tips of the postero-lateral papillae is 21.6 mm. The ratio of tongue length to bill length (measured from junction of nasal and jugal bars) is 0.64, similar to that of most waders of comparable size.

SKULL

The note on the skull of *Anarhynchus* by Lowe (1931) draws attention to an unusual feature: " . . . its bill is pseudo-desmognathous in the sense that a bony bridge extends in front of the vomer from one palatine process of the premaxillae to the other. This is doubtless an adaptive modification correlated with its curious way of feeding." Lowe does not comment on the remainder of the skull.

The feature referred to by Lowe is shown in Fig. 1, with that of a normal wader for comparison. In the skeleton specimen (probably the one examined by Lowe), the bridge is in fact fused with the tip of the vomer and is 3.5 mm in length. Beyond this, the paired ventral bars of the upper jaw are free of the dorsal bar for a further 10 mm. The curve to the right starts at their point of fusion. The presence of a similar bridge, and fusion with the vomer, has been confirmed also in the spirit specimen.

In neither specimen does the proximal portion of the bill show any sign of deflection to either side. There is no significant asymmetry in skull structure besides that of the bill; nor are there any other unusual features in the rest of the skull. Apart from the jaws, the

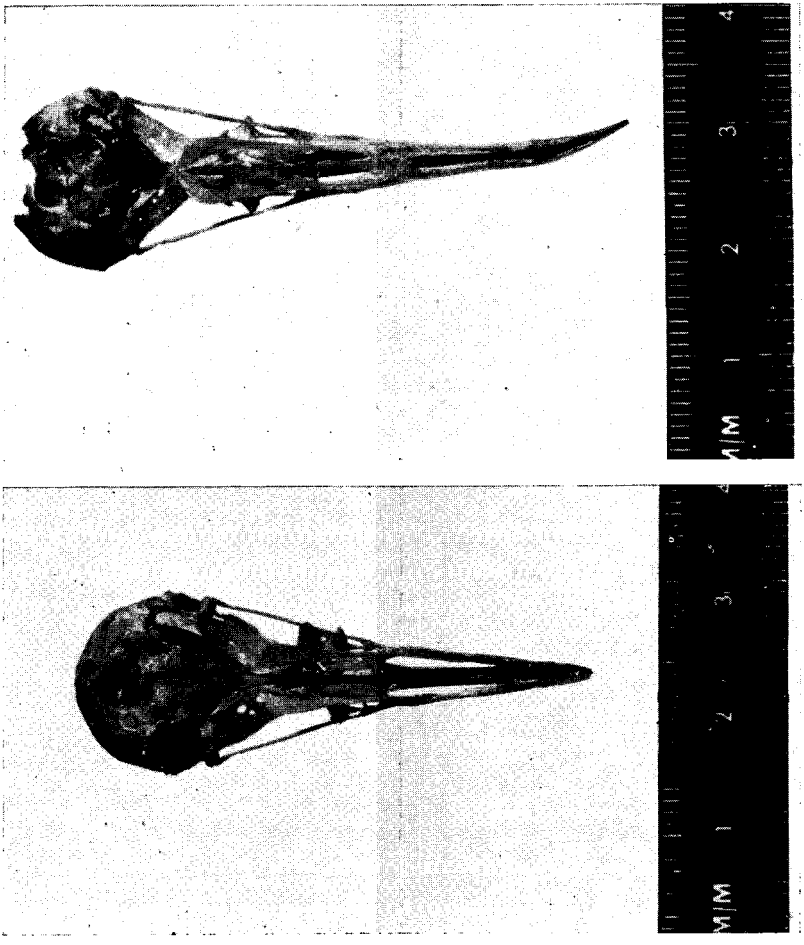

FIGURE 1 — Skulls of *Anarhynchus frontalis* (upper) and *Charadrius wilsonia* (lower) in ventral view with lower jaws removed.

skull is closely similar to that of most *Charadrius* species, if differences due to varying development of the supra-orbital glands are disregarded. The medial brace of the lower jaw (Bock 1960) is normally developed on each side.

KINESIS

Kinesis — the movement of the upper jaw and palate relative to the rest of the skull — is a property of most vertebrate skulls other than those of mammals, but reaches a high degree of refinement in birds. Two main types are generally distinguished. In prokinesis,

shown by the majority of birds, the upper jaw is hinged to the skull by a thin strip of flexible bone at its base; in rhynchokinesis (typical of waders), the upper jaw bends some way anterior to its junction with the skull. In all plovers so far investigated (except the Magelian Plover, *Pluvianellus socialis*) and in many sandpipers, the bending zone is a wide one, starting relatively close to the skull. In some highly modified types (e.g. snipes, stints, curlews), the bending zone is narrower, and situated far forward in the bill. Manipulation of the spirit specimen of *Anarhynchus* and skeleton specimen (previously softened in water) shows that the Wrybill is a typical plover, with a wide bending zone, centred around the midpoint of the bill. When manipulating the specimens, it was noticed that when the upper jaw is raised by exerting pressure at its tip, a slight twisting motion occurs, the left side rolling slightly downwards and inwards with respect to the right. This was more obvious in the spirit specimen, and may be accentuated by the presence of the rhamphotheca.

MUSCULATURE

Jaw and tongue muscles were dissected on both sides of the spirit specimen, without finding any indication of asymmetrical development. The entire neck musculature with the exception of M. longus colli was dissected without finding any asymmetry in the numbers or position of slips of attachment; nor was there any apparent difference in the bulk of any neck muscles between the two sides. The neck muscles attached to the skull have been compared throughout the Charadrii in a previous study (Burton 1969; and in press) and three of them show variation among waders in their sites of origin. In *Anarhynchus*, these origins are as follows: M. complexus from vertebrae 4, 5 and 6; M. splenius capitis from 2; and M. rectus capitis superior from vertebrae 1 to 5. This arrangement is found in many plovers as well as other waders. M. splenius capitis shows little indication of cruciform structure as described in several families of birds by Burton (1971).

SALIVARY GLANDS

The salivary glands resemble those of *Charadrius* species except that the right Gl. angularis oris is considerably enlarged, and consists of two lobes instead of the normal one.

DISCUSSION

It is clear from this investigation that the asymmetry of the bill in *Anarhynchus* has not led to any significant asymmetrical development in other features of head or neck anatomy.* In this respect it differs from the only other birds showing striking asymmetry of the bill, Crossbills (*Loxia* spp.) and the Hawaiian Honeycreeper *Loxops*

* Unless the condition of the right Gl. angularis oris in the spirit specimen is an example; more probably this is an individual peculiarity of this specimen.

coccinea, all of which exhibit marked asymmetry in the jaw musculature (Tordoff 1954, *Loxia;* Bock 1970, *Loxops coccinea*). However, these birds have the tips of lower and upper jaws twisted opposite ways, and exert lateral forces as a normal part of feeding. The Wrybill, as shown by Turbott's account, opens and closes its bill in an essentially normal manner, except that the head is frequently turned sideways, to bring the left side of the bill tip into contact with the substrate — a convenient position for grasping surface food items. Neck muscle asymmetry was perhaps more to have been expected in *Anarhynchus,* but has not been discovered. It may be noted that oystercatchers (*Haematopus* spp.) which also lay the head to the left when feeding show distinct asymmetry of the skull at the base of the bill (Stresemann 1929; Webster 1941) but in this case the bill is used to make forceful attacks on molluscs while in this position.

Nevertheless, the absence of asymmetry in the skull of *Anarhynchus* is somewhat surprising. Possibly it has been avoided partly by the device of a bony bridge connecting the mobile ventral bars of the upper jaw which transmit the movement of the quadrate and palate to the upper jaw tip. This bridge has two obvious properties. First, it must provide increased support against upwardly directed forces in a limited region of the bill; secondly, it must limit the movement of right and left ventral bars with respect to one another. The first of these seems of no obvious value; the ducts of the nasal glands would derive extra protection from the presence of the bridge, but there appears to be no reason why they should need it. The second property, the effect of the bridge on the two ventral bars, is probably of much more importance.

The deflected portion of the bill includes only the region in which dorsal and ventral bars of the upper jaw are fused. If it started behind this point, the left and right ventral bars would have to travel different distances, and follow a curved path during kinesis — an impossibly complex arrangement. Nevertheless, some unequal movement of the left and right ventral bars is possible if lateral movement of the bill tip occurs as a result of external forces; this can be shown by manipulating the two specimens. Such lateral forces may arise occasionally by pressure against the substrate while the left side of the bill is applied to the ground in the feeding action described by Turbott. The slight twisting movement seen when the bill tip is lifted by finger pressure is also indicative of unequal movement of the two ventral bars. Closer study and analysis may further clarify the mechanical consequences of the bent bill tip; nevertheless, it seems reasonable to suppose that the bony bridge has arisen as a result of stress between the two ventral bars, and has the effect of eliminating differential movement between them. It would be interesting to know the ontogeny of this structure; possibly it is in the form of a strong ligament in young birds which ossifies later; it is likely that such a condition preceded it in evolution.

It would also be of much interest to know more of the ontogeny of the bill deflection, but since this appears before hatching (Oliver 1955) it seems unlikely that it will ever be studied. The curious form of the tomia in the deflected portion of the bill is presumably an expression of its mode of development. It is worth noting that the tomium is of nearly normal structure on the left. This is the side which Turbott notes is normally used for prey capture, whether by sweeping the mud surface with head laid on one side, or by more conventional movements.

The anterior position of the gape in highly rhynchokinetic waders probably stems from an overall reduction in the extent of jaw opening, as a result of the enhanced mobility of the bill tip. The occurrence of this feature in the moderately rhynchokinetic *Anarhynchus* may also indicate a general decrease in the extent of jaw opening, but this case connected with its habit of feeding with the side of the bill against the substrate.

Unusual bill modifications are sometimes linked with a specialised and restricted diet — e.g. pine seeds taken by Crossbills, or snails by Openbill Storks (*Anastomus* spp.). However, there is nothing in the literature to suggest such specialisation in the Wrybill, although references to its diet are few. There is nothing surprising about the stomach contents of the spirit specimen which were as follows:

1 Staphylinid beetle, 4.0 mm long.

2 Dipteran larvae, 3.2 and 4.3 mm long.

3 jaws of polychaete worms, probably *Nereis*, respectively 1.2, 1.5 and 2.0 mm long; also a partly digested fragment of polychaete body, 4.0 mm long.

4 small stones, respectively 1.8, 2.3, 2.8 and 3.2 mm long.

Several fragments of plant matter, including some fine grass.

Similar items appear in the stomachs of many shore feeding plovers.

It must therefore remain for future investigators to place the bill form and feeding methods of the Wrybill in full ecological perspective. It is to be hoped that Turbott's paper and this one may stimulate further field studies on this interesting species.

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MOULT OF THE BANDED DOTTEREL (CHARADRIUS BICINCTUS) IN WINTER QUARTERS

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ABSTRACT

The Banded Dotterel *(Charadrius bicinctus)* is a short-distance migrant, breeding in New Zealand and wintering in some numbers in Australia. This study was done to check the hypothesis that the flight feathers are renewed before autumn migration and to determine the timing of the body moult. It is concluded that the flight feathers are renewed on or near the breeding grounds coinciding with the pre-basic body moult which is complete. The pre-alternate moult occurs on the wintering grounds and is incomplete, involving the body feathers only. A comparative table is given showing sequence of plumages according to Dwight (1900) and Humphrey and Parkes (1959).

INTRODUCTION

In general, long-distance migrants renew flight feathers after they have reached winter quarters, whereas short-distance migrants and resident species do so on or near the breeding grounds (Snow 1967). This appears to be so for waders because the Little Stint *Calidris minuta,* (Middlemiss 1961), Red-necked Stint, *C. ruficollis* (Thomas & Dartnall 1971) and Curlew Sandpiper *C. ferruginea,* (Thomas & Dartnall in prep.) moult remiges and rectrices in winter quarters. All winter exclusively in the Southern Hemisphere. Alaskan Dunlins *(C. alpina),* which winter in the Northern Hemisphere, moult flight feathers on or near the breeding grounds (Holmes 1966). The significant adaptation in these long-distance migrants is that the start of moult of the flight feathers is delayed until after the birds reach winter quarters and no longer does it coincide with the pre-basic (post-breeding) body moult (Thomas & Dartnall 1971).

The Banded Dotterel *(Charadrius bicinctus)* is a short distance migrant, breeding in New Zealand and wintering in south-eastern Australia and Tasmania, a few birds reaching Queensland and Western Australia. Probably most remain in New Zealand throughout the winter. It would be expected to renew flight feathers before autumn migration. The work reported here was undertaken to check this hypothesis and to determine the timing of body moult.

NOMENCLATURE

Many waders do not assume breeding plumage until nearly two years old. Because of this, the sequence of plumages and moults suggested by Humphrey and Parkes (1959) is preferred to the more often used one of Dwight (1900). The two systems are compared in Table I. Waders only renew flight feathers once a year. A moult is complete when body and flight feathers are renewed and incomplete when only body feathers are renewed.

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TABLE I: Sequence of plumages according to Dwight (1900) and Humphrey and Parkes (1959)

DWIGHT	HUMPHREY AND PARKES	
	Breeding in first year	*Breeding in second year*
Juvenile	Juvenal	Juvenal
First winter	Basic	Basic
A First nuptial	A Definitive alternate	Alternate
Second winter	Definitive basic	B Definitive basic
Repeat from A	Repeat from A	Definitive alternate
		Repeat from B

In all work dealing with moult the system of numbering primaries and secondaries should be stated clearly. In my work I number the primaries 1 to 10 starting with the innermost, and the secondaries 1 to 10 starting with the outermost and ignoring additional feathers ('tertials'). This appears to be the most logical sequence because normally moult starts with No. 1 and proceeds sequentially to No. 10. Additionally, the number of primaries may be reduced, e.g. the Bullfinch *(Pyrrhula pyrrhula)* has nine, when it is the outermost feathers that are absent (Newton 1966).

METHODS AND RESULTS

Skins in the Australian Museum (Sydney), National Museum of Victoria (Melbourne), including the H. L. White Collection, and Tasmanian Museum (Hobart) were examined. The presence/absence of moult of primaries, secondaries, tail, upperparts, head and breast was noted. A total of 73 birds was examined. All were collected away from New Zealand as follows:

Lord Howe Island	2
New South Wales	9
Tasmania	37
Victoria	23
Western Australia	2

No bird showed moult of primaries, secondaries or tail feathers. Several birds collected by me within a few days of their arrival in south-eastern Tasmania had new flight feathers which showed no signs of wear. It is concluded that these are renewed before birds leave New Zealand.

The results for body moult are shown in Table II. There is considerable variation in the timing of both the pre-basic and pre-alternate moults. Birds present in south-eastern Australia from February to June are in basic or (February to April) an intermediate plumage, in which the breast-bands are only faintly discernible. Individuals may not complete the pre-basic moult until May whereas others may have finished by February. As about 50% of February-March birds had finished moult, the pre-basic moult must start before the birds leave New Zealand. Although it is not apparent in Table II moult is only slight in April and May and is restricted to a few pteryla. Neither of the June specimens showed any moult. The pre-alternate moult starts in July and is probably completed before birds leave for the New Zealand breeding grounds.

Month	No. of birds examined	No. not in moult	No. showing moult of			% birds in		
			Head	Upper	Breast	Basic	Alternate	Intermed
January	1	0	0	1	1	-	-	-
February	8	4	3	0	3	88	0	12
March	7	3	2	2	3	71	0	29
April	22	9	2	4	11	84	0	16
May	8	5	0	0	3	100	0	0
June	2	2	0	0	0	100	0	0
July	5	1	2	1	4	0	80	20
August	16	6	4	8	9	6	69	25
September	2	1	0	0	1	0	100	0
October/November	0	-	-	-	-	-	-	-
December	2	1	0	0	1	-	-	-

TABLE II: The incidence of body moult in wintering Banded Dotterels

CONCLUSION

As with other short-distance migrants, the Banded Dotterel renews flight feathers on or near the breeding grounds. Moult of the flight feathers thus coincides with the pre-basic body moult, which is complete. The pre-alternate moult involves the body feathers only and is thus incomplete. It occurs on the wintering grounds.

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VARIATIONS IN DUCK NUMBERS AT CHRISTCHURCH DURING THE 1967 NEW ZEALAND SHOOTING SEASON

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ABSTRACT

Counts of Grey *(Anas superciliosa)*, Mallard *(A. platyrhynchos)* and hybrid ducks were made on 500 yards of the Avon River and Lakes Victoria and Albert between 16 April and 18 July 1967. During the pre-shooting season (16 April to 5 May) duck numbers rose steadily from about 1150 to 1800. Numbers continued to rise about the same rate during the first five days of the shooting season (6 May to 11 May). During the remainder of the season (12 May to 5 June) the numbers remained about 2200. During the post-shooting season (6 June to 5 July) the numbers declined during the first 14 days to about 1300 and then remained about this level. The increase in numbers during the shooting season was significantly different from both the pre-shooting and post-shooting numbers. The latter were not significantly different from each other. Flight patterns, feeding habits and behaviour during the shooting season are discussed.

INTRODUCTION

Grey and Mallard ducks *(Anas superciliosa* and *A. platyrhynchos)* and their hybrids tend to congregate in protected areas throughout the country during the shooting season. This habit may have a distinct selective advantage, as shooting losses account for a large proportion of deaths in these birds (Balham & Miers 1959).

Assuming the number of ducks on protected Christchurch city waters to be relatively stable, comparisons of pre-season, during-season, and post-season numbers will determine whether or not there is any significant increase in numbers during the shooting season. If an increase does take place, then the rate of drop-off in numbers at the end of the season should indicate whether or not the higher density is stable.

The localities chosen for this study were a stretch of the Avon River 500 yards long running around three sides of the Christchurch Botanical Gardens, some nearby ponds, and two lakes about 80 yards from the river. One of these, Lake Victoria, was relatively large (23120 square yards); the other, Lake Albert, was much smaller. The study areas were in Hagley Park and undisturbed by motor traffic. The ducks were predominantly Mallard-Grey hybrids, and the nearest major shooting area was Lake Ellesmere, 16 miles south by direct flight.

The 1967 duck-shooting season ran from 6 May until 5 June inclusive. The claiming and use of shooting shelters (" maimais ") was permitted from 16 April. The study ran from 16 April to 8 July. Counts were made daily from 16 April until 15 May, and following this date every three days. The last two counts were made

six days apart. All ducks seen within 50 yards of the water in the study areas were counted. I walked over the same route each time at a steady pace to standardise errors due to movement of individual ducks. The counts started at 8.00 a.m. before too many people disturbed the birds. Most ducks present were probably counted because the river and lake borders were grassy with little cover.

RESULTS

The total counts for all the study areas are given in Figure 1, which shows that numbers in the study area increased steadily from the first count on 16 April until 5 May, with a somewhat faster rate of increase from then until 11 May. The numbers remained at this level until 2 June, after which they fell away to reach a low, fairly constant level from 14 June onwards.

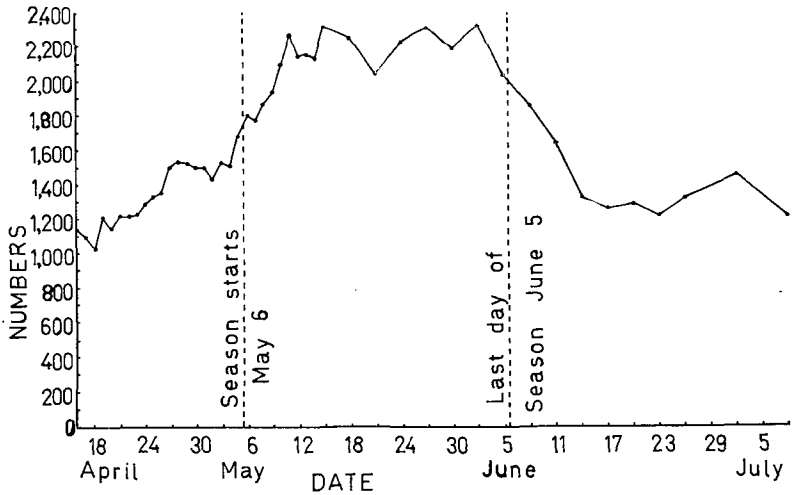

FIG. 1. DUCK NUMBERS IN STUDY AREA PLOTTED AGAINST TIME.

The data were then divided into three main groups for comparison. Sample I contained the results from 16 April to 4 May, Sample II contained the results from 12 May to 2 June, and Sample III contained the results from 14 June to 8 July (all dates inclusive). These three samples correspond to the pre-season, during-season, and post-season periods respectively. Data taken from 5 May to 11 May and from 3 June to 13 June were considered as transition periods when the numbers were changing rapidly.

T-tests were used to test if there was any significant increase between periods I and II, or significant decrease between periods II and III, and if periods I and III differed significantly.

Table 1 shows that there was a significant increase in numbers during the season, and that post-season numbers dropped to a level not greatly different from those prior to the season.

Table 1. Comparisons of pre-season, during-season, and post-shooting season duck numbers.

Sample	I	II	III
Dates	16-4-67 to 4-5-67	12-5-67 to 2-6-67	14-6-67 to 8-7-67
Description	Pre-May 6 level	May-season level	Post-May standing level
x	25394	22181	9100
x^2	34468220	49277067	11871486
N (no. in sample)	19	10	7
Mean	1336.5	2218.1	1300.0
Variance (SD^2)	113.42	7739.1	5296.6
T-tests	I/II	II/III	I/III
Deg. freedom	27	15	24
	1 tail	1 tail	2 tail
t	4.382	22.251	0.209
Null hypothesis	rejected (significantly different)	rejected (significantly different)	accepted (not significantly different)

I/II and II/III are testing if one is bigger than the other.

I/III is testing if one is bigger or smaller than the other.

Both Grey and Mallard ducks are fairly wide-ranging, Grey ducks banded in New Zealand having even been recorded from the Chatham Islands and Australia. Balham & Miers (1959) gave figures for percentage recoveries of banded birds:—

Species	Percentage recorded at distances greater than 25 miles from banding site	Percentage recorded more than 100 miles from banding site
Mallard	20.1	4.0
Grey	51.4	24.6

In the Christchurch area, radar evidence from Christchurch City Airport suggests movements after sunset of large birds, thought to be either ducks or swans, within the city and between the city and Lake Ellesmere (Dr. Bernard Stonehouse, *pers. comm.*). Also, I have frequently heard ducks flying overhead shortly after dusk

in the city area. Williams (1969) noted: " During the shooting season in May large rafts of mallards are frequently reported at sea or on Lake Ellesmere, during the day. Apparently these birds come in to feed at night and then make for the safety of the open water again at daylight."

Some observations were made on flight patterns, feeding habits, and behaviour during the high density period. I observed that ducks were using the larger, open lake as a landing and taking-off place when moving in and out of the Hagley Park area. Landings and takeoffs on the river tended to be associated with short-distance flights, although no quantitative data were taken. Long-distance flights were usually in a straight line well clear of the tree-tops, usually about 100 feet up, whereas short-distance flights were at a much lower level. The number of birds apparently making long-distance flights either to or from the lake increased greatly during the shooting season, but it is not known to what extent this includes long flights within the city.

The proportion of feeding birds was much higher on the river and river banks than on either of the lakes. Feeding fell into the following patterns:— searching through the grass when it was wet from rain or dew; current-filtering, where the duck faces upstream with its lower bill just under the water so that floating material is sifted out; and duck-diving in which the bird looks for submerged material. Of the last two, current filtering was not possible on the lake, and duck-diving was considerably less frequent than on the river.

Figure 2 shows that densities on the lake were usually much

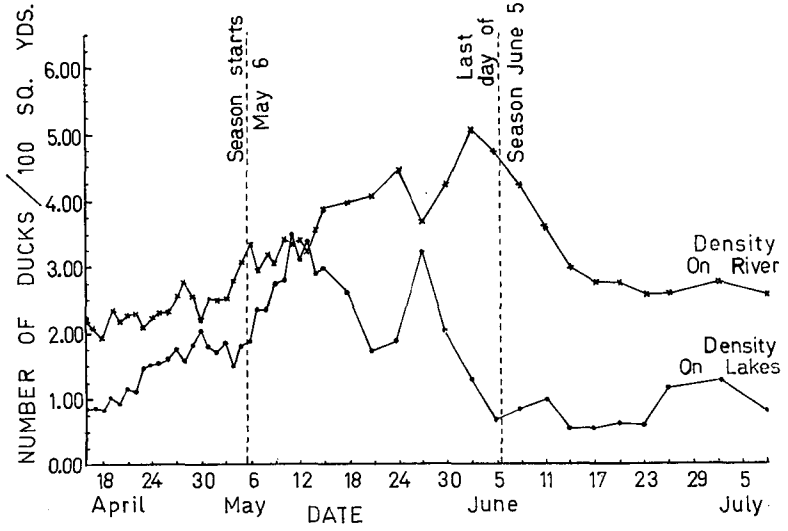

FIG. 2. DENSITIES OF DUCKS ON LAKES AND RIVER, PLOTTED AGAINST TIME.

lower than those on the river; densities on the ponds were not plotted, as pond numbers comprised a very small percentage of the total.

Stress appeared to affect the ducks in the high density periods during the shooting season in two ways: Firstly, they became more wary of people, would not let them approach closely and were more easily scared off the water by loud noises. Consequently large numbers of birds were in the air at any one time, mostly making short, low-level flights of 40 to 50 yards along the river. Secondly, squabbling and fighting among the birds became much more frequent.

DISCUSSION

The results suggest that ducks move into protected waters during the period of disturbance before and during the shooting season. At the time the study was initiated, on 16 April, the number of birds in the city study area was increasing steadily, coincident with disturbance at Lake Ellesmere as shooters claimed stands and erected shooting shelters from 16 April onwards. The first week-end of shooting increased the numbers still further, reaching a significantly higher level about 11 May. At the end of the season, the numbers fell away over a period of 12 days to a level not significantly different from the pre-season level.

The rapid fall-away of numbers could indicate that the high-level density was unstable. Several observations support this. Firstly, the small number of birds observed feeding on the lakes compared with birds on the river, correlated with the consistently lower densities on the lakes, suggests that food availability may become critical at the higher density level. Secondly, the squabbling and fighting among the high density birds suggests overcrowding. Their wariness of people at this period is probably due to gun-fright and may be infectious, spreading from Lake Ellesmere birds to birds normally resident in city waters. However, the adverse reaction of the birds to each other implies that some at least of the stress is due to overcrowding.

The ducks may use the Hagley Park lakes, especially the larger one, as land-marks in navigation. Ducks coming in or taking off on high-level and presumably long-distance flights use the lakes, rather than the river, where most flying is low-level and short- distance. Long-distance flying occurs at dusk or during the night and the lakes would be visible as reflecting bodies during either the day or the night. Once the lake is located, incoming ducks can move to the nearby river, which is surrounded by trees and may not be visible from high in the air. Lake Ellesmere is very large and ducks flying to it in clear weather should be able to recognise it from many miles away. Young ducks presumably learn the approximate direction to fly from older ducks.

Changes in the numbers of Lake Ellesmere and city birds could occur in two ways. The first postulates two sedentary populations, one at Lake Ellesmere and one in the city. With the onset of

disturbance at Lake Ellesmere, birds are forced off the lake and retreat to the city, forming a mixed-population group with the city birds. When the season closes, they move back to their home ground. The second explanation postulates that the two populations are not wholly separate entities, and that there is a small two-way exchange of birds throughout the year. Changes in the number of birds flying in either direction result in the phenomena recorded in the study. The first postulate requires that the birds confined to the city throughout the shooting season know when the season closes, and does not explain the night movements of ducks at other times of the year.

The second explanation is more satisfactory. The birds are wide-ranging and undergo long-distance flights throughout the year and an increase in ducks both landing on and taking off from the Hagley Park lakes during the shooting season has been noticed in the present study.

It seems feasible that throughout the year a small two-way traffic occurs between the two areas. The ducks, although appearing to anticipate the shooting season, come into the city during and following the first disturbance at Lake Ellesmere, the shelter-building. The incoming traffic to the city is thus suddenly augmented, and this continues when shooting begins. As the density in the city area builds up, food and overcrowding may become critical. The incoming traffic is still large, so that an unstable high level of numbers is maintained in the city by the increased inflow of birds. At the end of the season, when disturbance at Lake Ellesmere ceases, the incoming traffic drops considerably. Because the out-going traffic is still large, there is a rapid drop-off in city numbers. As the food and overcrowding situations are alleviated, the outward traffic also decreases, until fairly soon after the end of shooting, the city population is back to pre-season density, and the two-way traffic is small in both directions.

As the study was not initiated until 16 April, the date that disturbance started at Lake Ellesmere, it was not possible to ascertain if there was a pre-season stable level. Hence pre- and post-season numbers could not be compared to estimate total mortality during the shooting season.

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INVESTIGATION OF THE MECHANISM MAINTAINING POLYMORPHISM IN THE NEW ZEALAND FANTAIL, RHIPIDURA FULIGINOSA (SPARRMAN)

By JOHN L. CRAIG

ABSTRACT

Counts of the black and pied morphs (or forms) of the New Zealand Fantail *(Rhipidura fuliginosa)* in East Otago in 1969 gave a total of 824 pied (88.22%) and 110 black (11.78%). These proportions do not differ significantly from those established by other workers for the South Island.

However, morph frequency was found to vary in relation to the type of vegetation, the feeding station, and possibly also to altitude. Of the three vegetation types sampled, native hardwood forest had the highest frequency of the black morph (21%) and kanuka-manuka the lowest (5%). Introduced conifer forest had an intermediate value (14%). More pied birds were observed feeding in the canopy than in the ground to shrub layer, while the black morph showed the opposite trend. Only a restricted altitude range was sampled, but the data indicate that the black morph may be more common at higher than at lower altitudes.

Breeding data reported up to September 1970, are analysed and shown to fit the hypothesis (Caughley 1969) that the difference between pied and black is controlled by a single genetic locus with pied birds homozygous for a recessive allele. Allele frequencies are estimated as p_1 (black) 0.06 and p_2 (pied) 0.94 and morph frequencies overall agree well with those expected on the basis of Hardy-Weinberg equilibrium. There is no evidence, therefore, to implicate heterosis as a mechanism for maintaining the polymorphism. Differential habitat utilization may be such a mechanism but is unlikely to be the only one. Much work remains to be done in analysing the fantail polymorphism.

INTRODUCTION

Polymorphism as defined by Ford (1965) frequently takes the form of albinism or melanism in birds. The Fantail, *Rhipidura fuliginosa,* with its black and pied forms, is an example of the melanistic type. The range of the fantail includes Australia, Tasmania, New Zealand, the New Hebrides, New Caledonia, Norfolk, Lord Howe, Banks, and the Solomon Islands (Fleming 1949; Leach 1968) but only in New Zealand is it polymorphic. The species is believed to have arrived in New Zealand from Australia before the Late Pleistocene (Fleming 1961) and has presumably become polymorphic since then. As with most polymorphic species in birds, the fantail morphs were originally described as distinct species, and were still accepted as such by Oliver (1955). However, numerous reports of interbreeding of the two ' species ' led to early suggestions (Philpott 1919; Stresemann 1923) that they should be merged, and Fleming (1949) did so.

NOTORNIS 19: 42-55 (1972)

The black morph is rare in the North Island, but relatively common in the South Island. Early references to the frequencies of the two morphs are rather vague. Buller (1882) and Stresemann (1923) reported that the black morph was more common than the pied of the South Island, but no data were given. From 1943 to 1963, Mrs. I. Tily (pers. manuscripts) made counts in the Dunedin district, but as most of these were carried out in the same restricted area, a small sample is likely to have been counted repeatedly. Because no information is available on movement of fantails it would be unsafe to assume that her figures were representative of a large area although Oliver (1955) did so.

Pior to Caughley (1969), attempts to define a genetic model for the dimorphism were misled by the large percentage of pied birds which suggested to early workers unfamiliar with the principles of population genetics that the pied condition must be dominant (e.g. Oliver 1926, 1955). But models based on this assumption did not fit the breeding data.

As with most studies on polymorphic birds species, no attempt has been made to explain the mechanism maintaining the polymorphism, other than to assume that the morph frequencies must reflect Mendelian ratios. Of the three classes of polymorphism listed by Ford (1965), namely 'Neutral,' 'Transient,' and 'Balanced,' I have assumed that the fantail polymorphism fits the last mentioned, as there is nothing to suggest that morph frequencies are anything but stable. Stead (1932) reported that they had been stable for 30 years. Of the maintenance mechanisms for polymorphism listed by Williamson (1958), three can be meaningfully discussed.

1. *Heterosis.* Here the heterozygote is at a selective advantage compared to the two homozygotes and Ford (1965) suggested that this is the most common basis for polymorphism. Caughley (1969) postulated this as the maintainence mechanism in the fantail, but gave no evidence. If heterozygotes are at an advantage it would not be possible to obtain correct estimates of allele and genotype frequencies by assuming the Hardy-Weinberg formula as Caughley did.

2. *Preferential mating* with a member of the other morph(s). This has been demonstrated for the Arctic skua, *Stercorarius parasiticus,* (Berry & Davis, 1970). Mating appears to be random in the fantail and so this maintenance mechanism may not operate.

3. *Selective values varying in space or time,* or different ecological preferences of the different morphs. This is based on an extension of Gause's Principle, and assumes that for polymorphism or any other kind of sympatric diversity of form to exist, these different forms must have slightly different ecological preferences. Two types are illustrated: (a) *Different Temporal Selective Advantage* of the different morphs. This has been demonstrated in the Butterfly *Colias eurytheme* (Ford, 1965) where the orange morph of the female is at a selective advantage in summer while the white morph is at a corresponding

selective advantage in winter. The brevity of my study precluded investigation of this mechanism, but it should not be overlooked in future work.

(b) *Different Spatial Selective Advantage* or different habitat utilization by the two morphs. This has been demonstrated in the dipper *Cinclus cinclus* (Mayr & Stresemann, 1950), where the white-breasted morph is more frequent in lowland forest and the brown-breasted morph is more frequent in the open treeless steppes. Intermediate frequencies occur in intervening areas.

The aim of this study was to investigate whether the last mentioned maintenance mechanism might be operating, by seeking correlations between morph frequencies and factors such as vegetation type, feeding station and altitude. A genetic model for the dimorphism is postulated, and allele frequencies are calculated from observed population ratios and mating data, and then used to investigate the possible presence of heterosis.

METHODS

Periodic visits between 29 December 1968 and 26 August 1969 were made to forest, bush, scrub, and open areas within a thirty mile radius of Dunedin. Reserves and gardens within the city were also observed and the numbers of each fantail morph recorded. In general, new ground was covered on each visit, but in the few cases where the same area was recounted in a subsequent survey, there was an interval of at least two months between counts. Recounting was normally avoided and no area was counted more than twice. Gibbs' (1961) procedure was adopted on each visit: I walked slowly through the bush in a set direction, counting the numbers of birds seen. Gibbs' method was slightly modified because of having to distinguish which morph was heard. So when a bird could be heard but not seen, the search was continued away from the track till the bird could be observed. However, a small number of birds could not be located, and accordingly were not recorded. Extreme care was taken to avoid recounting the same bird during any one visit.

DESCRIPTION OF OBSERVATION AREAS

Most of the habitats visited could be grouped into three major types:

(1) *Native Hardwood Forest:* Initially this was divided into three categories, but because of insufficient numbers and basic similarities, these were subsequently grouped together. The first of the three was termed *'Transition Bush,'* that is, forest that had regenerated after burning or milling of the emergent podocarps. The canopy consists of *Griselinia littoralis, Fuchsia excorticata, Melicytus ramiflorus, Pseudopanax arboreum, P. colensoi, P. crassifolium, Carpodetus serratus, Aristotelia serrata* and *Pittosporum eugenioides.* The shrub layer includes many of the above mentioned species, but also *Pseudowintera*

colorata, Coprosma spp., *Dicksonia squarrosa* and *Cyathea* spp. The ground layer is mainly *Blechnum* spp., *Phymatodes diversifolium, Asplenium* spp. and *Microlaena avenacea.*

The second type, *Broadleaf Podocarp Forest,* is essentially similar except that the emergent podocarps *Dacrydium cupressinum, Podocarpus ferrugineus, P. totara* and *P. hallii* were present.

The third type, *Broadleaf Podocarp Beech Forest,* is similar except for the addition of *Nothofagus* spp. and sparser ground and shrub layers.

(2) *Kanuka-Manuka Association:* Kanuka, *Leptospermum ericoides,* and Manuka, *L. scoparium,* were present in all the previous bush types but formed only an inconspicuous part of shrub and canopy layers. In mature association they formed the great majority of the canopy. Shrub and ground layers had a similar composition to native hardwood forest except that pungas and *Asplenium* spp. were absent, while *Phymatodes diversifolium* was common. All layers were very open. (3) *Introduced Conifer Forest:* This consisted mainly of *Pinus* spp. but also included some *Pseudotsuga* spp., *Picea* spp., and *Cedrus* spp. Shrub and ground layers were absent but all roads and streams were fringed with small numbers of kanuka, manuka and other species common in the shrub layer of native hardwood forest.

MORPH FREQUENCIES

Of the 934 fantails scored by me, 824 were pied (88.22%) and 110 black (11.78%). Other counts for the Otago district are summarised in Appendix 1 and total 795 pied (86.98%) and 119 black (13.02%), while substantial counts for other South Island areas (Appendix 1) give a total of 981 pied (88.38%) and 129 black (11.62%). None of these frequencies differs significantly ($X^2 = 0.948$) from the others, and it appears that morph frequencies are relatively stable in the South Island. For the North Island there are only two substantial counts: for all the North Island, Caughley (1969) reported 419 pied and no black birds and in Wellington-Manawatu R. E. Brockie (pers. comm.) recorded 313 pied and 1 black. From incidental observations, I have recorded two black fantails and about 300 pied in the Manawatu and Coromandel. The contrast between the North and South Islands is, then, very striking.

MORPH DISTRIBUTION IN RELATION TO VEGETATION TYPES

In scoring birds according to the habitat in which they were seen, counts were normally made well away from the boundaries between vegetation types. Table 1 gives the counts for the three major vegetation types encountered.

Heterogeneity X^2 tests showed that the different areas for the native hardwood and conifer forest types were homogeneous in their morph frequencies (the considerable range in the hardwood forest samples is only to be expected from the small size of many

TABLE 1

MACROHABITAT DISTRIBUTION OF PIED & BLACK MORPHS

LOCALE	No. PIED	No. BLACK	TOTAL	Percentage Pied	Percentage Black
NATIVE HARDWOOD FOREST					
Leith Valley	53	10	63	84.1	15.9
Waipori	26	5	31	83.8	16.2
Waitati Valley	18	8	26	69.2	30.8
Powder Creek	10	4	14	71.4	28.6
Mount Cargill	10	3	13	76.9	23.1
Taieri Mouth	7	1	8	87.5	12.5
Saddle Hill	6	4	10	60.0	40.0
Total	130	35	165	78.8	21.2
KANUKA-MANUKA					
Powder Creek	150	4	154	97.4	2.6
3-Mile Hill - Waiora	50	2	52	96.2	3.8
Waitati Valley	46	2	48	95.8	4.2
Leith Valley	33	2	35	94.3	5.7
Pelichet Bay	33	7	40	82.5	17.5
Tirohanga	19	3	22	86.4	13.6
Outram Glen	18	-	18	100	0
Taieri Mouth	14	1	15	93.3	6.7
Fairfield	12	-	12	100	0
Otago Peninsula	10	-	10	100	0
Brighton	7	-	7	-	-
Waironga	3	-	3	-	-
Saddle Hill	2	-	2	-	-
Waipori	1	-	1	-	-
Total	398	21	419	95.0	5.0
CONIFER FOREST					
3-Mile Hill	111	18	129	86.0	14.0
Berwick	82	15	97	84.5	15.5
Leith Valley	16	2	18	88.9	11.1
Powder Creek	4	1	5	80.0	20.0
Total	213	36	249	85.6	14.4
CITY AREAS					
Total	59	12	71		
OTHER AREAS					
Total	24	6	30		
OVERALL TOTAL	824	110	934	88.22	11.78

of them). However, the kanuka-manuka areas were not homogeneous ($X^2 = 21.56$, d.f. 12, $P_{5\%} = 21.03$). The sample from Pelichet Bay was shown to differ significantly ($X^2 = 14.49$, d.f. 1, $P_{5\%} = 3.84$) from all the other kanuka-manuka areas, these forming a homogeneous subgroup. The anomalously high frequency for the black morph in the Pelichet Bay sample appears to be a sampling error: the counts were made in February at the end of the breeding season when 1 black

adult paired with a pied bird had a family of 3 black young, boosting the frequency of black. Because this territory marked the end and start of consecutive records, double counting is a likely source of bias. Subsequent visits in the following breeding season in search of breeding pairs revealed only 1 black bird, mated to a pied one, in a territory similar to the one in which the black birds had been observed earlier in the year.

Even when the Pelichet Bay counts are included, the frequency of the black morph in the kanuka-manuka association (5%) is significantly lower than in either the conifer forest (14.4%) or the native hardwood forest (1.2%), (X^2 = 17.85 and 79.29 respectively, d.f. 1, $P_{5\%}$ = 3.84). But a difference between the latter two vegetation types could not be demonstrated (X^2 = 3.19). Figure 1 illustrates the variation in morph frequencies with vegetation type.

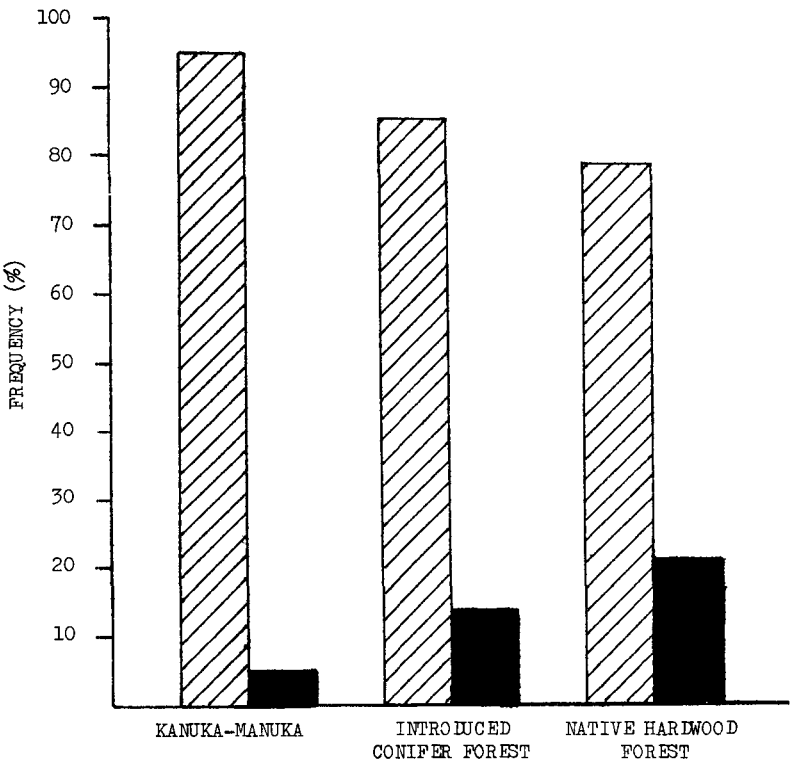


FIGURE 1 — Histogram of frequencies of black and pied morphs in the three major vegetation types. Pied frequencies are cross-hatched and black are blocked in.

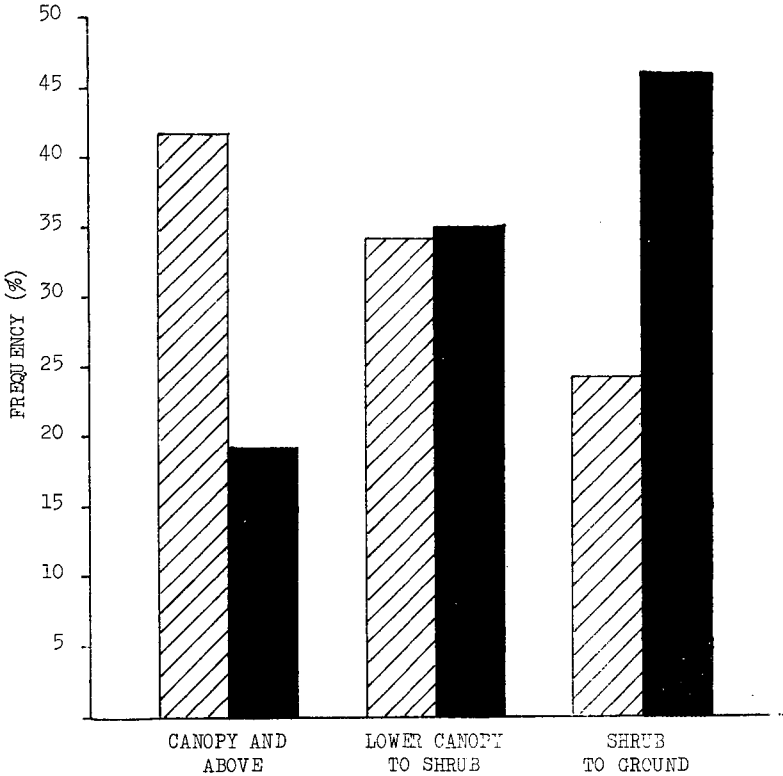
The only other count from a known type of habitat is R. H. Taylor's (pers. comm.) for a mixed beech forest in the St. Arnaud district, Nelson. He found 322 pied and 50 black (13.4%) — a value similar to mine for conifer forest, which resembles beech forest in the open nature of shrub and ground layers.

MORPH DISTRIBUTION IN RELATION TO FEEDING STATION

Four main feeding stations in the bush are recognised: (1) ground to shrub; (2) shrub to lower canopy. This includes understorey trees and is mainly an aerial station, in contrast to (1). As no shrubs were present in conifer forest, the lower limit was arbitrarily set at four feet, but it is a real station none the less. (3) canopy and above; (4) association feeding in which fantails feed on insects disturbed by other birds (almost exclusively other passerines). Table 2 gives the counts of black and pied birds in relation to feeding station for the forest types (also the Dunedin city and 'extra' tallies). The data indicate that pied birds are more likely to be found feeding in the canopy than in the ground to shrub layer, while black birds are commonest in the latter layer and rare in the canopy. (Fig. 2). According to McLean (1912), fantails feed high up on sunny days and near the ground on dull days. But when my data were subdivided according to whether days were sunny or dull, no correlation of feeding station with weather was apparent, so the data were pooled

TABLE 2 FEEDING STATION DISTRIBUTION of PIED AND BLACK MORPHS

FEEDING STATION	NATIVE		CONIFER		LEPTOSPERMUM		CITY		EXTRA		TOTAL	
	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.
Ground to Shrub	10	13	55	13	56	9	15	3			136	38
Shrub to Lower Canopy	38	10	68	12	71	5	12	2	3	-	192	29
Canopy	27	4	66	8	104	-	22	3	15	1	234	16
Association Feeding	18	1	6	-	47	2	51	1	1	-	77	4
Edge of Bush	10	6	3	-	40	2	-	-	-	-	53	8
Over Water	10	1	5	-	27	-	-	-	-	-	42	1
Other	2	-	-	-	5	-	7	3	3	5		
Not Feeding	15	-	11	3	48	3	-	-	-	-		



FIGUR E 2 — Histogram of the relative frequencies of black and pied morphs in the three major forest feeding stations (% derived from number of morph in each station over total numbers of that morph in all three stations). Pied birds are cross hatched and black birds are blacked in.

MORPH DISTRIBUTION IN RELATION TO ALTITUDE

Altitude was recorded to the nearest 100 feet (30.5 m) above sea level, and the data grouped into 500′ (152 m) intervals for analysis (Table 3). Most of the areas scored are below 500′, hence the preponderence of birds in the 0 - 500′ group. Only the hardwood forest vegetation type include reasonable numbers in all three altitudinal ranges. Here there is an indication that black birds may be proportionately more common at 1,000′ (304.8 m) and above than lower down, but statistical significance is not attained. On pooling the data for all vegetation types (Fig. 3), a trend similar to that in hardwood forest alone is evident, and the difference in morph frequency between 500′ (152 m) to 1,000′ (304.8 m) and 1,000′ (304.8 m) and above is now statistically significant ($X^2 = 7.64$).

TABLE 3 ALTITUDINAL DISTRIBUTION OF PIED AND BLACK MORPHS

Habitat	0 - 500'		500' - 1,000'		1,000' & above	
	Pied	Black	Pied	Black	Pied	Black
Native Hardwood	51	13	59	14	20	8
Introduced Conifer	164	31	40	3	9	2
Kanuka Manuka	350	19	26	2	2	-
City	61	12	-	-	-	-
Extra	21	1	-	-	3	5
Total	647	76	125	19	34	15

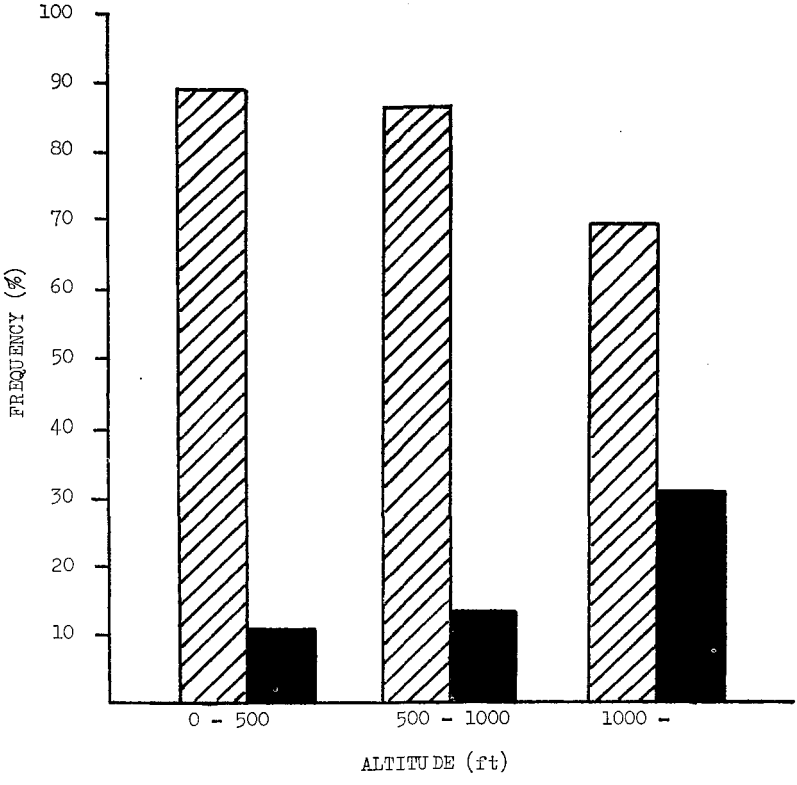


FIGURE 3 — Histogram of the distribution of black and pied morphs with altitude (morph frequencies calculated as a percentage of both morphs within each altitude range). Pied birds are cross-hatched and black birds are blacked in.

MECHANISMS THAT MAY BE INVOLVED IN MAINTAINING THE POLYMORPHISM

Of the various mechanisms possible, my field observations indicate that differential habitat utilization may be involved in maintaining the fantail polymorphism.

The striking and long recognised difference between North and South Islands in incidence of the black morph suggests that physiological adaptation to climate may also be involved. It is not profitable to speculate on which climatic factor or factors are important in the absence of more comprehensive data for different parts of the South Island. However, distribution of other New Zealand forest birds with darker forms suggest that temperature and precipitation may be involved.

(1) The tomtit *Petroica macrocephala* has a darker South Island form and a melanic one on Snares Islands.

(2) A melanic robin, *P. traversi,* is found only on the Chatham Islands.

(3) Two forms of the weka *Gallirallus australis* exist in the South Island. The lighter buff form is found in low rainfall districts of the eastern South Island. The second form, found in the western South Island and in Fiordland, an area with high rainfall, is dimorphic with a melanic phase (Annotated Checklist, OSNZ 1970).

A great deal more work is required to establish whether and how habitat selection is involved in maintaining the fantail polymorphism. Other factors, such as selective mortality and immigration, also need to be considered.

GENETIC MODEL

Oliver (1926, 1955) suggested two models on the assumption that pied was dominant (because it was the commoner morph), but neither accounted for the breeding data. Caughley (1969), using Oliver's figures, put forward an acceptable model (with black dominant and pied recessive) which accounted for all but one of the observed crosses. Matings additional to those reported by Oliver are, however, available and the breeding data assembled in Table 4 include all recorded up to September 1970. Thirty-two progenies from black x pied matings give a total of 54 pied and 49 black chicks. This agrees well with a 1:1 ratio ($X^2 = 0.24$). Twenty-six of these progenies were mixed, 3 each contained 4 pied chicks, 2 contained 3 black ones, and 3 one black chick each.

Seven of the eight progenies from black x black matings included black and pied morphs. The eighth family contained one black chick only.

Fifty-seven of the 58 matings between two pied parents recorded when the progeny were at least 11 days old (this being the earliest age (J. Hamel, pers. comm.) at which chicks can be positively classified as black or pied) gave only pied offspring. The 58th mating is a report of Stead's of a brood with one black and two pied offspring. However, like many observed matings, it is assumed that the pair

TABLE 4 RECORDED MATINGS

Authority	Parents	Young	
		Pied	Black
# A. Philpott (1919)	Black x Pied	1	1
"	" "	2	1
"	" "	2	1
"	" "	2	1
"	" "	1	2
"	" "	3	1
"	" "	3	1
"	" "	2	2
"	" "	2	2
"	" "	3	2
# L.A. Shand (Oliver 1955)	" "	4	-
# W.R.B. Oliver (1955)	" "	-	3
# C. Parr (Oliver 1926)	3 broods	3	9
# per Oliver (1955)	2 broods	2	5
G. Hamel (pers. comm.)	Black ♂ x Pied ♀	4	-
"	" "	1	3
"	Black ♀ x Pied ♂	3	1
"	" "	1	1
* B.D. Bell	Black ♂ x Pied ♀	1	1
I.W. St Paul (Notornis 8:212)	Black x Pied	-	3
A. Blackburn (Notornis 6:209)	" "	3	1
* D.V. Merton	" "	3	1
* J.E. Hilton	" "	-	1
"	" "	-	1
* J. Taylor	" "	2	-
"	" "	-	1
I. Tilly (Evening Star 7/2/53)	" "	4	-
C.A. Fleming (Notornis 2:172)	" "	1	2
(" 1:134)	" "	1	2
P. Moncrieff (1931)	Black x Black	1	2
" (Emu. 34:165)	" "	1	1
G. Hamel (pers. comm.)	" "	-	1
I. Tilly (Evening Star 7/2/53)	" "	both	
per W.R.B. Oliver (1955)	4 broods	"	
E.F. Stead (Oliver 1955)	Pied x Pied	2	1
Numerous others	" "		
	57 broods	162	-

Included in Oliver's (1955) ratio of 30 pied : 31 black
* Ornithological Society of New Zealand Nest Record Cards

concerned were not followed right through from nest building to the fledging of the young. Evidence presented below shows that birds observed around a nest after the eggs have been laid are not necessarily the pair that produced the eggs. If one bird deserts its territory, its place may be taken by another bird which may not necessarily be the same morph, and is presumably from a reserve breeding population. Stead's anomalous family may have involved an adopted parent, and therefore is not considered in the genetic model.

Philpott (1919) reported a black/pied mating where the nest was started on 8 November. The first egg was laid on the 11th and one on each of the next three consecutive days. The young left the nest on 12 December, but the pied parent had disappeared previously. A black bird which Philpott assumed to be a member of a previous brood began to assist feeding the young. This black pair then built another nest on 7 January suggesting that the incoming black bird was not an immature one as Philpott thought, but a member of a reserve breeding population.

Mrs. Jill Hamel (pers. comm.) reports a similar case where the pied male, distinguishable by a broken tail feather, of a black/pied pair abandoned the fifth nest soon after the young hatched. Not long after, another pied male (with a complete tail) started to form a territory in part of the black female's territory and eventually began feeding the fledglings and mated with the black female.

A third report from Hilton (Ornithological Society of N.Z. Nest Records) involved a mixed pair building a nest on 6 September. Three days later two pied birds were observed at the nest, but by 20 September the black bird had returned and was sitting on the nest.

The simplest model for explaining the breeding data is that put forward independently by Caughley (1969) and myself (1969), according to which a single locus with two alleles operates the switch mechanism in determining the black/pied difference, and that the pied birds are homozygous for the recessive alleles. All the breeding data fits this except for Stead's one anomalous family discussed above.

If it is assumed that the black parent in pied/black matings with all black progenies is homozygous for the dominant allele, a maximum estimate for the frequency of homozygotes may be obtained (families of only one black offspring were not considered to involve a homozygote). Two of the 32 matings would involve homozygous blacks on this basis, or 0.0625. From the population frequencies, black (BB + Bb) = 0.1178 and pied (bb) = 0.8822 (Table 1). So 0.1178 x 0.0625 = 0.0074 is a maximum estimate of the frequency of black homozygotes, with 0.1178 — 0.0074 = 0.1104 the frequency of heterozygotes. This yields estimated allele frequencies of p_1 (B) = 0.0626 and p (b) = 0.9374. If these are substituted into the Hardy-Weinberg formula, the calculated phenotype frequencies are very close to those observed.

Phenotype	Genotype	Frequency		
		H/W	Expected	Observed
Black	BB	p_1^2	0.0039)	0.1178
	Bb	$2p_1p_2$	0.1174) 0.1213	
Pied	bb	p_2^2	0.8787	0.8822

Thus there is no evidence that heterozygote advantage (heterosis) plays a prominent part in maintaining the polymorphism, contrary to the supposition of Caughley (1969). However, it is clear that further breeding data is required to evaluate the possible role of heterosis.

APPENDIX 1 COUNTS OF PIED AND BLACK MORPH

from other sources

(1) EAST OTAGO

Authority	Date	Pied	Black
# Allen, J.H.	1961-62	23	3
"	62-63	42	6
"	63-64	41	6
# Poppelwell, W.T.	-	48	6
	-	50	1
"	60-62	65	12
"	64-65	27	-
"	65-66	35	6
"	66	14	2
"	66-67	28	5
"	67-68	50	3
"	68	30	1
# Hamel, G.	66	15	4
* "	66	34	12
# "	65	3	1
# "	68	30	1
Dunedin Naturalists' Field Club (Notornis 3:24)	48	15	5
" (" 4:55)	50	31	6
" (" 4:193)	51	27	7
" (" 6:104)	54	9	1
Richdale, L.E. (Native Perching Birds)	no date	154	25
McKenzie, H.R. (Notornis 6:209)	55	10	4
* Westerskov, K.E.	69	14	2
		795	119

(2) Other South Island Areas

Caughley (1969)	Canterbury & Westland	298	44
* Jackson	Westland	361	35
* Taylor, R.	Nelson	322	50
		981	129

Ornithological Society of New Zealand Records

* pers. comm.

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NEW RECORDS OF THE KERGUELEN PETREL (PTERODROMA BREVIROSTRIS) IN THE SOUTH ATLANTIC AND PACIFIC OCEANS

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ABSTRACT

The range of the Kerguelen Petrel *(Pterodroma brevirostris)* is outlined and extensions into the South Atlantic and Pacific Oceans, based on observations from the ships *Eltanin* and *Eastwind,* are documented, suggesting a nearly circumpolar movement. "At sea" characters of flight pattern, plumage appearance and foot colour are noted.

The Kerguelen Petrel *(Pterodroma brevirostris)* breeds on the cool temperate and subantarctic islands of Gough, Marion, the Crozets, and Kerguelen in the Indian and South Atlantic Oceans (Swales 1965; Crawford 1952; Mougin 1962; and Kidder 1875), (Fig. 1). Elliott (1957) gave every indication that the species also nests in the Tristan da Cunha group, but confirmation is still needed. In addition to occurring near the breeding grounds, it ranges widely over the South Atlantic and Indian Oceans in the summer months, where it has been recorded from the coasts of Brazil (24°S, Pinto 1964) and Argentina (Paessler 1915; Olrog 1958); the cold waters of the Weddell Sea Gyre (Clarke 1907; Bierman & Voous 1950); the southern Indian Ocean from South Africa south and east around the Antarctic Continent almost as far as the Balleny Islands (Oordt & Kruijt 1954); well to the east of Kerguelen and Heard Islands from about 44°S, 95°E and 53° - 56°S, 85° - 92°E (Falla 1937); and near St Paul (Paulian 1953). Winter at-sea records are meagre. Rand (1963) reported Kerguelen Petrels between South Africa and the Crozets in June and July while carcasses have been washed up on beaches of western Australia and New Zealand after gales (Serventy & Whittell 1951; Condon 1954; Davenport & Sibson 1955; Falla, Sibson & Turbott, 1966).

Recent observations of the species in the South Pacific and South Atlantic Oceans by Harper aboard the antarctic research vessel, *Eltanin,* and by Watson and Angle on the US Coast Guard icebreaker, *Eastwind,* extend the known range considerably and suggest a nearly circumpolar movement (Fig. 1, Table 1). Harper saw it near the Antarctic Convergence between 100° and 145° West in October 1965 (Cruise 20), and in April and May the following year (Cruise 23), but failed to find it in the same area in the intervening November and December (Cruise 21). The species was more common east of

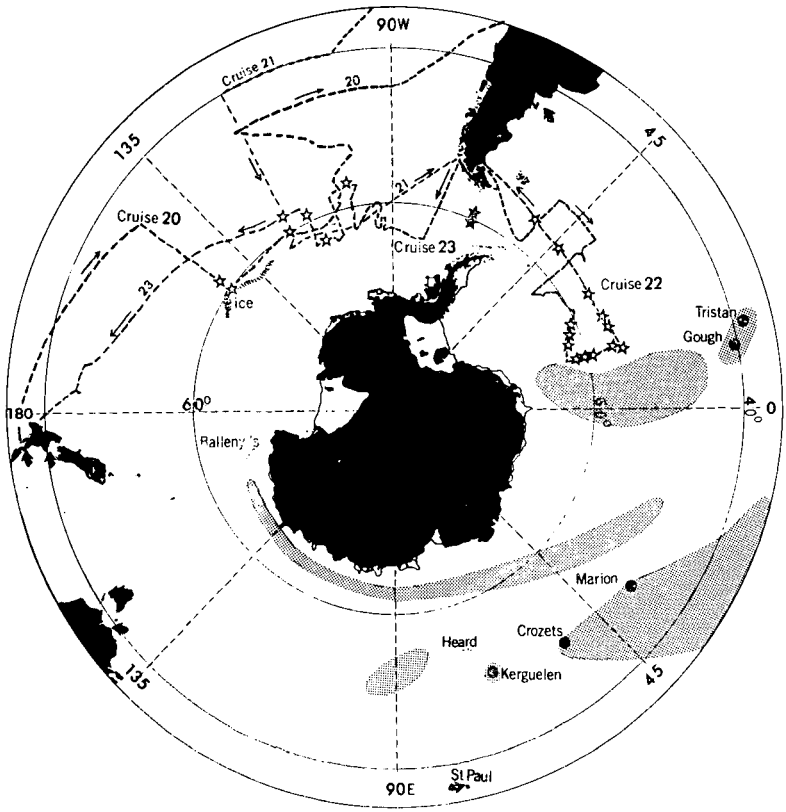

FIGURE 1 — Distribution of Kerguelen Petrel. Black circles indicate breeding sites; stippling, previously reported observations; black arrows, presumed vagrant records; open stars, *Eltanin* observations; and closed stars, East Wind observations.

the South Sandwich Islands (Cruise 22) in February and March 1966, where it was presumably feeding on krill *(Euphausia superba)* that threatened to clog the ship's cooling seawater intake. Watson and Angle saw it twice in February near the Convergence in the Drake Passage. Breeding birds generally remain in the vicinity of the breeding islands from September to March, suggesting that either these new records pertain to non-breeding subadult birds, or that the bird may breed on islands near Cape Horn. Harper did not see any petrels in wing moult, although the plumage of birds in the South Atlantic appeared faded in late February. Van dee Lee collected a specimen in body moult and saw other moulting birds in the same area in late January 1964 (Bierman & Voous, 1950).

TABLE 1. OBSERVATIONS OF KERGUELEN PETRELS IN SOUTH PACIFIC AND ATLANTIC OCEANS

DATE	POSITION S. Lat.	W. Long.	SEA TEMPERATURE	NUMBERS
Eltanin Cruise 20: Pacific Ocean				
1 Oct 1965	58° 31'	144° 55'	0°C	1
4 Oct 1965	59° 37'	144° 23'	-1.0	1
9 Oct 1965	60° 16'	126° 35'	1.0	Several
Eltanin Cruise 23:				
20 Apr 1966	58° 48'	100° 42'	5.8	1
30 Apr 1966	64° 02'	115° 38'	2.5	1
1 May 1966	63° 36'	115° 58'	3.1	Occasional
4 May 1966	58° 55'	115° 02'	5.3	Several
7 May 1966	57° 33'	118° 58'	5.1	1
Eltanin Cruise 22: Atlantic Ocean				
19 Feb 1966	61° 01'	26° 12'	1.0	2
20 Feb 1966	61° 44'	22° 27'	1.2	Frequent
21 Feb 1966	62° 29'	19° 03'	0.7	Frequent
22 Feb 1966	62° 33'	17° 34'	0.7	11
24 Feb 1966	61° 00'	14° 47'	0.5	Several
25 Feb 1966	60° 11'	14° 39'	1.0	2
26 Feb 1966	59° 16'	14° 52'	1.4	1
28 Feb 1966	55° 14'	15° 59'	2.7	1+
1 Mar 1966	55° 09'	15° 13'	2.2	4
2 Mar 1966	55° 24'	18° 58'	2.3	Several
3 Mar 1966	55° 23'	21° 53'	1.8	Occasional
4 Mar 1966	55° 29'	22° 35'	1.8	Occasional
7 Mar 1966	56° 19'	29° 53'	1.1	5
11 Mar 1966	55° 46'	45° 13'	4.0	4+
13 Mar 1966	55° 17'	53° 36'	6.4	3+
East Wind Cruise				
23 Feb 1966	60° 20'	64° 46'		2
23 Feb 1966	59° 13'	64° 48'		1

The unusual flight pattern of the Kerguelen Petrel is a good at-sea character as has been pointed out by Bierman & Voous (1950). They state that " . . . the birds were mostly observed flying alone, very high in the air; the slender profile and the very rapid wing beats recalled swifts *(Apus apus)* in flight." In a steady wind we observed Kerguelen Petrels soaring some thirty or more feet above the sea in long high glides or merely floating on the wind. Occasional individuals, attracted to the ship, would drift in close to the lee side

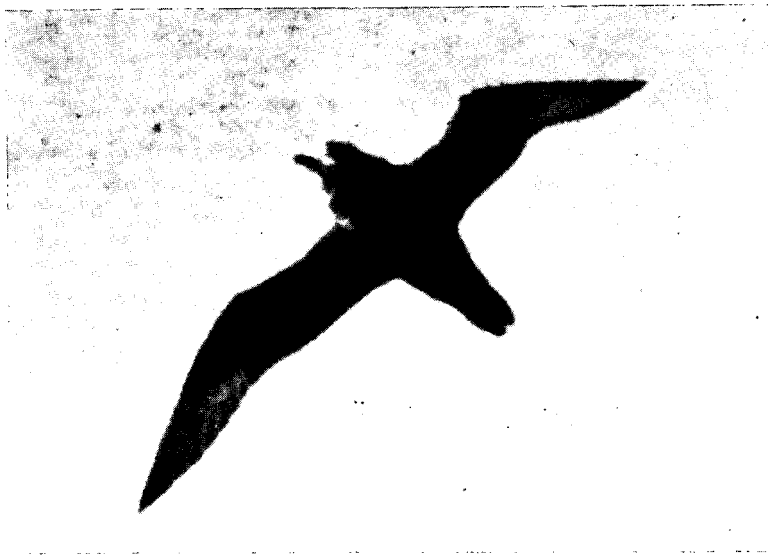

FIGURE 2 — Kerguelen Petrel in flight in South Atlantic Ocean shows reflective properties of glossy grey plumage.

of the bridge and remained long enough to permit Harper to take a photograph (Fig. 2) before floating off on the wind currents, still high above the surface of the sea. In the Southern Ocean's infrequent calms, the species resorted to a weaving, bat-like, flight just above the sea surface.

At close range, the glossy plumage displays reflective properties which impart the appearance of grey or white patches on the forehead, belly or wings. Harper's photograph demonstrates this phenomenon. In strong sunlight, the underwing coverts likewise can appear silvery or white. The head seems conspicuously larger than in other small gadfly petrels, and the feet are entirely black, or appear to be so when the webs are not spread.

A rare all-dark phase of the related Soft-plumaged Petrel, *P. mollis,* breeds on Marion and Gough Islands (Rand 1954; Elliott 1957; Swales 1965) and might conceivably occur in the areas of our observations. Such birds might seem difficult, or impossible, to distinguish from *brevirostris* at a distance. The flight pattern and the head size of *brevirostris* are, however, quite characteristic, apart from the silvery gloss on the underwing of *brevirostris* and its lack in *mollis.*

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PRELIMINARY REPORT ON BIRD BANDING IN NEW ZEALAND 1964 - 1971

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Since the publication of the 14th Annual Report of the New Zealand Bird Banding Scheme in November 1964 the scheme has undergone some dramatic changes in scope and administration. The historical development of two banding schemes in New Zealand resulted in the general splitting of activities into game and non-game birds under the administration of the Wildlife Service, Internal Affairs Department and the Dominion Museum respectively.

On the 1st April 1967 the two schemes were brought under the control of the Wildlife Service and have run basically as one scheme since that date. Prior to this merger the Dominion Museum had started the conversion of its recovery records to punch card storage for future computer analysis. However, the merger created initial problems of administration and record keeping for what were two basically different schemes, both in scope and methods of recording data. In some fields comparative data did not exist or were not compatible with the two schemes.

A further complication was a very rapid increase not only in the number of birds banded, but also the numbers recovered. This latter factor was a reflection of an increasing number of detailed studies producing a high recovery rate. Accordingly a number of delays occurred while the staff of the Banding Office coped with the conversion of the old non-game records to computer storage and the increasing number of recoveries. This preliminary report reviews the activities from 1 April 1964 to 31 March 1971. Because of historically different recording methods used the Grand Totals for Birds Banded and Recovered in Tables 1 and 2 are at present only provisional and represent a minimum figure.

For game-bird banding prior to 1967 there are as yet no final exact totals, so those shown are based mainly on published information and analyses at present in progress. Further, no records or incomplete totals have been included for the Northern Royal Albatross at Taiaroa Head, Notornis, Partridge and Californian Quail which have yet to be analysed in detail.

When dealing with recoveries, because only those for non-game birds have so far been completely converted to computer storage, it has not been possible to demarcate between recoveries of game-birds prior to 1964 and the period since then. Therefore the grand totals shown for recoveries and repeats will be larger than for the combined total of the two periods shown.

NOTORNIS 19: 61-73 (1972)

The provisional summary shown in Table 2 illustrates the dramatic increases in banding activity since 1964. Forty-one new species have been banded in the last seven years and a notable aspect of this is the start on studies of native bush birds. The provisional total of recoveries and repeats is 113,384. Just over 100,000 of these are currently in computer storage, the majority of them having been converted since 1968. On present indications close to 20,000 new recoveries and repeats will be added during the 1971/72 year. A selection of the interesting recoveries received from non-game birds during the period 1964-71 is shown in Table 3.

I am especially grateful to the following for their assistance: L. R. Moran, G. Hatzakortzian, Mrs. S. J. McKenzie, Miss J. Pascoe and my other colleagues in the Wildlife Service; the Education Department punching pool, Upper Hutt, for card punching and verification (some 18 million key depressions in all); the Ministry of Works E.D.P. Branch and the Applied Mathematics Laboratory, D.S.I.R., for the writing and development of the programme "BIRDBAND"; and to all banding operators who have suffered considerable inconvenience during the conversion period.

TABLE ONE

BANDING AND RECOVERY TOTALS

PAGE 1

Number banded = New birds only.
Recoveries = Birds Recovered at least once.
Repeat = Extra recoveries for birds recovered once.

( ) Provisional Total Only.

\+ = New Species 1964-71
* = Total unknown

SPECIES NAME	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Northern Blue Penguin	798	378	1,176	449	58	507	2,705	100	2,805
+ Southern Blue Penguin	0	65	65	-	1	1	-	-	-
White-flippered Penguin	166	666	832	6	63	69	-	6	6
+ N.Z. Crested Penguin	0	230	230	-	2	2	-	-	-
+ Snares Crested Penguin	0	642	642	-	12	12	-	-	-
+ Erect-crested Penguin	0	23	23	-	-	-	-	-	-
Wandering Albatross	114	1,027	1,141	4	46	50	-	9	9
Southern Royal Albatross	3,026	15,263	18,289	74	2,232	2,306	7	1,476	1,483
Black-browed Mollymawk	102	9,940	10,042	7	581	588	1	67	68
+ Grey-headed Mollymawk	0	3,089	3,089	46	481	527	10	126	136
Bullers Mollymawk	415	208	623	5	98	103	-	1	1
White-capped Mollymawk	529	3	532	18	3	21	1	1	2
Salvin's Mollymawk	232	2	234	1	-	1	-	-	-
Light-mantled Sooty Albatross	71	267	338	16	10	26	3	-	3
Giant Petrel	406	466	872	31	159	190	3	59	62
Antarctic Fulmar	1	0	1	-	-	-	-	-	-
Cape Pigeon	6,649	135	6,784	517	5	522	31	2	33
Broad Billed Prion	503	37	540	-	-	-	-	-	-

SPECIES NAME	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
PAGE 2	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Antarctic Prion +	0	20	20	-	-	-	-	-	-
Prion Sp.	3	1	4	-	-	-	-	-	-
Fairy Prion	10,304	20,986	31,290	250	713	963	15	88	103
Fulmar Prion	61	0	61	-	-	-	-	-	-
Flesh-footed Shearwater	1,361	119	1,480	55	5	60	1	1	2
Wedge-tailed Shearwater	2	306	308	-	-	-	-	-	-
Buller's Shearwater	169	195	364	-	-	-	-	-	-
Sooty Shearwater	651	2,402	3,053	47	47	94	5	12	17
Fluttering Shearwater	779	201	980	18	44	62	3	11	14
Huttons Shearwater	6	285	291	1	-	1	-	-	-
Kermadec Allied Shearwater +	0	4	4	-	8	8	-	-	-
N.Is. Allied Shearwater	163	118	281	-	1	1	-	-	-
Grey Petrel +	0	6	6	-	1	1	-	-	-
Black Petrel	10	4	14	-	1	1	-	-	-
Westland Black Petrel	162	196	358	1	2	3	-	-	-
White-Chinned Petrel	1	9	10	-	-	-	-	-	-
Grey-faced Petrel	2,108	6,280	8,388	75	163	238	41	11	52
White-headed Petrel	5	23	28	-	-	-	-	-	-
Black-capped Petrel +	0	228	228	-	-	-	-	-	-
Mottled Petrel	109	135	244	-	1	1	-	-	-
Kermadec Petrel +	0	944	944	-	-	-	-	-	-
Pycrofts Petrel	64	145	209	6	14	20	8	35	43
Gould Petrel	1	0	1	-	-	-	-	-	-
Cooks Petrel	1	7	8	-	-	-	-	-	-

SPECIES NAME	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
PAGE 3	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Black-winged Petrel	3	1,993	1,996	-	-	-	-	-	-
Chatham Is. Petrel	1	0	1	-	-	-	-	-	-
Grey-backed Storm Petrel	17	73	90	-	-	-	-	-	-
White-faced Storm Petrel	1,881	2,048	3,929	42	184	226	6	42	48
+ Black-bellied Storm Petrel	0	1	1	-	-	-	-	-	-
Diving Petrel	4,105	2,159	6,264	262	401	663	54	404	458
Petrel Sp.	0	1	1	-	-	-	-	-	-
Red-tailed Tropic Bird	22	94	116	-	2	2	-	1	1
White-tailed Tropic Bird	2	7	9	-	-	-	-	-	-
Australian Gannet	7,510	4,598	12,108	733	1,689	2,422	547	2,436	2,983
+ Brown Booby	0	1	1	-	-	-	-	-	-
+ Masked Booby	0	147	147	-	-	-	-	-	-
Pied Shag	31	98	129	2	28	30	-	4	4
Little Black Shag	2	3	5	-	2	2	-	-	-
Black Shag	15	0	15	-	2	2	-	-	-
White-throated Shag	10	7	17	3	1	2	-	-	-
Stewart Is. Shag	2	0	2	2	4	6	-	-	-
Campbell Is. Shag	26	31	57	-	1	1	-	-	-
Spotted Shag	101	12	113	6	-	6	-	-	-
+ White Heron	0	1	1	-	1	1	-	1	1
Reef Heron	14	1	15	3	-	3	-	-	-
White-faced Heron	4	8	12	-	1	1	-	2	2
Australian Bittern	3	1	4	-	-	-	-	-	-
Canada Goose	(11,685)	(8,902)	20,587	*	*	(11,497)	*	*	(9,091)

SPECIES NAME	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
PAGE 4	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Black Swan	(15,455)	(9,003)	24,458	*	*	(5,664)	*	*	(12)
Paradise Duck	(2,027)	(9,712)	(11,739)	*	*	(2,034)	*	*	(123)
Grey Teal	*	(351)	(351)	*	*	(47)	*	*	(6)
+ Brown Teal	0	67	67	-	3	3	-	-	-
Grey Duck	(20,722)	(9,052)	(29,774)	*	(1,836)	(8,705)	*	*	(36)
Mallard Duck	(24,368)	(25,098)	(49,466)	*	(4,210)	(7,860)	*	*	(205)
Shoveller Duck	*	(6)	(6)	*	*	(12)	*	*	(3)
Blue Duck	*	(16)	(16)	*	*	(2)	*	*	-
Mallard Duck Cross	(367)	(1,012)	(1,379)	*	*	(327)	*	*	(1)
Duck - Grey or Mallard	*	(13)	(13)	-	-	-	-	-	-
Australasian Harrier	444	632	1,076	128	172	290	11	105	116
Pheasant	(35,244)	(9,260)	(44,504)	(1,963)	(1,665)	(3,628)	*	*	(8)
Californian Quail	(22)	(250)	(272)	*	*	(109)	*	*	(1)
+ Chukor	0	184	184	-	1	1	-	-	-
Partridge	*	(10,903)	(10,903)	*	*	(884)	*	*	(24)
Banded Rail	4	0	4	-	-	-	-	-	-
Weka Sp.	1	0	1	-	-	-	-	-	-
North Island Weka	662	1,726	2,388	25	58	83	45	-	45
Western Weka	11	133	144	-	9	9	-	-	-
Eastern Weka	19	0	19	3	1	4	-	-	-
+ Spotless Crake	0	2	2	-	-	-	-	-	-
Pukeko	(64)	(336)	(400)	*	*	(65)	*	*	(1)
Notornis	(35)	(1)	(36)	*	*	(21)	*	*	(11)
S.Is. Pied Oystercatcher	135	536	671	5	76	81	2	24	26
Northern Oystercatcher	10	96	106	-	33	33	-	47	47

SPECIES NAME	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
PAGE 5	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Black Oystercatcher	4	75	79	-	5	5	-	3	3
Chatham Is. Oystercatcher +	0	12	12	-	-	-	-	-	-
Spur-Winged Plover	73	441	514	-	18	18	-	-	-
Banded Dotterel	270	111	381	1	4	5	-	3	3
N.Z. Dotterel	21	23	44	7	4	11	-	41	41
N.Z. Shore Plover +	0	17	17	-	-	-	-	-	-
Wrybill	24	118	142	-	1	1	-	-	-
Turnstone +	0	2	2	-	-	-	-	-	-
Chatham Is. Snipe +	0	22	22	-	-	-	-	-	-
Snares Is. Snipe +	0	45	45	-	6	6	-	-	-
Bar-tailed Godwit	3	0	3	-	-	-	-	-	-
Pied Stilt	170	108	278	4	26	30	-	1	1
Black Stilt +	0	11	11	-	-	-	-	-	-
Southern Skua	205	207	412	10	62	72	2	12	14
Arctic Skua +	0	1	1	-	-	-	-	-	-
Antarctic Skua	463	1,488	1,951	74	696	770	46	525	571
Black-backed Gull	25,713	24,437	50,150	1,514	1,861	3,375	71	100	171
Red-billed Gull	17,519	19,836	37,355	3,952	4,525	8,477	2,744	2,395	5,139
Black-billed Gull	16,399	8,881	25,280	1,015	758	1,773	805	496	1,301
Black-fronted Tern	302	367	669	3	66	69	-	30	30
Caspian Tern	883	1,097	1,980	49	8	57	-	-	-
Antarctic Tern	6	2	8	-	-	-	-	-	-
Fairy Tern	3	0	3	-	-	-	-	-	-
White-fronted Tern	8,586	6,544	15,130	250	194	444	-	34	34
Sooty Tern	4,604	9,980	14,584	-	143	143	-	-	-

SPECIES NAME		NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
PAGE 6		PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Common Noddy		1	0	1	-	-	-	-	-	-
White-capped Noddy	+	0	7	7	-	-	-	-	-	-
White Tern	+	0	2	2	-	-	-	-	-	-
Grey Ternlet	+	0	49	49	-	-	-	-	-	-
Malay Spotted Dove	+	0	2	2	-	1	1	-	-	-
N.Z. Pigeon		10	12	22	1	2	3	-	-	-
Kea		840	192	1,032	305	246	551	1,803	1,251	3,054
Antipodes Is. Parakeet	+	0	39	39	-	5	5	-	-	-
Kermadec Parakeet	+	0	6	6	-	-	-	-	-	-
N.Z. Parakeet		3	12	15	-	-	-	-	-	-
Reischeks Parakeet	+	0	33	33	-	-	-	-	-	-
Yellow-crowned Parakeet	+	0	34	34	-	4	4	-	-	-
Shining Cuckoo		9	11	20	1	1	2	-	-	-
Long-tailed Cuckoo		1	1	2	-	1	1	-	-	-
Morepork		3	18	21	-	7	7	-	19	19
Little Owl		1	11	12	-	-	-	-	-	-
N.Z. Kingfisher		32	63	95	-	12	12	-	3	3
N. Is. Rifleman	+	0	20	20	-	11	11	-	37	37
S. Is. Rifleman	+	0	162	162	-	-	-	-	-	-
Skylark		8	22	30	-	1	1	-	-	-
Welcome Swallow	+	0	65	65	-	-	-	-	-	-
N. Is. Fantail		31	72	103	1	25	26	1	74	75
S. Is. Fantail		15	122	137	-	1	1	-	-	-
Pied Tit		2	80	82	-	27	27	-	50	50
Yellow-breasted Tit		4	129	133	-	11	11	-	1	1

SPECIES NAME	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
PAGE 7	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Black Tit	0	4	4	-	-	-	-	-	-
South Is. Robin	1	33	34	-	3	3	-	-	-
Stewart Is. Robin +	0	1	1	-	-	-	-	-	-
South Is. Fernbird +	0	33	33	-	-	-	-	-	-
Stewart Is. Fernbird +	0	1	1	-	-	-	-	-	-
Snares Is. Fernbird +	0	50	50	-	-	-	-	-	-
Brown Creeper	2	14	16	-	2	2	-	-	-
Whitehead +	0	32	32	-	10	10	-	4	4
Grey Warbler	33	175	208	1	21	22	-	37	37
Song Thrush	836	1,239	2,075	89	143	232	34	75	109
Blackbird	1,933	2,197	4,130	411	565	976	288	836	1,124
British Hedgesparrow	556	745	1,301	65	140	205	79	223	302
N.Z. Pipit	1	38	39	-	5	5	-	-	-
Bellbird	158	692	850	4	72	76	4	69	73
Tui	46	256	302	1	23	24	-	11	11
Silvereye	8,177	17,376	25,553	355	2,478	2,833	169	4,382	4,551
Greenfinch	1,309	1,708	3,017	94	207	301	62	476	538
Goldfinch	899	745	1,644	36	23	59	11	4	15
Lesser Redpoll	2,105	2,265	4,370	169	345	514	354	1,699	2,053
Chaffinch	425	768	1,193	38	118	156	108	147	255
Yellowhammer	205	255	460	6	32	38	4	16	20
Cirl Bunting	1	1	2	-	-	-	-	-	-
House Sparrow	6,019	11,710	17,729	277	1,353	1,630	66	590	656
Starling	577	2,078	2,655	55	185	240	3	26	29
Myna	33	1,131	1,164	5	280	285	-	120	120

SPECIES NAME PAGE 8	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL	PREVIOUS	1964-71	TOTAL
Rook	75	882	957	3	215	218	-	103	103
Black-backed Magpie	1	33	34	-	14	14	-	2	2
White-backed Magpie	18	24	42	6	6	12	5	16	21
Magpie Sp.	0	4	4	1	2	3	-	7	7
N. Is. Saddleback	35	162	197	-	14	14	-	10	10
S. Is. Saddleback +	0	111	111	-	10	10	-	-	-
N. Is. Kokako	3	3	6	-	-	-	-	-	-
PROVISIONAL TOTALS	253,652	283,385	537,037	13,607	30,129	74,905	10,158	18,999	38,679

TABLE TWO PROVISIONAL SUMMARY OF BANDING TOTALS

ALL SPECIES	1950 - 1964 14 years	1964 - 1971 7 years
NUMBER BANDED	253,652	283,385
PERCENTAGE OF TOTAL	47.23%	52.77%
AVERAGE/YEAR	18,118	40,483
TOTAL SPECIES	133	174
GAME SPECIES - PERCENTAGE RECOVERED	20.59%	
NON-GAME SPECIES - PERCENTAGE RECOVERED	10.21%	
ALL SPECIES PERCENTAGE RECOVERED	13.9%	

NON-GAME SPECIES	1950 - 1964 14 years	1964 - 1971 7 years
NUMBER BANDED	143,698	199,829
PERCENTAGE OF TOTAL	41.83%	58.17%
AVERAGE/YEAR	10,264	28,547
NUMBER RECOVERED	12,640	22,429
PERCENTAGE OF TOTAL	36%	64%
AVERAGE/YEAR	902	3,221
NUMBER REPEATS	10,158	18,670
PERCENTAGE OF TOTAL	35%	65%
AVERAGE/YEAR	751	2,667

TABLE THREE

PAGE 1 A SELECTION OF INTERESTING RECOVERIES RECEIVED 1964-1971

SPECIES	BAND	BANDED LOCALITY AND DATE		RECOVERED LOCALITY AND DATE		AGE, DISTANCE y.m.d.	
Northern Blue Penguin	P-408	Somes Is.	1.3.57	Flaxbourne R. Mth.	19.11.69	12-8-19	57SW
"	P-510	Somes Is.	20.4.57	Wellington.	15.12.69	12-6-26	8W
White-flippered Penguin	P-2021	Banks Peninsula.	4.12.67	Otago Harbour.	4.4.68	0-4-0	174SW
"	P-2559	Motunau Is.	26.12.70	Moeraki.	11.1.71	0-0-16	193SSW
"	P-2579	Motunau Is.	26.12.70	Shag Pt, Palmerston.	24.1.71	0-0-29	198SW
"	P-2887	Motunau Is.	28.12.70	Papanui Inlet.	20.1.71	0-0-23	227SW
"	P-1563	Motunau Is.	7.11.61	Motunau Is.	28.12.70	9-0-22	
N.Z. Crested Penguin	J-307	Jacksons Head.	12.10.69	Okarito.	(8.12.70)	1-1-26	102NE
Snares Crested Penguin	ATI	Snares Is.	5.1.67	Waiau R. Mouth.	6.3.68	1-1-30	135NNE
Wandering Albatross	R-18908	Antipodes Is.	23.2.69	Malabar, (AUSTRALIA).	9.8.69	0-5-14	1776WNW
Southern Royal Albatross	R-12915	Campbell Is.	31.1.58	Campbell Is.	7.1.70	11-11-25	
"	R-12748	Campbell Is.	10.2.43	Campbell Is.	22.12.69	26-10-12	
"	R-1240	Campbell Is.	8.1.62	SOUTH ATLANTIC.	22.7.66	4-6-12	6225SSE
"	R-8357	Auckland Is.	23.1.66	SOUTH INDIAN OCEAN.	17.9.70	4-7-23	3478WSW
"	R-10989	Campbell Is.	12.5.67	SOUTH INDIAN OCEAN.	15.8.70	3-3-3	3432WSW
Black-browed Mollymawk	M-20075	Campbell Is.	5.4.69	Southport (AUSTRALIA).	27.5.70	1-1-22	1851NNW
"	0-12022	Campbell Is.	9.3.68	NEW HEBRIDES.	24.8.68	0-5-15	2449NNW
"	0-10708	Campbell Is.	9.3.68	TONGA.	24.3.70	2-0-14	2387NNE
"	0-12105	Campbell Is.	13.3.68	FIJI.	4.8.68	0-4-22	2449NNE
Grey-headed Mollymawk	M-750	Campbell Is.	9.11.61	Campbell Is.	21.9.68	6-10-11	
Bullers Mollymawk	0-1954	Snares Is.	5.2.61	At Sea, Timaru.	25.6.70	9-4-17	365NE
White-capped Mollymawk	16117	Cape Campbell.	24.1.57	SOUTH AFRICA.	29.9.68	11-8-4	6857SSW
Giant Petrel	0-8137	Campbell Is.	4.11.67	ARGENTINA.	30.5.68	0-6-25	5679SSE
"	0-8152	Campbell Is.	13.11.67	N.S.W. AUSTRALIA.	14.10.69	1-11-0	1549NW
"	0-12615	Tory Channel.	23.7.58	Antipodes Is.	4.2.69	10-6-13	626SSE

SPECIES PAGE 2	BAND	BANDED LOCALITY AND DATE		RECOVERED LOCALITY AND DATE		AGE, DISTANCE	
						y.m.d.	
Cape Pigeon	H-9426	Tory Channel.	20.7.63	ANTARCTIC.	(00.12.68)	5-4-0	2194SSW
"	H-1507	Tory Channel.	2.9.59	Wellington.	19.7.70	10-10-15	36ESE
"	H-4611	Oamaru, at Sea.	2.11.59	Snares Is.	12.2.70	10-3-11	304SW
Fairy Prion	D-15547	Motunau Is.	21.10.61	Motunau Is.	27.12.70	9-2-5	
Flesh-footed Shearwater	H-12678	Karewa Is.	29.3.64	Off White Is.	16.2.70	5-10-18	65E
"	Z-340	Off Waima R.	23.3.66	George Sound.	3.1.71	4-9-11	401WSW
Sooty Shearwater	Z-257	Motunau Is.	23.10.63	Quinault R. (U.S.A.)	9.9.66	2-10-16	7312NE
"	Z-132	Motunau Is.	7.12.61	Motunau Is.	29.12.70	9-0-21	
Sooty Shearwater	Z-230	Stephens Is.	1.10.63	California (U.S.A.)	26.8.65	1-10-24	6692NE
Fluttering Shearwater	X-392	Mercury Is.	4.9.62	Waiwakaiho R.	25.9.66	4-0-21	199SSW
Black Petrel	K-2106	Little Barrier Is.	29.11.63	Little Barrier Is.	12.12.69	6-0-13	
Pycrofts Petrel	D-24308	Hen Is.	14.12.61	Hen Is.	9.1.66	4-0-26	
White-faced Storm Petrel	C-4059	Motunau Is.	6.12.61	Motunau Is.	29.12.70	9-0-22	
Diving Petrel	D-6454	Brothers Is.	6.5.61	Brothers Is.	24.9.70	9-3-19	
Australian Gannet	M-12497	Cape Kidnappers.	15.1.51	Cape Kidnappers.	17.12.70	19-11-0	
"	M-13763	Cape Kidnappers.	21.1.67	Port Lincoln, (AUSTR.)	1.5.68	1-3-9	2283W
Campbell Is. Shag	M-5544	Campbell Is.	27.5.63	Campbell Is.	29.10.69	6-5-3	
White Heron	O-12701	Brighton.	29.8.68	Hari Hari.	(10.8.70)	1-11-10	195N
Grey Teal	Z-7027	Lake Wahi.	21.8.69	Poolburn.	2.5.70	1-2-8	587SSW
Australasian Harrier	L-4366	Invercargill Loc.	22.4.67	Motupiko.	5.8.68	1-3-14	408NNE
N.Is. Weka	M-15218	Rawhiti.	15.12.67	Tuakau.	3.5.68	0-4-18	151S
Pukeko	M-3910	Roslyn Bush.	4.11.63	Lake Murihiku.	24.12.70	7-1-20	7W
"	M-7942	Fairfax.	8.8.69	Kakapo Swamp.	5.8.70	0-11-26	62NNW
S.Is. Pied Oystercatcher	K-428	Invercargill.	5.11.62	Invercargill.	(11.12.66)	4-1-5	
"	K-257	Invercargill Loc.	20.12.64	Waimakariri R. Mouth	12.5.68	3-4-21	285NE
Black Oystercatcher	K-3231	Jacksons Bay.	12.7.67	Okarito R. Mouth.	13.7.69	2-0-1	74NE
Banded Dotterel	C-1734	Lake Ellesmere.	30.10.61	Lake Ellesmere.	(18.12.68)	7-1-18	

SPECIES PAGE 3	BAND	BANDED LOCALITY AND DATE		RECOVERED LOCALITY AND DATE		AGE, DISTANCE y.m.d.	
Pied Stilt	E-55652	Karitane.	16.11.67	Alexandra.	20.3.68	0-4-3	66WNW
Southern Skua	L-10908	Campbell Is.	29.1.58	Campbell Is.	16.11.67	9-9-16	
Antarctic Skua	L-4210	C. Hallett, (ANTARCT)	24.1.64	Hokkaido, JAPAN.	24.4.66	2-3-3	8016NNW
Black-backed Gull	S-6296	Makarewa.	17.12.62	Auckland.	27.11.67	4-11-9	818NNE
"	S-26107	Clarence R. Mouth	11.12.65	Mataura	24.11.66	0-11-13	366 SW
Red-billed Gull	E-71924	Kaikoura.	21.12.59	Petone.	9.2.71	11-1-19	100NE
Black-billed Gull	E-46468	Waipara R. Mouth.	20.11.66	Tutaekuri R. Mouth.	11.4.68	1-4-20	324NE
Caspian Tern	12793	S. Kaipara Head.	12.12.54	S. Kaipara Head.	6.12.69	14-11-24	
White-fronted Tern	6275	Firth of Thames.	28.1.53	Orere.	16.3.69	17-1-19	177ESE
"	D-20979	Ure R. Mouth.	8.12.62	Hamilton, (AUSTRALIA).	29.6.68	5-6-20	1722W
Kea	26959	Arthurs Pass.	15.9.56	Arthurs Pass.	26.10.70	14-1-9	
"	22296	Takahe Valley.	27.9.57	McKinnon Pass.	16.12.70	13-2-18	34N
Song Thrush	C-1467	Invercargill Loc.	28.1.62	Invercargill Loc.	31.1.68	6-0-2	
Blackbird	D-69746	Invercargill Loc.	22.3.60	Invercargill Loc.	18.4.70	10-0-26	
British Hedgesparrow	A-1308	Invercargill Loc.	23.4.60	Invercargill Loc.	31.7.66	6-3-7	
Silvereye	A-17158	Rangiora.	11.6.67	Otira.	12.11.68	1-5-1	61NW
"	876	Dunedin.	31.3.59	Dunedin.	(1.7.65)	6-3-11	
Greenfinch	B-2592	Invercargill Loc.	30.12.62	Invercargill Loc.	13.6.70	7-5-12	
"	A-7673	Upper Hutt.	3.10.65	Christchurch.	20.10.66	1-0-16	200SW
Lesser Redpoll	A-5350	Invercargill Loc.	26.9.61	Invercargill Loc.	25.8.69	7-10-28	
Chaffinch	A-5744	Invercargill Loc.	4.6.62	Invercargill Loc.	9.4.70	7-10-4	
House Sparrow	B-1439	Upper Hutt.	3.2.60	Lower Hutt.	9.2.69	9-0-6	14SW
"	B-10559	Upper Hutt.	6.1.65	Reporoa	(2.8.65)	0-6-25	197NNE
Starling	D-70051	Lower Hutt.	14.12.59	Lower Hutt.	6.10.68	8-9-22	
Myna	E-39915	Havelock North.	1.6.65	Havelock North.	15.2.71	5-8-14	
S.Is. Saddleback	D-22114	Big Stage Is.	28.8.64	Big Stage Is.	8.3.69	4-6-8	

HISTORY OF DISTRIBUTION OF THE CRESTED GREBE (Podiceps cristatus) IN THE NORTH ISLAND AND NELSON-MARLBOROUGH

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ABSTRACT

The Crested Grebe **Podiceps cristatus australis** is a rare bird in New Zealand, now confined to the South Island. It was formerly present on a few of the large North Island lakes; there is a subfossil record from a Maori midden, carbondated to A.D. 945, and more recent observations — from the period 1870-1900 of breeding populations on Lakes Waikareiti and Waikaremoana. In Nelson-Marlborough Crested Grebes were formerly found on Lakes Rotoroa and Rotoiti; they were possibly first seen in New Zealand and identified on Lake Rotoroa in 1846 by Heaphy, and certainly observed and correctly identified at these lakes by Haast in 1860. They have disappeared as breeding birds from the lakes some time during the last 15-20 years. There is a sub-fossil grebe from Lake Grassmere, Marlborough, possibly from a Maori midden. Today there are no longer Crested Grebes in the North Island or in Nelson-Marlborough, northern South Island.

INTRODUCTION

The Crested Grebe has a limited distribution in New Zealand and while now confined to the South Island was formerly also present as a breeding bird in the North Island.

As part of a study of the ecology and distribution of the Crested Grebe, this paper presents material collected about its presence in the North Island and in Nelson and Marlborough in northern South Island. In a previous paper (Westerskov, 1970) I have discussed the distribution and history of decline of this species in Canterbury Province where some of the country's most suitable grebe lakes are found.

The decline in the population of Crested Grebes in Canterbury has been in the order of some 35-40 per cent over the last 20-30 years; while this has been alarming, the situation in the northern parts of the country discussed in this paper is even gloomier as grebes there have disappeared entirely as breeding birds. This has resulted in a shrinking of the grebe range in a southerly direction, a shrinking process still continuing.

For general information about the scope of this study, material and methods, and acknowledgement of assistance received is referred to the first paper in this series.

The Crested Grebe is a native bird in New Zealand, immigrated from Australia. The species has undoubtedly been here for some thousands of years as indicated by its former and present distribution but does not belong to an old faunal element. Its ecological counterpart with which it shares its lake habitat in Australia, the Australian Coot *Fulica atra australis,* is, however, a recent arrival in this country from across the Tasman; while stragglers have appeared occasionally for many years, it was not till the fifties that a major influx and subsequent breeding was recorded; the first nest of Australian Coot in New Zealand was found at Lake Hayes near Queenstown in November 1958 (Small and Soper, 1959). Both in Australia and in Europe, Crested Grebes are commonly seen associating with Coots

and only the further establishment and spread of Coots in the South Island will show whether also here this ecologically enforced co-existence will eventuate.

While a number of species and subspecies of New Zealand native birds have become extinct or near-extinct during the last hundred years — since the discovery of the Southern Crested Grebe — this elusive waterbird seems, according to the few accounts available, to have been uncommon to rare even then. From all accounts it never was a common bird in New Zealand as it is in north-western Europe; in New Zealand it has suffered some — and is likely to suffer much more — from the activities of man. Crested Grebes have in the last century disappeared from (been exterminated in ?) Lakes Waikaremoana and Waikareiti and earlier Lake Taupo in the North Island, and several lakes including Lakes Rotoroa and Rotoiti in the South Island; the information about Crested Grebes at the latter two lakes is conflicting, and indications are that the grebes have now disappeared from these two lakes within the Nelson Lakes National Park. This is so much more sad as it was at these two lakes that the species was first observed, identified and reported upon, by Heaphy (1846, in Taylor, 1959) in 1846 at Lake Rotoroa, and by Haast during his explorations in Nelson in 1860 (Haast, 1861: 138); Haast's comment about this grebe was that " only very little is known."

CRESTED GREBE IN THE NORTH ISLAND

There are no verified records of recent breeding of Crested Grebes in the North Island and it is doubtful that it was ever fully established as a breeding bird except on Lake Taupo (altitude 1,172 ft.) and Lakes Waikaremoana and Waikareiti (altitudes 1,920 ft. and 2,900 ft., respectively). The North Island is spectacularly wanting in high country lakes suitable for Crested Grebe; neither are there the type of large lakes, fed by cool mountain streams, at lower elevations as found in Westland.

On the lakes, ponds and dams of the North Island, the endemic New Zealand Dabchick *Podiceps rufipectus* is a fairly common breeding bird while in the South Island this species is very rare and increasingly so. Indications are that the Dabchick was formerly much more common in the South Island than today; Buller (1888) even stated: " It is very abundant in all the freshwater lakes and lagoons of the South Island." A population shift to the north has certainly taken place since then. So today the two grebes are largely separated by Cook Strait in their distribution, the smaller Dabchick occurring in the warmer waters (and also some of the deep cool lakes) of the North Island, the Crested Grebe confined to the cooler snow-fed lakes of the South Island.

Lake Taupo

An extremely interesting sub-fossil find of Crested Grebe at Lake Taupo was first brought to my notice by Mr. R. J. Scarlett of the Canterbury Museum; he had identified the skeletal material for Mr. T. J. Hosking of the New Zealand Historic Places Trust, Geraldine.

This record is unpublished, and I am very grateful to Mr. Hosking for supplying me with the relevant detail and allowing me to publish this valuable find in this context.

The most interesting information about this find is undoubtedly its age. Carbondating (by Messrs. Ferguson and Rafter of the Department of Scientific and Industrial Research, Lower Hutt) of charcoal found in a hangi on the same floor as where the grebe material was found gave a date of year 1,005 ± 57 years at 1 January 1950, or A.D. 945; this carbondating was carried out for the New Zealand Archeological Association.

The site of the discovery was the Whakamoenga Point at Lake Taupo. The excavation was done with standard squares and baulks; the first level of human occupation was found at a depth of some three feet below the present surface.

The Crested Grebe material consisted of a single bone, a tarsometatarsus, and it was recovered on 26 January 1962; it was first identified by Mr. R. J. Scarlett, Osteologist of the Canterbury Museum, and later confirmed by E. W. Dawson of the Oceanographic Institute, identifying bone material for the Dominion Museum. Associated with the grebe bone was moa material (not identifiable) and various shells. Bones were also found of the common bush birds — hunted in the bush surrounding the lake — and Mr. Hosking advises that from memory there were bones of Kiwi, Weka, Kaka, Kakapo, Tui, North Island Thrush, Red- and Yellow-fronted Parakeets, but no New Zealand Pigeon or Huia; there were also bones of Grey Duck.

This find is extremely interesting as it shows occurrence of the Crested Grebe in earlier times at Lake Taupo, whence there has been no record in historic times. Indications certainly are of breeding of this grebe at the period shown as well as occurrence in numbers allowing hunting by the Maoris. Future research may reveal other pre-historic finds of Crested Grebes associated with Maori kitchen middens and camp sites elsewhere in New Zealand, and one can only look forward to the development of this special branch of archeology with expectation and high hopes. Such work in some European countries has given outstanding results and has shown distributional patterns, indications of habitats, vegetation types and climatic conditions, as well as comparative abundance and avifaunistic changes.

This find shows former presence of Crested Grebes at Lake Taupo; and as none of the early explorers nor more recent observers has ever observed and reported grebes on this lake — I lived at Lake Taupo for two years, 1952-53, and never saw or heard of Crested Grebes during many trips to, along and on the lake — one may speculate as to the reasons for their disappearance. Were they eliminated by the increasing Maori populations? Or was the disappearance caused by changes in lake level, disappearance of protecting reed-beds for nesting, volcanic activities, climatic changes?

There is one recent observation published of Crested Grebe in the Taupo area. Lacking qualifying statements, details of observations or other proof of such a unique occurrence, it may be wiser to treat with some caution Vaile's observation (1935: 156) at Broadlands, between Taupo and Rotorua. Vaile described his experi-

ences and observations during the many years when he broke in and developed his farming enterprise. He stated: " Only once have I seen the Crested Grebe at Broadlands." None of the field staff of the Wildlife Division, with sub-districts in the Rotorua Acclimatisation District, has ever seen and reported observations of Crested Grebe, although constant field work and ranging take them to all parts of Lake Taupo and other lakes within the district. I have personally on a number of occasions been in the Broadlands area, and have neither seen Crested Grebes, nor even remotely suitable habitat for them.

Lakes Waikaremoana and Waikareiti

Our earliest record of Crested Grebe occurrence in historic time in the North Island is Buller's statement (1877: 200): " I have never met with this species in the North Island, but Captain Mair informs me that he has on two occasions seen it in Waikaremoana Lake in the Urewera country, and once on the Waikareiti, another lake in the same country."

In 1888 in his classical ' A History of the Birds of New Zealand ' Buller again mentioned occurrences of Crested Grebe in the North Island: " The late Mr. Wilmer informed me that during an expedition with Major Goring to Waikareiti, in the spring of 1879, he shot seven or eight of them on that lake, and he sent me the skin of one he had preserved. This is a curious fact in the distribution of this bird, seeing that Waikareiti is at a much higher elevation than Waikaremoana, where this Grebe has never been found." The last remark, incidentally, is not in agreement with Buller's 11 years earlier published account, quoted above, that Captain Mair had seen this species twice on Lake Waikaremoana.

There is a further record of Crested Grebe from Waikareiti. Best (1897: 61) on his travels to ' Waikare-Moana, the Sea of Rippling Waters ' remarked on the birds of Waikareiti: " wild-fowl were formerly numerous, including the whio, maka, weweia, and kaha, the latter a large bird which nested in the branches trailing into the water on the shore-line." Kaha is one of the Maori names for the Crested Grebe (Williams, 1957: 82), and the description of the floating anchored nest fits accurately; Best appears either to have seen this bird and its nest at Waikareiti, or to have obtained a description of the nest which bears the mark of observation.

The above is practically the total of available evidence of Crested Grebe in the North Island, indicating a formerly very sparse and scattered occurrence with breeding birds established at Lakes Waikareiti and Waikaremoana, Lake Taupo and possibly Broadlands (the Crested Grebe observed at Broadlands if properly identified could have been a straggler).

To this can be added the following interesting account which shows that Crested Grebes may still persist in (or visit ?) Lake Waikareiti. Mr. David R. Rosenberg, Lecturer in Biology at Hamilton Teachers' College, writes in a letter dated 25 June 1968 as follows: " In late January 1961 I was carrying out a limnological survey of a bog area behind Lake Waikare-iti near Lake Waikaremoana, Urewera National Park. Late in the afternoon I returned to my camp in Sandy Bay on the north-eastern side when I saw a crested grebe

less than twenty yards from the rocky point on the right hand side. There was no mistaking the features with the prominent 'ears' and the body low in the water. It was in full view for about twenty minutes just paddling backwards and forwards, then disappeared around the point. No sound was made."

This observation made under ideal conditions can hardly refer to any other bird than the Crested Grebe although some specimens of the polymorphic White-throated Shag *Phalacrocorax melanoleucos brevirostris,* maybe with a light hind-wind stirring up their long crest feathers, can look deceptively like the Crested Grebe. At the 1968 New Zealand Ecological Society Conference, held in Auckland, Mr. I. L. James of the Forest Research Institute, Rotorua, read a paper (James and Wallis, 1969) on a study of the effects of introduced mammals at Lake Waikareiti. As James had had recent field experience at and in Lake Waikareiti (Rahui Island was visited as one of the sampling areas), I asked him whether he had seen any Crested Grebes during field work at the lake and sailing on the lake, but he had not. James' co-worker, Mr. F. P. Wallis, has kindly advised me (pers. comm.) that during field work at the lake during a six days' stay in May 1967 and a visit to the lake on 11 March 1969 no grebes were seen. Mr. A. E. Reiher, New Zealand Forest Service, Ruatahuna, advises (pers. comm.) that he has never seen nor received information about Crested Grebes in the area. Mr. Reiher further writes that Mr. W. Sander, Chief Ranger of Urewera National Park, has advised him that he has never heard of grebes being present on the lake. Forest and Park staff have been alerted as to the possibility of Crested Grebes on Lake Waikareiti.

Crested Grebes are large conspicuous birds, with an elaborate and spectacular courtship display, with a loud and penetrating call, and it is unlikely that it should have nested at Lake Waikareiti all these years without having been detected. But there is history of Crested Grebe occupation at Lake Waikareiti and Rosenberg's recent observation spurs to renewed attention. Could some of the keener North Island field ornithologists put in a full and careful study and establish whether Crested Grebes may be present on Lake Waikareiti? Or does a straggler occasionally reach the North Island after the breeding season in the south? Or is it possible that very rarely an Australian Crested Grebe, storm-caught and wind-borne, may find its way to our shores? In the first place both our Crested Grebes, and Dabchicks (the latter related to and originating from blown-over *Podiceps poliocephalus* from Australia) came from there; and over recent years the influx of Australian birds, in particular to the South Island, has been astounding; a most interesting arrival is the Australian Little Grebe *Podiceps novaehollandiae,* observed in a pond near Arrowtown, Otago in November 1968 (Chance, 1969).

CRESTED GREBE IN THE SOUTH ISLAND

Of the only two published maps known to me, showing world distribution of the Crested Grebe, one (Dementiev and Gladkov, 1951: 264) shows presence of this grebe in both North and South Islands, while the other (Voous, 1960: 26) rightly shows presence in South Island only although incorrectly all of this island is marked as being occupied by Crested Grebe. The distribution of the Crested Grebe

in the South Island is, however, very limited and probably was never extended except for a few peripheral occurrences, such as in some of the larger lakes in Nelson and Marlborough.

Nelson District

The area corresponds to the Nelson Acclimatisation District and its borders to the west are the Tasman Mountains, The Twins, Nuggets Knob, and Mt. Montgomery, to the south the Brunner and Victoria Ranges, and to the east the Spenser Mountains, St. Arnaud and Richmond Ranges, and Saddle Hill east of Nelson City. There are very few inland lakes in Nelson; there are no suitable coastal lakes or lagoons and only two large high country lakes so the area is not and never was suitable Crested Grebe habitat.

The only two lakes in Nelson which have supported populations of Crested Grebe are Rotoroa and Rotoiti.

Rotoroa is a large lake in a picturesque setting, and at an altitude of 1,460 ft. Both this lake and Rotoiti are situated within the Nelson Lakes National Park and are thus theoretically safeguarded.

What is probably the first published observation of the Crested Grebe in New Zealand originates from Lake Rotoroa. The 24 years old Charles Heaphy, who had come to New Zealand on a three years' contract as artist and draughtsman with the New Zealand Company, visited Lake Rotoroa in February 1846. With him were Thomas Brunner (after whom Lake Brunner was named) and the Maori Kehu. In his account of the trip, published in the *Nelson Examiner* for 7 and 14 March 1846 (and re-published pp. 188-203 in Taylor, 1959) Heaphy has this entry from Lake Rotoroa for 11 February 1846: " As we left the shore the whole expanse of the lake became visible, with its densely wooded shores, and the high snowy mountain range at its head, in its wild grandeur, closing the view. Grebes and divers with other water-birds, were floating about on the surface, nor did the instability of our shallop deter us from getting a shot at them." Heaphy also reports that while at Lake Rotoroa, Kehu for food snared four Wekas, caught ten eels, and shot six New Zealand Pigeons and four Blue Ducks, but grebes were not mentioned as being shot. While not fully satisfactory and convincing, this description suggests that Heaphy observed Crested Grebes on Lake Rotoroa in 1846. In his earlier book about New Zealand, Heaphy (1842: 47) who had spent two months in the Nelson district and altogether three years in various parts of New Zealand, had this to say about waterbirds observed by him: " The paradise and common duck, teal, widgeon, water-hen, and diver, are all found in great numbers in the rivers." But this statement is so general and vague — and downright incorrect if taken literally — that only an appreciable stretching of the imagination and an over-generous amount of good-will can equate Heaphy's 'diver' with the Crested Grebe of interest in this connection.

While Heaphy's observation of 'grebes' at Lake Rotoroa in explorations in Nelson Province, Haast (1861: 138) mentions that: 1846 may be doubted (and not considered acceptable as the first New Zealand record of the Crested Grebe), Haast's 1860 observation at this lake cannot be discounted. In the detailed report of his

" On the lakes, besides the several inhabitants before enumerated, we found the crested grebe *(Podiceps cristatus ?),* of which only very little is known." From the narrative it is evident that Haast by the lakes means Lakes Rotoiti and Rotoroa; furthermore, it is also evident from the report as well as from Haast's map of Nelson Province (not published with the report but later published as an appendix to his son, H. F. von Haast's 1948 biography) with his line of route shown, that Haast only visited Lakes Rotoiti and Rotoroa during his whole expedition. He did not visit Lakes Hochstetter and Brunner as he had planned (" the rain again pouring down, I resolved to return to the pah instead of going, as I had previously intended, to Lake Brunner "). Haast visited Lake Rotoroa in January 1860, and the observations at this lake and at Lake Rotoiti of Crested Grebes — although details are lacking and now untraceable — are the first published observation of Crested Grebes in New Zealand.

Lake Rotoroa became a well-known haunt of the Crested Grebe. Around the year 1900 Mr. Dudley Win, formerly a settler of Owen River, recorded some 20 Crested Grebes on the lake (Bull, 1965: 91). Grebes were recorded present in 1925 (Moncrieff, Emu 25: 24), and in 1928 Mrs. P. Moncrieff about Crested Grebes records: " On a large lake near Nelson it nests yearly; 1927 it built its nest, but never hatched its brood owing to floods, which, although the bird endeavoured to build its nest up to meet the fast rising waters, eventually swamped the structure." M. M. Small (pers. comm.) saw Crested Grebes on this lake in November 1952. In a letter dated 8 January 1968 R. H. Taylor of the Ecology Division states: " Crested Grebes are not present on the two lakes in Nelson Lakes National Park. Since 1962 I have travelled on, or around, these lakes extensively and have not seen these grebes or heard of any being sighted." Bull (pers. comm.) did not see any grebes during two visits in 1963 and 1965, neither did I see any in the northern end of the lake in January 1968. The only recent record obtained is the observation of two Crested Grebes in October 1967, in the top end of the lake (R. T. Brown, Nelson, pers. comm.). Indications are that Crested Grebes have ceased to breed at Lake Rotoroa some time during the last 15-20 years but that they may still occur as occasional visitors, or stragglers, maybe looking for suitable nesting habitat.

Lake Rotoiti is a smaller and narrower lake, surrounded by bush-clad ranges; elevation 1,997 ft. While no extensive reed-beds or other suitable nesting areas are found, this lake formerly harboured a small population of breeding grebes. Haast (1861), as mentioned above, saw Crested Grebes at both Lake Rotoiti and Lake Rotoroa in 1860 without, however, giving further details. Buller (1888: 284) mentions " A down-coloured chick killed by Mr. Cheeseman (out of a brood of seven) on Rotoiti lake, South Island, in January 1881, is preserved in the Auckland Museum " and (l.c.: 286) that his son in his collection has a particularly small Crested Grebe egg (51 x 32 mm.) from Lake Rotoiti. M. M. Small (pers. comm.) saw the species when surveying the lake in November 1952. P. C. Bull (pers. comm.) did not see any Crested Grebes during several crossings of the lake in 1963-65; as mentioned above under Lake Rotoroa, R. H. Taylor (pers. comm.) saw no grebes between 1962 and 1967 during extensive travel on and around Lake Rotoiti. I failed to see any grebes in the north end of the lake in January 1968.

At the small Lake Cobb in the Tasman Mountains, Ranger D. V. Zumbach (pers. comm.) of the Nelson Acclimatisation Society saw in 1961 what he believed was a Crested Grebe; the bird was seen from some distance and when approached dived: " I am certain it was one although I was not able to get close enough to be certain of its colour, etc. The position in the water was what drew my attention and there were no other waterfowl of any species on the lake at the time."

No Crested Grebes were seen on the two small lakes in Nelson Lakes National Park, Lake Constance, visited in March 1963, and Lake Angelus, visited in November 1962 and February 1963 (L. C. Batcheler, pers. comm.).

In 1938 " Grebes and water-fowl are definitely decreasing " in Nelson Province (Moncrieff, 1938: 228). Indications are that there are no more breeding Crested Grebes in Nelson, but a closer look at Lake Cobb may be worth the effort (although maybe only stragglers occur or have occurred there); the recent observations of Crested Grebes at Lake Rotoroa (1952 and 1967) may be of stragglers, but potential breeding in the future may be worth watching for by visitors and local bird-watchers.

Marlborough District

The area corresponds to the Marlborough Acclimatisation District. Its borders are the Sounds area to the north, the Southern Alps (the St. Arnaud and Richmond Ranges) to the west, the Kaikoura Mountains and the sea to the east, and Mt. Humboldt, Dillon Cone and the Conway River to the south. There is a dry high-altitude central plateau north-west of Molesworth. In the whole district there are no large lakes and only very few small lakes and tarns.

Although it has been stated that the Crested Grebe: " is rare in Marlborough " (Oliver, 1930: 88), there is little past evidence except the specimen labelled " Marlborough 1892 " from the Buller collection, now in the Canterbury Museum, and mentioned further below.

There is a new and unpublished record of a sub-fossil Crested Grebe found in Marlborough which Mr. R. J. Scarlett of Canterbury Museum has generously allowed me to publish in this paper. The skeletal part is a left tarso-metatarsus, collected on 4 October 1954 by Dr. R. S. Duff and Mr. J. R. Eyles in sand-dunes at Marfill Beach, Lake Grassmere. This specimen (now in the Canterbury Museum, AV 10729) was probably associated with man and may stem from a Maori midden.

There is an unconfirmed record of Crested Grebes occurring or having occurred on Lake Chalice at the headwaters of the Goulter River, north of the Wairau River (D. V. Zumbach, pers. comm.). Verification is needed.

Poorly labelled old museum specimens are of little value in establishing former distribution; for what it is worth, there is a male Crested Grebe (AV 1223) labelled " Marlborough 1892 " from the Buller collection and now in the Canterbury Museum.

Apart from the above, I know of no published record of past or present occurrence of the Crested Grebe in Marlborough, nor have I received reports of any. M. M. Small (pers. comm.) informs me that he saw no Crested Grebes during his extensive waterfowl survey in Marlborough in June-December 1952: during this survey practically all lakes, dams and lagoons in the district were visited.

During my own several visits to the district I have not heard of any reports or seen Crested Grebes in Marlborough; Mr. S. R. Kennington (O.S.N.Z. Rec. Scheme) also reported this species as not recorded in Marlborough; and Mr. J. A. Cowie, Regional Representative of the Ornithological Society of New Zealand reports (pers. comm.): "As far as I know there are no Crested Grebe in Marlborough. In the 12 years I have been here I have never heard of them in this region and if anyone has recognised the bird here, there would have been considerable publicity."

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SHORT NOTES

THE SPREAD OF THE BLACK-FRONTED DOTTEREL

(a) *MANUKAU HARBOUR*

For two successive winters a Black-fronted Dotterel has joined the Wrybills which at full tide have been roosting on the dredged shell and mud beside No. 4 pond A.M.D.B. Mangere. It was found by Gerald Robinson on 22 May 1970, this being the first record of the species as far north as Manukau Harbour. It remained at least till 15 August; and during its three months' stay it was watched at close quarters by Mrs S. Reed and other Auckland members on at least eight occasions. For example on 24 July 1970 it was standing quietly on the edge of a compact flock of c. 400 Wrybills; while at some distance was a loose scattering of c. 200 Banded Dotterels.

On 29 June 1971 Pat Crombie reported that a Black-fronted Dotterel was once again present with the wintering Wrybills. This bird also disappeared about mid-August. It especially favoured the edges of a shallow pool, where it could sometimes be found either by itself or near feeding stilts, while the Wrybills were away on the tidal flats. In both winters Banded Dotterels resorted to the five or six acres of dried out dredgings, which indeed provided an ideal dotterel habitat. Not once was the Black-fronted Dotterel seen to consort with the Banded Dotterels. On 10 August it was easily located near its chosen pool. It was missing next day nor was it seen thereafter.

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(b) *LOWER WAIKATO*

In the mid-1960s Ross McKenzie and I made several trips reconnoitring the numerous lakes of the lower Waikato. On 12 June we found a pair of Black-fronted Dotterels, which were frequenting an attractive little delta in the south-east sector of L. Waikare. They were in full view at the water's edge where a streamlet fanned over a pumicey beach. We were alerted by their flittings and movements. Then while H.R.McK. used his telescope I crossed some marshy ground and examined them from a distance of 20-30 yards. They were clearly a pair, one being rather bigger than the other. They were sharing their strip of beach with a pair of Pipits. Water-levels in L. Waikare are now controlled by the Waikato Valley Authority. At the time of our visit the level was low. When I returned on 7 August, no *melanops* could be seen, but a Welcome Swallow was flitting over the swampy delta. Now this area is overgrown with weeds and no longer suitable.

Although we have returned to L. Waikare on numerous occasions, we have no further sightings, but the lake is so large that there may be isolated stretches of shore where Black-fronted Dotterels could bring off a brood when the water is low.

Often have we looked hopefully across the water to a tongue of land which juts into L. Wahi. There have been reports that dotterels visit this locality in summer. On 1 February 1970 Mr Peter Howard kindly arranged to take me there and I was at once impressed with the possibilities of the shore-line. Stilts, of course, were numerous in the muddy shallows and two sandpipers were carefully diagnosed as American, *Calidris melanotos.* Of Black-fronted Dotterels there was not a sign.

Along the River Waikato itself sandy islands are often exposed in summer for weeks, even months, on end. In a dry summer these might well repay examination from Huntly downwards.

The provenance of the few Black-fronted Dotterels so far discovered in the province of Auckland is a matter of conjecture. All have appeared in winter. Are they fresh invaders from Australia or pioneers of a northward dispersal from Hawkes Bay?

R. B. SIBSON

(c) *TARANAKI*

On the morning of 1 August 1971, in the course of a regular beach patrol, W. Cash and R. Gallienne saw an unusual dotterel at a small fresh-water lagoon about 50 yards from the sea near Bell Block beach, 5 miles north of New Plymouth. In the afternoon the writer and W. Cash returned and were able to watch the dotterel closely as it fed actively around the edge of the same lagoon. It was a Black-fronted Dotterel *(Charadrius melanops),* the first known record of this species from Taranaki.

D. G. MEDWAY

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(d) *WAIKANAE*

On 13 November 1971 Dr and Mrs C. A. Fleming watched a Black-fronted Dotterel feeding on the north bank of the Waikanae River not far from the new marina.

(e) *MARLBOROUGH*

On 14 May 1969 we saw three Black-fronted Dotterels on the Wairau River bed, just below the main road (No. 1 State Highway) bridge. When we saw them again on the following day they had been joined by a fourth. Next Wednesday J.D. saw all four again in the same place, but during the few days after this the river was in flood and they probably moved elsewhere.

CHRIS SMUTS-KENNEDY
JOHN DREW

Wildlife Service,
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(f) *OUTRAM, OTAGO*

While walking along a gravel beach on the Taieri River near Outram at 7.30 p.m. on 21 December 1966 one of my dogs flushed a dotterel-like bird which flew round and landed some 70-80 yards further along the beach. It appeared brownish on the upper parts with white throat and a prominent black Y-shaped band on the breast, and with a black forehead. I contacted Mrs J. B. Hamel and she suggested that it might be a Black-fronted Dotterel.

I saw presumably the same bird again at 4 p.m. on 23 December on the same beach. It was feeding along the edge of the water and on viewing it through binoculars I could see in addition to the previous markings observed that there was a white line passing just above the eye and continuing round the back of the head. Also it had a bright red beak with black tip and a red ring round the eye. With the description given in the Field Guide it was possible to confirm that it was a Black-fronted Dotterel. It was on the beach again at 5 p.m. on 27 December. No further sightings were made in 1966. The beach is some 160 by 60 yards in area and situated approximately one mile downstream from the Outram Bridge (Map reference, NZMS 1, Sheet S163 - 930726).

On 26 November 1970 I noticed a Black-fronted Dotterel on the same beach and my wife and I observed it from 4 p.m. to 4.45 p.m. That same evening Mr P. Schweigman came out from Dunedin and we watched it for about half an hour. It was also observed on nine days between 28 November 1970 and 15 January 1971.

All the sightings were on the same beach, except for the last when the bird appeared on a gravel beach about a quarter of a mile upstream from the beach of the previous sightings. On this occasion it landed on the gravel beach and after a few minutes it flew to the opposite side of the river and began feeding on muddy ground at the edge of the water.

The beach where the bird was seen most often was inspected at least once a day from 26 November 1970 to 11 January 1971. After that date it was inspected frequently but not every day. Since 15 January there have been no further sightings up till the present time, 11 May 1971.

GEORGE GRANT

SEX AND AGE OF THE ONLY SPECIMEN OF THE DARTER *Anhinga rufa* (DAUDIN) RECORDED FROM NEW ZEALAND

The only record of a Darter, *Anhinga rufa* (Daudin), in New Zealand is that of a skin which was found nailed to the wall of a shed at Hokitika, South Westland, in January by F. R. Fuller. Buller (1875), when reporting the find, gave a detailed description of the skin and thought that it was either an adult female or an immature of either sex. The skin is in the Canterbury Museum (AV 14,971). It has the following plumage characteristics which indicate that it is that of an adult female. There are long, thin,

ornamental plumes on the wings which only occur in adults. The foreneck, breast and abdomen are buffy white as in females and immatures, and not black or dark brown as in adult males. The white stripes on the sides of the neck have distinct broad dark borders, which were black according to Buller but now somewhat faded. The borders are complete on the dorsal and incomplete on the ventral sides. The white stripes lack distinct dark borders in immatures (van Tets 1970: 206, pl. 12).

Normally it is immature and not adult birds which stray as vagrants far beyond their usual range. It is conceivable that the darter was caught by a cyclone and transported to New Zealand from Australia or New Caledonia. Darters use columns of rising hot air to glide and soar from one place to another. They ascend several thousand feet in contrast to shags and cormorants which rarely fly higher than a thousand feet above ground or water level.

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Division of Wildlife Research, CSIRO, Canberra, A.C.T. G. F. VAN TETS

Canterbury Museum, Christchurch. R. J. SCARLETT

WHITE-FACED HERONS IN DUNEDIN

In mid-November while driving to work at about 8.30 a.m. I noticed a White-faced Heron *(Ardea novaehollandiae)* launching itself into flight from the roof of a large two storyed house situated 100yds. from the main street of Dunedin. This was a new experience for me and while discussing the sighting was told that several reports of the species within city limits have been made.

White Herons *(Egretta alba)* have long been known to capitalise on the availability of an easy meal from a suburban goldfish pond. This seemed to me to be the best explanation of the presence of the White-faced Heron within city limits.

The following week I observed a White-faced Heron flying in its distinctive landing attitude with legs lowered and obviously preparing to land beside a goldfish pond I knew to exist. This incident took place at 400ft. altitude in typical suburban surroundings at 8.10 a.m. The bird, having selected and obtained his fish by the time I arrived on the scene, flew to the roof of a neighbouring house, paused for a few seconds, then flew off still carrying his victim.

Records kept by Mrs J. Hamel show that in 1967 a White-faced Heron was seen to catch a goldfish and another to stand watching goldfish through a wire netting cover. Both were within city limits.

400 Highgate, Dunedin R. F. GLEDHILL

SOME NOTES ON SPOTLESS CRAKE

Spotless Crakes *(Porzana tabuensis)* frequent the swamps on our farm at Honikiwi. I first found a nest in January 1968. It was strongly built in dense vegetation, including raupo, sedge, manuka and rushes, and it was placed about two feet above the level of the water. Composed of dead fern fronds and grasses, it had a very shallow cup. In it were four mottled brown eggs, three of which were later hatched. When the first two had hatched I was able to handle the chicks while the parents watched close by. Next day the third egg had hatched. Always one of the parents was on guard near the nest; but after two days the family had moved away.

In January 1969, I heard and saw Spotless Crakes in a different place in the same swamp. They flew about as if they had a nest nearby, but I could not find it. When later I came across the nest, the birds had already hatched and gone.

In September 1969 I heard the crakes calling again. They were making a purring sound mainly in the evenings. They also make a sound like ' pook-pook ' as in ' look.' I have also heard them uttering some surprisingly loud calls; as, for example, when one of a pair suddenly let out a call somewhat like an alarm clock going off and gradually running down.

The swamp in which they live is 10-15 yards across and meanders through rolling grassland with Spanish Heath, blackberry and manuka along the edges. I discovered that as long as I kept still, the crakes would pass within three or four feet of me. On the ground when not under cover they sometimes run two or three feet, then pause and quickly look around before running a few more feet. The crakes seldom seem to wade or swim, but prefer to walk along branches or rushes.

In this valley a series of dams has become choked with vegetation. Btween the swamp and the rushes in one of the dams was a fallen willow. When coming from the swamp to feed in the dam the crakes would either walk at the water's edge and pass the foot of the tree or fly into the branches and walk along them just above water level and finish by flying into the rushes on the dam.

On 10 October 1970 I discovered a pair of Spotless Crakes in another larger swamp at some distance from the first pair. I found also several old nests fairly close together and I think some of them are cock nests.

One evening I noticed that there were several crakes coming from the swamp to feed; and some of them had whitish throats, which I have read are a sign of immaturity. One day one was seen feeding up a bank where blackberry had been cut and burnt and hay had been fed out. I thought the crakes may have been eating grass seeds.

In January 1971 I found a pair with a nest placed at 4′ 6″ in raupo and containing one egg. On 13 January, when there were

three eggs, the birds started sitting. The eggs hatched on 31 January, i.e. after an incubation period of about 19 days which is rather shorter than the 22 or more given by Hadden (Notornis 17: 208), but is close to the figure given by Hindwood (Australian Birds in Colour, p. 22). In a spring nest also built about 4′ 6″ above water-level in a tangle of raupo and cutty-grass, three eggs hatched on 7 September. I now think that these crakes nest once in August-September and again about January. I have seen chicks crawling and swimming soon after they are hatched.

In all these swamps I now estimate that there are seven or eight pairs of Spotless Crakes.

EWEN FRASER

ORIENTAL CUCKOO ON LITTLE BARRIER ISLAND

All thirteen Auckland members who went to Little Barrier Island for Labour week-end (22-25 October 1971) saw this cuckoo *(Cuculus saturatus horsfieldi)*. Many watched it for half an hour or more while it perched low in a puriri tree *(Vitex lucens)*, occasionally flying down into the grass to take an insect then immediately returning to the same perch. It was first noticed as a " strange bird " by the Ranger's younger son (Bunny Wisnesky) on 20 October. Fresh to strong north to northwest winds blew from 19 to 22 October. Next day it rained steadily all day.

In description the bird closely follows that of the record from Kaihinu by P. Grant (Notornis 11 (2): 130) except in having no white tip to the tail and not moulting. One member (Alan Macdonald) heard it call quietly and described the call as a very regular ' Tsoo - tsoo - tsoo ' repeated about a dozen times at approximately one-second intervals. The bird stayed on the ' flat,' i.e., comparatively open pasture land, and was not seen after 10 November 1971.

The last few days it spent in the Ranger's garden, becoming quite tame.

This is the first record of an Oriental Cuckoo on Little Barrier Island.

SYLVIA REED

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Auckland, 5.

THE COPULATION OF NEW ZEALAND FALCONS

On 22 October my colleague and I arose at dawn to begin our search for the actual nesting site of a pair of New Zealand Falcons *(Falco novaeseelandiae)* which we had been observing from a distance for a period of about six weeks. From our observations, these birds appeared to be preparing to nest somewhere in a clump of partly milled mixed podocarp-beech forest. Our observation point had been from a log loading ramp situated on the eastern side of the Mokomokonui River south of the Urewera National Park. The

suspected nesting locality was situated on the other side of the river, halfway up a fairly steep slope leading to the top of a small hill. Most of the country surrounding this immediate area is still virgin forest. The remaining milled forest had only selected suitable trees felled, thus leaving many small fairly clear areas below the general canopy. These conditions would appear to be ideal for the falcon, and this was proved to be correct by our fairly frequent observations of them pursuing prey through the partially cleared areas.

We had noticed that the birds frequently perched in a high dead rimu and also spent some time in another about fifty yards to the right. After spending anything up to thirty minutes in these trees, they usually glided off out of sight behind them. The fact they spent so much time in this area, seemed to be too much of a coincidence to us, so we guessed they were going to nest somewhere very near there. It seemed to be a very suitable locality for these birds as they would have everything they required within easy distance — rich bird life, water, considerable weather protection, good view of surrounding terrain, vegetation not too dense, and probably, above all, little, if any, interference from man.

Upon climbing to the top of the hill by means of one of the old timber tracks, we were rather surprised to find that the area directly behind the trees where we had observed the birds was a small hidden bowl-shaped valley, and not as we had thought, a continuous slope leading down to the bottom of the next large valley system. This small valley is about a quarter-mile in diameter and 100 feet deep. Vegetation includes scattered rimu *(Dacrydium cupressinum)*, mountain totara *(Podocarpus halli)*, red beech *(Nothofagus fusca)*, hard beech *(N. truncata)*, mountain beech *(N. cliffortioides)* and numerous shrubs and ferns. There are scattered half rotten tree trunks, a remnant from milling days, many of these and the living trees having clumps of Astelia growing on their trunks and branches. Approximate height of this area is 2500 feet (761.6 m). During our observations from the top of the hill, we saw the male and occasionally the female entering and leaving the valley. They disappeared into a small area situated near the centre of the valley. At midday we decided to go into the valley and to try to locate the nest. We managed to find a position about half way down the side which gave us a commanding view of the bottom. Hiding ourselves in the ground ferns, we waited for the re-appearance of the birds.

At about 4 p.m. the female suddenly appeared from behind us and dived violently down to the top branch of a tall (50-60 feet) dead tree. She was closely followed by the male. She landed about a foot from the trunk on this branch whilst he landed on a branch about 10 to 15 feet below her. Whilst she stood quietly, he began to move back and forth along the branch in a rather excited fashion. His slim body and long legs combined with this graceful, gliding fast walk particularly attracted our attention. After about a minute

of this activity, including the uttering of some rather gentle, high pitched moaning noises, the male suddenly began leaping from branch to branch until he was standing at the end of her branch. He was now standing about three feeet from her. He then faced her, walked about three steps closer and jumped onto her back. She had assumed a squatting position as he had begun jumping up the branches. Upon his leaping onto her back, she immediately lowered her head so that she was looking at the ground. Her long tail was then raised vertically. The male, maintaining his balance by flapping his half opened wings, then started to twist the rear half of his body around behind her raised tail. Having achieved this, he suddenly looked in our direction and stopped his movements. He stood quietly for about seven seconds at which the female suddenly looked up too. He then hopped back down to the branch. After standing still for a moment he flew off into a nearby mountain beech. During the while proceedings, one or both of the pair made the described moaning noise. As my colleague and I did not have time to raise our binoculars to our eyes we could not ascertain which bird was making this noise — we think it was the male.

From my observations on another pair in the Ruahines, copulation is preceded by a spectacular and noisy mutual courtship flight in which both birds seem to chase each other around the sky for minutes at a time. During this courtship flight, they both carry out a variety of aerobatics including sudden dives and climbs, stalls, steep turns, loops and rolls off the top. Upon first sight they would appear to be quarrelling, but upon closer observation it will be seen that there is no violent contact. The male seems to be the initiator and aggressor in the proceedings and both birds are very vocal, emitting loud " kek kek kek kek's " and the afore-mentioned whine.

W. J. POWELL

112 Tomoana Road,
Hastings

PIPITS IN THE SOUTH ISLAND IN WINTER

Whilst on a visit to the Tasman Saddle Hut at the top of the Tasman Glacier in Mt Cook National Park in May 1971, I was surprised to find a Pipit *(Anthus novaeseelandiae)* in the vicinity of the hut (altitude 7,700 feet). It was watched for several minutes, during which no clue was gained as to what food the bird was finding. There was almost total snow cover surrounding, and the nearest uncovered rock was on the glacier moraine wall a thousand feet lower.

Another record was of a loose flock of about 30 Pipits in the Matukituki Valley, west branch, in June 1971.

A. WILKINS

BLACK-CAPPED PETREL IN THE WAIKATO

On 22 October 1971 a Black-capped Petrel *(Pterodroma externa cervicalis)* was found alive in a field by Mr T. Emmett at Ngahinapouri, south of Hamilton; he handed it over to Mr D. G. Berrett, a visitor from Hawaii. The bird died shortly after being picked up. Mr Berrett was able to identify it but verified this with an Auckland Museum specimen. Just before 22 October there had been a period of very strong winds from a northerly quarter. The bird which proved to be a male is now in the Auckland Museum, AV. 136-14. It is only the second specimen to be recorded from the North Island (see Notornis 19: 216).

SYLVIA REED

4 Mamaku Street,
Auckland, 5.

TWO UNUSUAL ALBATROSS RECOVERIES

Two interesting recoveries recently received by the Banding Office add further to our knowledge of the movements of Royal and Wandering Albatrosses.

Royal Albatross: R-20414. Banded as a chick at Campbell Island, 23 May 1970; recovered at Tematangi, Tuamotu Archipelago (21°42'S, 140°38'W) about the middle of 1971. The band and a leg bone only were found near a colony of Red-tailed Tropic Birds.

This is the most northerly Pacific recovery of a Royal Albatross.

Wandering Albatross: R-18693. Banded as an adult on the nest, Antipodes Island, 1 February 1969; recovered dead at Taiaro Island, Tuamotu Archipelago (15°44'S, 144°38'W), late December 1971.

C. J. R. ROBERTSON

31 January 1972

Wildlife Service,
Department of Internal Affairs,
Wellington.

LETTERS

The Editor,

Sir,

BLACK-FACED PENGUINS ON THE SNARES

You may have room for a few additional comments on the identity of the black-faced *Eudyptes* penguins from the Snares Islands discussed in recent issues of Notornis.

It is clear that the controversy boils down to an assessment of probabilities. Falla, Fleming and Kinsky argue that the 1969 bird was more likely to have been a Royal Penguin due to a combination of characters, all of which are known to overlap with those of the typical race, whereas I believe that the probability is in favour of its belonging to the typical sub-species due to the rarity of black-throated birds noted at Macquarie Island during 1959-61 and by Peter Shaughnessy during his 15 months there.

Falla *et al.* evidently believe that we are wrong in our estimates of this rarity. I'm sure, however, that if they had lived in close proximity to Royal Penguins or searched unsuccessfully for black-faced birds among the hundreds of thousands of penguins comprising the vast Hurd Point colony, as I did, they would agree on the scarcity of such animals.

I remain unconvinced as to the alleged blacker throats of dark-faced Royals: some skins of undoubted Macaronis e.g. some from Deception I. and Kerguelen in the British Museum (Natural History) could hardly be darker.

The additional data given by Falla *et al.* which we all agree must be comparable as regards sex, age and so on, hardly permit such comparisons. For instance, only one of the birds (16 Macaronis and 8 Royals) in the British Museum and none in the American Museum of Natural History (15 Macaronis and 14 Royals) is labelled as a breeder. Some probably were breeders, but many are unsexed and many clearly sub-adult. The best labelled that I have seen are the ANARE Royal Penguin skins in the National Museum, Melbourne, but these hardly comprise a good statistical sample. Jouanin and Prevost, in the paper referred to by Falla *et al.*, do not give the dimensions of the British Museum birds.

Nevertheless, as I have indicated previously, it seems that there are significant size differences between these two sub-species of *E. chrysolophus* and Downes and Gwynne's bird with a bill length of 66 mm may be atypical. But to evaluate the degrees of overlap in the various characters like bill size — perhaps measured in 3 dimensions (see Warham 1972, " Breeding seasons and sexual dimorphism in Rockhopper Penguins," Auk 89: 86-105), flipper length, under-flipper pattern etc., requires better data, preferably taken from good samples of live birds. It should then be possible to be more confident of

differentiating between pale-faced Macaronis and normal Royals and between black-faced Royals and normal Macaronis, if the problems of age variation can be overcome. Of course this assumes that abnormal birds like the black-faced examples from Macquarie, are not really all stray Macaronis, as I thought when the 1963 photograph to which Falla *et al.* refer was published.

Incidentally the under-flipper pattern of the 1969 bird was carefully drawn from life. It was darker anteriorly than Rand's Figue 2 of a typical Macaroni (reference in Falla *et al.*) so that if this feature has any diagnostic value it does not help their case. Unfortunately no such sketch was made of the 1970 bird.

Finally it seems doubtful that the latter was yet another black-faced Royal. According to G. R. Wilson it had a flipper 194 mm long, a bill length of 58.2 mm, an extensive exposure of bare skin at the gape, and a lemon-yellow crest: the latter suggests that it was not fully adult and the dimensions fit either sub-species.

JOHN WARHAM

Department of Zoology,
University of Canterbury,
Christchurch, 1
14 July 1971

The Editor,

Sir,

LEG AND FOOT COLOUR OF THE MARSH CRAKE

I read with much interest Dr K. E. Westerskov's article (Notornis 17: 324-330, 1970) on the leg and foot colour of the Marsh Crake *(Porzana pusilla)*. According to the author the Marsh Crake has olive green legs and feet, irrespective of the subspecies, sex, age and season, This opinion is in contrast to much of the European ornithological literature.

The Marsh Crake is an occasional breeding bird in the Netherlands. From 11 June till 5 August 1971 at least 8 males of *Porzana pusilla intermedia* were holding territories in an inundated polder in the neighbourhood of Amsterdam. Four nests containing one or more eggs were found (Veling, Mededelingenblad KNNV VWG Amsterdam, 9e jaargang, nr. 3: 20, 1971). On 14 July I had the opportunity to study both male and female for about a quarter of an hour. I was in company of three experienced birdwatchers. After a careful examination of the leg colour we all concluded that both male and female had brownish-flesh-coloured legs (1). Three other males were observed in electric torch-light at very close quarters (about 1 metre).

All these birds had flesh-coloured legs and feet (de Roever, Hinloopen, pers. comm.) (2). Mr A. Hinloopen, a Dutch Marsh Crake-specialist, did never observe a *pusilla* with olive green legs and feet (pers. comm.). In this connection a colour photograph of *pusilla* taken by Jean Phillipe Varin (Birds of the World, Vol. 3, Part 4, No. 28: 773, 1969) is interesting. The flesh-colour of the left leg and foot is visible (3).

In my opinion the leg and foot colour of *pusilla* is variable. This colour may range from brownish-flesh (1, 2, 3) to olive green (Westerskov 1970). Further research will perhaps throw more light upon this variability and the factors which affect it.

GERALD J. OREEL

Jozef Israelskade 130-3,
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7 December 1971

REVIEW

Oliver, L. Austin, Jr. *Families of Birds.* Illustrated by Arthur Singer. Golden Press, New York. US $1.95 200 pp.

Thumb-nail sketches of the 34 orders and 208 families of fossil and living birds with some hundreds of coloured illustrations of typical species, by the author and illustrator of " Birds of the World," certainly add up to a useful and relatively inexpensive paperback summary of the Class Aves. Introductory sections deal with faunal regions, origin and evolution, and the fossil record, which has a table showing relative numbers of species in the main groups of birds in past geological periods (based on Brodkorb's data). New Zealand species illustrated by Singer in reduced " Birds of the World " style are *Dinornis* (silhouette), kiwi, Rockhopper penguin, Yellow-nosed Mollymawk, Sooty Shearwater, Diving Petrel, some rarer storm petrels, Red-tailed Tropic Bird, Black and Spotted Shags, Least Frigate Bird, Night Heron, a few waders, Great Skua, Noddy, Barn Owl, Rifleman, Kokako, Indian Myna, and some introduced finches, but it is for the world-perspective the book will be valued.

I find especially useful the inclusion of fossil families, especially irritating the small page size (7¼ x 4 ins), uniform with little else, wasteful of shelf space, and not justified by pocket use in the field, but those who share my prejudice can buy the same book, hard cover, larger format, in the de luxe Goldencraft edition for US $5.95.

C.A.F.

NOTES & NEWS

AUSTRALIAN WILD LIFE TOUR

There are a few seats left for the 28 day Australian Wild Life Tour, departing 21 July, returning 17 August 1972. This is a camping - bus tour. Further details from Mr C. Searle, P.O. Box 2577, Auckland, C.1. Camping equipment and food will be provided.

CONSERVATIONISTS UNITE

CoEnCo, the Conference on Environment and Conservation, was formed in Wellington on 4 December 1971 as a body to unite 40 New Zealand conservation groups and will represent nearly 50,000 conservation-minded people in New Zealand, hopefully giving them one voice for the first time. The Minister of Lands and Forests (Mr Duncan McIntyre), opening the meeting, explained the need for a combined body rather than "a multitude of sectional voices competing for a share of public support." Mr F. D. O'Flynn, QC, was elected chairman of the group and Mr Lloyd Woods, Secretary of the Royal Forest and Bird Protection Society, was appointed acting secretary. The future of CoEnCo will be of interest to many OSNZ members.

THE AUSTRALIAN SEABIRD GROUP

At a meeting in Canberra in November 1971, a gathering of Australian ornithologists decided to form an Australian Seabird Group.

The aims of the group are envisaged to be, with geographic modifications, those of the original "Seabird Group" in Britain.

(1) To support and promote the study of seabirds.
(2) To maintain a list of people interested in the seabirds of Australasia, Antarctica, and Oceania; to discover the nature of their current interests and activities; and to make them known to each other.
(3) To build up a national and international network of active workers prepared to co-operate in the development of studies of all aspects of seabird biology.
(4) To circulate a newsletter containing news and views of work in progress.
(5) To encourage new work in fields which receive inadequate attention.

The meeting, when considering a motif, decided to adopt the White-faced Stormed Petrel, *Pelagodroma marina*, as its emblem. This bird is both distinctive and common in much of the area.

Anyone interested in further information is asked to write to:—

The Acting Secretary,
Australian Seabird Group,
P.O. Box 235, Civic Square,
A.C.T., Australia, 2608

TAIAROA HEAD ALBATROSS COLONY OPENED

The albatross colony at Taiaroa Head, Otago Peninsula, has now been officially opened to the public. The Minister of Internal Affairs (Mr D. A. Highet) performed the ceremony on 23 February and praised "the joint efforts of individuals and organisations who collaborated in the protection of the colony and the construction of the look-out shelter, which ends years of restricted public access to the cliffs where the birds breed."

NEW NATIONAL FILM UNIT SERIES

Television viewers in New Zealand will have enjoyed seeing the new productions of the National Flm Unit in their " Nature Series " (" Birds of a Single Flight " and " The Home of the Takapu ") which have recently been screened. These will be shown overseas in colour and are bound to attract favourable comment. Dr R. A. FALLA, doyen of New Zealand ornithology, provides the " front " for the series and the standard is equal to the NFU's best. Dr Falla was recently the subject of a " Saturday Profile " in Wellington's newspaper *The Evening Post* in which a most interesting biographical sketch was given with his personal philosophy of nature, man, and conservation. A previous profile, including an historic photograph of the young Falla of *Discovery* days, appeared in the same paper about 15 years ago. Dr Falla has just been re-appointed as Chairman of the Nature Conservation Council for a further three years. The same issue of *The Evening Post* of this year also gives (p.13) a useful account of the work of the NCC taken from a talk given by Dr Falla to the Wellington South Rotary Club.

Sources: BECK, S. 1972. Saturday Profile. Museum director, explorer and lively scientist. *The Evening Post,* 29 January 1972: 16; FANNING, L. 1958. Many parts of New Zealand helped to shape museum director. *The Evening Post,* 13 December 1958.

Dr R. C. MURPHY RETURNS

Visitors to New Zealand late last year were Dr & Mrs Robert Cushman Murphy renewing old friendships and their memories of New Zealand which they visited previously in 1947 and 1949. Dr Murphy, now aged 85, was Lamont Curator of Birds in the American Museum of Natural History and is still regarded as the greatest authority on seabirds of the world. His famous work " Oceanic Birds of South America " is also still of great value as an authoritative source of information despite much subsequent work in this region. Dr & Mrs Murphy were members of the 1947 expedition to the Snares Islands and were later at the 7th Pacific Science Congress. Dr Murphy was elected to honorary life membership of the OSNZ in 1948. They left an impression of friendliness and scholarly attainment with many younger members of the OSNZ whom they met including the present editor of *Notornis.*

STOP PRESS ON SWALLOW SIGHTINGS

An NZPA report of 14 January 1972 has given a photograph of an " Australian male white-browed wood swallow " found near Naseby, Central Otago. A subsequent report (19 January) gave an account of the sighting of a second swallow identified, however, as a " female masked wood swallow." Although this is the first " published " record of these two alleged additions to the New Zealand list, we await confirmation and a full account from Mr John Darby and other Dunedin members who were involved in what the newspapers called the " swallow mystery."

Sources: The Dominion, 14 January 1972, p. 32 (photo.); *The Press,* 14 January, p.1 (photo.); *The Dominion,* 19 January, p.8; *The Evening Post,* 19 January, p.13; *The Christchurch Star,* 19 January, p. 2.

FROM THE EDITOR'S DESK

An important analysis of the taxonomic status of introduced passerine birds in New Zealand has recently been published by Professor Gunther Niethammer of Bonn. " Differences in size or colouration between European and New Zealand birds could not be found, on the contrary, still to-day the latter agree exactly with the European populations of their respective species. Possible exceptions may be a House Sparrow population at Maraekakaho (North Island) and one of the Redpoll in the southern part of the South Island near Invercargill. For 7 species it could be proved that the New Zealand birds stem from British stock, as they agree subspecifically with the populations found in Great Britain."

Reference: NIETHAMMER, G. 1971. Zur Taxonomie europaischer, in Neuseeland eingeburgerter Vogel. Journal fur Ornithologie 112 (2): 202-226, tables 1-18.

Another paper of importance has come from our President, Mr F. C. Kinsky. In it he demonstrates the consistent presence of paired ovaries in the Kiwi and details the occurrence of this condition in 86 other species of birds belonging to 16 different orders, despite the text-book statement that " Normally in birds, as opposed to other vertebrates, only the left ovary and oviduct reach functional development." In kiwis, it is shown, the right ovary (as well as the left) is functional and successful ovulation from it is a normal occurrence. However, only the left oviduct is functional in kiwis and vestigial right oviducts occur only rarely. From the evidence obtained during his study, Mr Kinsky believes that the reduction of the right oviduct in birds might well have preceded the reduction of the right ovary during their evolutionary history. Mr Kinsky concludes with a useful suggestion: " If normal sexing routine in birds included the examination of the right side of the body cavity in addition to the usual examination of the left side, additional species (and additional orders) with paired ovaries might well be found."

Reference: KINSKY, F. C. 1971. The consistent presence of paired ovaries in the Kiwi *(Apteryx)* with some discussion of this condition in other birds. Journal fur Ornithologie 112 (3): 344-357, figs 1-5, tables 1-4.

Due to appear in *Notornis* during 1972 are important papers on field identification and distribution of the two prions *Pachyptila belcheri* and *P. desolata,* on the breeding biology of the Rook, on Fijian birds including the little-known Fiji Peregrine, and two notable contributions on the breeding, establishment, dispersal and distribution of the Spur-winged Plover in New Zealand.

As this issue of *Notornis* goes to press Archie Blackburn, Assistant Editor of *Notornis* and former President of the OSNZ, has gone into hospital in Gisborne for observation. All members and his many friends will want to wish him a speedy and lasting recovery.

ABOUT OUR AUTHORS

GORDON WILLIAMS is a very well-known figure in New Zealand ornithology and needs little introduction. Nevertheless, some biographical details may be interesting. Dr Williams was President of the OSNZ from 1967 to 1971, Secretary from 1957 to 1962 and a long-standing member of Council. He has also been Vice-President and Editor of the NZ Ecological Society and is closely involved in the forthcoming XVI International Ornithological Congress to be held in Canberra in August 1974. Many readers and listeners will know him through his book reviews in *The NZ Listener,* his numerous contributions in *An Encyclopaedia of New Zealand* and for his former radio feature *Nature Magazine.* He was born in South Africa in 1920 and gained his B.Sc. with Honours in Chemistry at Sydney University. For ten years he was in the Wildlife section of the Department of Internal Affairs, then lecturer in zoology at Lincoln College during which time he gained his Ph.D. He has also worked at the Bureau of Animal Population at Oxford University, and at the University of Aberdeen. In 1965 he returned to Wellington and is now Head of the Wildlife Service. Dr Williams is preparing a revision of Oliver's *New Zealand Birds* and is editor of an important work *The Natural History of New Zealand (An Ecological Survey),* to be published by A. H. & A. W. Reed during 1973, in which 18 distinguished scientists survey the changes and developments in the New Zealand environment during the past 1,000 years. MALCOLM HARRISON, born in 1942, is a technician with the Wildlife Service, Department of Internal Affairs. He has already contributed an important paper to *Notornis* in his survey of the Orange-fronted Parakeet. He has written another article on the Laughing Owl in the magazine *Birds of the World* (vol. 9, part 8, pp. 2892-3; 1971), even if it *was* wrongly credited to U.K. ornithologist M. P. Harris (corrected, however, in the index, vol. 9, part 12, p. 3005).

JILL HAMEL became Regional Representative for Otago in 1964 and a member of Council of the OSNZ in 1966. She spent her childhood on a farm near Hastings and moved to Dunedin during her secondary schooling. She graduated B.Sc. in Botany and Zoology from Otago University and worked as a technician in the Botany Department during the early years of her marriage. When her family of two boys were away at school Mrs Hamel took three units of Anthropology at Otago University and then discovered that the regulations prevented her from going on to Master's degree in Anthropology. After some preliminary preparation she began a Ph.D. thesis which has involved her in a numerical taxonomy of moas, some dendrochronology and general ecological studies, basically to try to determine the ecological relationships of the Polynesian occupation of the Catlins district, an attempt to solve the question of how did Polynesian people exploit the area and what effect did they have on the biota. She is interested in the application of multivariate analysis techniques and computer programmes, as used in her thesis work, to the OSNZ mapping schemes. Mrs Hamel's earlier contribution on "The future of ornithology in New Zealand" (*Notornis* 16: 206-209; 1969) has also provided some stimulation.

PHILIP BURTON has contributed several notable papers to *The Ibis* on the functional anatomy of wading birds. His bulletin on "Feeding and feeding apparatus in waders" is to be published by the British Museum (Natural History) shortly. He has also advised on many articles in the magazine *Birds of the World.* Dr Burton is in the sub-department of Ornithology of the British Museum (Natural History) at Tring, the home of the BTO and the famous Rothschild Museum. His Ph.D. study at the university of London (1969) was on "Anatomy and adaptive modifications of the feeding apparatus in waders" but Dr Burton also has interests in the ecology of geese and other waterfowl. He is at present on an expedition in South America.

DAVID THOMAS is a well-known member of the RAOU living in Tasmania. He describes himself as "middle-aged metallurgist," having graduated B.Sc. (Hons) from Manchester University in 1951. His ornithological interests date from his arrival in Tasmania eight years ago and he has already published extensively in *The Emu,* his most important papers to date being: Fluctuations in numbers of waders in south-eastern Tasmania *Emu* 70: 79-85; Breeding biology of the Australian Spurwinged Plover *Emu* 69: 81-102; Ecological aspects of the feeding behaviour of two calidritine sandpipers wintering in south-eastern Tasmania *Emu* 71: 20-26; and, Wader migration across Australia *Emu* 70: 145-154. Mr Thomas is currently interested in the breeding adaptations of temperate Australian birds and in ecological and zoogeographical aspects of the Tasmanian avifauna. He is also Nest Record Scheme Organiser for the RAOU and Editor of *The Tasmanian Naturalist.*

JOHN CRAIG obtained his B.Sc. with 1st Class Honours at Otago University in 1969 and began studies for a Ph.D. thesis at Massey University in April 1970 on the ecology and behaviour of the Pukeko. His other interests include wood carving and, while in Dunedin, he was active in surf lifesaving. He is married with two children.

GEORGE WATSON and PHIL ANGLE are Chairman and Museum Specialist, respectively, in the Department of Vertebrate Zoology at the Smithsonian Institution. They have been in the field together in the American sector of Antarctica, and with Peter Harper and others, have recently published a folio of distribution maps of Antarctic and Subantarctic birds for the American Geographical Society's series (Folio 14), as well as writing a handbook of Antarctic birds soon to be published. Dr Watson has also been responsible for the Smithsonian field guide to the birds of the Indian Ocean (1963) and the manual of seabirds of the Tropical Atlantic (1965, revised 1966). He was born in 1931 and received his university training at Yale, being postgraduate scholar at the American School of Classical Studies in Athens, 1953-4, and gaining his Ph.D. in 1964. He was appointed Assistant Curator of Birds in the U.S. National Museum in 1962 and became Chairman of Vertebrate Zoology in 1967.

PETER HARPER became well-known in the OSNZ as a beach-patroller of the Wellington west coast and quickly developed an extensive knowledge of storm-drifted birds especially prions. Through Dr R. A. Falla, who gave him much encouragement, he was appointed to the National Science Foundation's Antarctic research vessel *Eltanin* as ornithological observer for the Dominion Museum from 1965 to 1967. During eight long cruises in *Eltanin* he covered many thousands of miles of the Southern Ocean and developed a profound knowledge of the habits and distribution of pelagic birds rivalled by few others. His skill as a photographer, field worker and analyser of data will be well shown in a forthcoming major contribution on prions due in the next issue of *Notornis*.

CHRIS ROBERTSON, Banding Officer of the New Zealand Wildlife Service, Department of Internal Affairs, has been in charge of the NZ National Banding Scheme since 1967. He has been responsible for the reorganisation of the scheme involving, amongst other aspects, the conversion of previous recovery records held on hand-written cards to computer records. A good account of the use of the computer in the banding scheme was given by him in *Wildlife 1970 — A Review* (pp. 52-54) and the new banding report for 1964-1971 shows the results of his organisation in some detail. Mr Robertson, born in 1941, is a son of the late Rev. F. H. Robertson, well-known for his pioneer work on the gannets of Cape Kidnappers and for his organisation of OSNZ activities in Hawkes Bay (see obituary in *Notornis* 6 (5): 144-145; 1955). He has also had experience of Antarctic birds as a member of the NZ-US Balleny Islands/Ross Sea Expedition of 1965 led by Elliot Dawson. Other involvements are with the Taiaroa Head and Campbell Island albatrosses, as well as continuing his father's gannet work.

KAJ EJVIND WESTERSKOV was born in Denmark in 1919 and received his Diploma in Forestry from the Danish Forestry School. He took his M.Sc. at the Ohio State University and was game biologist at the Danish Game Research Station at Kalo from 1949 to 1951. He was with the Wildlife section of the Department of Internal Affairs in Wellington from 1952 to 1964 during which time he published many papers on the biology of game birds as well as on albatrosses and on the birds of Campbell Island. He also was awarded his Ph.D. at Victoria University. From 1961 to 1962 he held a Post-doctoral Fellowship of the National Research Council of Canada at the University of Alberta. Dr Westerskov is known to the public through his handy little guide book "Know Your New Zealand Birds" (Whitcombe & Tombs, 1967). He is now Associate Professor of Zoology at Otago University and has just returned after an extensive sabbatical tour overseas.

INSTRUCTIONS FOR AUTHORS

Publication will be quicker if authors will check their contributions very carefully for accuracy, consistency and readability and ensure, before submission, that they meet the requirements listed below. At least two other people ought to read every manuscript before it leaves the author's hands and their opinions should be heeded.

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SOPER, M. F. 1963. New Zealand bird portraits. Pp.1-104, frontis., pls 1-76. Christchurch: Whitcombe & Tombs.

WILLIAMS, G. R. 1969. Introduced birds. Pp. 435-451, pls 99-104 [chapter 25] *in:* KNOX, G. A. (ed.). The natural history of Canterbury. Pp. 1-620, pls 1-133, text illus. Wellington, *&c.:* A. H. & A. W. Reed.

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