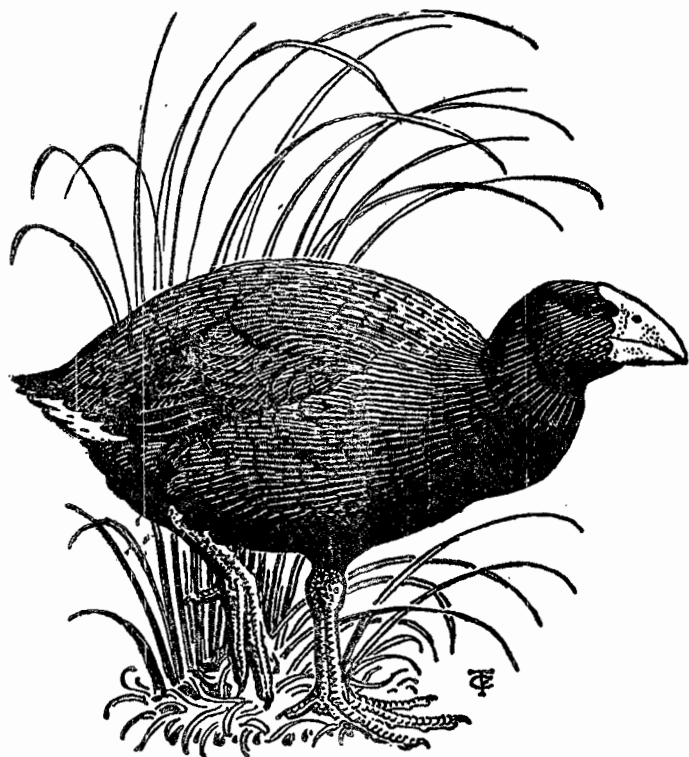


# NOTORNIS



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of the

Ornithological Society of New Zealand  
(Incorporated)



Volume Eighteen, Number Three, September, 1971

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# NOTORNIS

*In continuation of New Zealand Bird Notes*

Volume XVIII, No. 3

SEPTEMBER, 1971

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## SOME NOTES ON FIJIAN BIRDS

By A. BLACKBURN

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### SUMMARY

A survey of the land birds in three areas of the Fiji Group, viz. the Nausori Highlands of Viti Levu, Taveuni and Kadavu Islands, was made in August/September 1970 by members of the Society. All existing species and subspecies previously recorded from these areas, with the exception of a few ground-dwelling species, were observed and their present status assessed. Notes are made on the several species which have been exterminated or seriously depleted since the introduction of predators; but none of the existing avifauna appears to be endangered at the present time. One species new to Fiji is recorded; a megapode whose existence is only suspected from early native lore was probably sighted; and a probable new subspecies observed. Sea-birds and migratory waders are listed.

### INTRODUCTION

When the idea of a field trip to Fiji was first mooted, it was anticipated that some 18 to 20 members would be interested, and the original planning was for a party of this size to spend three weeks in the high altitude rain forest of Taveuni. However the proposal was received with unexpected enthusiasm, and there were no less than 54 applications. Plans were modified, three reasonably accessible forested areas being selected, and the members divided into three parties, each to spend up to six days in each of the three areas, which were:

1. A selected area in the Nausori Highlands, some 30 miles by road east from Nandi, much of the route being a winding mountain road ascending to about 1800 feet. Fletchers are milling much of the heavy rain forest in this part of Viti Levu, and the last few miles of the route are on well-surfaced forestry roads.
2. Taveuni Island, 26 miles long by 9 miles wide, lying to the south of Vanua Levu and 170 miles north east of Suva. Charter planes were used from Suva to Matei Airstrip at the northern tip of the island, and thence the only road runs down the north western coast. The selected area was about 14 miles down this road, near Somosomo, and inland  $1\frac{1}{2}$  miles at an altitude of 1500 feet, in tall rain forest. A narrow strip along the coast is taken up by coconut and cocoa plantations, and from these the terrain rises steeply to a heavily forested backbone range, 4007 feet at its highest point. One or two tracks, negotiable by 4-wheeled drive vehicles, lead up to the forest.
3. Kadavu Island, lying some 50 miles south of Suva. It is some 30 miles long and about 5 miles wide, mountainous with large areas of rain forest, and apparently of more recent volcanic origin than Taveuni. There is a small Government station at Vunisea, where the coastline is not enclosed by coral reefs, and otherwise settlement consists of little native villages scattered along the shores, connected in some cases by foot tracks. The only road on Kadavu runs some distance inland from Vunisea, and has been formed by Fletchers, who are logging in the area.

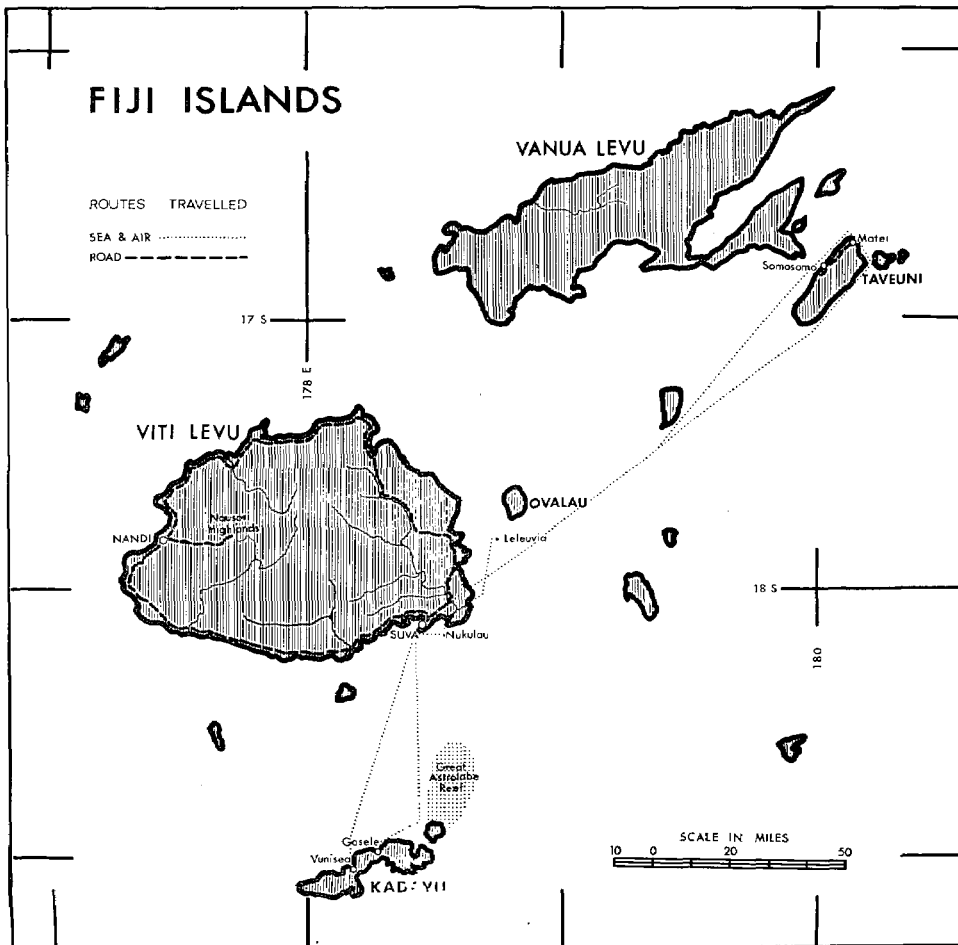
In the event, 38 members took part, and were divided into parties as follows:

'A' party: K. Rowe (leader), C. Challies (deputy), V. Davis, Mrs. N. Davis, Miss J. Davis, Mrs. H. Harty, Mrs. P. Jenkins, Miss E. Kennedy, Dr. G. Nicholson, A. Ringer, Mrs. M. Ringer, L. Rowe, and Mrs. P. Thynne.

'B' party: A. Blackburn (leader), L. Henderson (deputy), Dr. C. R. Barnicoat, Mrs. N. Barnicoat, Dr. Elizabeth Bowie, T. A. Brown, P. Crombie, J. Cook, Miss J. Hornabrook, D. McNeil, Miss J. Morton, G. P. Robinson, and Mrs. C. Veitch.

'C' party: R. B. Sibson (leader), J. Brown (deputy), Mrs. B. Brown, W. F. Cash, J. R. M. Chorlton, Mrs. P. Chorlton, R. V. J. Clark, Miss H. Cook, Dr. Elsie Gibbons, Miss A. Hutson, S. W. Johnson, and Mrs. J. Tizard.

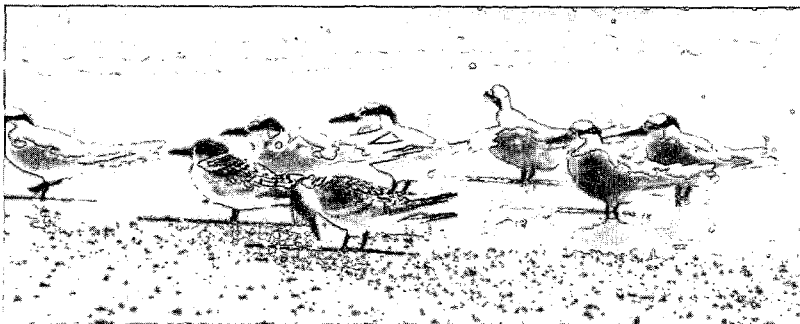
Members were advised to take light nylon tents proofed against mosquitoes, tent flies, sleeping bags and inflatable mattresses, and a cooking utensil; also a light raincoat or parka, as Taveuni has a mean annual rainfall of 212 inches! There was therefore no bulk baggage or equipment to be carried, apart from stores which were available from Morris Hedstrom's widespread chain at suitable points, such as Somosomo on Taveuni, and at Nandi Village en route to the Nausori Highlands.



It may be of interest at this point to mention the matter of cost. All travel from Auckland and return, including bus, boat, and plane charters, and the necessary accommodation at Nandi Airport, and at Suva when parties were changing over from one area to another, cost each member the sum of \$241. An amount of \$24 in Fijian currency was contributed by each member to meet the cost of stores and incidentals for the three weeks, and this proved more than sufficient by \$8 a head.

### ITINERARIES

The party left Auckland at 9.30 p.m. on 23/8/70 and arrived at Nandi Airport at 12.20 next morning. Later in the morning, after a spell at the Melanesian Hotel, 'A' party collected their stores, and departed by chartered bus for the Nausori Highlands in hot sunny weather. Unfortunately they failed to locate the selected camping area, which was on a side road, and after travelling some 20 miles past Fletcher's Mill, returned to a site a mile beyond the mill. Here continued strong wind and heat made conditions somewhat unpleasant, and birdlife in the area was restricted in variety and numbers. The mongoose was common in this modified habitat. On 28/8/70 the party travelled the 160 miles to Suva, en route for Kadavu; but adverse weather conditions prevented the chartered catamaran 'Longships' from sailing the following day. They set sail early in the morning of 30/8/70 for Kadavu; but after battling with southeast winds and rain squalls beyond the reef, they returned to Suva and set off for Nukulau, a two hours' sail inside the reef. Nukulau is a low coral cay of about 15 acres, off the mouth of the Rewa River, with highly modified vegetation. On 2/9/70 they left Nukulau to negotiate the river system of the Rewa Delta, and then made for Leleuvia Island, another coral cay of about 10 acres off the eastern coast of Viti Levu, and south of Ovalau. Leleuvia contrasts markedly with Nukulau, being little modified by man, and having a close canopy of coconut palms and tall broadleaved trees, with a dense



IC. Challies

FIGURE 1 — Black-naped Terns *Sterna sumatrana* adults and young on Leleuvia Island.

understorey. On 4/9/70 they returned to Suva, and on 6/9/70 flew to Taveuni, and camped on the excellent site previously occupied by 'B' party, some 1500 feet above the Wairiki Mission at Somosomo. Here they experienced continually cloudy weather with occasional showers; and an expedition by some members to Tagimaucia crater lake at 2700 feet was marred by heavy cloud. After very heavy rain on the morning of 10/9/70, the party moved down to the Mission for the night, and next day set out on the return to Suva and Nandi Airport.

'B' party proceeded by bus to Suva on 24/8/70, and next morning flew to Taveuni. Four-wheeled drive transport was needed to convey the party to the high altitude rain forest, and this was readily made available at no cost by Morris Hedstrom Ltd. and by Brother Kevin of Wairiki Mission. Except for patches of warm misty drizzle, the weather remained perfect until the night of the 30th, when very heavy rain fell, and continued next morning while packing up for return to Suva.. Consequently departure for the Nausori Highlands was delayed one day to allow for drying out of gear, and shopping in Suva. On arrival in the Highlands on 1/9/70, 'B' party also failed to find the selected area, but camped within a mile of it, in an area which proved equally rewarding in its birdlife. Returning to Suva on 4/9/70, there was again a delay of a day, this time because the catamaran 'Longships' had not obtained the necessary clearance certificate for rhinoceros beetle. On the 6th the 50 mile sail to Kadavu, skirting l'Astrolabe Reef en route, was made under perfect conditions. Sailing westward along the northern coast of Kadavu, the tiny village of Gasele attracted us with its palm-fringed sweep of beach and background of heavy forest, and here the party found an exceptionally interesting bird fauna, and came to appreciate to the full the delightful character and hospitality of the rural Fijian. The weather remained perfect for the return trip to Suva on 11/9/70, en route for Nandi.

'C' party sailed from Suva before 6 a.m. on 25/8/70, and headed for Vunisea, the Government station on Kadavu, having a fine 9 hours run. They returned to Suva on 28/8/70, a day earlier than planned owing to threatening weather, and had a rough but exhilarating trip, with an east wind strong on the beam. The next day John Smart, a Suva member of the Society, took some of the party to the Rewa Delta and Lauthala Island to look at waders. On 30/8/70 'C' party flew to Taveuni, and with the help of Mr. Reg Douglas of Qacavulo Estate in the matter of transport, set up camp on the edge of heavy forest at 1800 feet, some 5 miles south of Somosomo. Returning to Suva on 6/9/70, they proceeded to the Nausori Highlands next day, and were the only party to find the selected area, which proved ideal for camping and bird-observing. They returned to Nandi on 12/9/70 for departure for Auckland at 5 a.m. next day.

A brief comment on camping conditions in Fiji may not be out of place. In each of the three selected areas pure water from mountain streams was at hand, and likewise wood for cooking fires. Mosquitoes were not troublesome, but could have been so at some points if the tents had not been proofed against them; and the weather on Taveuni justified the inclusion of tent flies.



## ECOLOGICAL

The mongoose *Herpestes griseus* was introduced to the main islands, Viti Levu and Vanua Levu, in the early years of white colonisation, to deal with introduced rats, which were causing extensive damage to the sugar plantations. This rat, probably *Rattus rattus* or *R. norvegicus*, is reported to have displaced a native species, probably *R. exulans* which was said to have caused little damage. The mongoose appears to have exterminated snakes on the main islands, and to have had a considerable impact on ground-dwelling birds; or perhaps the damage was done by the introduced rat prior to the introduction of the mongoose. The latter has also practically exterminated the various lizards which are said to have been a feature of Fijian wildlife.

Of avian predators there are few: a Goshawk *Accipiter rufitorques*, the Swamp Harrier *Circus approximans*, a rare Peregrine Falcon *Falco peregrinus*, and the Barn Owl *Tyto alba*; and their impact on birdlife is natural and slight. All are indigenous.

The mongoose was not introduced to Taveuni or Kadavu, nor were rats in evidence at any of our camp sites or elsewhere, although probably present; and the effect of the small and scattered native population of these islands on the birdlife is slight, being restricted to the shooting of two large species of pigeon, both fairly common. In consequence, the avian fauna of these two large islands remains much the same in variety and numbers as it was when described by Finsch and Hartlaub 1867 (1) and by Layard 1875 (2) and 1876 (3). From a careful study of the papers written by Layard, and by Wood and Wetmore 1925 (4) and by Wood 1926 (5), it would appear that there has been no extermination of species on Taveuni and Kadavu, and little diminution in numbers.

Two species of snake, both harmless, are found on Taveuni, but we recorded only two sightings, of an attractively marked constrictor type, about 4 feet long. A large and somnolent introduced toad is not uncommon.

On Viti Levu, in the cleared areas of settlement and in gardens about Suva, the birdlife consists mostly of introduced species, viz. Malay Turtle Dove *Streptopelia chinensis*, Red-vented Bulbul *Pycnonotus cafer*, two kinds of Myna *Acridotheres tristis* and *A. fuscus*, the Strawberry Finch *Estrilda amandava*, and the Java Sparrow *Padda oryzivora*; but several native species are also common, viz. the Many-coloured Fruit Dove *Ptilinopus perousii*, depending on food supply, White-rumped Swiftlet *Collocalia spodiopygia*, Pacific Swallow *Hirundo tahitica* in the dry zone only, White-breasted Wood-Swallow *Artamus leucorhynchus*, Polynesian Triller *Lalage maculosa*, Vanikoro Broadbill *Myiagra vanikorensis*, Orange-breasted Honeyeater *Myzomela jugularis*, Wattled Honeyeater *Foulehaio carunculata*, Red-headed Parrot-Finch *Erythrura cyanovirens*, and the Grey-backed White-eye *Zosterops lateralis*. The introduction of many species, mostly Australian and several European, seems to have been attempted, including the Kookaburra, Magpie Lark, Brolga, Brown Quail, Red Grouse, Partridge, and Blackbird (Wood 1926 (6)); but all of these except the Brown Quail *Synoicus ypsilophorus*, after surviving for a time, and in some cases breeding, have disappeared. The Brown Quail survives on Viti Levu and Vanua Levu, and seems unaffected by the mongoose (Mercer 1966 (7)).

Species on Viti Levu which have been either exterminated or greatly reduced in numbers either by mongoose or rats, are as follows:

WHISTLING TREE DUCK *Dendrocygna arcuata*. This Australian duck, which has been recorded as a straggler to New Zealand, was recorded by Layard 1875 (2) in some abundance at Nandi during the rainy season, whither it had come down from the mountains. It was apparently of local occurrence.

GREY DUCK *Anas superciliosa pelewensis*. From being widespread and very abundant in all suitable habitat, its numbers have been greatly diminished.

FIJIAN MEGAPODE *Megapodius* sp. Although no reference to this bird appears in earlier literature, Wood 1926 (8) produces circumstantial evidence that a mound-builder similar to the Niuafoou Incubator Bird *Megapodius pritchardi* existed on Viti Levu before the introduction of the mongoose, and on Kadavu, where some of the natives thought a few still survived.

BANDED RAIL *Rallus philippensis*. Once a widespread and common bird, it has apparently disappeared, but survives on Taveuni and Kadavu, and on many small and waterless off-shore islands.

BARRED-WING RAIL *Nesoclopeus poecilopterus*. Layard reported this large rail as generally distributed in 1875, but according to Mayr 1945 (9) it has not been observed since the 1880's. Although recorded only from Viti Levu and Ovalau, the species could still survive in the fastnesses of Taveuni.

SOOTY RAIL *Porzana tabuensis*. A closely related subspecies of the Spotless Crake of Australia and New Zealand, it is so elusive that it may still be found to survive on Viti Levu. It survives on Taveuni and Kadavu.

WHITE-BROWED RAIL *Porzana cinerea*. Like the former, this is an Australian species, the White-browed Crake. According to Mercer 1966 (7) it is only known to survive on Viti Levu in one small swampy area where the mongoose has not penetrated. B. and J. Morgan 1965 (10) recorded two birds on a large swampy area of about 100 acres some 10 miles north of Suva.

Three rare species only recorded from Viti Levu are listed by Mayr 1945 (9), but are not referred to in the writings of Layard or Wood and Wetmore. They are the Grass Owl *Tyto longimembris*, the Pink-billed Parrot-Finch *Erythrura kleinschmidti*, both of which were apparently collected by Finsch and Hartlaub in 1864, and the Long-legged Warbler *Trichocichla rufa*, apparently collected or at least described by Reichenow prior to 1870. No subsequent references can be found; but Mr. Fergus Clunie, Assistant Director of the Fiji Museum (*in litt.*), made a positive sighting of the Pink-billed Parrot-Finch on 7/3/71 at a very low altitude in fairly dense bush near Joske's Thumb, an old volcanic plug on the far side of Suva Harbour. According to Mercer 1966 (7), the species has only been recorded with certainty on the Nadrau Plateau at 3000 ft., and Mr. Clunie states that the only other sighting in recent years was from the Nadarivatu area, i.e. the area mentioned by Mercer. It is possible that the other two species may yet be rediscovered by the opening up by milling of the Nausori Highlands, and the consequent easier access.

## LAND BIRDS

There is a generally held impression that the avian fauna of the Fiji Group is much impoverished, with many of the native land birds exterminated by settlement and the introduction of the mongoose; but during three weeks of intensive observation in three rather remote areas, the birdlife impressed us as comparatively rich and abundant for an island fauna so distant from the nearest land mass, i.e. Australia. As one would expect, there is a strong Australian influence, and some species have varied little from the original colonising stock, whilst some vary to a marked degree; others again have no apparent affinity with any existing Australian species, and no doubt have a different origin.

A striking feature is the strong sub-speciation of many species in the three different areas visited, divergences in plumage, song, and behaviour being so marked in some cases that they have probably developed into valid species. It will be seen from the following notes that remarkably few of the birds recorded by early writers were not observed in the course of this survey. One species not previously known from Fiji is recorded; another unrecorded bird was almost certainly seen; and a third will probably prove to be a new subspecies. Unfortunately the records of Finsch and Hartlaub 1867 (1) resulting from their extensive survey in 1864, which give a basic knowledge of the early birdlife, are published in German, and are not yet available.

For convenience, the order and naming used below follows Mayr 1945 (9), and for a like reason, the herons are included in this section instead of under 'Seabirds and Waders.'

**REEF HERON** *Demigretta s. sacra*. This bird was commonly seen on all the reef-lined coasts, in white, dark, and intermediate phases. No actual count was made of these phases; but on Nukulau and Leluvia Islands, where the bird was particularly numerous, it was estimated that white and dark phases were about equal in number. Dark phase birds are apt to escape notice on the reef. Mayr 1945 (9) p. 125 gives the following proportions for the S.W. Pacific generally: dark phase 65 per cent, white 20, and mottled or intermediate 15. Counts on three days during May 1965 on Nukulau Island by R.B.S. and party gave the relative percentages of dark and white phases as 73 and 27. Intermediate plumage was noted in several instances: white with a few grey feathers, grey with a few white feathers, greyish-blue with white throat. There was also a variation in the dark phase from slate-grey to dark blue-grey, with variable iridescence. A dark phase bird was observed in a coastal creek on Taveuni to have a remarkable iridescence on the head and neck. Mayr states that it is occasionally found up to 5 or 6 miles inland on *lowland* streams; but birds were seen in a mountain creek on Taveuni at an elevation of 1500 feet.

**LITTLE MANGROVE HERON** *Butorides striatus*. A geographic race of the Australian Mangrove Heron, this bird is so secretive in habit and cryptic in plumage that it is not often seen. One was watched at Namalata, near Vunisca, at dusk at the mouth of a creek, fringed and overhung with mangroves. It may have come down to the shore

to feed. Showing very rounded wings, it flew and settled in a tangle of mangrove roots, where it was most effectively camouflaged so long as it remained still.

GREY DUCK *Anas superciliosa pelewensis*. The only sightings were of two birds in flight near Nausori Village in the Highlands, and a flock of 30 in the Rewa Estuary.

FIJI GOSHAWK *Accipiter rufitorques*. This fine goshawk is widespread throughout, and fairly common, being frequently seen in the coastal plantations and on the forest fringes at all altitudes. It is often seen dashing across clearings or along forest tracks, or playing above the forest in dives and abrupt upward swoops, and sometimes investigating coconut crowns with a winnowing flight. A pair was frequently seen at a nesting site near 'B' party's camp on Taveuni; but as both parent birds normally defend the nest fiercely, it was apparent that it contained neither eggs nor young. Nesting was in progress in the Nausori Highlands, a bird being seen on the nest, and another in rapid level flight carrying prey, either a Golden Dove or a Golden Whistler. Earlier examination of stomach contents by Layard and by Wood showed that birds do not form a major part of the Goshawk's diet, which consists mainly of insects and lizards; but it will attack even large pigeons, one being seen to knock feathers from a Peale's Pigeon; and on a forest track in the Nausori Highlands, W.F.C. picked up 8 pairs of wings of the Grey-rumped Swiftlet. This Goshawk appears to be closely related to the Australian Brown Goshawk *A. fasciatus* but is considerably more colourful, is much smaller, and lacks the barring on underparts and tail. An immature bird was seen to advantage prospecting a coconut crown in the native gardens of Gasele village, Kadavu, and its distinctive plumage, with broad brown streaking on the throat and wide brown bars on breast and abdomen, all on a white background, was indistinguishable from that of the immature Brown Goshawk.

SWAMP HARRIER *Circus a. approximans*. This bird is generally distributed, and was seen in open country, and more frequently cruising above the forest canopy. At Vunisea one was actually flying among the coconut palms and scaring the Collared Lories.

PEREGRINE FALCON *Falco peregrinus nesiotes*. Mayr states that this dark falcon has only been recorded with certainty from Viti Levu and Taveuni. It was seen by us in the Nausori Highlands on at least two occasions, and 'C' party observed a bird high above the cliffs at the eastern end of Vunisea Bay which was probably of this species. It differs from *F. peregrinus* of Australia only in being darker on the back, blackish in fact, and a deeper rufous on the breast. Mr. Fergus Clunie (*in litt.*) reports the Peregrine as fairly numerous around the cliffs in the Joske's Thumb area.

[FIJIAN MEGAPODE *Megapodius* sp. On 10/9/70, two members of 'B' party (L.E.H. and G.P.R.) were seated in a creek bed inland from Gasele on Kadavu when a large all brown bird planed down from the forested side of the creek with the apparent intention of landing in its bed. Preparation for landing seemed awkward, with long legs dangling, and broad rounded wings held back and up as it endeavoured to reduce momentum. It saw the party, gave a surprised squawk, and landed in a patch of cane grass. A megapode

has never been recorded from the Fiji Group, and is only reported by Wood 1926 (8) from a belief by European settlers of the late 19th century that such a bird existed on Viti Levu and had been exterminated by the mongoose. It was said to be "like the Niuafou bird," and Wood quotes considerable native lore about the bird, including the fact that it could not fly well, and moved by 'great leaps and bounds,' no doubt using a planing flight on occasions. As stated earlier, some natives thought it still survived on Kadavu. Our observers estimated the length of the bird at 14 inches, and recorded the short tail and slender head and neck, which they likened to the head and neck of a game cock. This last feature is most noticeable in two fine mounted specimens of the Niuafou Incubator Bird in the Auckland Museum, and after examining these it seems reasonable to believe that a megapode exists in the forests of Kadavu.]

**DOMESTIC FOWL** *Gallus gallus*. Fowls were enumerated amongst the presents left in Fiji by Captain Cook, and from these, or perhaps earlier stock, feral fowls became widespread and common on all the larger islands. According to Wood and Wetmore 1925 (4) p. 823 they have reverted to the plumage of wild-taken Jungle Fowl of the Philippines, Celebes, Lower Siam, etc. They are extremely shy and difficult to observe, but a number were seen on Taveuni, and B.B. of 'C' party saw a hen with 8 striped chicks. Several cocks could be heard crowing in the forest before dawn, and sometimes during the day.

**BANDED RAIL** *Rallus philippensis sethsmithi*. This bird is present in some numbers on Nukulau Island, 'A' party seeing as many as 5 at one time feeding in the gardens and lawns round the caretaker's cottage, and others were seen on the beach. On Taveuni birds were noted along the track after rain at 1500 feet; one was prospecting the rubbish pit at Tutu School on the coast. This race differs from our Banded Rail in that the chestnut breastband is absent or reduced. Colour slides of a bird mist-netted on Nukulau show the absence of this band, and also a reduction in white spots on the upper parts.

**BARRED-WING RAIL** *Nesoclopeus poicilopterus*. On 31/8/70 a large dark-brown rail-like bird was seen on Taveuni (B.B.). The Banded Rail is the only large rail recorded from Taveuni, and the only other large rail recorded in Fiji is this species, which Mayr states was restricted to Viti Levu and Ovalau, and has been unrecorded since the 1880's. Layard 1875 describes it as generally distributed without defining the islands, and says the natives stated it was flightless. Mayr describes the bird as 'large . . . upper parts plain walnut brown, underparts dark ash grey.' It is possible that the species still survives on Taveuni.

**PURPLE SWAMPHEN** *Porphyrio porphyrio vitiensis*. Previously widespread and common, it has been exterminated by the mongoose on the larger islands. The only sightings were on Taveuni, one bird at 1500 feet in panic flight, and another in a swamp at Waijevo under coconut palms. The subspecies is characterised by a bright blue breast shield and larger size.

**MANY-COLOURED FRUIT DOVE** *Ptilinopus perousii mariae*. This beautiful species was found to be fairly common in the Nausori Highlands, where it was frequently seen and more often heard calling in dense foliage. At Vunisea it was found to be relatively common,



[L. Rowe

FIGURE 2 — Banded Rail *Rallus philippensis sethsmithi* on Nukulau Island.



[K. Rowe

FIGURE 2 (a) — Banded Rail *Rallus philippensis sethsmithi* on Nukulau Island.

but only one sighting was made in the Gasele area. Mayr states that it is found throughout the Fiji Islands; but neither Layard nor Wood record any specimens or sightings from Taveuni. None of our parties sighted it there, nor was its distinctive call heard. It inhabits the lowlands of Viti Levu, the favourite food of the flock in the Suva gardens being the fruit of the weeping fig (Mercer 1966 (7)).

*Ptilinopus luteovirens* group. The following three *luteovirens* doves are each restricted in range, the Orange to Taveuni, Vanua Levu and two off-shore islands, the Velvet to Kadavu, and the Golden to Viti Levu and some off-shore islands:

Taveuni: ORANGE DOVE *Ptilinopus victor*. Casey A. Wood 1926 (5) p. 114 states "The doves of the genus *Chrysoena* (*Luteovirens*), peculiar to the Group, are the chief glory of the Fijian avifauna, and of these the most wonderful in point of plumage is the Orange Dove"; and again Layard 1876 (3) p. 151 "This gorgeous dove is the glory of the forest of Taveuni." Our own opinion was that the doves in this group must rank amongst the world's most beautiful birds. We found the Orange Dove not uncommon, but the vivid green females and juveniles with peagreen bills seemed to outnumber the more retiring clear orange males by about 6 to 1, the females and immatures often perching in the open on dead trees on the edges of clearings, up to 7 being counted in one tree. A male coming into its first adult plumage presented an unusual mottled pattern of bright green and clear orange feathering. The call is a clicking 'tok.'

Nausori Highlands: GOLDEN DOVE *Ptilinopus luteovirens*. This species we recorded as fairly common, again the green females and immature birds being much more frequently seen than the golden males. Its puppy-like bark, an accelerating 'uh-uh-uh-uh' was often heard.

Kadavu: VELVET DOVE *Ptilinopus layardi*. This dove was not recorded by 'C' party in the Vunisea area, where the Many-coloured was found in good numbers. In the Gasele area 'B' party found the Many-coloured rare, but the Velvet Dove very common, frequently occurring in parties of 7 or 8. The bright green plumage of the male, with yellow head and undertail coverts and vivid green bill, make it an unusually beautiful bird. Its peculiar call, a double whistle, was heard in all parts of the forest throughout the daylight hours.

PACIFIC PIGEON *Ducula p. pacifica*. This large fruit pigeon is only mentioned in the available earlier literature as being rather uncommon, and difficult to distinguish from the other two large pigeons at any distance. It was doubtfully sighted by 'C' party at Qacavulo on Taveuni; but 'B' party had a definite sighting of 4 birds in company with Peale's Pigeons on the edge of a forest clearing above their camp site on Taveuni, with other records in this locality, as well as two birds at a lower altitude. Also they had a probable sighting of one bird from the bus on the way out from the Nausori Highlands, the dark green back and vinaceous underparts being noted. Mercer 1966 (7) states that this pigeon is found in the Lau Group, well east of the main islands; but Mayr includes all Fiji in its wide Pacific range.

PEALE'S PIGEON *Ducula latrans*. A common bird in all situations and at all levels. Its hound-like 'woof-woof,' achieved by inflating the breast, then depressing the head and expelling the air, was a feature of the forest noises throughout the day, and much of the night. Other calls were a parrot-like squawk, and a noise like the coughing of a croupy sheep. Often seen singly in the understorey, it was more frequently observed sitting in the canopy in small groups. Layard records its gastronomic powers, two seeds taken from one crop measuring respectively 4" with circumference 3.6", and 5" with circumference 3"; and from these the outside pulp had been digested! Mounds of feathers of Peale's Pigeon were found throughout the forest on Taveuni, and were particularly numerous along a track to a clearing above the camp site of 'A' and 'B' parties; but shooting by the Fijians seems to have no effect on numbers.

WHITE-THROATED PIGEON *Columba vitiensis*. Usually seen as singles or in pairs, many were noted in flight over the camp site on Taveuni in the late afternoon. On Kadavu only one sighting was made in the Vunisea area, but at Gasele several pairs were seen to advantage, the glossy green, almost black, of the head, and white throat being noticeable features. In the Nausori Highlands a few were seen in flight near 'A' party's camp, and 'C' party noted them usually as a dark bird in rapid flight among the trees.

FRIENDLY GROUND DOVE *Gallicolumba stairi vitiensis*. 'Friendly' is a misnomer, for the bird is very wary and shy, and was thus rarely seen by our parties. On Taveuni there were three or four observations, one of which was detailed; but the light was not right for the brilliant copper sheen on the otherwise brown back and wing coverts to be recorded. There were two records in the Nausori Highlands, where its extreme wariness and rapid take-off has evidently allowed it to survive the ravages of the mongoose, for it is entirely a ground feeder. In one of these, only the characteristic loud clapping of the wings was heard in thick vegetation; and in the other, R.B.S. disturbed a bird, which took off in rapid low flight through the undergrowth.

MALAY TURTLE DOVE *Streptopelia chinensis*. A bird of the lowlands, this introduced species is common about gardens and settlements, where it is destructive of crops, especially rice. It was common on Nukulau Island; and well established coastally on Taveuni.

RED-THROATED LORIKEET *Vini amabilis*. This small lorikeet is restricted to Taveuni and Viti Levu, Wood in 1926 considering it extinct on Ovalau, where it was previously found. It is a bird of the outer canopy of the mountain forest, and so is difficult to see. We failed to find it on Taveuni, and our only record is of two birds seen by P.C. in the Nausori Highlands. It is all green, except for red cheeks, throat and thighs, and tail tipped yellow.

COLLARED LORY *Phigys solitarius*. This beautiful little multi-coloured bird was called *solitarius* by Latham 'because it is never seen alone'! We found it abundant in all three areas; in Taveuni from the coconut palms of the coast to the forest at 2000 feet; in the Nausori Highlands in clearings, forest, and the cultivated areas near Nausori Village; on Kadavu among the coconut palms and usually in small flocks among the scarlet flowers of *Erythrina indica*.



It was regularly seen in small groups in the crowns of coconut palms on Nukulau and Leleuvia Is. Small flocks in flight were commonly seen, particularly towards dusk.

**RED-BREASTED MUSK PARROT** *Prosopiea tabuensis*. There are four geographical races of this fine parrot in Fiji, and the two we recorded are quite distinctive in plumage, calls and size. They are called 'kaka' by the Fijians.

Taveuni: *P. t. taviunensis*. This race has maroon head and underparts, and is noticeably smaller than the others; also it lacks a blue collar. We found it numerous throughout the rain forest, usually single birds or in pairs, and it, and the Kadavu subspecies, were remarkably conspicuous when perched below the canopy.

Kadavu: *P. t. splendens*. The head and underparts are crimson and there is a conspicuous blue collar. In the Gasele forest it was numerous, and its raucous call, of higher pitch than the Taveuni bird, was constantly heard. In the Vunisea area it was noted from the mangroves to the high hills. A number frequented the village, and one periodically visited the local store for its ration of biscuit. Early observers spoke of large flocks of this and the succeeding species doing considerable damage to maize and other crops, and they were destroyed in numbers. *Splendens* is not restricted to Kadavu, but is also found on Viti Levu. 'C' party recorded birds seen and heard about their camp in the Highlands, and K.R. observed one near Nausori Village. Mayr states that *splendens* was introduced to Viti Levu, although Layard collected it there in 1874. However there is a trade, probably of ancient origin, in Kadavu parrots, which are favourite cage parrots in Fiji because of their intelligence, affection, and conversational powers (Wood and Wetmore 1926 (5) p. 123), and the introduction could be accounted for in this way.

**YELLOW-BREASTED MUSK PARROT** *Prosopiea personata*. This species is restricted to Viti Levu, and in the Nausori Highlands we heard and saw it very frequently. In the vicinity of Nausori Village 'A' party found it common in the forest, and in the native gardens where it fed on the flowers of banana palms.

**FAN-TAILED CUCKOO** *Cacomantis pyrrhophanus simus*. In the forest of Gasele on Kadavu, its rapid trill with a downward inflection was heard frequently, and at Vunisea a young bird sitting along a bough and petulently begging for food was probably of this species. It was heard on occasions on Taveuni, and there was one good observation in the Nausori Highlands, the barring of the underparts being most noticeable. It is an Australian species with races extending into some islands of the South-west Pacific.

**LONG-TAILED CUCKOO** *Eudynamis taitensis*. There were no sightings, but on Taveuni it was reported to be common in the vicinity of native villages on the coast; and on Kadavu its call was heard in the hills of the isthmus at Vunisea. Mayr records it as being generally silent in its winter quarters.

**BARN OWL** *Tyto alba*. This cosmopolitan species is apparently common throughout the lowlands and inhabited areas, although we only had one sighting, in a coconut plantation on Taveuni. The subspecies *lulu* is found throughout Polynesia. Wood states that he

saw at least two species of owl on Kadavu, but the second is not mentioned in the literature. Also Layard speaks of having seen on occasions a large brown owl on Viti Levu, which does not seem to tally with the Grass Owl *Tyto longimembris* listed by Mayr. There appear to be owls still awaiting identification in Fiji.

WHITE-RUMPED SWIFTLET *Collocalia spodiopygia*. This is possibly the commonest bird in Fiji, to be seen in numbers hawking over clearings, cane grass areas, creeks, forest verges, etc. There is an audible snap as it takes an insect, but otherwise it makes no sound, except for a twittering in the nesting caves. Members of 'A' party found it the only bird at Tagimaucia crater lake at 2700 feet on Taveuni; and on Nukulau Island it was one of the commonest birds.

[WHISKERED TREE SWIFT *Hemiprocne mystacea*. R.B.S. writes as follows: "As I was strolling back to camp at about 5.30 on the evening of 11/9/70, I saw an unfamiliar bird flying about 100 feet overhead. In size and shape it was quite unlike any bird I know — long and narrow. The flight appeared to be straight and level, as if the bird was going directly from the top of one tall tree to another across a clearing. It was, I suppose, in view for about 20 yards. I judged the bird to be about 9 inches long; the wings were not markedly long; across the chest the bird seemed to be very narrow, say about 1½ inches. I compared it in shape with a much reduced and attenuated Long-tailed Cuckoo. The body was small and the tail very long in proportion; but if forked, the streamers were held closed. In the fading evening light, no true colours or clear markings were discernible. No call was heard. All this is rather nebulous. By now I was reasonably familiar with most Fijian land birds; but this sighting puzzled me very much, and I did not know what to think. However, while turning the pages of Mayr's 'Birds of the S.W.P.' I was agreeably surprised to find a bird which seemed to offer a possible solution, although no such bird is as yet known from Fiji. The Whiskered Tree Swift *Hemiprocne mystacea* occurs throughout the Solomons, coming nearest to Fiji at San Cristobal. According to Mayr, dawn and dusk are their periods of greatest activity (vide p. 78). A bird such as this could easily have existed unnoticed in the mountain forests of Fiji." The bird may be well established in the Nausori Highlands, and if so, may in due course prove to be a new subspecies, although only one race has been recorded in the S.W. Pacific.]

WHITE-COLLARED KINGFISHER *Halcyon chloris*. This is a very common bird, seen in a wide variety of situations, such as along the coastline, on coastal and mountain streams, in coconut plantations, forest clearings, and within the forest. A considerable variation in breast plumage was noted, from clear white through buff to a rich smoky orange. The bar across the nape varied from prominence to almost complete absence, and there was much variation in the blue of the back.

PACIFIC SWALLOW *Hirundo tahitica*. Apparently this swallow seldom ranges far from the coast, although one was seen in the Nausori Highlands. One over the beach at Gasele, a pair over the beach at Vunisea, and a few near the Wairiki Mission on Taveuni,

hawking flies over drying copra, completed our scanty records; whereas in May 1966, R.B.S. found them in a number of localities on Taveuni. The bird is commonest in the dry western zone of Viti Levu.

**POLYNESIAN TRILLER** *Lalage maculosa*. There are five recognised subspecies in Fiji, of which we recorded three as follows:

Taveuni: *L. m. woodi*. This bird was seen in fair numbers from sea level to 2000 feet. In the forest it habitually perches high in the canopy, usually choosing the tops of the taller trees, either in parties or pairs. Many were seen, however, at moderate height on the verges of the clearing above the camp site of 'A' and 'B' parties, and here the U-shaped barring on the sides of the neck and on the flanks which distinguishes the race was clearly seen. It was only here that the trilling song was heard, which is a fine, long-sustained trill, like that of a canary. Otherwise it is a noisy bird, calling a rasping 'zzit' and 'si-si-tsi.'

Nausori Highlands: *L. m. pumila*. Many birds were seen to have a pale, almost white breast, with little marking, and were probably immatures; but the majority were heavily barred, denoting the subspecies. Working in different areas, 'C' party recorded it as not uncommon, 'B' party as the most common bird in the Highlands, and 'A' party had many sightings. Some breeding was in progress, as a pair was seen carrying food.

Kadavu: *L. m. soror*. This race was found to be very common in the Gasele area, and subspecific differences were noted in the somewhat darker breast with fainter barring. In the Vunisea area it was recorded as noisy and conspicuous, and as one of the few native passerines that will perch in the open. No variation in voice in the three races was noted. Here breeding was also taking place, a nest being found at 60 feet in a mango tree, and changeover at the nest observed.

**RED-VENTED BULBUL** *Pycnonotus cafer*. Introduced from India about 1903, it is widespread and extremely common on Viti Levu and some of its off-shore islands. It is reported as doing serious damage to fruit. In the Highlands it was in numbers in clearings, forest verges, and the gardens of Nausori Village, but it does not invade the forest to any extent. It was rare on Nukulau Island, with only one record, and on Leleuvia, where two were seen.

**ISLAND THRUSH** *Turdus poliocephalus*. There are 5 very distinct races, each restricted to particular islands, and of these we recorded three. All are extremely wary, and are difficult to observe, except by sitting still and watching for a period. The species is closely related to the European Blackbird and the American Robin.

Taveuni: *T. p. tempesti*. Well distributed in the forest, its behaviour when disturbed resembles that of the Blackbird in the New Zealand bush, with similar alarm notes and rapid low flight. Both the male and female *tempesti* are black, except for grey head and throat in the male, and streaky greyish-black head and throat in the female. The song is also Blackbird-like, except that some cadences are repeated three or more times. It contributes fine song to the dawn chorus from the canopy, and is vocal again towards evening.

Nausori Highlands: *T. p. layardi*. The plumage is quite different, being dark brown above, light grey throat, and chestnut flanks and abdomen. In the area surveyed by 'B' party it appeared to be the most common bird after the Swiftlet and White-eye, and several of both sexes were seen to advantage. Some birds, having streaked grey and whitish underparts, were presumed to be females.

Kadavu: *T. p. ruficeps*. It was seen, and heard singing strongly from cover in patches of forest, in the Vunisea area, and several were briefly seen in the native gardens behind Gasele, especially along the banks of a stream; but everywhere it was so elusive that the distinctive plumage of this race, black with ochre head and throat, was not recorded.

**SILKTAIL** *Lamprolia victoriae*. On Taveuni we found this beautiful little bird (5") to be fairly common and apparently well distributed in the forest from 1500 feet upwards. It is a bird of the fairly open understorey, and not seen higher than about 20 feet, but more often on the ground, or within a few feet of it. In fine weather it is easy to find and approach, and in shape and plumage reminds one of the Riflebirds of Queensland in miniature. It was always found in pairs at least, and sometimes in groups up to four; not restricted to three as Layard found in 1874; but his visit followed close upon the fledging of the first clutch, and only one large egg, 1" x .9", is laid by this small bird (Layard 1876 (3) p. 149). A description of the plumage is merited: velvety black head, back, wings, and tip of tail, all with a remarkable iridescence of blue and green; snow-white tail and upper tail coverts; glossy blue spangles at the throat. The Fijians call the bird 'wali-na-kole,' meaning 'the dog cannot catch it,' in allusion to its habit of running along the ground, and then flying up just out of the dog's reach (Layard 1875 (2) p. 438).



[V. T. Davis

FIGURE 3 — The Silktail *Lamprolia victoriae* on Taveuni.

FIJI WARBLER *Vitia ruficapilla*. There are four races, of which we only recorded two, failing to find the Taveuni subspecies *V. r. funebris*.

Taveuni: *V. r. funebris*. With nothing in the available literature to indicate habits or song, but only that it is found in thick undergrowth, none of the parties recorded the Warbler on Taveuni, although it is doubtless present in suitable habitat.

Nausori Highlands: *V. r. badiceps*. On the day prior to 'B' party's return from the Highlands the first sighting was made by L.E.H. Shortly after daybreak the following morning, it was suddenly realised that song coming from many points in dense tangled undergrowth close to the camp was from this bird. Any attempt to enter the tangle meant immediate silence from all birds in the vicinity, and in any case light in the jungle was too dim for observation. Later two birds crossed the forest road to an open glade, and came under close observation, up to 10 feet at times, by all members of the party. Its flight is somewhat uncertain with small undulations, reminiscent of our Fernbird *Bowdleria punctata*, and even more Fernbird-like are its actions on the ground, as it creeps rapidly in and out of cover. The tail is jerked as it warbles, and is held cocked in open situations. Contrary to descriptions in the literature, taken no doubt from museum specimens, long legs and bill did not strike us as a characteristic of the bird in the field. The white eye-stripe, rufous crown, and other features distinguishing the race were clearly observed. Later 'C' party, in an area about a mile distant, had three sightings, including one close observation as the bird worked rapidly down a tree trunk from about 20 feet to ground level. Song heard frequently from the campsite and elsewhere was uncertainly, but correctly, ascribed to the Warbler. It was described by B.B. as plaintive, of flute like quality, and consisting of one prolonged deep note followed by five or six ascending notes. Listed by Mercer as uncommon on Viti Levu, we would assess it as common, at least locally, in the high forest.

Kadavu: *V. r. ruficapilla*. Only one bird was seen, the locality being inland from Gasele village, and song was heard. Observation was not close enough to record the subspecific features.

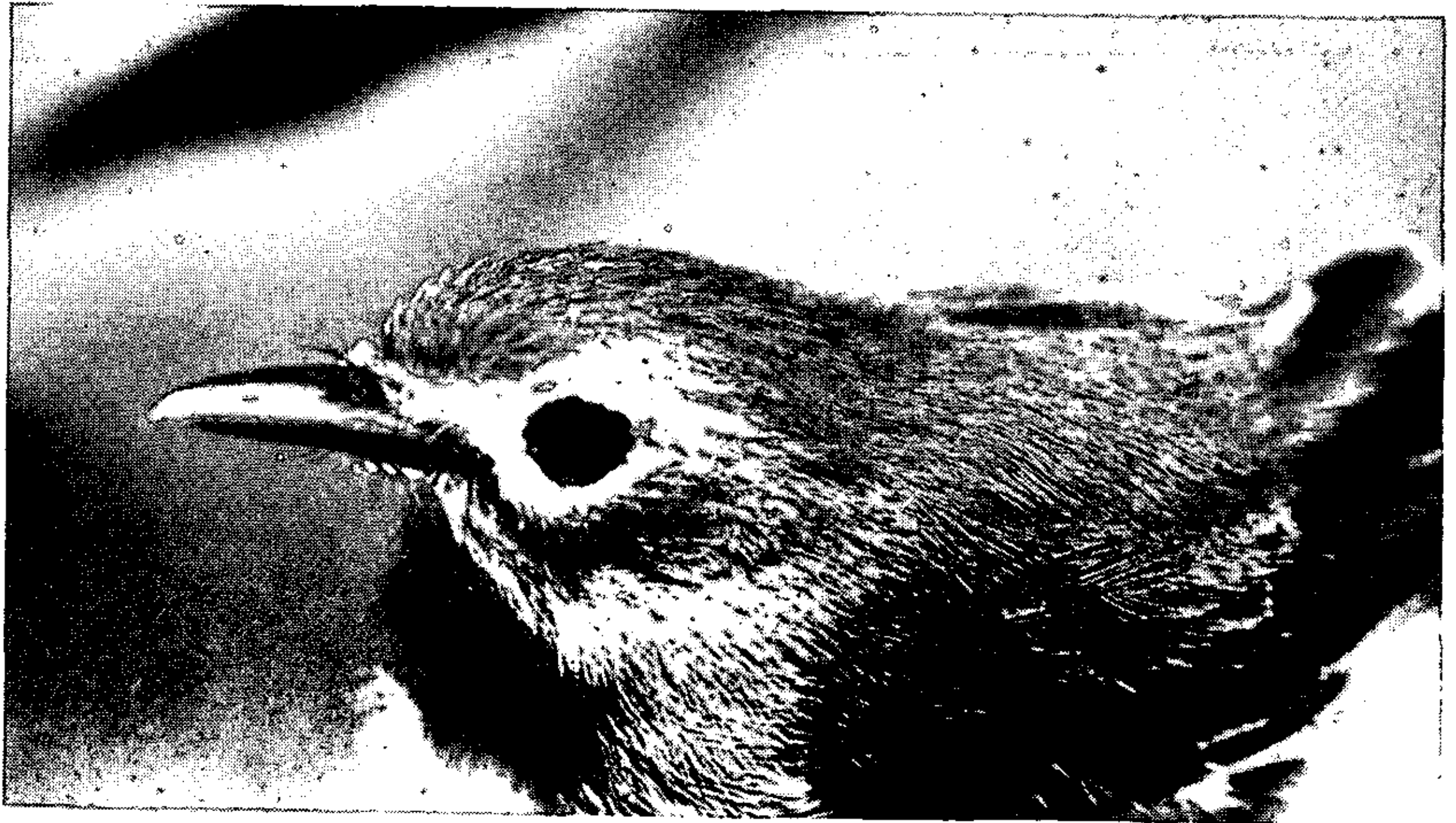
KADAVU FANTAIL *Rhipidura personata*. The striking feature is a black crescentic band across the upper breast, with an inverted V of black joining this band. The tail is all black except for a narrow white edging to the two outer feathers. It was elusive in the Vunisea area, with only two sightings; but in the forest at Gasele, 4 or 5 would usually be seen up one of the steep bouldery creek beds which provided the only reasonable access into the forest. Extremely active, it has a variety of song, frequently a musical succession of single notes in one key, followed by a succession in a lower key, and then back to the first key. When in groups, a high 'plonking' chorus would be heard, with very loud cadences rising and falling. The species is probably well distributed.

SPOTTED FANTAIL *Rhipidura spilodera*. Of three subspecies in Fiji, those of Taveuni and Viti Levu are recorded.

Taveuni: *R. s. rufilateralis*. It is well distributed and fairly common at all levels in the forest, but apparently rare in the cleared coastal areas. Several noisy parties of 5 and 6 birds were recorded, plus at least two family parties containing lately fledged young. Probably the other groups were family parties, judging from the variation in intensity of spotting on the breast.

Nausori Highlands: *R. s. layardi*. The race is characterised by very strong streaking on the breast, and it is generally a much darker bird. It was not uncommon, but not particularly noticeable. If we sat quietly in the forest, a bird would usually come into view. The call is usually a 'chip, chip.'

SLATY FLYCATCHER *Mayrornis lessoni*. Essentially "a bird of the substage in lowland and mountain forest" (Mayr 1945), on Taveuni 'A' and 'B' parties recorded it as fairly common in the forest, and it was often seen, sometimes at eye level, on the track below the camp. Strangely, 'C' party, who worked an area some miles to the south-west, found the bird rather scarce, or elusive. Again, in the Nausori Highlands, 'B' party found it common, and not shy; but 'C' party found it elusive and seldom recorded it. On Kadavu it was rare in the Vunisea area, with only two records, whereas at Gasele it was a very common bird. 'A' party found it one of the three most common species on Leleuvia Island, where several were mist-netted. It is an attractive bird, clothed in quiet grey, with dark eye and whitish eye-ring, and black tail, and betrays its presence by a noisy scolding chatter, and grating, rasping notes. In this it reminded one of the Whitehead of New Zealand.



[K. Rowe

FIGURE 4 — The Slaty Flycatcher *Mayrornis lessoni* on Leleuvia Island.

FIJI SHRIKEBILL *Clytorhynchus vitiensis*. Mayr 1945 says that this species is "found in the substage of the darkest parts of the forest, gleaning insects from vines and branches," and it was in this type of habitat that most observations of three races were made.

Taveuni: *C. v. layardi*. Many were recorded by 'A' and 'B' parties, all in the substage in heavy forest; but 'C' party's only sighting was in a tangled hollow open to sunlight. White edging along both mandibles is diagnostic of the species, and ochreous underparts indicate the race. They were usually seen in pairs, searching the trunks and lianes.

Nausori Highlands: *C. v. vitiensis*. Again 'B' party saw many of this race, at first thought to be juveniles from their smaller size and paler grey of the underparts. One bird was mist-netted in the forest of Leleuvia Island.

Kadavu: *C. v. compressirostris*. There was a somewhat doubtful record of two birds in a dense acacia thicket near Vunisea Hospital, for probably Layard 1875 is right in saying "this bird frequents the forest, never coming near the haunts of men." It was far from uncommon in the forest of Gasele, frequently in pairs, and coming close to the observer. The warm olive-brown colour, heavy bill, and prominent white on the mandibles was noted. A usual call is a harsh 'trrt'; but by following up a very long drawn out mournful call which had been puzzling us, it was discovered to be made by this bird. L.E.H., an excellent mimic, imitated the call with startling results, for the bird immediately moved in close and displayed continuously and brilliantly. The vibrations in the call increased as wings were vibrated and tail spread. The call consisted of simple variations easy to imitate (according to L.E.H.). One declining note was followed by one ascending, and then with all appearance of anger, the bird gave several guttural 'clucks.' This was again followed by more melodious vibrating notes accompanied by much display.

BLACK-FACED SHRIKEBILL *Clytorhynchus nigrogularis*. This species was recorded on Taveuni only by 'B' party, the first observation being of a female collecting nest material on the forest floor, then creeping on tree trunks in search of food. Later several were seen. The male is a handsome bird, with his black face and throat and white ear patches. In the Nausori Highlands it was met with not infrequently, and the calls were noted to be similar to those of the previous species, but louder and more varied. We found later on Kadavu that it also gives the long mournful call in a descending quavering whistle. There were further sightings in the Gasele area, about one of which L.E.H. has this comment: "Calling brought us to a nest, but despite our provocative imitations, display was modified to energetic wing spreading and vibration, and spreading of the tail. This we feel was due to our close proximity to the nest. The female came off the nest." The rich brown colouring of the female was noted, some having a grey-black diffusion on the head; and the heavy ivory grey-green bill of the male was recorded. Both sexes sing and display.

VANIKORO BROADBILL *Myiagra vanikorensis*. Four subspecies are recognised, of which we probably noted three.

Taveuni: *M. v. rufiventris*. This is the common small passerine of the coastal trees, and still present in small numbers at 200 feet.



I.K. Rowe

FIGURE 5 — Vanikoro Broadbill *Myiagra vanikorensis dorsalis* on Leleuvia Island.

Both sexes have a sparrow-like chirp, and the male a persistent and resonant 'pee-pee-pee-pee,' also a double whistle 'toet, to-eet.' It sometimes calls at night.

Nausori Highlands: *M. v. dorsalis*. Much less common than in the lowlands, but 'A' party found it in numbers in the shrubbery and gardens about Nausori Village. No racial differences were noted, and the race may be referable to *rufiventris*. 'A' party found it common in the forest of Leleuvia Island, but did not record it on Nukulau. The race here would be *dorsalis*.

Kadavu: *M. v. kandavensis*. It was not common in the Vunisea area, where a distinct difference in the song was noted: a long drawn-out rather plaintive 'pe-eep,' instead of the sustained ringing call of *rufiventris*. This swarthy race, with more black, and a deeper orange breast, was abundant in the native gardens in the wide valley behind Gasele village.

**BLUE-CRESTED BROADBILL** *Myiagra azureocapilla*. There are three races of this beautiful little bird listed by Mayr, being restricted to Viti Levu, Vanua Levu, and Taveuni. No specimens are recorded in the available literature as coming from Kadavu, so the birds seen there by us could prove to be a new subspecies.

Taveuni: *M. a. azureocapilla*. The male is a very striking bird, with a vivid orange bill against a sky-blue crest and rich chestnut throat. Many sightings were made, frequently in the canopy, and three birds were mistnetted by 'A' party.



Nausori Highlands: *M. a. whitneyi*. A number of sightings were made, and here it was found to be not so much a bird of the canopy, but of the understorey at 10 to 50 feet, sometimes perching still on a bare bough in full view. The golden-brown of the throat was noted. A pair was seen in a feeding association with two Slaty Flycatchers, a Fiji Shrikebill, and a Spotted Fantail. Rather a silent bird, and no calls were recorded.

Kadavu: subsp. *nov.*? On 7/9/70 a female was seen in the Gasele area, with a further sighting two days later. Insufficient details of plumage were noted to give a detailed description.

SCARLET ROBIN *Petroica multicolor kleinschmidti*. This attractive little bird is a miniature of the Scarlet Robin *P. multicolor* of Australia, for no differences in plumage were obvious; but we estimated its size at 3½ inches, and certainly one of the tiniest Fijian birds. Quite a number were seen in the forest of Taveuni, one pair having a nest with young. In an open situation on a thin branch at 16 feet, the nest was nicely placed under the shelter of a large leaf. A soft 'plink, plink' was all that was heard at the nest; but it has a sweet whistle, running down the scale in quick succession. It was fairly common in the Nausori Highlands, with nesting in full swing, for pairs could always be found in the same places, and several nests were found. 'A' party observed a pair in one of Fletchers' pine plantations. Mayr lists a race *becki* for Kadavu, but we did not see it there, and from earlier literature it is apparently rare.

GOLDEN WHISTLER *Pachycephala pectoralis*. There are no less than 80 recognised races in the South-west Pacific, of which Fiji has its full share of 10. We observed three very distinct subspecies in the areas surveyed.

Taveuni: *P. p. torquata*. Fairly common in the forest and probably well distributed, but it is a bird mostly of the high canopy, and so not easy to locate. At times, however, it would be seen to advantage, and the male's fine plumage admired, with his yellow throat, black breastband, and yellow abdomen. Singing in the canopy, it is more easily heard than seen, for it has a loud clear song, which frequently ends with an upward whip-crack note. Its song was always a feature of the early morning chorus. The female is a plain bird, very rufous.

Nausori Highlands: *P. p. graeffi*. We found this bird not uncommon, but again usually high in the canopy. It begins singing very early in the morning, in concert with honeyeaters, but is a poor songster compared with *torquata*, its song consisting of few notes, and quite unremarkable. Its plumage differs widely from the foregoing, for there is no breastband, but a black bib with the underparts all golden yellow; and its mate is a rather drab bird, with a vermiculated grey breast.

Kadavu: *P. p. kandavensis*. This was not recorded in the more settled area of Vunisea, but we recorded it as very common in the coastal bush of Gasele, and met with it less frequently in the higher forest, where it was rather a bird of the understorey. A great songster, but endless repetition of the same cadences tended towards monotony. In plumage it was the nearest of all three races to its Australian congener, having a white throat surrounded by a narrow black collar, with lemon yellow breast and abdomen.

WHITE-BREASTED WOOD-SWALLOW *Artamus leucorhynchus*. This is a common lowland bird, to be seen on telephone lines and roadside vegetation. None was recorded in the higher levels of Taveuni; but in the Highlands a few were seen in clearings, and greater numbers about Nausori Village. Nesting was in progress at the Douglas homestead on Taveuni, and elsewhere courtship feeding was seen. It is absent from Kadavu.

POLYNESIAN STARLING *Aplonis tabuensis*. Essentially a bird of the forest, it was recorded in small numbers on Taveuni, mostly in pairs. A flock of 10 visited trees near 'C' party's camp in the early mornings, then broke off into pairs. In flight like the European Starling, it is a plain bird, with dark grey-brown upper parts, pale streaked grey under, but with a coppery sheen in some lights. It was present on Kadavu, where some nesting was noted; and in the Nausori Highlands nesting was well advanced. Five nests were found, all in dead trees at 25 to 70 feet. In at least one nest young were being fed. Nests were in holes or rotten wood, in sites typical of *S. vulgaris*. J.A.B. noted a pair bringing food at 3 and 4 minute intervals; and R.B.S. watched a Starling feeding at the flowers of the Fijian mistletoe (*Amelotheca insularum*).

INDIAN MYNA *Acridotheres tristis*. An extremely common bird of the lowlands, and frequenting the coastal villages of Taveuni, it is apparently, and fortunately, absent from Kadavu.

JUNGLE MYNA *A. fuscus*. Glossy plumage, an erectile crest at the base of the bill and vivid yellow eye characterise this species, which is common in the cultivated areas of Viti Levu and in Suva gardens, and very common on Nukulau Island, to the exclusion of *A. tristis*.

ORANGE-BREASTED HONEYEATER *Myzomela jugularis*. This attractive little honeyeater (4") is common in most situations and at all altitudes, at least up to 2000 feet, except that we found it rare in the Gasele area. It was one of the most common birds on Leleuvia Island, but absent from Nukulau. Variations in plumage were noticeable amongst small groups feeding in lantana, the crowns of coconut palms, flowers of the flamboyant tree, and so on, due no doubt to age and sex. There was no song, other than a monotonous 'tzit,' punctuated by a higher 'tchee,' and a loud demanding 'sweet sweet.'

WATTLED HONEYEATER *Foulehaio carunculata*. There are three subspecies, of which two occur in the areas visited by us, *taviunensis* on Taveuni and *procerior* on Viti Levu. Mayr 1945 queries the presence of the latter race on Kadavu, although Mercer 1966 quotes the species as being found throughout the Group. It was certainly collected by Wood on Kadavu (one specimen only) in 1923, and Wigglesworth 1891 (11) recognised its occurrence there; but neither 'B' nor 'C' parties saw it on Kadavu, and we would have been surprised to have found it sympatric with the very similar Kadavu Honeyeater, an extremely common bird.

Taveuni: *F. c. taviunensis*. Very numerous and very vocal at daybreak in the forest, particularly along the margins, it was not common coastally or in cleared country. Its endlessly repetitive three note call became rather monotonous. The yellow wattle is small and variable, probably according to age, in many birds appearing as just a small patch of bare skin below the gape.

Nausori Highlands: *F. c. procerior*. This darker race was much less conspicuous in the Highlands than in the lowlands, where it is common in all situations, especially in gardens, and is usually the first Fijian bird to come to the notice of a visitor. 'C' party found it common in the scrubby part of Nukulau Island, where *Myzomela jugularis* does not occur.

KADAVU HONEYEATER *Xanthotis provocator*. We found this bird to be very common. Layard 1876 records it as one of several Fijian passerines which lay only one egg, and says "it accounts for the paucity of individuals one sees in the forest"; but to us one egg clutches seemed more probably due to the population being at saturation point in all favoured habitat.

GIANT FOREST HONEYEATER *Gymnomyza viridis*. This fine large honeyeater (10½") with a long curved bill is restricted to the tall forest, and is not seen at lower altitudes. It does not occur on Kadavu.

Taveuni: *G. v. viridis*. One was seen at 1500 feet feeding on wild banana flower in the forest, several more at altitudes above 1800 feet, and others near the top of the rim of Tagimaucia crater at 2700 feet. Its call was not heard from either camp site, and it seemed to be a less noisy bird than the other race; but three pairs were closely observed by B.B. feeding in a pandanus resembling our kiekie, with courtship feeding by two of the pairs. In addition to 'keetoo, kee-too,' they "produced a remarkable volume of sound, loud melodious whistling gurgles with rapid mellow notes."

Nausori Highlands: *G. v. brunneirostris*. The race is distinguishable by blackish bill and legs, in place of the bright yellow of *viridis*. Although considered by Wood 1926 to be rare, we found it to be fairly common, and certainly by far the noisiest bird of the rain forest. Its ringing 'keetoo keetoo' would begin at 2.15 each morning, and usually continue until long after dark, and birds calling in one area would set off birds in other areas. It also produced small noises like a Tui *Prosthemadera novaeseelandiae*, and its method of bathing after rain was the same as that of the Tui, diving into thick canopy until thoroughly soaked. Frequently it ran about dead branches conspicuously, and was seen to display when calling, bending forward with tail raised and fanned out. It was noticeably aggressive towards some other species, e.g. the Collared Lory.

LAYARD'S WHITE-EYE *Zosterops explorator*. Distinguished from *lateralis* mainly by its yellow underparts and plumper build, it was by no means common on Taveuni. 'B' party found it abundant in their partly cut-over area in the Nausori Highlands, while 'C' party had only one probable sighting, and 'A' party thought it the only White-eye in the vicinity of Nausori Village. There was a tentative record of three birds in the Gasele area on Kadavu.

GREY-BACKED WHITE-EYE *Z. lateralis flaviceps*. This race is much more yellow about the head than *lateralis* in New Zealand. Many were seen in small flocks on Taveuni, particularly along the coast, in cleared country, and along the forest verges. In the Nausori Highlands and on Kadavu it was very common, and was still in small flocks, although some nesting was in progress. The race *flaviceps* is restricted to the Fiji Group, but apparently does not extend into the Lau Archipelago to the east (Mees 1969 (11)).

**RED-HEADED PARROT FINCH** *Erythrura cyanovirens*. A beautiful little finch which we found to be fairly common on Taveuni, frequently in parties of 3 to 6. Mainly a bird of the clearings, it was sometimes seen inside the forest. It was quite common in the Nausori Highlands, in the grassy clearings along with Strawberry Finches, but we did not record it on Kadavu.

**STRAWBERRY FINCH** *Estrilda amandava*. In lowland open parts of Taveuni, this introduced bird was seen in small flocks, and in the cultivated parts of Viti Levu, including cleared areas in the Highlands, flocks were numerous.

**JAVA SPARROW** *Padda oryzivora*. 'A' party recorded small flocks in the grasslands and old gardens in the vicinity of Nausori Village, and also in the lowland areas of Taveuni. Large flocks are not uncommon in the wetter eastern parts of Viti Levu.

**BLACK-BACKED MAGPIE** *Gymnorhyna tibicen*. This undesirable introduction appears to have become widely established in the lowlands along the north-west side of Taveuni.

To complete the records of land birds, it only remains to list some observations by competent observers of birds which were not identified. These were as follows:

1. On Taveuni there were at least four records of a sparrow-sized bird with a blue crown, marked eye-ring, white markings on the face beginning at the gape, narrow below the eye, and widening into a large patch; length  $5\frac{1}{2}$  inches; sparrow-like plumage on back and tail; strong dark bill, distinctly orange at base; a brightish dark rufous patch on throat, and greyish-white underparts. A bird of the undergrowth, with a warbling song akin to that of the Grey Warbler of New Zealand.
2. Each day at dawn on Taveuni a bird was heard to give a deep, steady 'tong, tong, tong' like the ringing of a bronze temple bell. It was never heard after 6.15 a.m., and its identity remained a mystery.
3. Also on Taveuni, a small bird of about 4 inches; black head, back, wings and tail; light grey underparts, and a short red flycatcher type bill. A party of three was seen by a creek at the edge of the forest.

#### SEABIRDS AND WADERS

The object in visiting Fiji was to study the land birds, but as adverse weather caused some changes in scheduled sailings between Kadavu Island and Suva, and the abandonment of this trip by 'A' party, opportunities were taken to observe seabirds and migratory waders. There is a marked absence of seabirds round the coastline of the larger islands, but 'A' party in particular made some interesting sightings in the course of their visits to Nukulau and Leleuvia Islands.

**BROWN BOOBY** *Sula leucogaster*. Several on beacons off Somosomo on Taveuni, and 15 to 20 on beacons north of the Rewa Delta. Several in flight en route to Leleuvia Island.

**RED-FOOTED BOOBY** *Sula sula*. In fair numbers between Suva and Kadavu, and recorded in the vicinity of Nukulau Passage.

LESSER FRIGATE BIRD *Fregata ariel*. Up to 4 harrying Crested Terns at Vunisea. Several over Matei airfield, Taveuni. Two at Rewa Estuary. Several in flight south of Leleuvia Island.

PACIFIC GOLDEN PLOVER *Pluvialis dominica*. Rewa Estuary 60; Leleuvia Island 20; on reef at Gasele 4; Nukulau Island 4.

DOTTEREL sp. *Charadrius mongolus* or *C. leschenaulti*. Rewa Estuary 4. Strong wind made viewing very difficult.

LONG-BILLED CURLEW *Numenius madagascariensis*. Rewa Estuary 1.

WHIMBREL *Numenius phaeopus* subsp. Rewa Estuary 25+; Taveuni 1 under forest canopy.

BAR-TAILED GODWIT *Limosa lapponica*. Rewa Estuary 80; Nukulau 1.

WANDERING TATTLER *Tringa incana*. Nukulau 30+; Leleuvia 15 to 20; scattered along Taveuni coastline; common on reef at Gasele, with much trilling; Rewa Estuary 100+.

SIBERIAN TATTLER *Tringa brevipes*. Rewa Estuary 2.

TURNSTONE *Arenaria interpres*. Nukulau 20+; Leleuvia 10; Rewa Estuary 25.

CRESTED TERN *Sterna bergii*. Nukulau 30; Leleuvia 15, and commonly seen in flight en route; several off Somosomo; reef at Gasele 12; Vunisea Bay up to 15, including young not long fledged; Rewa Estuary 150+.

BLACK-NAPED TERN *Sterna sumatrana*. Around Leleuvia Island and in the southern channel to the Rewa Delta, many mixed feeding flocks of this species and noddies were seen. Flocks varying from 10 to 200 passed in flight close to the catamaran. A small group, including juveniles, regularly rested on a sand bar on Leleuvia.

NODDY *Anous* sp. Large flocks, some exceeding 500, were seen feeding with the preceding species, but they could not positively be identified as Common or White-capped.

No petrels were recorded, but John Smart (in pers. comm.) quotes information supplied by Fijians to the effect that petrels breed near the summit of Mt. Washington at the western end of Kadavu, and also of Mt. Challenger to the east. Those at Mt. Washington are said to be in their burrows by day, and the latter which are taken by the villagers for food, by night. Information on plumage is unreliable, and at variance with some gleaned by 'C' party at Vunisea.

## DISCUSSION

The Fiji project was intended to provide an introduction for New Zealand ornithologists to the avifauna, in the hope that it will lead to a wider study there, with an eventual extension to the avifauna of the whole of the South-West Pacific area. Fiji is recognised as having the richest birdlife in this area, but Samoa, Tonga, and other island groups also have much of interest in their land birds. It will be seen from the foregoing survey that the variety of species is not so great as to confuse the amateur, with the result that in any area one quickly comes to recognise the main species, and study is simplified.

There has been no extensive survey of any part of the Fiji Group since 1924, so that further work is now overdue, particularly with a view to recommending to the Fiji authorities the provision of adequate faunal reserves, for the development of forest resources is proceeding apace.

Literature on the Fijian avifauna is somewhat scanty, and much of it difficult of access. However Mayr 1945 (9) summarises and briefly describes all the recorded species and races; but from our short survey, it will be seen that there are still species unrecorded as yet.

The British Museum has an extensive range of study skins, and collections are held in several American museums; but if New Zealand is to take its place as the centre of the South-West Pacific in ornithology, as it is expected to do in other directions, then the establishment of a small, but representative, collection of study skins in one of our main museums would appear to be essential.

#### ACKNOWLEDGEMENTS

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On Taveuni, Morris Hedstrom Ltd. and the Wairiki Mission gave invaluable help in providing Landrover transport to take 'A' and 'B' parties to the high altitude forest, and Bro. Kevin of the Mission was unfailing in his daily trips with fresh bread and tropical fruit. Mr. Reg Douglas, of Qacavulo Estate, provided the same help to 'C' party, and extended the greatest hospitality to them.

On Kadavu, 'C' party had the use of the Government school buildings through the courtesy of the Hon. Minister of Education, and enjoyed the kindness and co-operation of the two schoolmasters, Mr. Wame Salabogi and Mr. and Mrs. Ieli Irawa. 'B' party appreciated the ready consent of Chief Levi to camp by the village of Gasele, and Mr. Semisi Bulivou, Deputy Chief, could not have been more assiduous and kindly in his help in many ways.

I am indebted to Mr. F. C. Kinsky and the Dominion Museum for providing photo-copies of some of the early papers on Fijian birds; to Mr. Chris Challies for drawing the accompanying map; and to him, Messrs. K. and L. Rowe, and Mr. V. T. Davis for providing the photographs.

## APPENDIX 'A'

*Bird Measurements:*

All measurements were taken from live birds with vernier callipers accurate to .01 cm.

	Culmen	Tarsus	Wing	Total Length
<i>Banded Rail:</i>				
Nukulau Is.	34.6	48.1	150.0	294.0 mm.
<i>Red-vented Bulbul:</i>				
Nausori Hld.	17.3	28.8	96.0	222.0
Nukulau Is.	17.2	25.2	72.0	206.0
<i>Island Thrush:</i>				
Taveuni Is.	23.0	37.1	114.0	216.0
<i>Jungle Myna:</i>				
Nukulau Is.	22.5	38.6	126.0	218.0
"	22.0	39.2	117.0	226.0
"	21.8	38.0	118.0	220.0
<i>Silktaill:</i>				
Taveuni Is.	13.7	25.4	79.5	142.0
"	13.9	24.9	81.0	146.0
"	12.9	23.6	86.0	149.0
"	12.5	24.5	80.0	136.0
"	13.5	24.8	80.5	137.0
<i>Slaty Flycatcher:</i>				
Leleuvia Is.	11.4	18.1	66.0	142.0
"	10.7	19.3	68.0	145.0
<i>Fiji Shrikebill:</i>				
Leleuvia Is.	18.0	24.0	88.5	186.0
Taveuni Is.	21.7	22.7	84.0	191.0
"	20.5	23.0	86.0	190.0
<i>Vanikoro Broadbill:</i>				
Leleuvia Is.	12.7	17.8	73.5	150.0
	Bill width — 9.0; Bill depth — 4.5			
"	13.4	18.5	69.5	140.0
	Bill width — 9.6; Bill depth — 4.5			
<i>Blue-crested Broadbill:</i>				
Taveuni Is.	12.0	21.8	78.0	157.5
"	13.5	21.9	80.0	164.0
"	13.1	22.0	81.0	161.0

	Culmen	Tarsus	Wing	Total Length
<i>Golden Whistler:</i>				
Taveuni Is.	16.7	28.9	90.0	171.0
<i>Orange-breasted Honeyeater:</i>				
Nausori Hld.	14.5	16.8	56.0	107.0
"	15.4	17.7	61.0	108.0
Leleuvia Is.	13.9	16.5	55.0	104.0
"	15.7	17.8	56.5	108.0
"	15.3	17.0	57.5	112.0
<i>Wattled Honeyeater:</i>				
Nukulau Is.	18.2	28.7	88.0	186.0
"	17.8	27.9	89.0	187.0
"	19.2	28.1	91.0	185.0
"	21.6	31.6	102.0	204.0
"	21.9	31.4	104.0	211.0
"	23.1	30.3	96.0	199.0
<i>Layard's White-eye:</i>				
Nausori Hld.	11.7	19.1	60.3	128.0
"	12.0	19.0	56.0	-
<i>Red-headed Parrot Finch:</i>				
Nausori Hld.	9.2	18.0	53.7	102.0

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## THE BEHAVIOUR OF THE NEW ZEALAND DABCHICK

By ROBERT W. STORER

### ABSTRACT

Observations and motion pictures were made on New Zealand Dabchicks in August and September 1969. Feeding, agonistic, courtship, and mating behaviour is described and compared with that of other grebes. The two principal courtship ceremonies are the Patter Ceremony and the Diving Ceremony. The former was observed frequently and is common after territorial encounters. The latter may be the ceremony of pair formation and like the former may be important in strengthening the pair bond. These ceremonies differ considerably from those of other grebes studied, but presumably resemble those of the related Hoary-headed Grebe *Podiceps poliocephalus* of Australia.

Although the New Zealand Dabchick *Podiceps rufopectus* is not uncommon locally and is easy to observe, remarkably little has been published on its biology. The most extensive paper is that by Buddle (1939), who studied its breeding on Lake Rotoiti. Sibson (1952) has been collecting data on its distribution and ecological preferences for some time, and there are short accounts or notes by Potts (1870, 1871), Buller (1888, 1905), Biddle (1962), and Edgar (1962). It was my good fortune to visit New Zealand from August 18 to September 16, 1969, and to spend much of this period observing and filming the behaviour of this interesting grebe. Most of the field work was done at the Muriwai sand dune lakes in the Woodhill Forestry Area northwest of Auckland and at Lakes Rotorua and Rotoiti on the volcanic plateau. A short time was spent watching three birds at Kourarau Dam near Gladstone. Observations were made from the shore with binoculars, at times using a car as a hide. Motion pictures and field sketches provided the bases for the figures, which were prepared by Martha B. Lackey.

Of the many persons who made this work not only possible but also extremely pleasant, I am especially indebted to F. D. Drower, R. A. Falla, Wyn and Denys Goddard, Mr. and Mrs. F. C. Kinsky, Mrs. Milford Reed, R. B. Sibson, and E. G. Turbott. The study was supported by a grant (GB 8269) from the National Science Foundation.

The New Zealand Dabchick is clearly a geographic representative of the Australian Hoary-headed Grebe *Podiceps poliocephalus*. Strictly speaking "dabchick" is a misnomer, as these birds differ both in behaviour and in morphology from the "true" dabchicks or little grebes (*Tachybaptus ruficollis* and *T. novaehollandiae*). The New Zealand endemic is somewhat larger, proportionately longer billed, and much more heavily pigmented than its Australian counterpart; it also differs in lacking a distinct winter plumage.

At first glance these birds appear remarkably dull in colour, then one turns and the pale eye becomes conspicuous against the dark head and the rufous breast glows as the sunlight catches it. At times they appear high sternal like Black-necked Grebes *P. nigricollis* and from behind the predominant colour of the feathers is light grey. In the extreme of the high-sternal posture, the folded wings are held at an angle, the tips high, and the flank feathers are spread. Then two patches of silky white feathers, one lying on each side of the lower back and normally covered by the wing tips and the dark ends of the flank feathers, are spread, each in a semicircle centred

around the blackish ankle joint. The thin black tail is held somewhat raised between the two white patches, the whole resembling a large pair of eyes (Figs. 1E, 2F). This posture is mentioned by Potts (1871) "in brief intervals between the dives, the wings are carried high, somewhat in swan fashion, as if the more readily to catch the drying influence of the air." It is my impression, backed up by films, that birds on territory tend to use this posture, whereas birds in wintering flocks do not. Thus it may be a sort of territorial announcement. In its extreme form, it is part of the Patter Ceremony described later.

The pale, hairlike plumes on the head do not show up well in the field and are considerably fewer and shorter than those of Hoary-headed Grebes in breeding plumage. Large white wing patches, formed by the inner two-thirds or more of the secondaries and inner primaries, show when the birds fly. These patches do not extend as far toward the trailing edge of the wing as the larger ones of the Australian species. The sexes are nearly alike in plumage. Males average larger than females, but there is overlap in both wing and tarsal measurements. There is little or no overlap in bill length, and it is usually possible to distinguish members of a pair when they are together by the longer bill of the male.

Compared with other grebes, New Zealand Dabchicks remain very alert; I rarely saw them in the "pork-pie" resting posture so characteristic of grebes. As well described by Potts (1871), they move their heads almost constantly when even mildly disturbed and appear "much more restless and fidgety than the large Crested Grebe." At times the head is bobbed forward and back like that of a coot, at others it is thrust first to one side and then to the other. These motions suggest the "Principle of Rapid Peering" described by Grinnell (1921), but in the case of the grebes, used for spotting enemies rather than prey.

*Flight.* — Potts (1871) stated that the Dabchick flies seldom and when it does "it just skims the surface of the water, with a very rapid motion of the wings." I saw one Dabchick frightened by boys in a boat get up and fly off at least one hundred yards with a flock of New Zealand Scaup *Aythya novaeseelandiae*. The grebe flew low, most of the time within a yard of the water, and in spite of its very rapid wing beat it was soon outdistanced by the Scaup. The grebe impressed me as a weak flier, especially as compared with the migratory Horned Grebe *Podiceps auritus*. Although Buller (1888) said that they fly with difficulty and only for a short distance, they must make fairly long overland flights in order to occupy new bodies of water like Kourarau Dam. On one occasion I saw a Dabchick get up and fly against a strong wind in what may have been an upwind flight like those of the Horned Grebe (Storer, 1969).

*Feeding.* — Like other grebes, these Dabchicks obtain most of their food by diving. The foraging dives which I observed most frequently were of the type described by Lawrence (1950) as the usual "feeding dive," but occasionally a bird leaped clear of the water in what Lawrence referred to as a "springing dive," a type often used in rough water. Twenty-eight timed dives by two grebes on Karaka Lake, August 24 and 25, ranged from 7 to 38 seconds (mean, 24.8; standard deviation, 8.8 seconds). Eighteen intervals

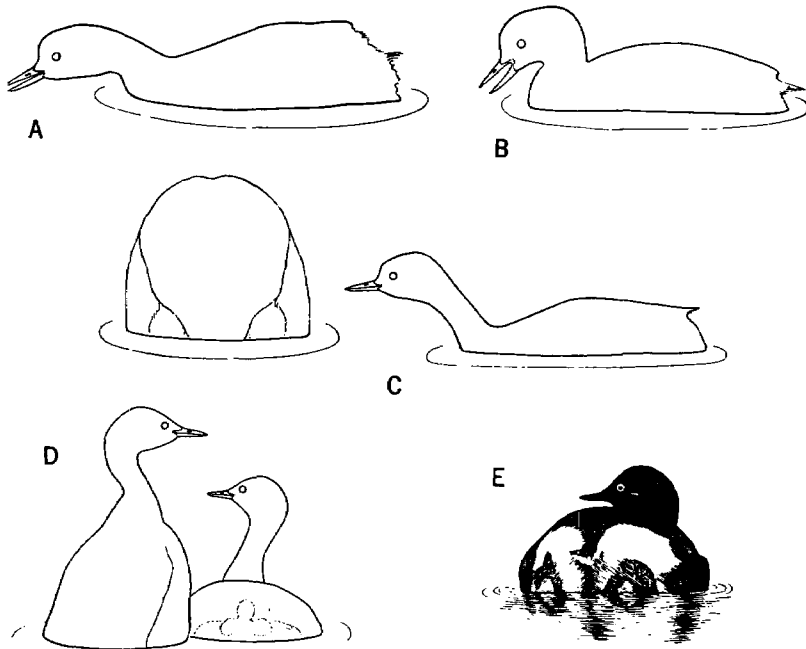


FIGURE 1 — Behaviour of the Dabchick. A: Picking midge off the surface of the water. B: About to cast a pellet. C: Rearing bird (left) showing white patches on either side of the rump. D: Postcopulatory Head Turning. E: Bird on territory, showing face-like pattern when viewed from behind.

between dives ranged from 10 to 37 seconds with a mean of 17. These figures contrast with Buller's (1888) "usual" timings of 20 and 7 seconds, respectively, and with 33 seconds, the mean of 6 dives timed by Edgar (1962) in the Rotorua District. The length of dives presumably is related both to the depth of the water and to the abundance of food, hence considerable variation is to be expected. I seldom saw food brought to the surface in the bill, but when it was, it was pinched repeatedly before it was swallowed. Several birds surfaced with objects about the size of their bills, and one brought up what appeared to be a fish approximately two inches long. From August 30 to September 2 there was a hatch of midges on Lake Rotorua, and Dabchicks spent much time picking them off the surface of the lake (Fig. 1A). One was also seen snapping at flying midges. Dabchicks were also seen picking midges off the surface of the water at Kourarau Dam on September 10. It is likely that much of the food of these grebes consists of small invertebrates which they swallow before surfacing, as in the case of the Horned Grebe on the breeding grounds (Storer, 1969). That invertebrates make up a large part of their diet is also suggested by the fact that I saw three instances of pellet casting. It is noteworthy that these

Dabchicks made no drinking movements before coughing up the pellets with the usual choking motions (Fig. 1B). Horned and Pied-billed grebes *Podilymbus podiceps* make repeated drinking motions at this time (Storer, 1961).

Although feather-eating undoubtedly occurs, I did not observe it, and even saw a preening bird let three of its feathers drift away. When grebes are feeding regularly on insects, a small plug of feathers in the pyloric outlet of the stomach is sufficient to keep chitin and other indigestible material from entering the intestine, and as I have shown in the case of the Horned Grebe (1969) this plug is not cast with pellets. Large masses of feathers are found in the stomachs of grebes which are feeding on fish and may function in retaining fish bones in the lumen of the stomach until they are dissolved.

A variety of food is reported in the literature: Potts (1871) implied that fish and insects are fed to the young. Buller (1888) wrote the food is "small mollusca, among the aquatic plants at the bottom" and reported three "stomachs crammed with a species of leech, about an inch in length and of a pale yellow colour." Oliver (1955) reported the food "consists largely of insects and fresh-water mollusca." According to Buddle (1939) food brought to the young included a "small fish, probably inanga," "a large toi-toi or bully, too large for her to swallow," which she broke up, and "several large koura (fresh water crayfish)," which she also broke up. He also reported a young taking a koura. If, like the Horned Grebe, the Dabchicks swallow small food items under water, the above reports are not representative of the total diet, but strongly biased in favour of large items.

*Comfort Movements.* — The comfort movements of all grebes are rather similar. I observed bathing, preening, oiling, swimming-shakes, head-shakes, wing-flapping, wing-and-leg stretches, both-wing stretches, and head-scratching (nomenclature of McKinney, 1965) performed by Dabchicks. The swimming-shakes appeared to be more rapid than those of other grebes, possibly because of the small size of the birds. In the both-wings stretch, the wings were fully extended as in most other grebes. Bathing dives of two kinds were observed: one in which the bird dived head-first and one in which it dived breast-first. Otherwise, I noted nothing remarkable in this category of behaviour.

Shipping a foot under a wing and flank feathers and resting in the "pork-pie" posture, usual grebe mannerisms, were also observed. Of interest was a reaction to a sudden gust of wind which I have not noticed in other grebes. On August 22, there was a strong, gusty southwest wind, and a Dabchick which was facing into the wind lowered its flank feathers, as before diving, just as a gust, announced by its rattle, approached.

*Agonistic Behaviour.* — New Zealand Dabchicks gather in flocks in winter; up to 40 have been reported in a winter flock on the volcanic lakes (Anon., 1959). During the breeding season, however, they are strongly territorial. On the Muriwai sand dune lakes, most birds were defending territories by the time of my arrival on August 20, but there was considerable variation in the time of breeding of different pairs. One pair with two half-grown young was seen on

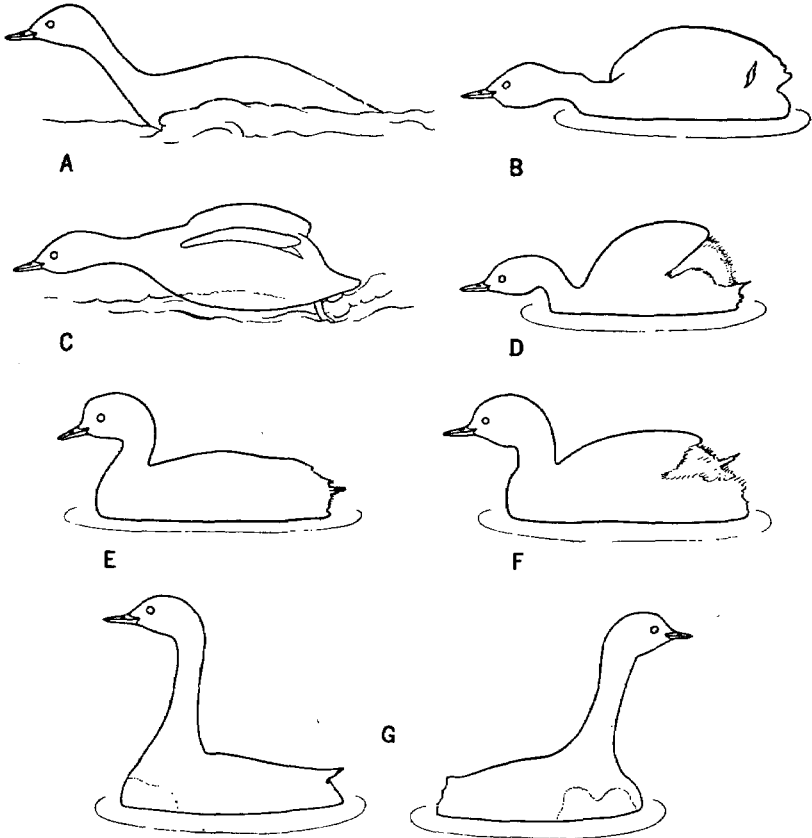


FIGURE 2 — Behaviour of the Dabchick. A: Skidding retreat. B: Threat. C and D: Patter Ceremony. E: Normal swimming posture. F: Usual posture when on territory (see also Figure 1E). G: Head Turning.

Lake Piripoua on August 22. (I would estimate that the eggs for this extraordinarily early brood had been laid in mid-July.) The presence of several single birds guarding territories in late August suggested that these birds had incubating mates, and this idea was supported when occasionally a second bird (in one case with a small young on its back) appeared when trespassers were being driven off by the guard bird. (I did not go into the reed beds looking for nests.) As late as September 14, I saw a closely-knit group of four adults on Lake Kareta, indicating that at least a few were not yet on territory.

The aggressive posture of the Dabchick is like that of many other grebes, the head forward, neck kinked, and body feathers somewhat expanded (Fig. 2B). Short pattering dashes in this posture

are made at other birds. This is probably the evolutionary origin of the Patter Ceremony. Often an attacking bird will fly low over the water at an intruder, at times covering the intervening distance in two flights, each ending in a dive. At the last dive, the attacked bird usually dives also. I saw only one case of actual combat, and in it had a fleeting glimpse of one bird on its back, kicking out coot-like with its feet. Later both dived, one holding on to the other with its bill. Upon returning to its mate, at least one of the combatants had a long session of bathing, preening, and oiling as though its feathers had been badly disarranged.

An upright posture is also used in agonistic situations. One form of this is an appeasement posture similar to that of the Horned Grebe (Storer, 1969) and other species, in which the head and neck feathers are slicked down and the head held somewhat back so that the head, neck, and body form a Z. In the second form, the feathers, especially those of the body, are more expanded. I once saw two birds in an aggressive encounter make short dashes and then assume this posture from which first one, then the other, dived head first. Each then emerged in approximately the same place as it went down. (They were about ten feet apart.) In context, this appeared like the "Token Dive" of the Great Crested Grebe *Podiceps cristatus* (Simmons, 1955) and the Red-necked Grebe *P. grisegena* (Wobus, 1964), but it differed markedly in the type of dive used and appeared to have a less strong aggressive component. It may be related in an evolutionary sense to the Diving Ceremony discussed later and thus may have a sexual component.

The principal appeasement posture is that mentioned above. As in most grebes, underwater attacks usually result in the attacked bird's diving. This is probably to prevent an attack from below. Fleeing by skittering across the water with the wings folded and the feathers of the head and neck slicked down was seen once and resembled the skidding retreat described and illustrated by Simmons (1955) for the Great Crested Grebe, except that the head was held somewhat more forward (Fig. 2A). This kind of retreat results from a sudden disturbance and may be common to all grebes.

*Alarm and Predators.* — Mild alarm caused by two Grey Ducks *Anas superciliosa* flying over or by my presence resulted in bobbing of the head back and forth and a special posture — the stern very high and fluffed out, the head high, the neck pencil-thin, and the back of the neck awash. Several times I saw Harriers *Circus approximans* swoop at a Dabchick. Each time this happened, the Dabchick made a crash dive, going under breast-first and sending a jet of water perhaps three feet in the air. The alarm posture appears to be in part a preparation for the crash dive and in part a signal. The lowered breast and flattened neck feathers suggest the former and these, plus the expanded, pale flank feathers, all probably have a signal function. In all, I recorded eight crash dives, seven when Harriers flew over the Dabchicks; and one probably resulting from my frightening a bird. The jet of water must be sent up by the feet in the powerful stroke with which they submerge and may have some selective advantage. Although I never saw a Harrier come close enough to be hit by the jet, this may happen occasionally and could well interrupt the hawk's pursuit of the grebe. These

limited observations suggest that the Harrier is the principal avian predator of the Dabchick. Southern Black-backed Gulls *Larus dominicanus*, which visit the Muriwai sand dune lakes to bathe, may possibly take young Dabchicks.

*Courtship: Head Turning.* — This display may correspond in part with Head Shaking in the Horned and Great Crested grebes, but it is entirely different in appearance, and probably, in derivation. In it the birds appear to fling their heads first to one side and then to the other with such force that the body is turned partway in the same direction. This movement is made in a special posture, the head stretched up, the neck thin, and the body feathers moderately compressed (Fig. 2G). The motion is rapid and jerky, stopping briefly at the end of each turn and at times mid-way in the turn as well. The display is performed in the presence of another bird, the two birds often performing it together repeatedly as a ceremony. (I use "ceremony" in the sense of Simmons, 1955, "fixed, conventional sets of displays.") In the course of Head Turning Ceremonies, the birds remain close together but move about apparently at random, facing first one way and then another.

Head Turning may be set off by mild disturbance and may precede a Diving Display. In mating, it is performed before and after mounting by the active bird and in less intense form by the passive bird before mating. The head movements resemble those used in mild alarm but appear exaggerated and more forceful. The posture resembles that of alarm in that the head is high, the neck thin, and the body feathers depressed. However, the head is held forward, not back as in the typical appeasement posture. Its origin from looking about in mild alarm seems probable, and it is likely the two may grade into one another.

*Courtship: Diving Ceremony.* — This is an uncommon, but regular courtship ceremony of the Dabchick. The components are shown in Figure 3. In it two birds face each other with their heads up, necks somewhat thin, flank feathers spread laterally so that the white patches show beside the wings, and tails horizontal. One bird lowers its head and points the bill down then raises the head and thrusts the bill toward the second bird. These head movements, which together take one-half second, are repeated, usually first by one bird and then by the other. Then as one bird points the bill downward, the other dives under it. The first bird then turns and faces the second as it emerges from the dive, which takes approximately one second. The whole procedure may be repeated several times, the birds alternating roles or one diving twice or more times in succession.

Diving ceremonies were preceded, and hence possibly triggered, by several types of behaviour. One was preceded by the two birds turning face-to-face, then tail-to-tail, and finally face-to-face. Once two birds dived almost simultaneously, came up close together, swam about "nervously" in the pre-dive posture, possibly with some pivoting, but not with anything that looked like stereotyped behaviour, then the Diving Ceremony began. Once my disturbing the birds led to a Patter Ceremony followed by a Diving Ceremony, and a second Diving Ceremony may have been set off directly by human disturbance.

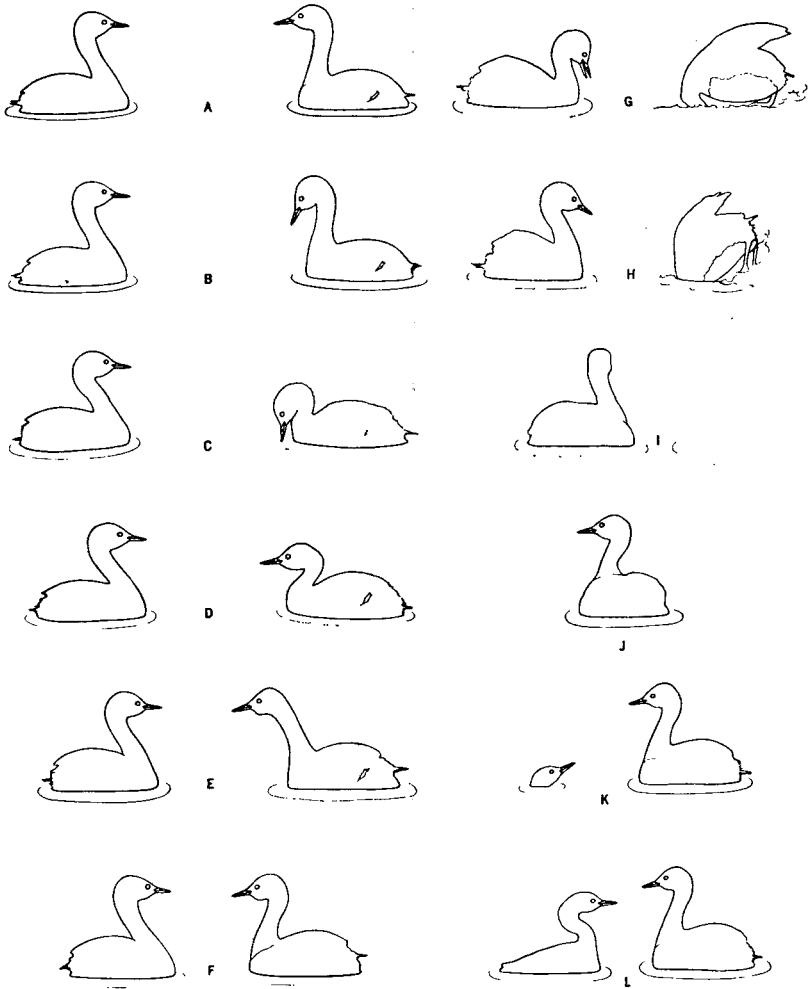


FIGURE 3 — Diving Ceremony of the Dabchick. B and C: Bill dipping. E: Thrusting bill at mate. G and H: Diving. I and J: Mate turning. K and L: Emerging from dive.

The Diving Ceremony is at least superficially most like the Bumping Ceremony of Rolland's Grebe *Rollandia rolland* (Storer, 1967), a ceremony which needs to be filmed and analysed in greater detail. My guess is that the Diving Ceremony is the one by which pair formation takes place and one of those which serve to strengthen the pair bond. Thus it is probably the counterpart of the Discovery Ceremony of the Great Crested Grebe and its close relatives.



The Diving Ceremony contains a complex of agonistic components. The bill-thrusting preliminary is an aggressive act but differs from strongly aggressive thrusts in being delivered from high above the water, an aspect which is emphasised by the lowering and raising of the head which precedes it. The second bird meets this thrust in an almost full appeasement posture (Fig. 3E). Diving at another bird is in grebes usually an aggressive act, but in this ceremony the dive is made from a largely appeasement posture. It is met by a bird facing it (aggressive) but in an appeasement posture. This ambivalence is continued as the bird on the surface turns to face the diving bird as it emerges. In both the bill thrust and the dive aggression appears to predominate, hence only when this aggression can be balanced by sexual motivation does a full ceremony occur.

*Courtship: Patter Ceremony.* — This was the most frequent courtship ceremony I observed, and it is evidently used through much of the breeding season. It was performed infrequently and in low intensity by birds still in winter groups on Lake Rotorua in early September, very often by pairs on territory on the Muriwai sand dune lakes in late August, and I saw it performed at least once by a pair, one of which was carrying a small chick. I saw it and other courtship and aggressive behaviour more often on clear, calm days than on dark, windy ones.

The Patter Ceremony consists of several elements put together in a variety of ways. As far as I could tell, it is always performed by pairs. The two birds swim together in a special posture, which becomes intensified as they move closer together. In this posture (Fig. 2D) the head is held low and the neck kinked, the folded wings high and close together, and the stern fluffed out. The patch of white feathers growing from the lower back and sides, which makes the white part of the eye-like pattern from the rear, is expanded. Upon coming together, the two birds mill about, remaining close together. At times they are side-by-side, at others face-to-face, or tail-to-tail, but much of the time their orientation appears random. Meanwhile they move their heads, extending or retracting them or moving them from side to side. From analysing motion picture film of these ceremonies, I could find no indication that the sequence of these head and body movements is stereotyped. During this milling about, a bird may depress the throat and utter a low four-note call of very low carrying power. The call is difficult to describe but to my ears sounded like a guttural chatter. After milling about, one bird suddenly patters away from the other (Fig. 2C). In doing so, it makes a loud noise as its feet strike the water and kick up a considerable splash. Immediately before pattering the wings are lowered, concealing the white patches. The patter appears very ritualised, with a propulsive phase lasting almost exactly one-third of a second (8 frames at 24 frames per second) with very little variation. This is followed by a glide as the bird decelerates. At the height of the patter, the bird's body seems to clear the water and occasionally the closed wings are raised somewhat. Toward the end of the glide or immediately after, the bird turns and swims toward its mate. At the start of the patter, the second bird may be facing the pattering bird (18 instances on film), more or less perpendicular to it (14 instances), or facing away (7 instances). By the end of the patter, the figures were 33, 4 and 2, respectively, in all but one

instance the bird moving to face the pattering bird before the patter ended. In all cases the bird had moved to face the pattering bird within a very brief interval after the patter ended. The two birds swam together again, their postures becoming more intense, there was more milling about, then another patter, and so on. The sequence of pattering is not fixed. For example, of 24 instances of pattering in which the bird which had pattered previously is known, the same bird pattered 5 times and the other bird 19. One instance of the same bird pattering three times in succession was recorded. In two films of six successive patters each, there was regular alternation of roles in one and only one repeat in the other. On one occasion I filmed two birds pattering simultaneously, but this must be rare.

Patter Ceremonies appear to be triggered by several things. In my observations, most frequently (12 to 14 times) this was by aggressive behaviour after either the aggressor or the chased bird or both returned to their mates. On four occasions presumed mates coming together after being separated pattered, and after three of these ceremonies, the birds resumed foraging. Twice disturbance resulting from my presence set off Patter Ceremonies; after one of these the birds resumed alarm attitudes and after the other they went into a Diving Ceremony. The circumstances under which Patter Ceremonies are performed resemble those under which Horned Grebes perform at least three ceremonies. In the Horned Grebe meeting after separation and disturbance may set off either Discovery Ceremonies or bouts of Head-shaking, depending on the intensity of the stimulus and the strength of the pair bond, whereas after aggressive encounters, Triumph Ceremonies are most frequent. The lack of uniformity in what precedes and what follows Patter Ceremonies indicates that they are not part of a more complex ceremony.

It is likely that most or all of the few mentions of courtship of the Dabchick by earlier authors refer to the Patter Ceremony, but the descriptions are vague and probably inaccurate. Buller (1905) referred to "the amorous gambols on the water . . . , with their backs arched and feathers puffed out, splashing about and chasing each other in the wildest state of excitement," probably a combination of Patter Ceremonies and agonistic behaviour. Buddle (1939) wrote "then ensued a short period of courting — the male fluffed out his feathers, stretched his neck straight along the water and made short rushes at the female, which then did the same thing." This was probably a Patter Ceremony, although in all Patter Ceremonies I observed and filmed, the rushes were invariably made *away* from the mate.

*Mating Behaviour.* — As in most grebes, there are two soliciting displays: Rearing and Inviting. Both are illustrated by Buddle (1939: pl. 11, upper right and lower left figures, respectively), but have not been described in detail. I observed mating on the beginnings of a platform of aquatic vegetation at Otaramarae and on a small rock at Rotorua; presumably it also occurs on the nest as in other grebes. The Rearing posture is similar to that of other grebes studied, but I observed no Wing Quivering. (Further observations are needed to prove this point.) Two white spots, one on either side of the rump, showed conspicuously during Rearing and Inviting (Fig. 1C).

In Inviting, the head is turned from side to side in a short arc, and this turning is continued during copulation. However, the head of the passive bird is not raised to stroke the breast of the active bird, as in the true dabchicks (*Tachybaptus*) and the pied-bills (*Podilymbus*). Prior to mounting, the active bird flings its head from side to side, often using a two-stage turn, that is, stopping the turn briefly with the head pointed forward, the movements thus being left to centre to right to centre to left, etc. During mounting the active bird's posture, as shown in Buddle's photograph (1939: pl. 11, lower left figure), is more upright than the Rearing Posture, and the head is not turned. After copulation, the active bird moves forward over the passive bird's head, which has previously been lowered, and treads water, the body sinking down but the head remaining in approximately the same position as the neck appears to elongate. The water treading is brief and appears less exaggerated than in other species I have observed. Post-copulatory displays consist of more head turning. Both one- and two-stage turns may be used by either bird, but the active bird performs vigorous head flings whereas the passive bird merely turns the head (Fig. 1D).

On at least two occasions at Otaramarae, I thought it was the larger member of the pair which assumed the passive role in mating. Reverse mounting is common, if not regular, in grebes at the beginning of the breeding season. Therefore, one cannot sex a grebe by its role in mating, and I have used the terms "active" and "passive" roles in description of platform behaviour.

*Vocalisations.* — The Dabchicks impressed me as rather quiet birds; neither of the two vocalisations which I heard was as loud as the noise made by the birds' feet in Patter Ceremonies or during the foot-pattering flights at intruders. This contrasts markedly with Buller's statements (1905) that when pairing starts in September, "the birds become then very noisy, chattering to each other across the water all day long" and "in the breeding season, scolding each other and keeping up a loud confabulation." I suspect that Buller, writing from memory, either confused the noises made by pattering with vocalisations or attributed vocalisations like those of the Australian or Eurasian Dabchicks to the very different New Zealand bird.

The two calls which I heard were the four-note call given as part of the Patter Ceremony (see p. 183) and a mild alarm call which I heard once from a bird which I had disturbed. The bird moved about with its head held high and gave a series of three soft, rolling, somewhat harsh notes which I recorded as *grraaaa*. One film shows a bird with its beak open in a Diving Ceremony just as its mate starts a dive (Fig. 3G), so it is possible that a soft note accompanies this. If so, I did not hear it. Nor did I hear any note during copulation, a time when loud calls are given by many species of grebes (Storer, 1969). Buller (1888) reported "a peculiar sibilant note, from which it derives its native name of *Weweia*," which I did not hear or failed to recognise. Edgar (1962) reported a "series of low pitched 'tuk tuk tuk' notes" used to communicate between members of a pair. This probably corresponds with the conversational Platform Call of the Horned Grebe (Storer, 1969) and other species.

Potts (1871) reported that the young utter "a soft trilling note not unlike, but less marked than, the call of the parent birds." From this very limited and somewhat confusing information, it is clear that recordings of vocalisations documented with descriptions of the birds' behaviour at the time are very much needed.

*Conclusions.* — The Patter Ceremony is unlike that of any other grebe so far studied. In the posture and the "eyed" pattern of the stern, it resembles a posture of coots (*Fulica*); in the pattering rushes, it resembles a display of the Ruddy Duck *Oxyura jamaicensis*. These resemblances, however, must be results of convergent evolution. The Diving Ceremony is most like the Bumping Ceremony of Rolland's Grebe but differs in that there is no bodily contact between the birds. The Head Turning Display resembles a display which has developed into the more elaborate Turning Ceremony of the Great Grebe *Podiceps major* (Storer, 1963). The apparent lack of advertising and a Discovery Ceremony set *rufpectus* apart from the Great Crested Grebe and its close relatives. The fact that the passive bird in copulation does not stroke the breast of the active bird with its head and the few and soft vocalisations set the New Zealand bird apart from the true dabchicks and the Pied-billed Grebe. The absence of drinking before pellet casting is so far not reported in any other grebe. It would thus appear from behavioural evidence that the New Zealand Dabchick and the Hoary-headed Grebe have no close relatives. The ancestral stock must have reached the Australasian region early and differentiated there before the true dabchicks and the Great Crested Grebe arrived.

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## ASPECTS OF SOCIAL BEHAVIOUR IN THE BLUE DUCK

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### SUMMARY

The social behaviour of the aberrant Blue Duck is reviewed. The bird is territorial and aggressive, except towards its own mate and offspring. The male's "territorial call" — a loud whistle delivered in a special posture — appears to be the main signal keeping pairs apart, but fights do occur, and a pronounced carpal knob on the wing is used in attack. As the Blue Duck appears to pair for life, courtship is not easily observed. Repeated acts of copulation, early in the breeding season, probably serve to synchronise the reproductive states of the pair. Copulatory display and the pre-flight signal have elements similar to those of perching and dabbling ducks.

Both adults care for the young, although this may not involve more than keeping them together, since anti-predator behaviour is not conspicuous. Family life seems to continue until adult plumage is attained at five months, at which time young birds probably leave their parents' territory.

The Blue Duck *Hymenolaimus malacorhynchos* is one of the most interesting and yet least studied of the waterfowl group. Phillips (1926) reported that since the earliest writers, almost no good field notes had been made and nothing of its behaviour recorded. Although healthy birds were maintained at the London Zoo for some years (Mitchell 1911), no observations on them were published and, unfortunately, of the captive birds at the Wildfowl Trust only males survived for any time (one for as long as ten years). Johnsgard (1965) studied unpaired birds there, but never saw a female.

Delacour (1956) thought the Blue Duck one of the most puzzling of waterfowl as to its affinities, and Phillips (1926) was of the opinion that it had no near allies anywhere in the world. It is in the species' social display, such as that shown at pair formation and, especially, at copulation, that clues to its evolutionary relationships are likely to be found (Delacour and Mayr 1945; Johnsgard 1965). With this in mind, M. Williams (1967) watched Blue Duck among a flock of New Zealand waterfowl kept at Mount Bruce Native Bird Reserve, Wairarapa, North Island. These were, however, relatively inactive and showed little other than aggressive interest in the other birds.

The following preliminary account of social behaviour is based on captive birds in England and New Zealand, on a brief study of wild birds by J.K., and on the analysis of cine films taken by T.H.S. in the wild. Most of the observations were made on the rivers Waipoa, Rere, Ruakituri and Hopuruahine.

### PRE-FLIGHT MOVEMENTS

Like most waterfowl, the Blue Duck has a social signal which synchronises the pair or the family for take-off. This headflick is performed without calls and may be repeated a number of times before flight occurs. Figure 1 traces the slightly rotary movement from cine film frames and times the various phases. Shelducks, Hartlaub's Duck *Pteronetta* and some *Aythya* use similar repeated upward movements of the bill which McKinney (1953) called "chin-lifting," although in *Aythya* at least, the neck and head are fully stretched up. Several perching ducks (such as *Aix* and *Cairina*) perform slower craning movements of the head and bill upwards and forwards (Johnsgard

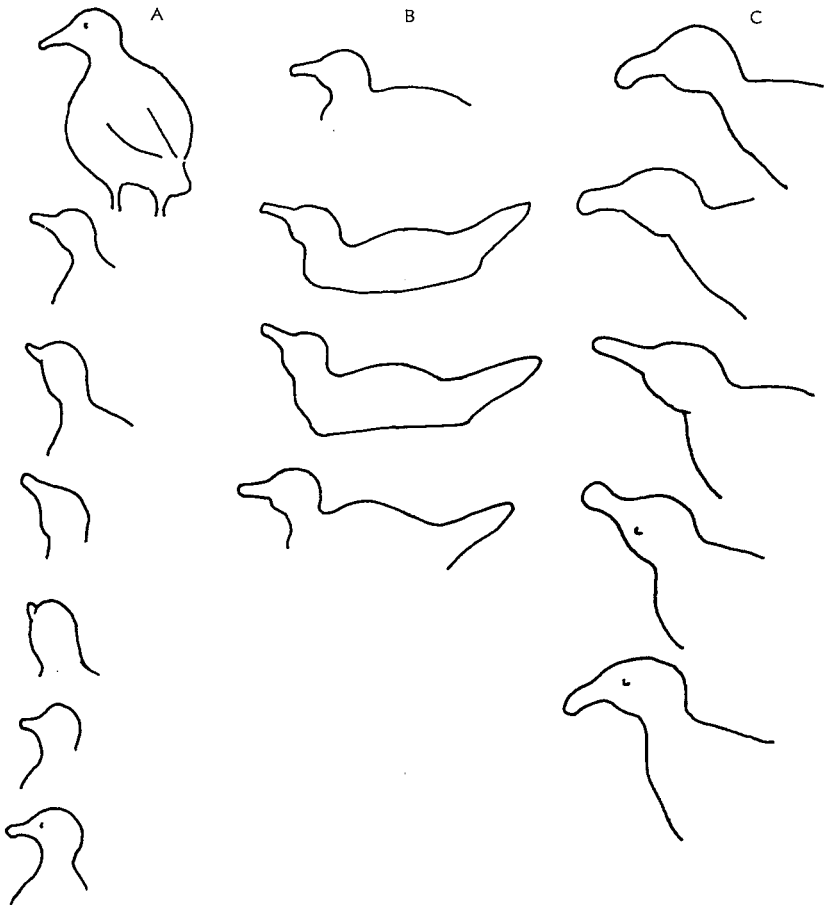


FIGURE 1 — Preflight signals from three different Blue Duck traced from consecutive frames of super-8 cine film (18 frames per second). Note the slightly rotary movement in (a) and (c). The downward component is performed more rapidly than the initial “chin-lift.”

1962), while in other perching ducks and typical dabbling ducks (*Anas*) a faster “neck-jerking” is employed (McKinney 1953). Lateral head-shakes which are typical of most *Anas* species in a pre-flight situation, seem to be absent in the Blue Duck.

#### INTRASPECIFIC AGGRESSION

Mr. J. R. Forster, the naturalist who accompanied Captain Cook in 1773, noted that Blue Duck were always found in pairs. Indeed, *Hymenolaimus* is unusual among ducks in being highly territorial, possibly in relation to its insectivorous food supply (Kear and Burton

1971). Each male typically demands and defends a stretch of river into which he allows only his family, presumably as long as any ducklings are less than five months old and have not, therefore, attained adult plumage. The drake's voice appears to be the main signal keeping birds apart, but fights sometimes occur if individuals transgress each other's boundaries (Douglas, in Pascoe 1957; Steel 1970). Douglas recalled how he once walked four miles of a creek and, for the fun of it, drove every Blue Duck ahead of him. "On reaching the flats there was 13 pair of ducks with their numerous offspring engaged in a sort of Donnybrook. They fight with their wings trying to hit with a spur on the tip, but with all their fighting they don't appear to hurt each other much. On going up the same creek next day, I found . . . every pair was back to their own ground and with all their young with them."

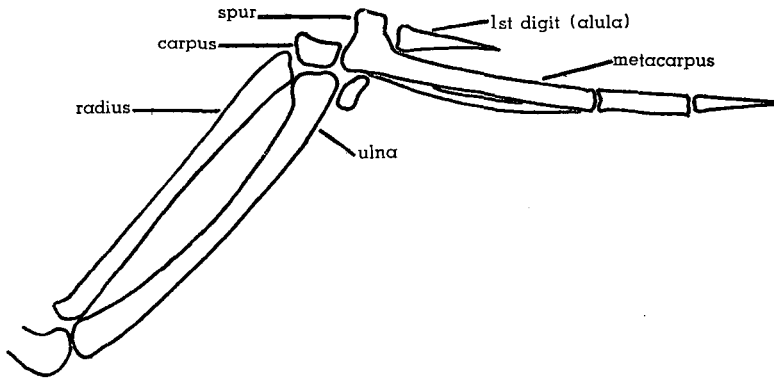


FIGURE 2 — Wing bones of adult male Blue Duck showing metacarpal spur. Traced from an X-ray.

The carpal joints of all birds examined, of six months and over, possess blunt bony knobs and those of adult males are frequently bare of feathers as well. These spurs are extensions of the first metacarpus (Figure 2) and thus comparable with, although larger than, those of many other waterfowl (Rand 1954). Wing knobs of only slightly smaller size are found in the African Black Duck *Anas sparsa* (Figure 3), which has a rather similar ecology and is also territorial (W. R. Siegfried pers. com.). Better developed, sharper spurs occur in the Torrent Duck *Merganetta* (Figure 3) which again is a territorial inhabitant of mountain streams. Johnsgard (1966) and Weller (1968) have stated that in *Merganetta* the use to which the spurs were put was still unknown. The bird is well protected from most terrestrial predators, "and no intraspecific fighting among males has been noted to my knowledge. There is no evidence that the spurs are used as an aid in climbing rocks, as has been suggested" (Johnsgard 1966). Travers (1872), however, interpreted their function in the Blue Duck thus: "they use their wings like hands, to cling to the stones in order to assist them in overcoming the rush of the water." Buller (1873) wrote "it climbs the slippery face of the rocks with facility, assisting itself in the ascent by its wings, which are armed at the

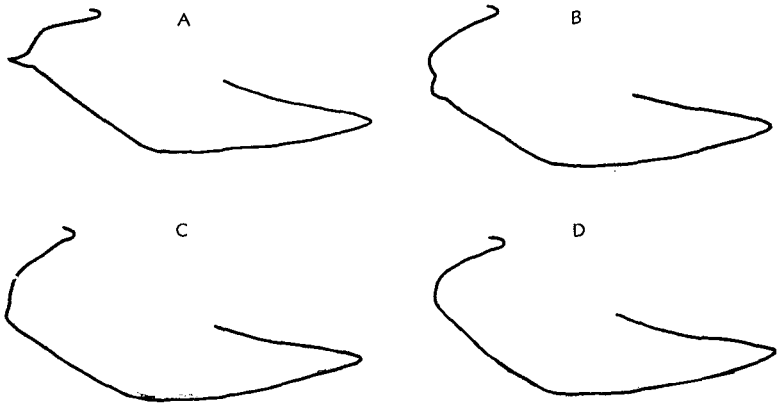


FIGURE 3 — The carpal joints of four species of duck: (a) *Merganetta*, (b) *Hymenolaimus*, (c) *Anas sparsa*, (d) *Anas penelope*. The last species is non-territorial.

flexure with a hard protuberance or knob," and Moncrieff (1957) went further in saying that the bird burrowed and climbed by aid of its wings. The present authors confirm that the wings are sometimes used in fighting and, although they have not seen the behaviour noted by Travers and others, suggest that further observation is required.

Described territories vary greatly in size. Douglas (Pascoe 1957) wrote "every pair keeps 2 or 300 yds. of the river to themselves," while in Guthrie-Smith's (1927) opinion three or four miles were required to support a pair on some rivers. On the Waipoa, an apparently well-stocked stream, five pairs are found in approximately 2½ miles. In other places, territories are obviously larger, but banding would be necessary in order to establish the maximum length of river that can be defended in its entirety. Boundaries often seem to be marked (to the human eye) by some prominent feature of the landscape such as a log or large boulder, and here the birds interact mainly by calling. The "territorial call" (M. Williams 1967) is a piercing drawn-out whistle, rendered by Johnsgard (1965) as *whee-ooo* and in the Maori name for the bird as *Whio*. It is delivered, sometimes from the water and sometimes from a rock, with the head and neck stretched out and the bill partly open (Figure 4). M. Williams (1967) noted, in addition, that the tail is slightly raised, the neck feathers ruffled and the call itself usually uttered twice. The whistling voice, although not the posture, develops in males at about 14 weeks of age (Pengelly and Kear 1970). It is loud enough to carry over the roar of waterfalls and differs markedly from the rasping quack of the female. Apart from the voice and a slight size difference, males weighing about 890 gm. and females 750 gm., the sexes appear identical.

The territorial call is heard in the early morning, and especially in the evening when birds emerge to feed. At this time they often fly the length of their territory and presumably interact with their neighbours. Two pairs on the Waipoa usually arrived at their common



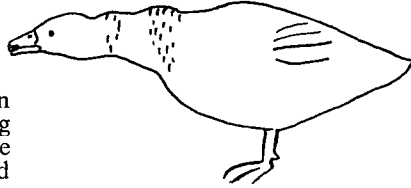


FIGURE 4 — The posture of an adult male Blue Duck giving the territorial call. Note the stretched and ruffled neck and the open bill.

boundary at dusk, whistled and quacked, and then spent the night within "shouting distance," sometimes no more than eight feet apart. Their visits seemed friendly rather than otherwise; fights were not seen here, even when one pair was deliberately driven into the territory of the other. All four birds merely became very excited in their calling. Perhaps as in swans (Kear 1972), it is only strangers that provoke full threat and attack, and neighbouring territory owners become well tolerated since they are not "expected" to move from their domain.

Except in this context, and when in family groups, Blue Ducks are not gregarious. They will, however, occasionally congregate at the mouths of rivers after flooding (Travers 1872), or in winter (Potts 1871; Soper 1965), when food shortage presumably drives them to leave their own ground.

#### AGGRESSION TOWARDS OTHER SPECIES

All the Blue Duck territories visited also contained Grey Duck *Anas superciliosa*, and signs, such as hatched nests and ducklings, of occasional breeding. Observations in the rivers Aniwaniwa and Rere indicated that Blue Duck were very aggressive towards, and had ascendancy over, Grey Duck. They may even have been responsible for the disappearance of a number of Grey ducklings. On the Aniwaniwa, they also put Mallard *Anas platyrhynchos* to flight. Male and female Blue Duck are both aggressive towards these other birds, rushing and finally flying at them over the water, with neck extended and head low, bill open and scapular feathers raised.

Neither species is likely to compete with the Blue Duck for food, except perhaps at the duckling stage; the main potential dietary competitors seem likely to be native eels (Burnet 1952) and other fish, the introduced trout (Kear and Burton 1971), and possibly insectivorous birds, many introduced, which feed on imagos. A shortage of nest sites is unlikely to be a problem since these are relatively numerous, and Grey Duck at least frequently nest in tree sites which are not selected by the Blue Duck. The antagonism is probably incidental to a territorial system of great selective advantage.

Paradise Shelduck *Tadorna variegata* are also occasionally seen in Blue Duck country. This species is, however, generally avoided. A single threat posture from a male Paradise Shelduck can produce flight, although at other times apparently undemonstrative birds are merely whistled at (Child 1961). Subordination to Shelduck and dominance over other New Zealand waterfowl accords with observations

made by M. Williams (1967) in captivity. Domestic Muscovy Duck *Cairina moschata* have also once been seen to threaten wild Blue Duck and produced a typically "frightened" response. The male gave a short, sharp whistle, both he and his mate made for the bank and were chased about 12 feet up it.

It is a commonplace that human beings invoke a territorial response from Blue Duck rather than frozen silence or flight. This is especially true when feeding birds are encountered early or late in the day. Indeed, in summer, they are not often visible at other times and when disturbed from their hiding places, are usually quite quiet and fly away to hide once more beneath the bank or under a log. However, if already in the open, the male stands his ground and whistles repeatedly at the intruder. In the past, this reaction was interpreted as mere stupidity (Phillips 1926) as, of course, it was until man came to appreciate the aesthetic value of a "tame" avifauna. Thus it is frequently possible to approach Blue Duck closely before they slip into the water and drift downstream. Douglas (Pascoe 1957) wrote "I have . . . walked within a foot of them . . . and on looking round there they were, stretching their necks, whistling and hissing."

Sometimes the birds' reactions to man do look ambivalent, as though they were undecided as to the best course of action: to stay or to flee. In this situation, the bird gives jerky, forward-and-backward movements of the head and neck (Scott 1958), which probably enable it to see any intruder, and to judge distance and direction, better. Cocking of the tail, by both sexes and all ages, is also often apparent in the presence of humans, and is common when the adults have ducklings, or during courtship and aggressive display. The significance of this tail cocking is not known; perhaps it usually serves to make the duck more conspicuous to its offspring, parent, mate, or the object of its aggression.

Blackburn (1963; 1967) reported that he once disturbed a bird from hiding and was surprised to see that the usually white bill (often a pale pink in the breeding season) was a brilliant "shocking" pink. He suggested that, as in some other avian species, confusion or fright caused a rush of blood to the bill. He pointed out that such an observation would be unusual, as this species is normally so completely unafraid of man. M. Williams (1967) has recorded the same reaction from a captive Blue Duck which was being handled.

#### PAIR FORMATION

Very little information is available on pair formation. The situation in which it takes place seems obviously different from that in gregarious ducks where males display together around the females. Perhaps further observation will reveal that courting parties of unattached juveniles do occur. Unpaired Blue Duck at the Wildfowl Trust called at dusk, using a sound indistinguishable from the territorial call. It is possible that some element of this cry attracts unmated females to a drake which already has an established territory. On the other hand, in New Zealand, captive drakes have more than once attracted wild males into their pens. And it is possible for humans

to bring Blue Duck males "out of the sky" by imitating the whistle (L. Ross pers. com.). Interestingly, a decidedly unbalanced sex ratio in favour of males seems normal in adult Blue Duck (B. A. Vercoe in litt. 1963). A higher female death rate at hatching and in early life may be typical of all ducks (Kear 1965). Females are, in addition, exposed to risk during egg-laying and incubation. So an uneven sex ratio in Blue Ducks may be unexceptional, although of no advantage to an apparently long-lived, monogamous and unpromiscuous species.

The age of pair formation is not known but it probably occurs after the bird is five months old. At the Wildfowl Trust, a six-month old female (that is, one in adult plumage) was placed in the pen of a male at least eight years of age. He pursued her closely, often with his tail cocked, giving a quiet three or four syllabled whistle. This the young female seemed to regard as a threat; she rushed to hide in the bushes and repeatedly escaped from the pen. Two weeks later, they were again put together, this time in an unfamiliar pen. Here they both hid, spending most of the first 24 hours in the same box, and emerged apparently firmly mated. Thereafter they were never far apart, although except for frequent soft calling, were undemonstrative. Unfortunately, the female died before the next breeding season and no observations could be made on their subsequent courtship.

Johnsgard (1965) reported on a male Blue Duck at the Wildfowl Trust which became associated with a female Common Shelduck *Tadorna tadorna* that was already paired. The Blue Duck followed this bird constantly, although he was often chased by the drake Shelduck. The Blue Duck would face her with his chest low in the water and tail and hindquarters lifted as he uttered a whistled *zweee* repeatedly, each note rising in pitch towards the end. As he called he lifted his chin and bill strongly and repeatedly in a manner resembling the chin-lifting display of wigeon. He showed no tendency to Turn-the-back-of-the-head toward the female, as wigeon and other dabbling duck do, but a general body shake, similar to the Introductory shake, was observed several times during display. Johnsgard (1965) interpreted this as courtship; however Williams (1967) reported similar chin-lifting and calling in both male and female Blue Duck, the female producing staccato, low-pitched rasping notes rather than the whistle. These head-flicking calls were recorded in two situations: when a pair was chasing a third Blue Duck (probably a female) and in response to intraspecific fighting and Inciting among the Paradise Shelduck. In the latter instance, one or both of the Blue Ducks would race to the vicinity and dart about continuously uttering the head-flick call. If they were responding to an Inciting display, they were frequently charged by the Shelducks. Williams was uncertain as to the correct interpretation of this display, but did not accept that it was courtship.

#### PAIR MAINTENANCE

It is likely that Blue Ducks pair for life (Buddle 1951), although banding would be necessary in order to prove this. Pairs are certainly found throughout the year and except during egg laying and incubation, male and female seem never far apart. Cohesion is probably maintained partly by voice since, in captivity at least, the pair call softly

to each other for much of the time. This repeated vocalisation seems typical in the wild also, although it is often difficult to approach near enough to hear it without disturbing the birds.

In the breeding season, which is extended so that egg-laying includes any part of the period from August to January (Kear, in prep.), the bills of both sexes may turn pinkish in colour. Repeated acts of copulation apparently function to synchronise the reproductive condition of male and female, since it occurs much more frequently and over a longer period than would be necessary to fertilize the clutch.

Before copulation, the male follows the female more closely than usual, often carrying his tail slightly higher than she does. The pair finally face each other and bob their heads a number of times (between two and six), as is typical of all surface-feeding ducks.

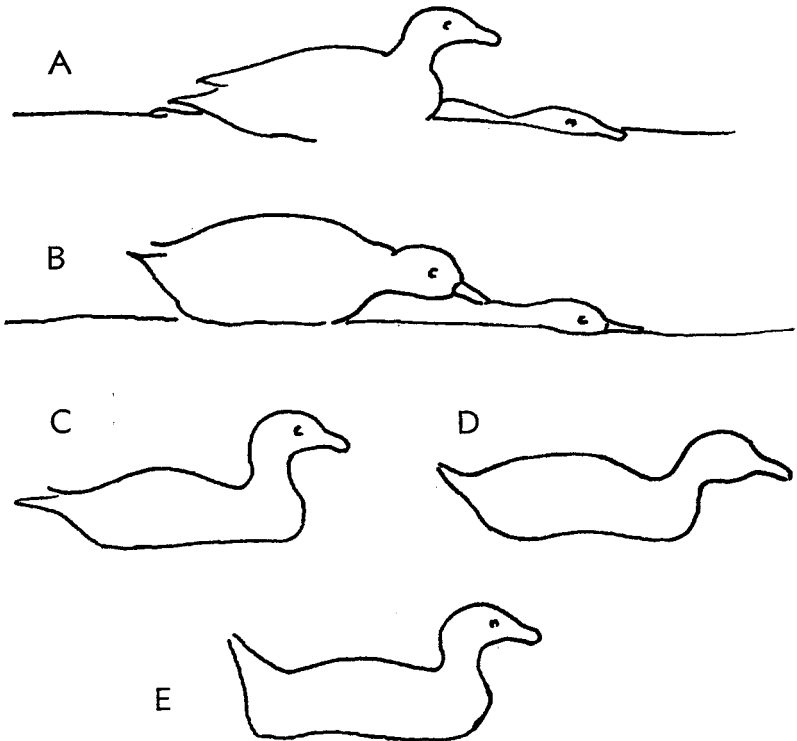


FIGURE 5 — Copulation in the Blue Duck: (a) the female takes up a prone posture, (b) the male grasps her neck quite far back, (c - e) after mounting, the male holds an erect posture, moves his head slightly forward and back, and raises his tail; he is positioned sideways on to the female and does not move his body forward. If a call is made, it would be expected at (d). Traced from a super-8 cine film.

She lowers her body in the water and extends her neck. He then swims round to her side and may nudge her a number of times with his chest before mounting crossways, turning and grasping her neck in his bill. He shakes his tail a number of times and intromission is achieved with a fast sideways movement. Treading lasts from four to eight seconds, after which the male slips off — in all cases observed he mounted on her left and climbed off on the right. He then raises his head and stays erect for a moment, sideways on to his mate; he may extend his neck forward slightly, withdraw it and then raise his tail. He does not obviously Bridle or Nod-swim, as many *Anas* ducks do, and no calls have been heard from either bird, although a note might be expected from the male at stage (d) in Figure 5. The female always washes and preens, sometimes merely head-dipping but at other times plunging deep, wings flapping and tail wagging. The male may occasionally join her in bathing.

The whole performance is rather variable, especially between presumably long-mated birds. The preliminary close following, tail erection and even head-bobbing, do not always occur, in particular when, as sometimes happens, the birds copulate a number of times in rapid succession.

Before head-pumping, the female may flap her wings on the water in front of and around the male, dragging her body low at the surface with the wings held slightly out. In other ducks, the behaviour would probably be interpreted as rather intense bathing, unritualized into display. In the female Blue Duck, however, this particular performance has only been observed at pre-copulation (it is interesting that M. Williams (1967) reported that bathing was noticeably infrequent in Blue Ducks). Johnsgard (1965) described a possibly similar display in *Anas sparsa*. "During intensive mutual display, the female will sometimes suddenly flatten out almost prone on the water and swim rapidly round the male once or twice. The performance reminds one at once of Nod-swimming, but it lacks any "nodding" and does not occur in a typical Nod-swimming situation. I believe it must represent a primitive form of Nod-swimming rather than a copulation solicitation display."

The only other behaviour of the pair possibly involved in pair maintenance, is the male's occasional touching or pecking of the female on the back. This is too rapid to be allopreening and may merely be the first stage of attempted mounting (although it was never seen to be followed by copulation). It is probably similar to the behaviour shown by male *Aix sponsa* and *Anas sparsa* (Johnsgard 1965). Guthrie-Smith (1927) mentioned a possibly corresponding observation in which he did not enlarge. He wrote that the parents of a brood of feeding Blue ducklings floated motionless or paddled slowly about, "every now and then one of them in play making hostile feints at the other."

#### PARENTAL CARE

As in many other tropical or near-tropical ducks, which have extended breeding seasons and long pair-bonds, only the female incubates but both adults share parental duties after hatching (Kear 1970). Presumably because of a lack of ground predators, the species has evolved no injury-feigning display to draw potential enemies from its young. (It is remarkable that the Paradise Shelduck with apparently

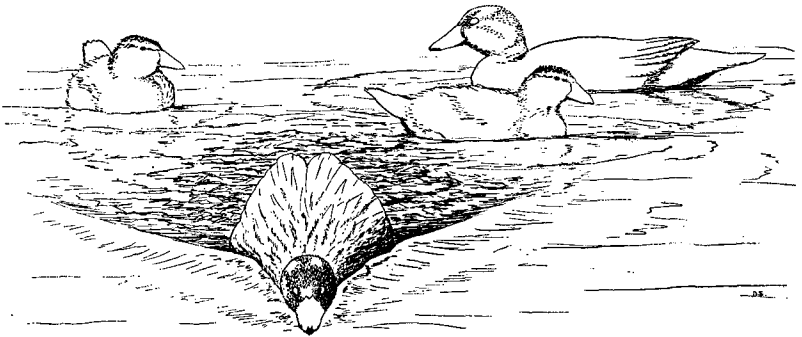


FIGURE 6 — Aggressive rush by drake Blue Duck in defence of his brood. Drawn by D. Scott from a photograph by C. Roderick.

the same absence of predation, does give one of the most spectacular broken-wing displays seen in the Anatidae.) However, a male Blue Duck with small ducklings has on rare occasion been seen, and photographed, rushing at a human intruder over the water in a similar posture to that used in chasing other birds (C. D. Roderick pers. com.; G. R. Williams 1963). Predators may be more numerous than at first appears likely. Circumstantial evidence indicates that the fresh-water eel takes ducklings (large eels are known to have strongly developed carrion-feeding tendencies (Burnet 1952)), and raptors could also be predatory. It is not known whether special behaviour patterns have been evolved to reduce underwater attack, but Soper (1965) stated that to escape danger from the air the Blue Duck flattens itself on the rock on which it is standing, stretches its head forward and freezes. Possibly a special alarm call makes the ducklings rush for cover. Blue Ducks with young may take up the posture described by Soper when approached by man, if the family is already on the rock.

Unfortunately, against the introduced rats, stoats, weasels and polecats, as well as dogs and cats, the Blue Duck seems to have little defence except to keep their young on the water (Potts 1871) or to hide them beneath the bank (Buddle 1951). While they have a family, the adults themselves do not retire during the day except for short rest periods. Presumably this is because their offspring must feed more or less constantly through the hours of daylight. Blackburn (1967) suggested that the young were taken to the bank to be brooded, where they would be, of course, particularly vulnerable. They have, however, also been seen under the female on rocks in mid-stream.

To move downstream through their territory, the whole family launches itself over the rapids and the young seem to come to no harm from the buffeting of the water. In order to go upstream again, the ducklings may have to come ashore. Buddle (1951) recalled one such incident: "the drake led them to the bank, where they climbed out on to a little shingly beach, then in single file the whole

party threaded its way through a mass of boulders and broken rocks a distance of twenty yards till they were able to take to the water again in the pool above, the duck following behind." Potts (1871) described a similar occurrence although he thought it was the female who led: "the duck marches in front, with her low wailing call, the small brood follow, whilst the drake protects the rear, or rather offers himself as the first victim to the pursuer."

The family stays together while the young are in juvenile plumage, which lasts until five months of age and is described in Pengelly and Kear (1970). Possibly it breaks up as in some other waterfowl, when the parents eventually chase away any Blue Duck which appears to be an adult, and therefore a potential rival.

## DISCUSSION

Much remains to be learnt about *Hymenolaimus*. This paper describes a very preliminary study to serve as a basis for future investigation. The species remains a puzzle with regard to its evolutionary relationships, since many of its behaviour patterns obviously adapt it to an exceptional environment. Territoriality seems at a premium and sexual activity is probably directed towards a single, life-long partner. It is difficult therefore to distinguish between adaptive and more basic, "primitive" characteristics. The *Anas* type pre-copulatory head-pumping seems to place it with that group; however the male's post-copulatory posture is not typical (especially as he appears to make no sound), nor are pre-flight signals. Complex post-copulatory displays are lacking. Other behavioural elements suggest affinities to the most "generalised" species of *Anas*, the African Black Duck *A. sparsa* (Johnsgard 1965), and to some of the perching ducks. The species is for the moment probably best thought of as deriving from an early stage in the evolution of the dabbling ducks from their perching duck-like ancestors.

A number of questions about the birds' biology cannot be answered until a population has been banded. This will confirm their life-long pairing, and enable an assessment of longevity. Where are the "spare" young birds waiting to fill the inevitable gaps? Do Blue Ducks ever move to more desirable territories or ever feed outside their own? Other points particularly worthy of research are the mechanisms of family break-up and the repertory of vocalizations — an obvious social feature barely touched on in this study.

## ACKNOWLEDGEMENTS

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## YELLOW-EYED PENGUINS BREEDING ON BANKS PENINSULA

By G. HARROW

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### INTRODUCTION

Richdale (1957) gives the breeding range of the Yellow-eyed Penguin *Megadyptes antipodes* as 45° 45' S at its most northerly point, and he states that an unmarked fledgling was picked up at Birdling's Flat, immediately south of Banks Peninsula, which is 176 miles north of the nearest known breeding place. The Annotated Checklist of the Birds of New Zealand 1970, and the Field Guide 1966, both agree that Oamaru is the northernmost breeding place for this species of penguin, although the Field Guide does suggest breeding may have taken place farther north formerly. Oliver (1955) places North Otago Head as the northern end of the breeding range. The purpose of this paper is to report the establishment of Yellow-eyed Penguins breeding in the eastern bays of Banks Peninsula during the past five years. This is about 200 miles north along the east coast of the South Island from the previously known breeding place.

During the spring of 1966 a pair of these penguins was observed by campers and the local farmer 'keeping company' in Long Bay. They were described as being about two feet tall with yellow markings around the head but no definite crest. The campers and the farmer were quite definite that they had never seen this type of penguin in the bay before, although they had been closely associated with the area for many years. The pair of birds created much interest that year and were harassed by people and dogs; they finally left Long Bay in late December 1966 and were not seen again that summer. These penguins were likely to be two or three year old Yellow-eyed Penguins which had formed a pair bond and were looking for a breeding site.

The writer heard of these penguins late in the spring of 1967 and a careful search of the area revealed no trace of them that season in Long Bay, but reports were received that birds which could have been Yellow-eyed Penguins moulted in Stony Bay and Long Bay in March 1968. In November 1968 a pair of Yellow-eyed Penguins was seen 'keeping company' in Long Bay. One was an immature bird, in that the yellow band did not join behind the head; the other was in full adult plumage. This pair was observed regularly together that season usually in the late afternoon and sometimes early in the morning. They were most likely a two and three year old. Mutual display by this pair was noted. There was no evidence of breeding that summer.

A nest with one chick was found by the author during the second week in November 1969 attended by two adult Yellow-eyed Penguins in the same area of Long Bay where a pair had kept company the previous season. This nest was visited several times during the summer, and the breeding dates were similar to those found by

Richdale further south. The chick, when first seen, was showing traces of secondary down and had most likely hatched about the 7th of November. The guard stage ended on the 27th December and the chick entered the sea between the 15th and the 21st February 1970. A juvenile was seen several times in close proximity to the nest during the 1969-70 season, and feeling certain that this individual had not been raised in Long Bay, I made a detailed search in surrounding bays.

Little Fisherman and Big Fisherman Bays confirmed my suspicions, for a substantial population of Yellow-eyed Penguins was found. Five nests were located in a fairly superficial search, and there are most likely many more than this in these two bays. Mr. L. K. Muirson, a farmer of Fishermans Bay, told me that they first turned up about 1965 in small numbers, which have steadily increased each year, until in 1970 as many as a couple of dozen of these large penguins could be seen at one time at the landing places in the late afternoons. From the signs of excreta found in Little and Big Fishermans Bay I have no doubt that there could be a resident population of more than forty Yellow-eyed Penguins.

Farmers and fishermen were contacted by the author and it was found that penguins whose descriptions corresponded with those of Yellow-eyed Penguins had been seen regularly ashore in many Banks Peninsula Bays from Birdlings Flat to Hickory Bay. Several witnesses said that these penguins were seen quite frequently at different times of the year, which suggests that they are resident in these bays and likely to be breeding.

In the spring of 1970 the breeding pair in Long Bay shifted their nest site some ten feet from the place used in 1969. Two chicks were successfully reared but it was encouraging to record the increase in unemployed birds. This season besides the two breeding adults and their two chicks, another pair was present, one of which was a juvenile, and in addition an unattached juvenile, making a population of seven in Long Bay altogether, during the 1970-71 breeding period.

## DISCUSSION

Richdale has shown that once Yellow-eyed Penguins establish themselves as a breeding bird at one site they usually become permanently attached to that area or fairly close to it, for the rest of their lives. He found that females up to two years old and males up to three or four years old had a very strong pattern for widespread wandering before finally fixing on a permanent breeding site. It is probable that the breeding colonies of Yellow-eyed Penguins on Banks Peninsula are the result of juveniles wandering from the Otago breeding sites further south and settling finally at the eastern bays of the Peninsula. Richdale also produced some data that suggests that fledging juveniles tend to wander north rather than south, although he did not find any evidence that there was a permanent northerly shift. Kinsky (1968), discussing the seabird mortality around the southern coasts of the North Island during the April 9 to 11 tropical cyclone, commented on the large numbers of immature Yellow-eyed Penguins found dead. He points out that this storm advanced from

the north with onshore southerlies washing the corpses onto the Palliser Bay beaches. Kinsky argues with good evidence that these young Yellow-eyed Penguins were most likely well into the Cook Strait area when they were overcome by the cyclone, and he was impressed by the northerly range of this sedentary species. However, in 1968 there were good numbers of Yellow-eyed Penguins already coming ashore on Banks Peninsula, and there may have been some breeding by that date. There is a possibility that some of the Yellow-eyed Penguins found after the cyclonic storm were from breeding grounds on Banks Peninsula.

The build-up in numbers of Yellow-eyed Penguins in the eastern and southern bays on Banks Peninsula has been quite rapid and it is interesting to speculate why this should be so, when during the same period there has been a marked decline in numbers of White-flipped Penguins *Eudyptula albosignata*. Feral cats have certainly been responsible for some mortality of chicks of White-flipped Penguins on Banks Peninsula and it is unlikely that these predators would be able to tackle the much larger Yellow-eyed Penguins. Another likely explanation might be human interference on the breeding grounds on the Otago coast further south where many of the colonies are adjacent to quite large cities and towns. Richdale mentions human interference on Otago Peninsula which resulted in a shift from the area of two to four year old Yellow-eyed Penguins. The small breeding colony at Cape Wanbrow, Oamaru, has almost been wiped out by human visitors and dogs.

Yellow-eyed Penguins usually prefer a rocky coast for their breeding grounds and apart from a few outcrops at Timaru which could hardly be considered ideal habitat, the next part of the South Island coast north of Oamaru suitable, is Banks Peninsula. What is surprising is that they have not established themselves here earlier.

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## SHORT NOTE

### FANTAIL AND MOTH

Recently, while searching for Kokako in the Hunua Ranges, I saw a Fantail catch a moth about  $\frac{3}{4}$ " long. Obviously this was too big to swallow, so the Fantail held the moth in one foot, parrot-fashion, and devoured it in small pieces.

— HARRY WAKELIN

## BIRDS OF WHANGAREI HARBOUR

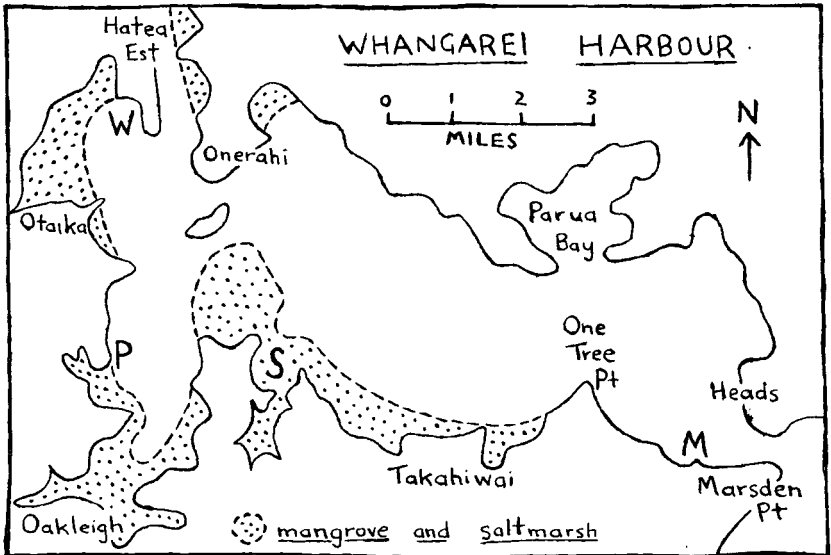
By MURRAY MUNRO

This paper summarises the results of regular observation of the bird population of Whangarei Harbour over the period January 1970 to April 1971 and includes a selection of past records, published and unpublished, which provide evidence of increase or decrease of individual species during the period 1939-1970. Published records are mainly from Classified Summarised Notes (*Notornis*); previously unpublished records are from local observers, notably Mr. H. C. Hewlett, whose experience of Skull Creek wader roost, overlooked by his farm, goes back over a period of 50 years.

Bird counts were carried out by Whangarei Forest and Bird Society in 1962 and by a team led by G. P. Adams, Wildlife, in 1970, but no general account of the area has been published. Modifications of environment in the upper harbour by dredging and reclamation at Port Whangarei and by discharge from Portland Cement Works so far appear to have helped rather than hindered the bird population of the harbour; establishment of Marsden Point Oil Refinery and expanding industry at Port Whangarei may in time have an opposite effect. This paper attempts to provide a set of data by which future changes may be assessed.

### WHANGAREI HARBOUR

Total area about 40 square miles, of which about 25% is mangroves and saltmarsh and perhaps 50% is exposed mudflats, excluding mangroves, at low spring tides. The northern shore from Onerahi



to Whangarei Heads is rocky, with very little mudflat and no mangroves. The southern shore is sandy from Marsden Point to One Tree Point; from Skull Creek to Takahiwai extensive areas of mangrove and saltmarsh with a few shellbanks lie behind a vast area of mudflats which at low tide support the bulk of the wader population. The upper harbour, an estuarine area west of a line drawn from Onerahi to Skull Creek, is mainly mangroves and mudflat, modified as stated by dredgings and effluent. A major wader roost at Skull Creek and a smaller roost at Marsden Bay sandspit are submerged at spring tides: there are spring tide roosts at Portland and at Whangarei Port where, within a few hundred yards of a busy shipping terminal, thousands of waders congregate and dotterels, terns and gulls breed in season on the man-made habitat. Ruakaka is also used as a roost at spring tides.

### SPECIES LIST

Selected previous records are included, followed by my own 1970/71 record summary. Where no previous record is given the species was not recorded until the 1970/71 survey. Observers are identified by name or by initials, as follows:—

G.P.A. (G. P. Adams); L.W.D. (L. W. Delph); C.W.D. (C. W. Devonshire); A.T.E. (A. T. Edgar); C.A.F. (C. A. Fleming); H.R.McK. (H. R. McKenzie); K.R.R. (Mrs. K. R. Reynolds); W.S. (Wesley Sanderson); E.K.S. (E. K. Saul); P.D.G.S. (P. D. G. Skegg). Where no reference is given the observation is from my own note books.

The main wader roosts are identified by letters:—

M = Marsden Bay; P = Portland; S = Skull Creek;

W = Whangarei Port.

The list of species follows 1970 Annotated Checklist.

Blue Penguins breed around the northern shoreline. Petrels and Shearwaters of various species occur at times within harbour limits, but are not discussed here, as pelagic birds are outside the scope of this paper.

Gannet *Sula serrator*. Occasional large flocks in winter, e.g., Portland Channel (H.C.H.); Parua Bay, 100, July 1942 (W.S.); 50 on 18/7/70. 29/10/55, Taurikura, 150 (H.R.McK.).

Black Shag *Phalacrocorax carbo*. 1941, 40-60 on the western side of the harbour (W.S.); 1970-71, present in small numbers, usually ones and twos, no flocks seen.

Pied Shag *P. varius*. A long-established colony in dense mangroves at Skull Creek; 1940, c10 nests (W.S.); August 1970, 60 nests, eggs and young. Breeds elsewhere around the harbour in small numbers. Population has increased. 1940, small numbers, less numerous than *melanoleucos* (W.S.). 1970, the commonest species, more numerous than *melanoleucos*; roosting flocks, upper harbour, up to 50; Parua Bay, 18/7/70, 80.

Little Black Shag *P. sulcirostris*. Apparently an autumn and winter visitor. 15/6/42, 26 (W.S.). Taurikura, flock of up to 25 in season (L.W.D.). Hatea Estuary, 1970/71, February to July, flocks of 20-30. Harbour population c50.

Little Shag *P. melanoleucos*. Population has declined. 1942, the commonest species, up to 100 roosting at Skull Creek (W.S.). 1970, largest count 25. 1965, both phases reported breeding in Oakleigh colony.

Spotted Shag *Stictocarbo punctatus*. November 1940, one seen (W.S.). December 1970, one dead, Skull Creek (H.C.H.).

White-faced Heron *Ardea novaehollandiae*. Earliest harbour record 1949 (Notornis 17: 12). Skull Creek, 1950, two; by 1960, 60 (H.C.H.). 1970/71, flocks of up to 80 roosting in mangroves and on paddocks inland at high tide. Estimated harbour population 200+.

White Heron *Egretta alba*. Occasional in winter at Oakleigh, Skull Creek, Hatea Estuary, Parua Bay (H.C.H., W.S.). Not recorded since 1960.

Reef Heron *E. sacra*. Breeds at Aubrey's Island, off Whangarei Heads. Local residents consider that numbers have declined over the last 20 years. Still present along northern shore, at Marsden Bay and in the Hatea Estuary; none seen recently at Skull Creek. Decline in total numbers may be real, or apparent because of withdrawal of *sacra* from estuarine areas now occupied by increasing numbers of White-faced Herons.

Bittern *Botaurus stellaris*. Port, observed around a pool on reclaimed land.

Royal Spoonbill *Platalea leucorodia*. 1968, two reported in Otaika Estuary.

Black Swan *Cygnus atratus*. Winter flocks formerly up to 130, now only occasional parties of 8-16 (H.C.H.). Used to feed on sea grass; reduction in numbers as this food supply disappeared (W.S.).

Mallard *Anas platyrhynchos*

Grey Duck *A. superciliosa*. Both species present in large numbers, including many hybrids.

Brown Teal *A. aucklandica chlorotis*. Formerly numerous at Otaika, disappeared around 1940 (H.C.H.). 1940, bred around Skull Creek, none seen since 1943 (W.S.). Small numbers present in Parua Bay near Onerahi until 1960 when disappeared. 20/3/71, Parua Bay, one, with grey duck (C.W.D.).

Banded Rail *Rallus philippensis*. Skull Creek, 1940, common and breeding (W.S.); none in recent years (H.C.H.). Still present in various localities around the mangrove fringe (C.W.D. et al).

South Island Pied Oystercatcher *Haematopus finschi*. Autumn and winter visitor, numbers increasing. M, 1956, 22 (H.R.McK.); 1958, 50 (J. & A. Prickett); 1961, 70 (O. Cullen); 25/7/70, 350; 115 still present on 21/11/70. Harbour counts, July 1970, 540; 20/3/71 450.

Variable Oystercatcher *H. reischeki*. Outer harbour, up to 20 recorded in area Whangarei Heads - Marsden Bay.

Pacific Golden Plover *Pluvialis dominica*. S, 21/2/70, 9; 14/3/70, 14; 24/10/70, 18; 5/12/70, 14; 30/1/71, 8. Oakleigh, one, 20/3/71.

New Zealand Dotterel *Charadrius obscurus*. M, 24/11/59, 20 (*Notornis* 9: 75). 1970, bred at S (up to 3 pairs); M, one pair; W, 10 pairs, on reclaimed land. Not less than 14 pairs therefore bred within harbour limits. It may be assumed that at least a proportion of the 20 birds seen at M in 1959 were breeding. The reclaimed area on which birds now breed at W was created in 1968, and has been quickly utilised by dotterel as a main breeding ground. 1970/71, pre-breeding flock, W, August, 42. Autumn flocks, M, March, 37; S, April, 50; W, May, 38. The 10 resident pairs may be seen at W in any month of the year. Autumn flocks appear to move between the three roosts.

Banded Dotterel *C. bicinctus*. S, between 1930 and 1950 about six pairs nested on pasture and ploughed land (H.C.H.); May 1942, flock of 200 (W.S.) W, a pair may have nested in 1970. Flocks, autumn and winter, Onerahi Airport, fairly regular, up to 240; S, mainly in autumn, up to 250; W, late summer, up to 200. Harbour count, 20/3/71, 415.

Wrybill *Anarhynchus frontalis*. 1957, M, up to 12 reported (H.R.McK.). 1970, W, January - August up to 100; P, up to 50; overall counts, May 120, August 115. 1971, March, P, 70; W, 44; total 114. S, occasional, once 32.

Long-billed Curlew *Numenius madagascariensis*. S, 1939-41, two on occasions (W.S.); P, 14/3/70, one (A.T.E.).

Asiatic Whimbrel *N. phaeopus variegatus*. 1970, sightings of a single bird, ssp. unid., W, May; S, July. S, September, two, identified as *variegatus*.

Bar-tailed Godwit *Limosa lapponica*. 1951, harbour population estimated at 3500 (H.R.McK.). 14/3/70, harbour count, 3000 (G.P.A.). Biggest flocks (up to 2400) at S; smaller flocks at P and W, except at spring tides when additional birds congregate especially at W, from other parts of the harbour. Winter flocks, previous records 300-350 (various observers); 1970, July, S, 500; W, 85; total 585.

Terek Sandpiper *Xenus cinereus*. W, 10/1/70, one; S, 11/4/70, two; 11/7/70 and 5/9/70, one. P, 27/2/71, two; 27/3/71, three; 12/5/71, one.

Turnstone *Arenaria interpres*. 15/12/60, P, 6 (P.D.G.S.). 1970, S, single birds in February and April; W, January, 7; February, 6; March, 3; April to July, one. 1970/71, W, 2 in September, 6 in October-November, 10 in December-January, 5 in February.

Knot *Calidris canutus*. Present in season for the last 50 years (H.C.H.). 14/3/70, harbour count, 2900 (G.P.A.). S is the usual roost, but 2500 at W on a February 1971 spring tide. Counts of over 2000 have been recorded only in February and March: October-January population seems to be nearer 1000. S, 12 on 11/7/70.

Red-necked Stint *C. ruficollis*. W, one on 28/9/69 and in January - March 1970.

Pied Stilt *Himantopus himantopus*. A few pairs have nested around the harbour for many years; autumn population probably 7 - 800, 75% in the upper harbour.

Black Stilt *H. novaezealandiae*. Occasional black or near-black stilts recorded at S in past years (H.C.H., W.S.).

Southern Skua *Stercorarius skua lonnbergi*. 31/5/42, one seen at S during a south-easterly storm (W.S.).

Arctic Skua *S. parasiticus*. Occasional in season, with White-fronted Terns.

Black-backed Gull *Larus dominicanus*. Single pairs nest around the harbour. 12 pairs nested on W dredging islands in 1970. Large congregations at Hatea Estuary and city dumps in autumn and winter.

Red-billed Gull *L. novaehollandiae*. Nesting colonies of up to 200 pairs on various rocky islets at Whangarei Heads (K.R.R., L.W.D.); island in Parua Bay, 155 pairs, 1955 (H.R.McK.); W. dredging islands, 200 pairs in 1968, only 20 pairs in 1970. Large winter flocks, c. 8000 roosting on W wharf in April 1970.

Caspian Tern *Hydroprogne caspia*. S, 1940, 180 pairs (W.S.). Population has declined. S, August 1970, 30 pairs. W, dredging islands, 1968, 12 pairs; 1969, 30 pairs; 1970, at least 15 pairs. Scattered pairs nest around the harbour.

Fairy Tern *Sterna nereis*. S, up to 5 recorded 1939-43 (W.S.); pair with nest scrape 1951 (E.K.S.). P, 14/12/60, one (P.D.G.S.); 30/1/71, 8 birds, including one juvenile.

Eastern Little Tern *S. albifrons*. P, 14/12/60, 3; 29/1/62, 7 (P.D.G.S.). Sighted in 1970. 1971, January, one off Parua Bay (H.C.H.); W, 27/2/71, 3; P, January-February, certainly 6, probably 12 birds.

White-fronted Tern *S. striata*. 1940, 100 pairs nested on shell-bank at Onerahi west; 1941, S, 24 pairs nested at the Caspian Tern colony (W.S.). Frenchmen stack, Whangarei Heads, c. 150 pairs nest annually (K.R.R.). W, dredging islands, 100 pairs nested 1968 and 1970. A report of 50 pairs nesting on Snake Bank (Whangarei Heads) 1/1/71.

#### ACKNOWLEDGEMENTS

I am grateful to all those who have helped in preparation of the paper by passing on information and by helpful discussion, and especially to Mr. H. C. Hewlett and Mr. Wesley Sanderson; to those who have joined me in my expeditions and helped in counts and with transport; and to Mr. A. T. Edgar, O.S.N.Z. Regional Representative.

Full details of all counts will be deposited with O.S.N.Z. Recording Scheme.



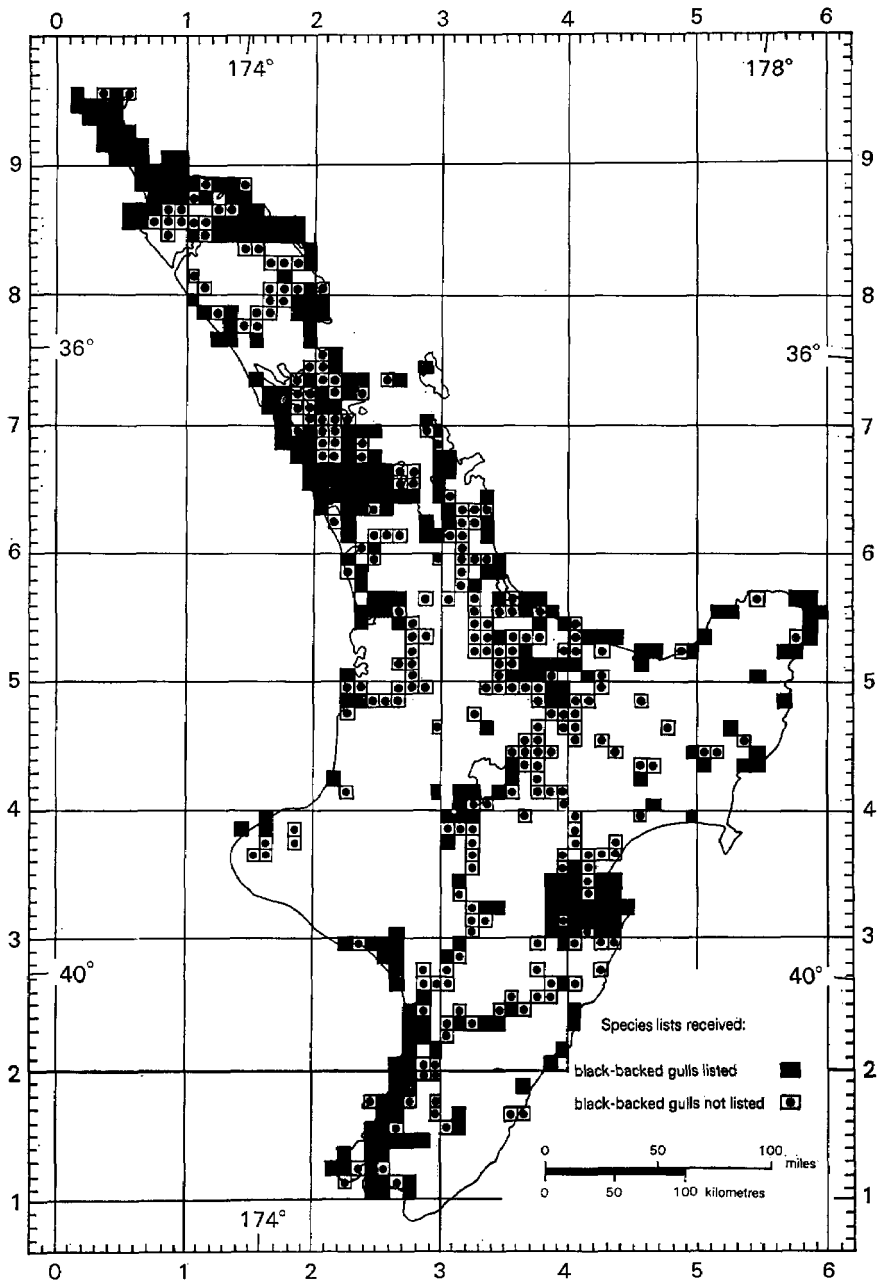
## BIRD DISTRIBUTION MAPPING SCHEME REPORT FOR 1970 - 71

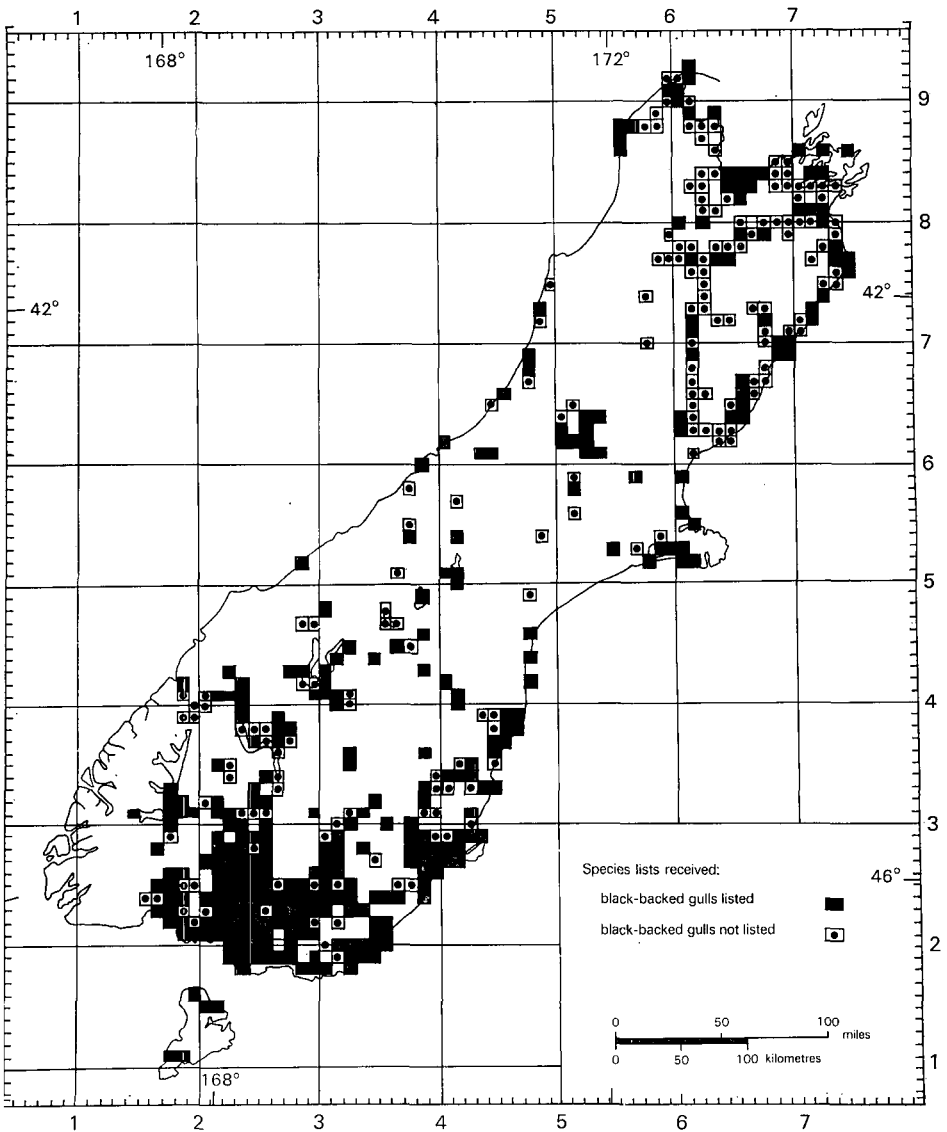
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The bird mapping scheme, based on lists of species from the 10,000 yard squares of the National Grid, provides much needed information on the detailed distribution of birds throughout New Zealand; its success requires the active participation of a large and widely scattered group of people able to identify birds accurately. Some results of a two-month feasibility trial, and a general account of the scheme's purpose and methods were published in *Notornis* for September 1970 (Vol. 17, pp. 231-235). On this basis, Council accepted the scheme as an official activity of the Society for three years as from May 1970; after this, its future will be reconsidered. The main achievements during the past year have been the compilation of lists from many new squares and the printing of new stationery to facilitate field recording and subsequent analysis of results.

A total of 1061 lists of species, contributed by 102 observers, was added during 1970-71. By 30 April 1971, lists had been received from 29% of the 1599 North Island squares (up 8% since last year) and from 19% of the 2006 South Island ones (up 9%). The maps (Figs. 1 and 2) show the squares from which lists were available on 30 April 1971; several additional lists, compiled before this date, were received too late for inclusion in this report and have been held over for next year. Although several districts have already achieved very good coverage, more lists are needed, especially from Urewera-East Cape, Taranaki, Wairarapa, North-West Nelson, Canterbury, Westland, Otago and Fiordland. As coverage improves, progress will be slower because many of the remaining squares are difficult to reach or are in areas with few resident ornithologists. On present indications, greatly increased efforts are needed if anything like complete coverage is to be achieved within the next two years. To this end, perhaps some of the stronger ornithological centres will mount occasional week-end expeditions to areas that are too large to be covered by local observers. Good lists are always welcome from any square but, at least for the next two years, it is better to visit a new square than to go on searching for additional species in squares already well covered.

Although the main purpose of Figs. 1 and 2 is to show which squares have at least one bird list and which have none, the maps also indicate the squares from which Black-backed Gulls have been reported. These birds were present in all coastal areas from which lists were available and also at many inland localities scattered along the lengths of both islands. Although these findings are not particularly novel, the supporting data are more numerous and detailed than any previously published. Nevertheless, the available data still fall far short of what is required. For instance, many more lists are needed to establish whether any substantial areas are free of gulls or if there are well marked seasonal differences in the birds' distribution. Further, the plotting of mere presence or seeming absence fails to





differentiate between a square that has a large breeding colony of gulls and one in which someone once saw a gull passing overhead. These deficiencies will be overcome gradually as more lists are accumulated thus providing a better geographical coverage and permitting the plotting of distribution in terms of frequency of occurrence, season, or breeding.

New record cards and instructions for using them are now available from your Regional Representative or, failing him, from Mr. P. D. Gaze (Ecology Division, D.S.I.R., P.O. Box 30466, Lower Hutt); the new cards are of convenient size for field use, reasonably simple to complete and allow easy transcription of data for computer analyses. In the past, some observers were unable to find maps showing the 10,000 yard grid squares for their districts. Recently, however, several new sheets have been published in the NZMS 18 series (about 4 miles to 1 inch), and there are now comparatively few districts where lack of maps remains a serious problem.

#### ACKNOWLEDGEMENTS

The new record cards and the instructions for using them are the outcome of much discussion and field testing and I am grateful to the many people who assisted in this, especially Dr. B. D. Bell and Mr. C. J. R. Robertson. Mr. P. D. Gaze, Ecology Division, D.S.I.R., took over the despatch and receipt of cards, the tabulation of data, and the drafting of the maps (Figs. 1 and 2), which were later redrawn for publication by the Cartographic Section of D.S.I.R. The printing of the new cards and the Xeroxing of the instructions were arranged by Mr. C. J. R. Robertson of the Wildlife Division of Internal Affairs. Special thanks are due to the Society's Regional Representatives for organising and supervising the scheme in their districts and, last but not least, to the many people who compiled bird lists.

— P. C. BULL,

Organiser, Bird Mapping Scheme

## SONG THRUSHES FEEDING ON MUD SNAILS

By PAULINE A. NYE

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### ABSTRACT

Song Thrushes *Turdus philomelos* were found feeding on mud snails at Papanui Inlet, Otago Peninsula. Thrushes break open mud snails with the same technique that they use for garden snails but their hammering must be more persistent because of the thicker shell. The distribution of this habit is discussed and further records requested.

### RECORDS OF THRUSHES FEEDING ON MUD SNAILS

On two occasions during the 1970-71 summer, Song Thrushes *Turdus philomelos* were seen feeding on mud snails *Amphibola crenata* Martyn, in two separate areas of Papanui Inlet, Otago Peninsula. The first place was by Dick Road, to the east of where the road leaves the inlet and the second was where Sheppard Road joins the inlet. On 2/12/70 I saw a thrush fly down to a drainage ditch by the inlet and pick up something in its beak and fly with it under a tree lupin. A loud scraping noise followed and when I disturbed the bird I found a stone surrounded by mud snail shells being used by the thrush as an anvil (Figure 1). Seven shells had been broken open in the same way and three more, including the fresh one just gathered, were intact or only chipped. Several other clusters of broken *A. cenata* shells were found around stones within this area on this occasion and on subsequent visits. Some anvils were on



FIGURE 1 — The first thrush's anvil discovered at Papanui Inlet, Otago Peninsula, surrounded by mud snail shells.

the grass bank and others in the ditch itself. The first anvil was visited eight times after the original discovery and the shells were counted and removed. The results are shown below:—

Date	No. of <i>A. crenata</i> shells	Date	No. of <i>A. crenata</i> shells
9/12/70	8	28/2/71	8
23/12/70	26	19/3/71	0
2/1/71	8	18/4/71	7
3/2/71	16	22/5/71	2

On 2/1/71, I saw a thrush hopping over the mudflats just after the tide had fallen and pick up and drop a mud snail several times. Then it flew on to the road and banged the shell against a stone. When the road was examined a large quantity of broken mud snail shell was found mixed with the road metal and broken shells were also found on the mudflat, just below the sea wall.

Kinsky 1970<sup>(3)</sup> was the first to report seeing thrushes feeding on mud snails when he visited Rough Island in the Nelson area during October 1969. He and his companions saw at least two dozen thrushes visiting the mudflats for *A. crenata* and taking same to their nestlings for food. Kinsky remarked that the area could not have supported so many thrushes unless they exploited this source of food. Mr. A. Wright, Wildlife Ranger for Otago Peninsula, has told me that he has seen thrushes taking mud snails on the harbour side of Otago Peninsula.

#### THE TECHNIQUE OF SMASHING SHELLS

An examination of the broken shells (Figure 2) shows immediately that they have all been broken by the same technique. The apical part of the shell is broken into a large number of small pieces which fall away from the largest and strongest whorl near the opening. It is evident that the thrush holds the shell by the rim as it bangs it against a rock. The thrush does not hit the shell with a vertical movement, which might be expected, but it brings down the shell onto a rock with a downwards and sideways movement of the head. Morris 1954<sup>(4)</sup>, suggested that snail hammering by thrushes may have been derived from pecking and shaking movements, or beak wiping. Morris studied the method by which thrushes break garden snails and his description, with the photographs in his report, make it clear that garden snails and mud snails are broken open in the same way. Granada T.V. have made a film which shows thrushes breaking garden snails. The film is called "Song thrushes: Snail smashing; Mongoose: Egg smashing," and it is available from the New Zealand National Film Library, catalogue entry A3440.

It would be interesting to know how snail smashing develops in thrushes. In his paper Morris 1954<sup>(4)</sup> quotes the observations of the naturalist Pitt, who hand-reared a thrush and offered it snails when it was fully fledged. She found that the shell smashing behaviour developed gradually and that the first reaction of the thrush to snails was to peck at moving snails. When tested two days later the thrush pecked harder, turned the shell and looked into the cavity and shook the shell before casting it away. After another two days it carried a snail around and struck it on the ground several times and finally battered it open and ate the contents.

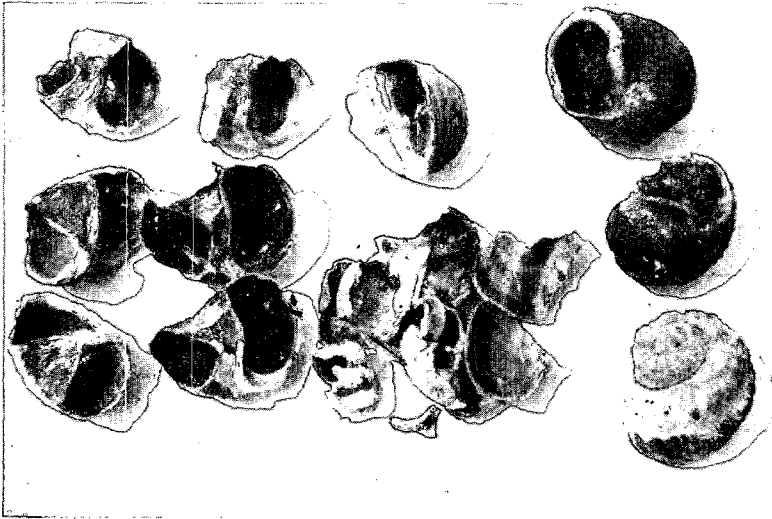


FIGURE 2 — *Amphibola crenata* shells removed from the thrush's anvil. The intact snail at the upper right is fresh and living, the two intact shells below it are chipped and empty, the other seven shells have fractured in the same way. In the centre are some of the larger shell fragments chipped from the apices of the broken shells.

On the evening of 6/2/71, I put twenty living *A. crenata* on the grass in our garden which had been frequented by a thrush, morning and evening, for some weeks. There are no garden snails within this area and it is probable that this bird had been reared this season. On several occasions it approached the snails and merely looked at them, cocking its head on one side but later it picked one up and dropped it quickly giving a little jump. A few minutes later it picked up a second shell and flew a short distance before dropping it. Although the thrush continued to feed in the garden for another 15 minutes it appeared to avoid the place where the mud snails were. When the mud snails were picked from the grass they made a bubbling sound as they retracted, which may have startled the thrush. The mud snails were put out again, two evenings later but the thrush ignored them and the experiment could not be continued as the thrush ceased to visit our garden.

#### DIFFERENCES BETWEEN MUD SNAILS AND GARDEN SNAILS

What is new about this exploitation of *A. crenata* by thrushes is that the thrushes are feeding on a new species of snail with a harder shell and the mud snails are collected on mudflats, an unusual location for thrushes. (Though New Zealand has such an extensive coastline and it is not unusual to see passerines such as goldfinches, sparrows and starlings foraging on beaches). On three separate occasions I found a shell of the scavenger whelk *Cominella glandiformis* by a

thrush's anvil at Papanui which suggests that the thrushes are experimenting with snail-like objects. Presumably if they can be broken and the contents eaten, that type of shell will be collected again. *Amphibola crenata* is a Pulmonate snail, more closely related to garden snails than most other marine snails, so its soft parts may not taste very different from garden snails. *A. crenata* has been used for human consumption, and I have seen many shells of this species in Maori middens. The shell of the mud snail is much thicker than garden snails and is consequently more difficult to open. Morris 1954<sup>(4)</sup> says of thrushes breaking garden snails, "The number of beats required to break open the shell is variable, according to its thickness, a weak shell being smashed in as few as four or five beats." Thrushes must hammer very persistently to break open mud snails. I saw a thrush hammer one such shell forty times, and still not succeed in opening it. I took two intact mud snails and held the shells by the rim and hammered them on a thrush's anvil; the first broke after forty blows and the second after nineteen, but both broke in the same way as shells broken by thrushes. Intact shells were found at anvils with broken shell on several occasions, so shells are sometimes abandoned without being broken.

#### DISTRIBUTION OF THE HABIT OF THRUSHES EATING MUD SNAILS

It would be interesting to know how widespread is this habit of thrushes feeding on *A. crenata* in New Zealand. As suitable areas for exploiting this food are scattered around the coast and the previous record is about 345 miles from Otago Peninsula, one would suspect that the habit can be developed independently by a few thrushes in different areas, where it may spread by imitation. The well-known habit of tits and other birds of opening milk bottles was spread in areas of England and Europe in this way, as shown by the studies of Fisher and Hinde 1949<sup>(1)</sup>, and 1952<sup>(2)</sup>. It is unlikely that the exploitation of mud snails has spread from a single focus, as recorded by Pettersson 1959<sup>(5)</sup>, for *Daphne* eating by Greenfinches.

I would be very interested to receive further records of this behaviour from other observers in different parts of the country and I would be willing to collate and publish this information as it became available.

#### REFERENCES

1. FISHER, J., and HINDE, R. A., 1949: The opening of milk bottles by birds. *British Birds*: 42, 347-357.
2. HINDE, R. A., and FISHER, J., 1952: Further observations on the opening of milk bottles by birds. *British Birds*: 44, 393-396.
3. KINSKY, F. C., 1970: Song thrushes: foraging on mudflats. *Notornis*: 17, 77.
4. MORRIS, D., 1954: The snail-eating behaviour of thrushes and blackbirds. *British Birds*: 47, 33-49.
5. PETERSSON, M., 1959: Diffusion of a new habit among Greenfinches. *Nature*, 184, 649-50.



## RECENT OCCURRENCES OF RARE PETRELS IN NEW ZALAND

By F. C. KINSKY  
Dominion Museum

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### 1. SOFT-PLUMAGED PETREL *Pterodroma mollis*

On 16/5/71 a Soft-plumaged Petrel was found in a weak condition, but still alive, in the Hutt Valley. It was brought to the Wellington Zoological Gardens, where it died the following day, and was handed in to the Dominion Museum.

The bird, on dissection, proved to be a juvenile male, which could not have been off its nest for more than a few weeks, and possibly even less. Its plumage was fresh and in excellent condition. Although very thin, when found, the bird must have been trying to feed by scavenging at sea, as a complete tail of a young Short-tailed Shearwater *P. tenuirostris* was found in its stomach.

The description of the bird is as follows:

Crown, hindneck, sides of neck, back and short scapulars uniformly ash-grey; upper tail coverts and tail similar but slightly paler. Feathers of forehead and sides of face white-tipped, giving a mottled appearance. A black patch in front and behind the eye. Long scapulars and entire wing blackish, except for both rows of greater secondary upper wing coverts, which are ashy grey with white edgings. Inner webs of all primaries narrowly edged with white. Underwing coverts mainly sooty-grey, but greater underwing coverts more or less white-tipped and white-based. Longest axillaries white on outer web, remainder grey and white-tipped. Chin and throat white, grey collar extending in an ashy-grey band across the foreneck. Remainder of under surface white, except for faint freckling on flanks. Undertail coverts pure white. Outer tail feathers white on inner web with heavy grey mottling on outer web; some grey mottling on next two pairs of rectrices; remainder of tailfeathers grey. Bill black; iris dark brown; tarsus flesh coloured, and this colour extending one third down the toes and webs, remainder of toes and webs black.

#### Measurements:

Bill:	35.8mm	Wing:	258.0mm
Tarsus:	36.7mm	Tail:	111.0mm
Toe:	45.9mm	Weight:	176.0gr.

This specimen represents an extremely light colour phase, particularly in the uniform colouring of its dorsal surface. Its general plumage pattern and its measurements fall within the published records for the Southern (Indian and Atlantic) Ocean races of the species, and it can therefore be considered to belong to the nominate race, *Pterodroma mollis mollis* (Gould).

The above specimen constitutes the first reported occurrence of a Soft-plumaged Petrel on the mainland of New Zealand.

## 2. BLACK-CAPPED PETREL *Pterodroma externa cervicalis*

Following the unusually heavy tropical storm which hit New Zealand on 10/4/68, a Black-capped Petrel was found exhausted, but still alive, on farmland on the Mamaku Plateau (Rotorua). The bird died shortly after it was picked up and was placed in a freezer, where it was consequently forgotten. However, it eventually reached the Dominion Museum late during 1970. The bird was very thin and somewhat dehydrated, but its plumage, in spite of the long delay, was still in very good condition.

The specimen, an immature male, was prepared as a study skin (DM-15736) and its measurements are given below:

Bill:	25.8mm	Wing:	309.0mm
Tarsus:	46.0mm	Tail:	140.0mm
Toe:	50.3mm	Weight:	295.0gr.

Up to a very short time ago Black-capped Petrels were known to breed only on Raoul Island (Kermadec Islands), where their numbers were rapidly decreasing. Within the last few years their numbers on Raoul Island declined to a stage at which the race was considered to be on the verge of extinction. Quite recently, however, a hitherto unknown and thriving breeding colony was discovered on Macauley Island, one of the more southerly islands of the Kermadec Group. Although Black-capped Petrels may be observed fairly regularly at sea in the vicinity of the Kermadec Islands, no specimen of this race has ever been found storm-wrecked in New Zealand before.

## 3. SUBANTARCTIC LITTLE SHEARWATER *Puffinus assimilis elegans*

On 7/6/70, a Subantarctic Little Shearwater was found killed on Campbell Islands, after hitting a building during the preceding night. Late during the same year the specimen was forwarded to the Dominion Museum, where it was prepared into a study skin (DM-15797).

The measurements of the specimen, an adult male (by dissection) are the following:

Bill:	24.6mm	Wing:	188.5mm
Tarsus:	42.4mm	Tail:	70.0mm
Toe:	48.0mm	Weight:	224.0gr.

The Subantarctic Little Shearwater, the largest of the three races of the species, breeding in the New Zealand region, is known to breed on the Chathams, Antipodes and Auckland Islands. Some specimens are known to have straggled to the South Island of New Zealand, but none has, as yet, been recorded from Campbell Island.

## SUSPECTED CASE OF BIRD POX IN A SMALL POPULATION OF NEW ZEALAND PIPITS

By P. J. QUINN, N.Z.E.D., Te Mahoe

The New Zealand Pipit *Anthus novaeseelandiae* is one of the most common native birds to be found on the flat pumice land at the base of the Matahina Hydro-Electric Dam at Te Mahoe. There is a resident population of between six and twelve birds.

On 27/12/69 a pipit which was feeding around the outside of the station was noticed to have tumours about 6 m.m. in diameter on both sides of the loreal region of the head, the colour of which was a yellow tan. The bird seemed to suffer some discomfort, scratching at that area and cocking its head. The bird remained in the area for several weeks during which time the tumours gradually changed to a greyish brown, with no visible effect on the general activities of the bird.

On 28/1/70 another bird was noticed with a tumour about 9 m.m. in diameter on the under side of the left tarsus. There were no other sightings until 23/2/70, when one bird was noticed to have a lame right leg with signs of a swelling at the lower end of the tibia. This bird was very excited and five days later was seen with a fledgling chick.

On 11/2/71 one bird was seen with a tumour on the top left outer toe and another tumour under the hind toe of the same foot. This bird was suffering a certain amount of discomfort, resting every few minutes.

On 18/3/71 another bird was seen with a tumour about 9 m.m. in diameter on the left loreal region. By 19/3/71 it had increased to 13 m.m. diameter. The bird being active and alert but seemed to have restricted vision. On 22/3/71 the tumour had shrunk to about 6 m.m. diameter and was hanging slack with the colour now a dark brown.

On 24/3/71 in a flock of 8 pipits, two had tumours, the bird mentioned above and another with a very large tumour over 13 m.m. in diameter protruding from the left lores.

On 24/4/71 a scruffy, thin, but active bird was seen with a tumour at the base of the left middle toe. No feathers on the left side of the head and neck; the colour of the tumour was a blacky brown; this bird appeared to be blind in the left eye, and was slightly disturbed and feinted to the left, but flew strongly when flushed. This could be the bird mentioned on 18/3/71. Also in company with the above bird was one with a tumour on the left oral region 9 m.m. in diameter, dark in colour and with the feathers falling out in this area. There was another tumour on the outer side of the left tarsus, this bird was active but holding the affected leg up against the body.

Not being conversant with diseases in birds, I contacted Mr. R. Weston, of Kawerau, who thought there was a strong possibility that this was bird pox. He referred me to a paper by K. Westerskov and this seems to confirm the fact that it could be bird pox.

### REFERENCE

WESTERSKOV, KAJ, 1953: Bird Pox in a New Zealand Pipit. *Notornis* 5 (5).

## SHORT NOTES

### SUB-FOSSIL AVIAN REMAINS FROM THE AWAKINO-MAHOENUI AREA

In *Notornis*, 1967, 14 (3): 158-160 I published a note dealing with recoveries of sub-fossil avian remains from caves in the Taumata-maire district. In the note referred to only 12 positively identified species and sub-species were dealt with. Since that time a very considerable amount of additional and most interesting material has been recovered.

It is intended in due course to write a comprehensive account dealing with such sub-fossil avian recoveries but in the meantime it seems desirable to place on record a list of the 41 positively identified species and sub-species so far recovered.

Once again I am grateful to Mr. R. J. Scarlett for identifying the bones recovered, nearly all of which have been deposited in the Canterbury Museum.

#### LIST OF SPECIES AND SUB-SPECIES RECOVERED

North Island Kiwi *Apteryx australis mantelli*  
 Little Spotted Kiwi *Apteryx oweni*  
 Cook's Petrel *Pterodroma cooki cooki*  
 Black Petrel *Procellaria parkinsoni*  
 Blue Duck *Hymenolaimus malacorhynchos*  
 New Zealand Scaup *Aythya novaeseelandiae*  
 North Island Weka *Gallirallus australis greyi*  
 North Island Notornis *Notornis mantelli mantelli*  
 New Zealand Pigeon *Hemiphaga novaeseelandiae novaeseelandiae*  
 Kakapo *Strigops habroptilus*  
 North Island Kaka *Nestor meridionalis septentrionalis*  
 Red-crowned Parakeet *Cyanoramphus novaezealandiae novaezealandiae*  
 Yellow-crowned Parakeet *Cyanoramphus auriceps auriceps*  
 Morepork *Ninox novaeseelandiae novaeseelandiae*  
 Whitehead *Mohoua albicilla*  
 North Island Robin *Petroica australis longipes*  
 Bellbird *Anthornis melanura melanura*  
 Tui *Prosthemadera novaeseelandiae novaeseelandiae*  
 North Island Saddleback *Philesturnus carunculatus rufusater*  
 Huia *Heteralocha acutirostris*  
 North Island Kokako *Callaeas cinerea wilsoni*  
 North Island Thrush *Turnagra capensis tanagra*

#### MOAS

*Anomalopteryx didiformis*  
*Anomalopteryx oweni*  
*Pachyornis elephantopus*  
*Pachyornis mappini*  
*Pachyornis septentrionalis*  
*Euryapteryx curtus*  
*Euryapteryx geranoides*  
*Euryapteryx exilis*  
*Dinornis novaezealandiae*  
*Dinornis giganteus*  
*Dinornis struthoides*  
*Dinornis gazella*

## OTHER EXTINCT SPECIES

North Island Goose *Cnemiornis septentrionalis*  
 Finsch's Duck *Eurynas finschi*  
 Cave Rail *Capellirallus karamu*  
 Little Extinct Woodhen *Gallirallus minor*  
 Lesser Aptornis *Aptornis otidiformis*  
 Owllet-Nightjar *Megaegotheles novaezealandiae*  
 Snipe *Coenocorypha aucklandica medwayi*

— D. G. MEDWAY

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## THE COPULATION OF KAKAS

Saturday 24/10/70 in Sudden Stream was windy and cold. I was at the edge of a belt of north-west rain, actually in sunshine with frequent sunshowers, often of sleet. On a northerly face at the corner where the stream turns into its gorge, in one of the uppermost red beech, *Nothofagus fusca*, trees along the line with mountain beech *N. cliffortioides* the Kakas *Nestor meridionalis* have their nest. While watching other birds last year I became aware of the Kakas nearby, but it was not until 25/7/70 I searched and found their nest. I think they selected the nest but probably did not lay in it during 1969.

24/10/70 at 11.00 hours a few minutes after taking position to watch my other nest, I heard a Kaka return to its nest. Five minutes later I had covered the two hundred yards to the Kaka nest but they had gone. There was fresh biting inside the mouth of the nest-hole. I returned to my other nest. At 11.55 three Kakas were about, each separated by 100 yards and with one by the nest, all judged by sound. At 12.40 a Kaka by the nest called "kwoy" several times. At 13.05 the cock Kaka came flying back, calling as it crossed the valley, to be greeted by the hen "kwoy" as she rose from by the nest. They settled on a tree 25 yards uphill and 100 feet above me, 50 foot up the tree at the base of the forest canopy. I took no notice of them. They continued calling and 13.10 I decided to look at them. The cock was mounted on the hen. To improve my view I gradually moved around their tree so I was on the uphill side and level with them. They were facing out across the valley, so now I was behind them. The hen's tail was partly fanned. Her head was low and snaked well forward. Often it seemed she had been following my movements with her head twisted sideways. Sometimes she called "kwoy." She seemed wan and patient. The cock was mounted a little to the left, and was vigorously flapping his wings. His left wing especially curled well around her. With the flaps he was yawing his body across her backbone and his head usually high was working with his exertions. The exertions were transmitted, rather attenuated, through her body to the branch. At 13.19 after at least 10 minutes of this vigorous activity he dismounted and stood alongside her, quietly for 5 minutes. He called "key" quietly through his nose, pushed her with the side of his body three foot along the branch and soon another foot.

Then he dropped off the branch and flew 50 yards to another perch. The hen stretched, preened and looked at me. At 13.32 the cock glided back to the branch below, quickly climbed three feet on to her branch six inches away from her. He called "key-key-key"

and pushed her along. He jumped back three feet. A minute later she walked back alongside him. At 13.40 he was facing me and she was facing away, but both were watching me. He jumped around, called "key-key" and pushed her. She turned and pushed back with her head down pushing with the top of her beak under his slightly spread wing against his flank. He mounted and after a few weak flaps dismounted within 15 seconds. 15 seconds later he was mounted again, flapping vigorously. Sometimes her head would snake upwards (the twist sideways would help her watch him) and his head down as if he were trying to grasp her beak and feed her. In half a minute he was off, standing a foot from her. She had a big stretch. At 13.45 he "key-key-ed" alongside her and flew 50 yards to the same perch as before. She immediately followed. I went after them but could not find them. At 14.20 a Kaka called across a gully 300 yards away.

— J. R. JACKSON

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#### A MIXED GATHERING OF SEABIRDS IN THE TASMAN SEA

On 14/3/71, M.V. Karepo, whilst on a voyage from Tauranga to Melbourne, crossed an intrusion of warmer water in the central Tasman Sea. The following sea temperatures and positions are relevant:—

0800	36.38	South	159.38	East	Wind SE 15	Knots	Air 71°	Sea 72°
1000	36.43	South	159.12	East	Wind SE 09	Knots	Air 72°	Sea 75°
1200	36.48	South	158.43	East	Wind SE 09	Knots	Air 72°	Sea 75°
1400	36.55	South	158.18	East	Wind NE 09	Knots	Air 75°	Sea 72°

The position recorded for 1200 hrs. is some 317 miles south of Lord Howe Island and 800 miles west of the Auckland Isthmus.

The numbers of birds in sight increased rapidly from 0830 and remained at peak throughout the morning, decreasing just as rapidly after 1230. There were very few birds about for the rest of the day.

The following species were seen:—

Wandering Albatross *Diomedea exulans*. Very few about, especially considering that this was found to be one of the best areas when I was keeping records for J. D. Gibson. There were four present at 0800 after which no more were seen until 1200 when three were recorded. No young (brown-backed) or old (white-winged) birds were seen. All birds recorded were either showing or just past the stage of showing the white roundel on a dark wing (v. Gibson, *Notornis* 14: 56).

Grey-faced Petrel *Pterodroma macroptera*. Rafts of 11, 8, 4 and 3 were put up on being approached by the ship, and others were in sight throughout the morning. Not fewer than 150 birds were seen. However, some of these were probably counted twice if they stayed with the ship any length of time.

About 10% of these birds seemed to have very light underwings, much lighter in colour than the rest of the birds seen. That they were *macroptera* cannot be doubted, as their grey faces and relatively short bills were seen well. I have never seen such light underwings on or about the breeding islands of New Zealand.

Black-winged Petrel *Pterodroma nigripennis*. The most common bird seen, there were at least 250 recorded during the period. As

is usual very few were seen on their own. They were mostly in twos or threes. There was none of the high acrobatic flight one associates with these petrels, and very little chasing and calling. From the number of times they were seen to land on the surface, feeding must have been the main concern.

One is tempted to think that this is the feeding ground of the Three Kings Blackwings as it would explain why they are rarely seen about the New Zealand coast and only in small numbers to the north of the Three Kings.

*Pterodroma ? leucoptera.* Amongst the Black-winged Petrels there were noticed birds with a lighter coloured upper surface, being lighter grey than the brownish-grey of the Blackwings. There was an indistinct darker pattern resembling an M across the wings and back. The underwing was white with a narrow dark margin and none of the black line across the axillaries as in the Blackwing. In size the birds appeared about the same. I took these twenty or so birds to be Gould's Petrels, or an allied subspecies.

*Pterodroma ? neglecta.* One bird which could have been of this species. In size between Blackwing and Grey-faced, of a rich chocolate colour all over except for lighter patches on the underwing between the elbows and the wingtip, and some light feathering about the front of the head. Had I been near the Kermadec Islands I should have had no hesitation in identifying the bird as a dark-phased Kermadec Petrel. But in this latitude ?

*Pterodroma ? rostrata.* Six birds seen — about the size of Black-winged, but appeared fatter or fluffier and not so energetic in their flight. The upper surfaces were dark brown, but definitely brown, not black. The head and neck were of the same colour but this changed abruptly to white at the upper belly, about in line with the fore-edge of the wing. The white continued onto the undertail coverts, but the tail feathers were dark brown as on the upper surfaces. The tail was fairly long and at times appeared round. The underwing was wholly dark, almost as dark as the upperwing surfaces. Field notes taken at the time of observation do not record any white on the chin. Since the birds were not seen very closely this white may or may not have been present.

I at first thought that these birds could have been Tahiti Petrels. However, it has been pointed out to me that *rostrata* is larger than Blackwinged and that without the chin being shown to be definitely dark, the possibility of the birds being *P. alba* cannot be ruled out. These birds, therefore, and the two mentioned below, must remain unidentified.

Two other birds with the same shape, size, and flight pattern were seen, but these birds had no visible white on them at all, being of the same brown colour overall.

Storm Petrel ? *Fregetta grallaria.* One storm petrel with very black head and neck, white underwing and belly and black back — not seen well enough to distinguish between White-bellied and Black-bellied.

Blue Noddy *Procelsterna albigitta.* Two birds seen at a distance of about 30 feet. After many years of seeing these noddies in the Pacific Islands, I had no hesitation in identifying these two birds, though I must admit to being mystified at finding them here. Blue Noddies are usually seen close to land.

Gannet *Sula serrator*. One lifted off the water on being approached. It was a young bird, very brown on the upper surface. It circled the ship once and then flew off strongly on a course of about 260°, i.e. towards south-eastern Australia.

During the return passage to N.Z. "Karepo" crossed the above longitude at latitude 40° South on 30/3/71. The sea temperature remained constant throughout the day at 67° F. and very few birds were seen. I should like to thank Mr. R. B. Sibson, Mr. F. C. Kinsky and Dr. W. R. P. Bourne for reading this note and commenting upon some of the identifications made originally.

— JOHN JENKINS



## LETTER

Sir,

### *Pacific sight-records of Great Shearwaters*

I apologise for reverting to an increasingly stale issue, but I have only just noticed that Captain John Jenkins has repeated his claim to have recorded the Great Shearwater *Puffinus gravis* in the south-west Pacific. It may therefore be useful to state why these records would not be considered acceptable in the North Atlantic where they would be considerably less unusual. If the bird was as rare in North America as it is in New Zealand, the record would not be accepted there until a specimen had been collected. It might be accepted on the strength of a sight record in Europe, or at least in Britain and Ireland, if all details agreed with the species claimed and there was little possibility of any confusion with any other species; but the original description published by Captain Jenkins does not agree with that of the Great Shearwater in all respects. The tail of a Great Shearwater is not long for a member of that group, only averaging about 117 mm. in fact; and it is brown below, not whitish as reported by Captain Jenkins. The white band across the rump above certainly varies in conspicuousness, but it is exceptional for it to be absent, and it certainly would not be expected in several birds, the only ones seen in a new area; discussion at this end of the world usually concentrates on the fact that Cory's Shearwater *Calonectris diomedea* may also have white on the rump, rather than that the Great Shearwater may have it dark. The Great Shearwater also has a more or less dark underwing, not a white one with a narrow dark line fore and aft as reported by Captain Jenkins, and while the dark patch on the belly of the Great Shearwater is remarkably seldom noticed, it is surprising that Captain Jenkins did not notice this distinctive feature if he was able to see the colour of the under tail and under wing coverts.

Personally, I am surprised that the Great Shearwater does not appear to have been recorded yet in Australasia, especially when other rather less likely species such as Cory's Shearwater and the Manx Shearwater *Puffinus p. puffinus* have occurred there; and I agree completely with Captain Jenkins that it might turn up on a beach there some day; but its occurrence there does not seem fully proven yet.

Zoology Dept.,  
Tillydrone Av.,  
Aberdeen, Scotland.

— W. R. P. BOURNE



**NOTICES**

## CONFERENCE AT MASSEY

The 12th New Zealand Science Congress will be held at Massey University, Palmerston North from January 31-February 4, 1972. The Congress is being organised around the theme "The Cost of Growth," considered a very relevant topic for New Zealand scientists to discuss at the present time.

To encourage participation of the non-scientist two evening Public Symposia will be held in Palmerston North City, to hear papers and discussion on "The Cost of Growth" and "The Cost of Stagnation." The papers to be presented during the daytime sessions will be grouped under the following headings within the theme: (a) the growth and development of science in New Zealand; (b) growth and use of natural resources, and (c) growth and its impact on society.

Further information from: Dr. T. J. Brown, Secretary — 12th N.Z. Science Congress, C/o Public Relations Office, Massey University, Palmerston North.

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## REQUEST FOR INFORMATION ABOUT SADDLEBACKS

As part of a long-term co-operative project to re-establish Saddlebacks in some places on the mainland, I am preparing a map showing the former distribution of Saddlebacks in New Zealand. I would be grateful to receive any records of localities where Saddlebacks formerly occurred or to receive information concerning rare books, old diaries, manuscripts, etc., that may contain references to Saddlebacks. It is hoped to have this part of the project completed during the next three months.

— I. A. E. ATKINSON

C/o Soil Bureau,  
D.S.I.R.,  
Private Bag, Lower Hutt.

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## NEST RECORDS FOR ROBINS AND TOMTITS

I am initiating studies of mainland and island populations of Robins and Tomtits. Detailed and complete records of the nesting of these species are lacking. I would be most grateful to members who could obtain records, paying particular attention to date and size of clutches, length of incubation and nestling stages, and numbers of birds hatching and fledging. *Notornis* nest record cards provide a good form to follow. Additional information that would be useful would include notes on the abundance of robins and tits in the habitat where the nest is found, and a description of the habitat (especially height and density of canopy and nature of ground cover, including litter). Records should be sent to Dr. J. A. Douglas Flack, Wildlife Branch, Dept. of Internal Affairs, Private Bag, Wellington. After processing all records will be deposited permanently with the *Notornis* Nest Record Scheme.

## REGIONAL REPRESENTATIVES

- FAR NORTH & NORTHLAND: A. T. Edgar, Inlet Road, Kerikeri  
 AUCKLAND: Mrs. S. Reed, 4 Mamaku Street, Auckland 5  
 SOUTH AUCKLAND: H. R. McKenzie, P.O. Box 45, Clevedon  
 WAIKATO: D. W. Hadden, Waingaro Schoolhouse, Waingaro, R.D.1  
 Ngaruawahia  
 BAY OF PLENTY: R. M. Weston, 250 River Road, Kawerau  
 VOLCANIC PLATEAU: R. W. Jackson, 9 Kenrick Road, Rotorua  
 GISBORNE/WAIROA: A. Blackburn, 10 Score Road, Gisborne  
 TARANAKI: D. G. Medway, P.O. Box 476, New Plymouth  
 WANGANUI: R. W. Macdonald, 127 Ikitara Rd., Wanganui East  
 MANAWATU: Dr. I. G. Andrew, 6 Eaton Place, Palmerston North  
 HAWKES BAY: N. B. Mackenzie, Pakowhai, Napier, R.D. 3  
 WAIRARAPA: B. W. Boeson, P.O. Box 30, Carterton  
 WELLINGTON: R. Slack, 31 Wyndham Road, Pinehaven, Upper Hutt  
 NELSON: F. H. Boyce, 19 Marybank Road, R.D.1, Nelson  
 MARLBOROUGH: J. A. Cowie, P.O. Box 59, Kaikoura  
 CANTERBURY: J. R. Jackson, 103 Linwood Avenue, Christchurch  
 WEST COAST: Vacant  
 OTAGO: Mrs. J. B. Hamel, 42 Ann Street, Roslyn, Dunedin  
 SOUTHLAND: R. R. Sutton, P.O., Lorneville, Invercargill



## LITERATURE AVAILABLE

From all bookshops:

**A Field Guide to the Birds of New Zealand**, by R. A. Falla, R. B. Sibson and E. G. Turbott. 2nd Revised Edition, \$5.00.

From B. D. Heather, 10 Jocelyn Crescent, Uinehaven, Silverstream:

**A Biology of Birds**, by B. D. Heather. \$1.33 post free.

From B. A. Ellis, 44 Braithwaite Street, Wellington 5:

**Field Guide to the Waders**, by Condon and McGill. Price 75c.

The following are available on order from Mrs. H. R. McKenzie, Box 45, Clevedon:

**Back Numbers of Notornis** at 60c each (Vol. 18 \$1.00 each). Large orders for full or part sets at special prices.

**O.S.N.Z. Library Catalogue**, 70 pp., 50c.

**Birding Reports**, Nos. 8 to 14, 50c each. Nos. 1 to 7 are incorporated in early issues of 'Notornis.'

**Kermadecs Expedition, 1964**, by A. T. Edgar. Reprints at 45c.

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## **"THE BIRDS AROUND US"**

**by R. H. D. STIDOLPH**

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The above book will be published late October. It will have a foreword by Dr. Falla and will be illustrated by Nora Stidolph. It will contain 8 Photographs in black and white, 4 Water Colours and 7 Drawings. Size 9½ ins. x 7 ins. with 140 pages.

The Author, R. H. D. (Bob) Stidolph, was for forty years a member of the Royal Australasian Ornithologists' Union, is a Foundation Member of the Royal Forest & Bird Protection Society of N.Z. and of the Ornithological Society of N.Z., and for 10 years was Editor of the "Notornis," first known as "N.Z. Bird Notes." This book contains his observations of Bird Life in N.Z. over the fifty years from 1921 to 1971. The book will retail at \$5.50.

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