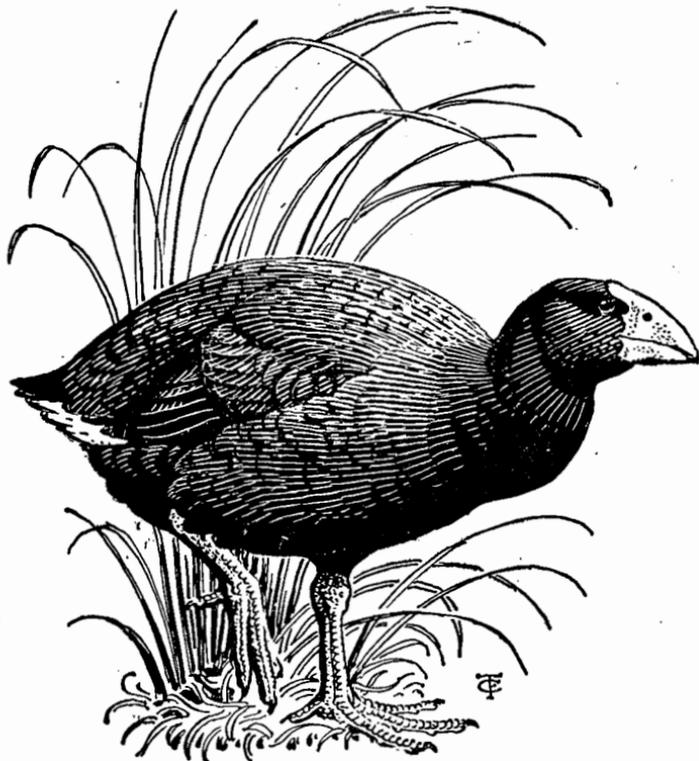


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NOTORNIS

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A PACIFIC BIRDS ISSUE

RECORDS OF WADERS IN THE COOK ISLANDS

By D. T. HOLYOAK

In their useful paper on the birds of Penrhyn and Suvarrow, northern Cook Islands, J. & A. Batham (1973) recorded "Asiatic Whimbrels *Numenius variegatus*" from both islands. Whimbrel (*N. phaeopus*, of which *variegatus* is usually regarded as a subspecies) have not, hitherto, been recorded in the Cook Islands or elsewhere in southeast Polynesia, where they are replaced by the Bristle-thighed Curlew (*Numenius tahitiensis*). The Bathams do not list the latter species, although it is common in the northern Cook Islands. However, they comment that the call of the 'Whimbrel' they saw approximated the local name of 'Keewee.' This strongly suggests that it was Bristle-thighed Curlew they saw, as that species has a 'keewee' call whereas Whimbrel give a series of six or seven quick whistles.

These authors also list Bar-tailed Godwit (*Limosa lapponica*) for Suvarrow. This species has not been definitely recorded from the Cook Islands, although it has been found in small numbers in American Samoa (Stickney 1943) and the Phoenix Islands (Clapp & Sibley 1967). Substantiation of their report, therefore, seems desirable.

During a visit to the Cook Islands from July to September 1973 the following wader species were identified:

Lesser Golden Plover, *Pluvialis dominica*

Recorded on Rakahanga, Manihiki, Pukapuka, Nassau, Suvarrow, Aitutaki, Manuae, Takutea, Atiu, Mitiaro, Mauke, Rarotonga and Mangaia; the Bathams record it on Penrhyn, and Burland (1964) recorded it on Palmerston. This is one of the commonest shorebirds of the region, second in abundance only to the Wandering Tattler (*Heteroscelus incanus*).

Grey Plover, *Pluvialis squatarola*

One seen on Manuae on 31 August 1973 is the first record for the Cook Islands. It was seen in company with Lesser Golden Plover, from which it differed in its larger size, grey upperparts with no

yellow markings, white rump patch and white stripe at tip of wing, and black axillaries. This species has been recorded a few times in the Line Islands (Clapp & Sibley 1967), but has not yet been found in French Polynesia.

Sanderling, *Calidris alba*

Previously unrecorded in the Cook Islands. One was seen at Manihiki on 13 August 1973 and two on Manuae on 1 September 1973; all diagnostic features were noted.

Bristle-thighed Curlew, *Numenius tahitiensis*

Recorded from Rakahanga, Manuae, Takutea, Mitiaro, Mauke and Rarotonga; local people told me that it occurs on Penrhyn, Manihiki and Atiu; 29 were collected on Suwarrow in 1923 (Stickney 1943) and it was seen there in 1972 (R. Desforges, pers. comm.); Burland (1964) saw it on Palmerston, and it, presumably, also occurs on Nassau, Aitutaki and Mangaia, although there are no records as yet. Usually occurs in small groups, but several hundred were seen on Takutea on 3 September 1973.

Wandering Tattler, *Heteroscelus incanus*

Recorded on Rakahanga, Manihiki, Pukapuka, Nassau, Suwarrow, Manuae, Takutea, Atiu, Mitiaro, Mauke, Rarotonga and Mangaia; Burland (1964) recorded it on Palmerston and local people reported it on Penrhyn; presumably it also occurs on Aitutaki, although there are no records. This species is generally the commonest wader in southeast Polynesia; the Bathams presumably overlooked it.

Turnstone, *Arenaria interpres*

Recorded from Penrhyn and Suwarrow by the Bathams in 1968; R. Desforges (pers. comm.) saw several on Suwarrow in October 1972; my own records are of one at Manihiki, at least eight at Manuae and one on Mitiaro.

A few other species of wader have been recorded elsewhere in southeast Polynesia and will probably be found in the Cook Islands eventually. These are Semipalmated Plover, *Charadrius semipalmatus* (one collected in Phoenix Islands, Clapp 1968), Pectoral Sandpiper, *Calidris melanotos* (small numbers collected in Phoenix Islands, Clapp 1968; one collected on Scilly, Society Islands, Thibault 1974; recently collected on Rapa, Austral Isles, J.-C. Thibault, pers. comm.), Sharp-tailed Sandpiper, *Calidris acuminata* (small numbers collected in Phoenix and Line Islands, Clapp & Sibley 1967, Clapp 1968), Buff-breasted Sandpiper, *Tryngites subruficollis* (recently collected on Rapa, Austral Isles, J.-C. Thibault, pers. comm.) and Common or Spotted Sandpiper, *Actitis hypoleucos* or *A. macularia* (one seen in Phoenix Islands, Clapp 1968). Grey Phalarope, *Phalaropus fulicarius*, have been seen at sea in the Line Islands (King 1967) and might occur further south.

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NOTES & NEWS

CORRECTION

In the September *Notornis* review of Harper and Kinsky's *New Zealand Albatrosses and Petrels* it was stated that although the dark undertail of the Grey Petrel was shown in their sketch it was not referred to in their text. This is incorrect. On the contrary, the authors clearly emphasise on page 35 the value of the dark undertail coverts in identifying this bird in flight. This *lapsus calami* on the part of the reviewer is much regretted.

J. W.

REQUEST FOR INFORMATION

At Kaikoura during the 1975-76 breeding season approximately 500 breeding pairs of Red-billed Gulls have been individually colour-marked. Would members of the Ornithological Society who sight these colour-marked gulls please send the combination, date and locality to:—

J. A. Mills,
 Wildlife Service,
 Department of Internal Affairs,
 Wellington.

If any member is willing to search regularly for colour-marked gulls in their locality would they make contact at the address given for further particulars.

An example of how the band should be read:—

<i>Gull Left Leg</i>	<i>Gull Right Leg</i>
Green over yellow	White
over Aluminium	

BIRD NOTES FROM THE KINGDOM OF TONGA

By ANDRE DHONDT

UNDP/FAO Project for research on the control of the coconut palm
Rhinoceros Beetle, P.O. Box 597, Apia, Western Samoa

INTRODUCTION

In March and again in April 1974 I visited Tonga for about one week, the first visit was limited to Tongatapu, but the second also brought me to Vava'u.

Since so little seems to be published on the birds of Tonga, it seems worthwhile to record even these very incomplete and accidental notes.

As far as the non-marine birds go Mayr (1945) mentions 20 breeding species of which only one is endemic (*Pachycephala melanops*).

Since Mayr wrote this book two species have become established: the Red-vented Bulbul (*Pycnonotus cafer*) and the European Starling (*Sturnus vulgaris*). The bulbul occurs both in Fiji and in Samoa and the subspecies there is *bengalensis* L. (Mercer 1966). I did not observe any difference between the birds in Tonga and those in Samoa so I presume the subspecies must be the same.

The European Starling is recorded by Mercer (1967) as occurring on some islands of the Fiji group.

To the list of non-marine birds 6 migratory species must be added (5 waders and the Long-tailed Cuckoo) and Mayr mentions that *Hirundo tahitica* was recorded once.

During my short visits in Tonga I observed 13 breeding and 5 migratory species, and further 8 species of sea birds.

LIST OF SPECIES

The observations are summarised per species.

Red-footed Booby, *Sula sula*

27/4/74: Vava'u — 1 adult and 2 juveniles of this species identified among about 10 boobies feeding over sea at Neiafu.

25/4/75: One unidentified booby at Nuku'alofa pier.

Great Frigate Bird, *Fregata minor*

27/4/74: An adult female over Nuku'alofa flying very low. A strong northerly wind was blowing.

Fairy Tern, *Gygis alba*

24/3/74: Abundant over sea along the southern coast of Tongatapu at the Blowholes.

28/3/74: One holding a fish flying overland at the radio-mast, probably breeding.

Sooty Tern, *Sterna fuscata*

27/4/74: Two close to the coast in Neiafu, Vava'u.

Black-naped Tern, *Sterna sumatrana*

25 & 27/4/74: 2 and 1 flying along the coast, Neiafu, Vava'u.

Crested Tern, *Thalasseus bergi*

Regularly seen in small numbers over lagoons and reefs in Tongatapu and Vava'u.

25/3/74: 2 fishing in shallow water at low tide in lagoon near Nuku'alofa.

25/4/74: 2 at the pier in Nuku'alofa — one in wing moult, one with a completely black crown.

25, 26, 27/4/74: Neiafu, Vava'u, 3 to 5 seen fishing over reef.

Brown Noddy, *Anous stolidus*

24/3/74: Large numbers fishing off the southern coast of Tongatapu with Fairy Terns at the Blowholes.

27/4/74: A flock of 20 fishing in quite rough water, Vava'u.

Black Noddy, *Anous tenuirostris*

27/4/74: 10 fishing much closer to the coast than the Brown Noddies picking up food among floating detritus, Vava'u.

Pacific Golden Plover, *Pluvialis dominica*

Common in March, only a few left at the end of April. On cliffs, on reefs, but mainly along beaches or on grass. On 27 March in a sample of 8, 4 had some black and 2 were completely in summer dress at Kanokupolu. On the airport on 23 April several dozens could be seen. On 27 April at high tide they were resting one by one along the narrow beach of Kanokupolu.

In April in Vava'u a few were seen on the mud flats and on 27 April about twenty were observed on a lawn in Neiafu.

American Wandering Tattler, *Heteroscelus incanus*

This species occurs mainly on mud flats and was quite common at the end of March in Tongatapu. On 25, 26 and 27 April in Vava'u several were noted near the Stowaway Motel.

Turnstone, *Arenaria interpres*

27/3/74: Along the high water line at high tide 12 were counted in Kanokupolu; 3 were in summer plumage.

25/3/74: One on the mud flats at Nuku'alofa.

Bar-tailed Godwit, *Limosa lapponica*

27/3/74: Kanokupolu, two in winter plumage feeding in shallow water.

26/4/74: On mud flats near Stowaway Motel, Vava'u, two were seen feeding; they were still in winter plumage.

Reef Heron, *Demigretta sacra*

The Reef Heron is common both on Tongatapu and on Vava'u. The number of birds seen in different colour phases in Tongatapu were: grey: 6 (40%), white: 7 (47%), mottled 2 (13%). Mayr stated — grey 65% and only 20% white phase birds,

Grey Duck, *Anas superciliosa*

One observation only of a duck flying along the lagoon behind Nuku'alofa on 28 March.

Banded Rail, *Rallus philippensis*

This species which is very abundant in Western Samoa was not often observed in Tonga. Along 16 km of road on 24 March only one was seen. On 25 March only two were observed during half a day's driving.

On 25 April three were watched while feeding among detritus on the beach and reef on Vava'u close to the Stowaway Motel. One was seen on 26 April in Vava'u amongst plantations.

Crimson-crowned Fruit Dove, *Ptilinopus porphyraceus*

A few observed on Tongatapu and on Vava'u.

Pacific Pigeon, *Ducula pacifica*

One seen while driving along the road towards Kanokupolu on 27 March.

Long-tailed Cuckoo, *Eudynamis taitensis*

One seen on 26 April flying across the road between plantations.

White-rumped Swiftlet, *Collocalia spodiopygia*

Common both on Tongatapu and Vava'u.

White-collared Kingfisher, *Halcyon chloris*

Mayr (1945) noted that the Tongan subspecies *sacra* Gmelin is very blue above. I made this same remark in my field notes. This species is quite abundant both in Tongatapu and in Vava'u and seems more common than *Halcyon recurvirostris* in Western Samoa. I even saw it in the garden of Beach House in Nuku'alofa.

On 24 March one was seen in wing and tail moult in Tongatapu. On 25 April one was fishing on the reef in Vava'u. Its tail was moulting.

Polynesian Triller, *Lalage maculosa*

This species is abundant in the villages of Tongatapu and Vava'u.

Red-vented Bulbul, *Pycnonotus cafer*

This species is not mentioned by Mayr (1945) as occurring in Tonga. Now it is abundant all over Tongatapu but was not seen in Vava'u.

On 23 March most birds seen close by were in full moult. They appear to moult at the same time as in Western Samoa from my own observations.

Wattled Honeyeater, *Foulehaio carunculata*

This species does not seem to be very common in Tongatapu as it is in Western Samoa.

Polynesian Starling, *Aplonis tabuensis*

Common both in Tongatapu and in Vava'u.

European Starling, *Sturnus vulgaris*

This introduced species was often seen feeding on lawns in Nuku'alofa and perching in all kinds of trees. On 28 March a group of several hundred was seen at the airport.

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—————

The Life of Birds by J. C. Welty, 2nd edition, reviewed in the last issue of *Notornis*, is readily available from: N. M. Peryer Ltd, P.O. Box 833, Christchurch; price \$16.65.

—————

BIBLIOGRAPHY OF THE PEREGRINE

The U.S. Fish and Wildlife Service is compiling a bibliography with abstracts of English language literature, both books and periodical, on the Peregrine Falcon (*Falco peregrinus*). Authors who wish to have their articles included in this work should send two reprints, copies, or abstracts to the senior author, Dr Richard D. Porter, I.F. & R.E.S. Shrub Lab, 735 North 500 East, Provo, Utah 84601, U.S.A.

Articles in which the Peregrine Falcon is mentioned but is not the main subject, and articles in foreign languages with English summaries are also wanted.

A FIJI PEREGRINE (*Falco peregrinus*) IN AN URBAN - MARINE ENVIRONMENT

By FERGUS CLUNIE

ABSTRACT

The daily routine and hunting methods of a female Peregrine (*Falco peregrinus*) resident in Suva, Viti Levu island, Fiji, are described, and her food examined. The falcon was capable of hunting in very poor light conditions, and specialised in birds weighing roughly 100 - 300 g., although larger and smaller prey were available. Food consisted mainly of pigeons, waders and sea-birds, unlike that of rainforest-dwelling Peregrines at a nearby eyrie, which fed on flying fox bats. The Suva falcon showed a tendency to kill birds which were unusual or uncommon on her hunting range, including two species of rail previously thought to be extinct or near extinct on Viti Levu.

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INTRODUCTION

Until recently the presence of the Peregrine as a breeding species in Fiji was doubted (Brown & Amadon 1968: 852). In 1971 it was proved that the Peregrine does nest in Fiji, and the diet of a pair at Joske's Thumb in southern Viti Levu, which fed largely on the flying fox or giant fruit bat (*Pteropus tonabus*) was described (Clunie 1972; 1973: 9-11). Peregrines have since been seen in several parts of Viti Levu, in central Vanua Levu, and on Ovalau, and I have learnt of their presence on Vatuvara island in the Lau Group (D. McCarthy, pers. comm.). It appears that the Peregrine is widespread in Fiji and not so rare as was thought. Fiji Peregrines are probably of the Melanesian race, *F. p. nesiotes* (see Brown & Amadon 1968: 852).

From February 1972 to time of writing in April 1975 a female Peregrine was present in Suva, and its hunting and food were studied. The results are presented here.

HABITAT

The Fiji Islands lie in the south-west Pacific, scattered across the 180° meridian between latitudes 15-22°S. Suva, the capital city (pop. 70,000) covers a peninsula projecting from the south coast of rugged and mountainous Viti Levu (10,429 km²), the largest island of the Fiji archipelago.

The waters of Suva Harbour to the west of the peninsula, and those of Laucala Bay to the east, are protected from the open sea by a barrier reef, broad tracts of which are exposed at low tide. From the west coast one looks across the harbour at ranges of low but rugged rainforest-clad mountains, which rise from the north shore of Suva Harbour, and include the Peregrine nesting cliffs at Joske's Thumb, 14 km to the northwest. Immediately north of the low hills of the peninsula, which rarely exceed 60 m above sea-level, the ground rises sharply to over 100 m to the suburbs of Samabula and Tamavua, while across Laucala Bay lie the broad mangrove swamps of the Rewa delta.

Almost all of Suva peninsula is built on, but the large trees and shrubs of suburban gardens give a rather well-wooded appearance to all but the central-western and north-western sections, the commercial and industrial hearts of the city.

Land reclamation has removed the foreshore along the northern half of Suva's west coast, but at low tide muddy sand flats, from 100 m to several hundreds metres wide, extend from the south and east coast, and from the north shore of the harbour. These support a large population of migratory shorebirds from early September to late April. Quite large numbers over-winter, and can be seen there throughout the year. These shorebirds are mainly the Golden Plover (*Pluvialis dominica*), Wandering Tattler (*Tringa incana*), Bar-tailed Godwit (*Limosa lapponica*) and Ruddy Turnstone (*Arenaria interpres*). The Reef Heron (*Egretta sacra*) is present along the waterfront and reef. Patches of mangroves occur on the southeast coast, larger concentrations clustering about creek mouths in the extreme northwest of the peninsula and in the east, with the Mangrove Heron (*Butorides striatus*) present. The common sea-bird of Suva Harbour is the Crested Tern (*Sterna bergii*), while occasionally the Red-footed Booby (*Sula sula*), Lesser Frigate Bird (*Fregata ariel*), Black-naped Tern (*Sterna sumatrana*) and Black Noddy (*Anous minutus*) straggle in, especially in stormy weather.

Ashore introduced birds predominate. The Feral Pigeon (*Columba livia*), Malay Spotted Dove (*Streptopelia chinensis*), Jungle Mynah (*Acridotheres fuscus*), Indian Mynah (*Acridotheres tristis*) and Red-vented Bulbul (*Pycnonotus cafer*) are present in thousands, with the Java Rice Sparrow (*Padda oryzivora*) and Strawberry Finch (*Estrilda amandava*) also numerous. A variety of native birds is present, most conspicuously the Fiji Goshawk (*Accipiter rufitorques*) which invades the city after its breeding season, the Swamp Harrier

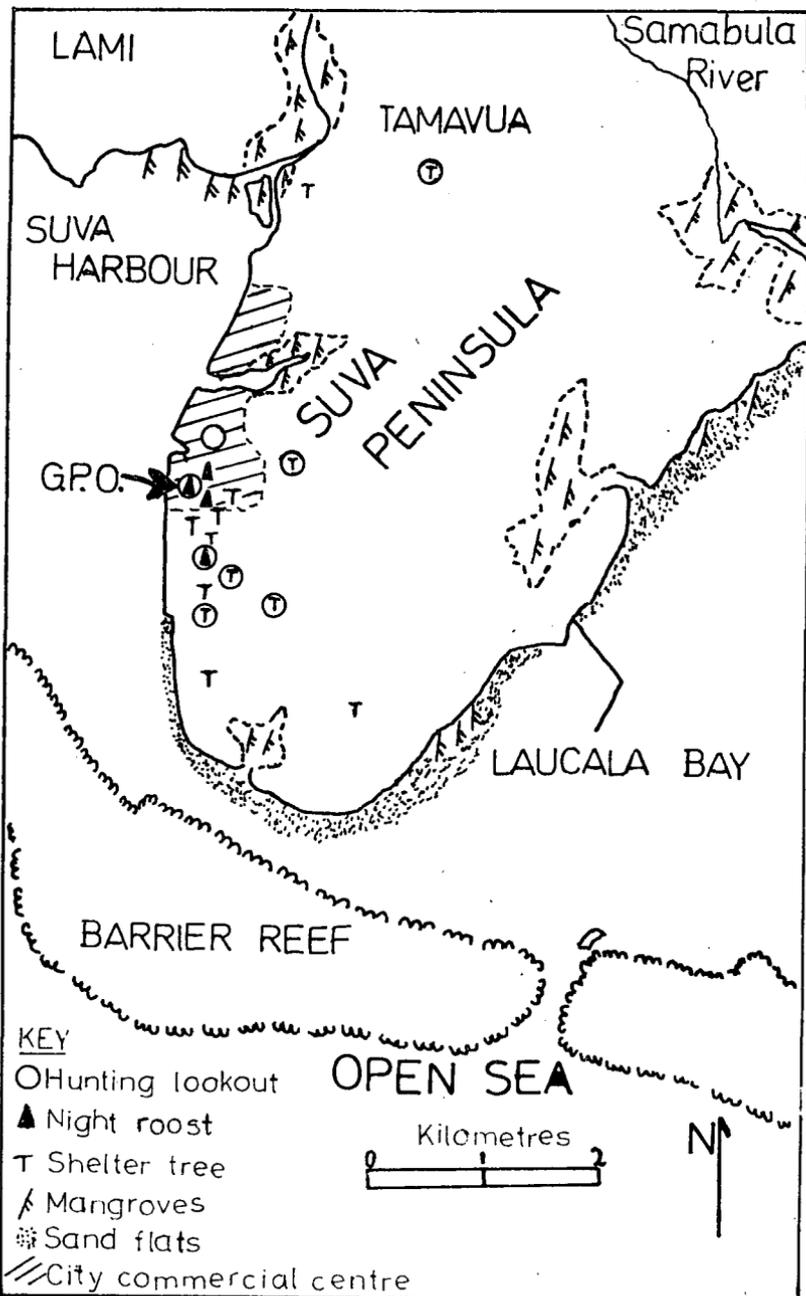


FIGURE 1 — Suva peninsula showing hunting lookouts, night roosts and shelter trees of the resident Peregrine.

(*Circus (aeruginosus) approximans*), Collared Lory (*Phigys solitarius*), Many-coloured Fruit Dove (*Ptilinopus perousii*), White-rumped Swiftlet (*Collocalia spodiopygia*), the Wattled and Orange-breasted Honeyeaters (*Foulehaio carunculata* & *Myzomela jugularis*), and the Red-headed Parrot Finch (*Erythrura cyanovirens*). Several other native bird species are either present in smaller numbers or restricted to a few localities.

The flying fox also commonly enters the city at dusk.

Suva's climate is very wet, with an average annual rainfall of about 3,000 mm.

OCCUPATION PERIOD

Early in February 1972 I received a report of two Peregrines from a Suva suburb, one of which ate a Feral Pigeon on top of a concrete lamp-post (M. G. MacKenzie, pers. comm.). On 16 February I saw the falcon, which became resident in the city perched in the dead top branches of a tall tree in the Suva Botanical Gardens, being mobbed by Wattled Honeyeaters and a mixed group of mynahs and bulbuls. There may have been another Peregrine in the area as the falcon called several times, something she never did when alone as future observations were to show.

The streaked plumage of the underparts and the very large size of the falcon established her as a yearling female early in the moult to the barred breast and belly of an adult, which she acquired over the next few months. She was recognised as the same bird throughout the study period by her established habits, roosts, lookouts and feeding posts.

This falcon stayed on the Suva peninsula throughout 1972 and through early 1973, disappearing at the end of June and only reappearing occasionally until late September, when she again took up residence until mid-May 1974 after which, apart from an occasional visit she was missing until early September when she became resident, still being present at time of writing (April 1975). The disappearances of 1973 and 1974 coincide with the known Peregrine nesting season for Fiji, which extends from at least as early as June to September (Clunie 1972: 311-313) and longer in cases of successful breeding. It is likely that the falcon left town for breeding cliffs on these occasions, although irregular appearances of several days duration, and her lone and early return, suggest she did not, in fact, nest.

DAILY ROUTINE

Shortly after arriving in Suva the falcon established a basic daily routine which was followed through the study period. She roosted overnight on high window ledges and fire-escapes, or on exposed church towers or tall radio-telephone masts, these last often being occupied even in very bad weather. In the early morning she usually hunted; resting in the heat of the day in the middle of tall shady trees and remaining quiet there until the late afternoon, although

she did sometimes hunt under the midday sun. She generally hunted again, or at least occupied a hunting lookout, through the late afternoon and evening, before returning to her night roost.

In dull weather she often remained quite openly on a prominent hunting lookout for most of the day, making no attempt to fly to more protected roosts, even in conditions of heavy rain. Indeed, she could generally be said to have sheltered more from the sun than rain.

The most regular night roosts seen were an exposed ledge near the top of the north tower of the Roman Catholic cathedral in the commercial heart of the city, and the radio-telephone mast on the roof of Suva's General Post Office (referred to henceforth as the GPO mast) only 200 m away. She usually roosted on the grid of the maintenance platform near the top of the GPO mast, the very tip of which was also her favourite hunting lookout. The ledge on the cathedral tower was so narrow that she had to face inwards when roosting there, as Peregrines roosting on narrow cliff ledges do elsewhere in the world (Herbert & Herbert 1965: 74). These two roosts, which were in the heart of her favourite hunting area, were often used alternately, one for several hours, then the other. She often slept there in the rain with sheltered window ledges available within 100 m.

A common daily routine was for the falcon to wake on the cathedral tower and fly direct to the top of the GPO mast in the early morning, hunt from there for a couple of hours, then return to shelter on the shady west side of the cathedral tower until the sun came overhead, when she flew into a tall African Tulip (*Spathodea campanulata*) tree 200m away to rest until late afternoon. Then she returned to the GPO mast and hunted from there until dark, finally roosting on the cathedral tower. She also commonly roosted overnight on a window ledge of the fifth floor of the Government Building, and on other large buildings in the city, usually occupying one particular roost for several consecutive nights. Daytime shading places were in African Tulip, Weeping Fig (*Ficus benjamina*), Breadfruit (*Atocarpus altilis*) and Rain Trees (*Samanea saman*), all of which provide good shade.

During the long periods of inactivity on day perches, she dozed fitfully; watched passing birds, paying particular attention to Feral Pigeons (her favourite food), and to Reef Herons (which she never attacked); and scratched, stretched and preened frequently. Between heavy showers of rain she spread her wings and fanned her tail as if to dry them. One early morning, after a wet night, she definitely sunbathed on the GPO mast platform, standing facing the sun, bending her body forward parallel to the floor, her tail sticking out behind her, level with her back, and her wings opened out and drooping down. After several minutes she turned to face west, adopted the same stance, and exposed her back to the sun for 10 minutes or so.

VISITS BY MALE PEREGRINES

Several times in 1972 adult Peregrines, which from their much smaller size must have been males, were seen in company with the resident female, who had just assumed adult plumage, and did not leave the city that nesting season.

On 16 July 1972 a male perched quietly with the female on top of the GPO mast (M. M. Brown, pers. comm.), and I saw a male perched alone there on 3 August. A pair were also there in early October (A. Blackburn, pers. comm.). These sightings all fall roughly within the nesting season.

From 21 to 25 November 1972 a male was present in the city and associated with the resident female on the first two days, before being attacked by her. I became aware of him in the late afternoon of 21 November when I heard the female repeatedly give a high-pitched and repeated "ee-chip ee-chip ee-chip" call, similar or identical to calls made by nesting birds and sounding like the creaking of a rusty and heavily loaded metal pulley. She flew from the GPO mast with a fluttering flight quite unlike the normal strong Peregrine flight, and hovered low over the top floor scaffolding of the partially completed YWCA building about 150 m away, where a male peregrine was perched, then fluttered back to circle the GPO mast and returned to land on the penthouse roof of the YWCA building, directly above the male, locking down at him and giving the "ee-chip" call for several seconds. The male ignored her and a few minutes later flew to a window ledge on a building only 50 m away, sending incubating Feral Pigeons out in panic, while the female called after him. Here he ate pigeons' eggs from at least two nests. Minutes later the female flew past him with the curious fluttering flight, dangling her legs as she passed his ledge, then flew on again, circled the GPO mast, and returned to perch on the YWCA scaffolding, giving a series of strident "ee-chip" calls. I have seen a female falcon at Joske's Thumb entice her mate from a feeding ledge and into the nearby eyrie by this very movement, although in that case she dangled a kill which she bit at twice, and not just her empty feet.

A minute later the female again fluttered past him and landed on the GPO mast platform, where she gave loud "ee-chip" calls for several seconds, before falling silent. Both birds roosted quietly in these positions until dark.

It seems probable that the female was trying to attract the male to her favourite roost, hunting lookout and feeding platform. She may possibly, however, have been attempting to lure him into the open where he could more easily be attacked.

Early next morning both birds were high on the same scaffolding as before, the male perched fluffed up with a full crop, while the female was perched, very nervous, on the scaffolding 5 m above and 2 m to his right. She showed intense interest in him, leaning forward and gazing down at him constantly, while he occasionally glanced up

at her. This went on for 20 minutes, when the female gave several "ee-chip" calls but was ignored by the male. She grew progressively more agitated over the next half hour, shuffling about and making head-bobbing movements. Suddenly she walked along the scaffolding until directly above him and without warning dived and struck him hard in the back with her feet, knocking him off the scaffolding. After falling about 3 m he regained control and with a high-pitched scream fled at speed, while the female flung up 10 m above him and stooped, kicking out at his back as he dodged violently aside, screaming as if in terror. She flung up and stooped again, and he turned over in flight and seized her slashing feet in his own, screaming. Once more she flung up and stooped, the male rolling over screaming and lashing at her with his feet as she struck at him. She rose and dived, and he dodged aside with a scream, then landed on the penthouse of a building some 400 m from his starting point. She came at him in a shallow stoop from 100 m, hitting him in the back and sending him tumbling down the roof, dashed on, turned, and came in again very fast, striking him in the back as he regained the roof top, rolling him down the pitch of the roof. She then broke off the fight and flew direct to her roost on the Roman Catholic cathedral, to perch facing the wall. A few minutes later the male emerged, perched huddled up on the balcony surrounding the roof down which he had tumbled. The female did not even look over her shoulder at him from her perch 500 m away.

Despite this vicious attack the male hunted Feral Pigeons in the area on 24 November, feeding on one on a window ledge only 150 m from the GPO mast, and was photographed next day roosting on the scaffolding from which he had been knocked.

The only other sighting of a male Peregrine in Suva was on 7 December 1972, when a male and female were seen on the GPO mast, one on the very top and the other on the platform (M. M. Brown, pers. comm.).

INTERACTIONS WITH OTHER RAPTORS

The Suva falcon was seen to clash with both the Fiji Goshawk and Swamp Harrier, the only other diurnal raptors in Fiji.

Fiji Goshawks often hunted the commercial area while the falcon was on her GPO mast lookout, although I only saw one approach closer than 150 m, and it was attacked. These hawks caused a far greater reaction among the mynahs, bulbuls and even the Feral Pigeons than ever the Peregrine did. The falcon generally appeared to ignore the hawks, but she did once attack a Fiji Goshawk as it rose from the roof of a building only 150 m from the GPO mast. The falcon, in direct pursuit of Feral Pigeons, suddenly dived at the goshawk, stooping at it as it dived into the streets below, narrowly missing it. The hawk fled only a metre or two above the road, and the falcon did not pursue. This attack was made without sound or warning and was perhaps a hunting rather than a territorial clash, the falcon

stooping at the hawk as it rose vulnerably off the building in front of her, possibly even mistaking it for a pigeon.

On another occasion the falcon and an immature Fiji Goshawk appeared to deliberately avoid each other. The hawk flew straight for the tree in which the falcon was resting. As it approached, the falcon rose from the tree and flew northeast to another tree several hundred metres away, while the hawk immediately altered course to the southwest.

The territorial attachment of urban Peregrines to certain buildings in New York has already been pointed out by the Herberts (1965: 66) and two direct territorial clashes between the Suva falcon and other raptors in defense of the GPO mast were seen. In one of these an immature Fiji Goshawk chased a flock of Feral Pigeons to within 100 m of the GPO mast, and was herself attacked by the falcon, which had retired to its night roost on the Roman Catholic cathedral. The falcon flew straight at the hawk and struck at it with her right foot as she passed over its back, the hawk dodging the blow successfully. The falcon swung round in a wide arc and came at the hawk again, striking at it with one foot as it passed over its back, the goshawk dodging the blow and turning and flying rapidly back the way it had come as the falcon swung round to renew the attack. She did not pursue the hawk but instead chased some pigeons swirling about in the vicinity, making two unsuccessful attacks then returning to her cathedral roost. The duel was carried out in silence and the falcon flew more slowly and with more apparent caution while attacking the goshawk than she did when hunting prey, and generally seemed reluctant to press the attack seriously.

In the second territorial clash two Swamp Harriers flew low over the city, one straying within 100 m of the GPO mast, on which the falcon was perched. As it approached she spread her wings and commenced the harsh "airk airk airk airk airk" battle cry used when defending eyries against intruders. The harrier flew steadily on and the falcon flew slowly out at it, following it for about 100 m as it passed. The angle of the harrier's approach brought it no closer than 80 m from the GPO mast. The falcon did not return to the mast but flew to an African Tulip tree several hundred metres away, and perched there for 15 minutes before resuming her hunting.

HUNTING METHODS AND PREY

The entire Suva peninsula and Suva Harbour were hunted over by the Peregrine, while prey remains suggest hunting was often carried out to sea. The area most hunted over for Feral Pigeons was the commercial heart and market area of the city, most hunting flights being launched from the GPO mast.

The falcon's basic hunting method was to perch on a prominent lookout and from there make flights against flocks of birds. If the first attack of a hunting flight failed, she often made several more

on other targets before returning to her lookout to rest. Should a series of hunting flights from the one lookout fail, as was commonly the case, she abandoned it and flew to another more than a kilometre away, to hunt a fresh area from there. Alternatively, she rose to great height and circled widely as if prospecting for new and less alert prey. After a series of fruitless hunts over the fresh area, she returned to her original lookout, first making a low level surprise attack before perching and launching another series of hunting flights from there. Such surprise approaches were made well below roof or tree top level, and in the commercial area were usually made along Nabukalou Creek, which flows through the heart of the city. The falcon would follow the course of the creek, keeping just above the water, and when she reached its mouth suddenly turn off to attack the unsuspecting pigeons in the wharf and market area.

By far the most regular of the falcon's hunting lookouts was the GPO mast. She perched there on most mornings or evenings and often throughout dull days and overnight. The GPO mast commands a wide view of Suva's commercial heart and Suva Harbour and barrier reef. It is only 300 m from the wharf, market and bus stand area, whose population of Feral Pigeons runs into thousands. The falcon usually returned to the mast with her kills, plucking and eating them on the grid of the maintenance platform near the top of the mast, although she did sometimes feed on top of other buildings when hunting this area successfully. Kills which dropped from the mast platform to the GPO roof were retrieved by the falcon and eaten on the balcony surrounding it or on the roof of the lift penthouse. Several other hunting lookouts were also discovered on the tops of tall buildings or trees, particularly tall casuarina (*Casuarina equisetifolia*) trees. All these lookouts commanded a fine view of Suva and its harbour. The falcon did not necessarily favour the highest building top in an area as a hunting lookout; in fact she showed the same strong preference for her habitual lookout on the GPO mast even when new high-rise buildings rose up and dwarfed it in 1973-1974. Indeed, apart from commanding fine views, all of the hunting lookouts gave the falcon unobstructed vision in all directions. The falcon may have chosen these lookouts with a partially defensive motive, as she was seen being stoned by humans on several occasions, and may have learnt to choose lookouts without a blind side.

A favourite casuarina tree lookout 1.4 km from the GPO mast was definitely used as an alternative lookout to it, as was another 3 km away on Tamavua heights, the falcon regularly flying to them after a series of unsuccessful hunts from the GPO mast.

Most hunting took place in the early morning, from dawn until three hours after sunrise, or in the late afternoon and evening. The Peregrine rarely hunted in the heat of a sunny day, although she frequently hunted throughout the day in dull weather.

Several species of falcon are capable of hunting under poor light conditions late in the evening and the Peregrine is one of them.

Crepuscular bat hunting by Peregrines has been summarised recently by Porter & White (1975: 30); while Beebe (1960: 171) was convinced two Peregrines he saw late one evening over cliffs on a British Columbian island were waiting to hunt outgoing sea-birds. It was so dark that the falcons kept disappearing then re-appearing in flight but he thought they would attack the prey as it was silhouetted against the sea. In support of this he cited cases of crepuscular bat hunting, and stated that trained Peregrines were easily able to take a lure flung against the sky when it was far too dark to see it against the ground, and would even come in to lures illuminated by car headlights at night.

Careful observation of the Suva Peregrine confirms that this species is indeed capable of hunting under surprisingly dark conditions, and does so with a high success rate. In this its behaviour was reminiscent of that of Eleanora's Falcon (*Falco eleanorae*) which often hunts at dusk and dawn, surprising migratory birds over the sea (Brown & Amadon 1960: 820) in a similar manner.

She was seen to hunt successfully in the early dawn, with stars still in the sky and her underparts eerily lit up by the street lamps as she passed overhead. In the evenings hunting flights were made under even darker conditions, the falcon waiting until after sunset before hunting, often perching on the GPO mast for several hours beforehand, dozing and preening through the late afternoon and only hunting as the light faded from the day. This hunting under poor light conditions only became common after she had been in Suva for several months, but from then on became so prevalent that she would specialise in it for weeks on end.

Evening hunting was of short duration, the lack of a twilight period in the tropics leaving only a limited amount of time between sunset and dark. The falcon regularly launched successful hunting flights when it was so dark that I, with good night vision, could barely distinguish her with the naked eye from 100 m away, when she was perched in silhouette against the eastern sky. With the aid of 8 x 30 binoculars the fading light reflecting off the calm harbour waters made it possible, however, for me to clearly see flocks of waders passing low over the water, and the falcon could perhaps discern them as easily. It is thus probably significant that most of the late evening flights were over the harbour. The success rate of this crepuscular hunting appeared to be high, and it is likely that she achieved complete surprise at this time, when a predator would be unexpected and hard to see. Light conditions were so bad that I could see only the beginning and end of these flights, losing the falcon immediately after she passed over the shore street lamps. On several occasions I left her hunting under these conditions, further observation being impossible; only to return an hour before first light to find dew-covered but freshly plucked feathers with congealing blood on them beneath the GPO mast.

Sea-birds, shorebirds, and the light coloured male of the Many-coloured Fruit Dove (*Ptilinopus perousii*), which appears very pale in flight, were the commonest kills at early dawn or late evening. It is possible that the Collared Lory (*Phigys solitarius*) which can often be heard passing overhead up to two hours after dark, was also susceptible to predation at this time.

Hunting flights, whether crepuscular or in broad daylight, always began in a similar manner. The falcon, perched on her lookout, would watch birds very closely, occasionally bobbing her head slightly. Suddenly she would brace herself, very deliberately spread her wings to their full extent, hesitate a moment, then fly out at her target. Targets appeared to be selected with some care, the falcon often spreading her wings, hesitating, then folding them again, sometimes recovering her balance with difficulty.

Her commonest method of attack was to approach a flock of say pigeons at great speed and from slightly above, alternating a series of rapid wing strokes with a sudden surge of speed when she folded her wings against the body, followed by another rapid series of wing strokes, only to shoot forward when she again folded her wings. Such an attack flight would sometimes be made from more than a kilometre from the prey. Nearing the flock she would dive through it at a shallow angle, making rapid jinks and passes and slashing at the scattering birds. If unsuccessful she would approach another flock in the same manner, and attack again and again. She would attempt to seize a bird directly beneath her or fly alongside and roll over sideways, kicking out at its side with her foot. Another very common hunting method was to approach in the same manner until directly above a flock of pigeons, glide for a moment on out-stretched wings as if selecting a target, then suddenly fold her wings and stoop at an almost vertical angle down through the scattering birds, attacking one and following it almost to earth as it dived away. Such stoops were usually made only from 5 m to perhaps 15 m above a flock, the classic grand stoop of the Peregrine over longer distances only being seen on two occasions, and then from not more than 100 m above the target.

A quite common method of attack was to approach at a shallow angle with the usual rapid wing strokes alternating with a short surge of speed with folded wings, then dive beneath a flock and suddenly shoot up through it at great speed, slashing at her target as she passed over it. Direct pursuit of fleeing stragglers was also practised, the falcon easily overhauling them if they were not too far ahead, and kicking at their backs or rolling on her side and kicking at them. The manoeuvrability of the Feral Pigeons served them well here, and many hairbreadth escapes were seen. The falcon was also once seen attempting to take pigeons head on, making a fast horizontal approach straight into a group of them, closing at tremendous speed, the pigeons scattering at the last instant, and the falcon slashing vainly at one and dashing on. It was common for two or three varying attack

methods to be used in quick succession in a single hunting flight.

When attacking pigeons feeding in open fields or on the wharf the falcon dived down at great speed when 200 m or more away, then shot along less than $\frac{1}{2}$ m up, grass-clipping, forcing the birds to rise as she approached then swinging up through them and stooping straight down on one, only pulling out of her headlong dive when it seemed she must smash into the ground. In one of the few hunting flights seen over water at close range in good light she used similar tactics, skimming low over the waves, but the two shorebirds she was pursuing kept low and out-maneuvred her, she seeming reluctant to press the attack too recklessly when less than a metre above the sea.

Attacks were made with apparent recklessness over the city, the falcon pursuing pigeons up Suva's main streets at only 5 m up, twisting in and out between buildings and up side streets, or shooting along the wharf in direct pursuit of pigeons, only a metre up and paying scant regard to wharf workers and tractors, only to shoot through the rigging of a ship, turn, and make another attack run. Most attacks took place low down, rarely above 50 m and usually lower, although attacks on high flying pigeons and shorebirds were sometimes made at much greater altitudes. Attacks were pressed repeatedly at high speeds. After a series of vigorous pursuits the falcon returned slowly to her lookout, gliding up at it from slightly below, to perch bill agape and clearly panting, apparently winded. After a few minutes rest another hunting flight would be launched.

By far the greatest numbers of attacks seen were against Feral Pigeons, a favourite prey of the Peregrine through much of its range, falcons having followed them into many cities outside the breeding season (Hickey 1969: 9). In Suva, the alert nature and agility of the Feral Pigeon made it a difficult bird to kill, and although it was by far the commonest prey species in the Suva area, and the falcon devoted far more time to hunting it than any other species, it is only by a relatively slight margin the most common bird on the prey list. The kill rates against Feral Pigeons was low. Brown & Amadon (1968: 853) have noted that wild Peregrines often make 10-12 unsuccessful attacks for every successful one, and the Suva Peregrine, when hunting Feral Pigeons, certainly had a difficult time. In 74 definite hunting flights seen against this species I saw 130 actual pressed attacks. In the majority of these cases I only saw part of the flight, the falcon being hidden by buildings for much of each flight, and more attacks were surely pressed home. Of these 74 hunting flights, I did not see the end of 12, the falcon not returning to its original lookout, but of the remaining 62 flights only 6 resulted in successful kills. In 2 other cases pigeons were hit and dropped but not retrieved, the falcon in one instance flying about screaming with a fistful of pigeon flight feathers, examining them as she flew then casting them away. There was thus a success rate of about 1 in 10 hunting flights, and only about 1 kill to every 20 pressed attacks. Against other prey species, especially at dusk and dawn,

the falcon seemed to have greater success, but I do not have enough data to give a reliable judgement.

The three actual kills I saw were made on Feral Pigeons. Death was immediate in one case, when the falcon seized a pigeon at great speed just as it was rising up off a roof in alarm. Each of the other two times the falcon seized the pigeon in her feet, then bent forward in flight, swung her legs forward, and bit the wildly struggling bird in the neck or head, killing it instantly. Examination of the more complete prey specimens recovered suggests that the falcon almost invariably seized its prey live in this manner, then despatched it by biting through the neck, or more rarely, the skull. Uneaten prey I recovered had been bitten through the neck, the vertebrae being severed and massive internal bleeding having occurred, but they were otherwise unmarked apart from tiny skin punctures where the falcon had gripped them.

Only one flight, which is not listed among the hunting flights, appeared definitely to be in play, the falcon, with its crop still swollen, terrifying a passing pigeon but not pressing the attack close. She did, however, certainly kill when not immediately hungry, as she was several times seen to cache fresh kills untouched on the GPO platform, returning to feed on them later, sometimes not until next morning. Partially eaten kills of the previous day were also commonly eaten if hunting proved unsuccessful, and she sometimes ate from quite stale kills. A successful evening hunt did not necessarily preclude hunting in the morning, although it usually began later than usual, and if the falcon killed in the morning she would often hunt again in the late evening. This could perhaps account for kills being cached untouched on the platform overnight.

Beebe (1960: 172) reported that *F. p. pealei* often kills in excess of its needs, and records that 5 or more untouched kills are often found near eyries. The Suva Peregrine certainly killed in excess of her needs on at least three occasions, and like the Peale's Peregrines did not behead her prey. One morning she killed an adult and an immature Sooty Tern (*Sterna fuscata*), eating only the neck flesh of the adult; while on another morning she killed two Collared Petrels (*Pterodroma leucophaea brevipes*) and one Fan-tailed Cuckoo (*Cacomantis pyrrhophanus*), and only ate one of the petrels. The day before she had eaten only the neck and breast meat of an Audubon's Shearwater (*Puffinus lherminieri*). On the third occasion she killed two Sooty Terns and left them to rot on the GPO mast maintenance platform. It is perhaps not coincidental that the three instances mentioned above took place in mid-April 1972, early May 1973, and early April 1975, all of which are either in or very close to the onset of the known Peregrine breeding season in Fiji. On many other

occasions birds were only partially eaten and left to rot on the GPO mast platform or on the GPO roof.

The falcon fed on Feral Pigeon nestlings on at least two occasions at night roosts, while a male Peregrine ate pigeon eggs, as noted earlier. Peregrines have been recorded feeding on sea-bird nestlings elsewhere (e.g. Brown & Amadon 1968: 854). I did not see any real indication of systematic hunting of window ledges and other niches for pigeon chicks or eggs by Peregrines, although a Fiji Goshawk was once seen deliberately searching a building for them.

The remains of 425 birds of 19 species were collected and identified from falcon feeding posts, all but two coming from the GPO roof. As the falcon fed on the grille-work maintenance platform of the GPO mast, the dismembered heads, wings, legs, etc., fell through the grille to the flat roof of the building, from where they were collected periodically for identification. This roof was often littered with heads, wings, legs and partially devoured corpses, Jungle Mynahs sometimes gathering to feed on dermestid beetle larvae present in the rotting remains, while once a Malay Turtle Dove fed on rice and maize from the burst crop of a Feral Pigeon the falcon had killed that morning.

Care was taken to clear the roof of all remains at each visit, to avoid duplicating evidence. The total number of birds given here for the various species is the minimum possible for each. For example, if a pair of legs, a left wing and a head of a Collared Petrel were recovered on the same visit, they were taken as belonging to the one bird. As many of the remains found were fragmentary, only a foot or mandible being present to indicate a kill in extreme cases, this was considered the safest method, although it must have inevitably led to some underestimation. Often most of the remains of a particular kill would be blown clear of the roof, or other remains would be washed away in torrential downpours, so the number of kills recovered from the GPO is by no means a complete record of the birds eaten there by the Peregrine. A few of the kill remains from the GPO roof could have been left there by the visiting male Peregrine(s), but they could only have accounted for a few of them, and no change in the type or size of bird taken was noted during the periods they were present.

Several castings or food pellets were recovered from the GPO roof, one containing the remains of the only Peale's Pigeon (*Ducula latrans*) known to have been eaten by the Suva falcon. This pigeon does not normally occur in Suva and was probably taken on an excursion into the rainforest, or along the forest fringe. All other prey evidence is from kills.

PREY SPECIES IN ORDER OF FREQUENCY WERE:

<i>Species</i>	<i>No.</i>	<i>% of kills (approx.)</i>
Feral Pigeon (<i>Columba livia</i>)	101	24%
Collared Petrel (<i>Pterodroma leucoptera brevipes</i>)	81	19%
Wandering Tattler (<i>Tringa incana</i>)	76	18%
Golden Plover (<i>Pluvialis dominica</i>)	55	13%
Sooty Tern (<i>Sterna fuscata</i>)	45	11%
Many-coloured Fruit Dove (<i>Ptilinopus perousii</i>)	22	5%
Audubon's Shearwater (<i>Puffinus lherminieri</i>)	7	2%
White Tern (<i>Gygis alba</i>)	7	2%
Collared Lory (<i>Phigys solitarius</i>)	7	2%
White-collared Kingfisher (<i>Halcyon chloris</i>)	5	1%
White-browed Rail (<i>Poliolimnas cinereus</i>)	4	1%
Bar-tailed Godwit (<i>Limosa lapponica</i>)	3	<1%
Black Noddy (<i>Anous minutus</i>)	3	<1%
Banded Rail (<i>Rallus philippensis</i>)	2	<1%
Fan-tailed Cuckoo (<i>Cacomantis pyrrophanus</i>)	2	<1%
Jungle Mynah (<i>Acridotheres fuscus</i>)	2	<1%
Crested Tern (<i>Sterna bergii</i>)	1	<1%
Peale's Pigeon (<i>Ducula latrans</i>)	1	<1%
White-breasted Woodswallow (<i>Artamus leucorhynchus</i>)	1	<1%
	425	

The kills collected clearly show that the Suva Peregrine depended on medium sized birds for its food, mainly pigeons, shorebirds and sea-birds. This is a typical diet for a Peregrine in an urban-marine environment practically anywhere in its range (Brown & Amadon 1968: 854), but it differs markedly from that of rainforest-dwelling Peregrines at Joske's Thumb (see Table 1) only about 14 km from, and in plain view of the GPO mast lookout (Clunie 1972: 315-322; 1973: 10-11). Here the staple diet of the falcons was the flying fox (*Pteropus tonabus*), which is also killed by Peregrines at Vatuvava Island in Lau (D. McCarthy, pers. comm.). In contrast the Suva Peregrine did not kill a single flying fox.

In my earlier papers (Clunie 1972: 319; 1973: 10-11) I suggested that the rather unusual dietary habits of the Joske's Thumb Peregrines was perhaps a necessity forced on them by the dense rainforest cover, which effectively shields many potential prey species from attack. The Suva falcon, with an adequate supply of suitable prey birds in the form of pigeons, shore and sea-birds certainly had ample opportunity to add fruit bats to its diet as these big clumsy mammals were commonly active in Suva well within her hunting times. Indeed, following a hurricane in October 1972, starving flying foxes streamed

TABLE 1

COMPARISON OF THE PREY OF RAINFOREST-DWELLING PEREGRINES AT JOSKE'S THUMB WITH THAT OF THE URBAN-MARINE PEREGRINE IN SUVA.

PREY SPECIES.	JOSKE'S THUMB.	SUVA
Collared Petrel (<u>Pterodroma leucoptera brevipes</u>)	*	*S
Audubon's Shearwater (<u>Puffinus l'herminieri</u>)		*
Banded Rail (<u>Rallus philippensis</u>)		*
White-browed Rail (<u>Poliolimnas cinereus</u>)		*
Golden Plover (<u>Pluvialis dominica</u>)		*S
Wandering Tattler (<u>Tringa incana</u>)		*S
Bar-tailed Godwit (<u>Limosa lapponica</u>)		*
Black Noddy (<u>Anous minutus</u>)		*
White Tern (<u>Gygis alba</u>)		*
Sooty Tern (<u>Sterna fuscata</u>)		*S
Crested Tern (<u>Sterna bergii</u>)		*
Feral Pigeon (<u>Columba livia</u>)		*S
Many-coloured Fruit Dove (<u>Ptilinopus perousii</u>)	*	*
Golden Dove (<u>Ptilinopus luteovirens</u>)	*	*
Peale's Pigeon (<u>Ducula latrans</u>)	*	*
Red-throated Lorikeet (<u>Charmosyna amabilis</u>)	*	*
Collared Lory (<u>Phigys solitarius</u>)	*	*
Fan-tailed Cuckoo (<u>Cacomantis pyrrhophanus</u>)		*
White-rumped Swiftlet (<u>Collocalia spodiopygia</u>)	*	*
White-collared Kingfisher (<u>Halcyon chloris</u>)	*	*
Polynesian Triller (<u>Lalage maculosa</u>)	*	*
Vanikoro Broadbill (<u>Myiagra vanikorensis</u>)	*	*
Golden Whistler (<u>Pachycephala pectoralis</u>)	*	*
White-breasted Woodswallow (<u>Artamus leucorhynchus</u>)		*
Jungle Mynah (<u>Acridotheres fuscus</u>)	*	*
Orange-breasted Honeyeater (<u>Myzomela jugularis</u>)	*	*
Wattled Honeyeater (<u>Foulehaio carunculata</u>)	*	*
Red-headed Parrot Finch (<u>Erythrura cyanovirens</u>)	*	*
Flying Fox (<u>Pteropus tonabus</u>)	*S	
Unidentified rat species	*	

KEY : * = prey item.

S = staple prey item, 10% or more of diet.

into Suva by the thousand, and were present at all hours of day for several months. On numerous occasions I watched the falcon actively and vainly pursue Feral Pigeons when the surrounding sky teemed with clumsy flying foxes, which she completely ignored. The whole question of Peregrines killing and eating these big bats is one which will have to await further investigation in other Fiji habitats and elsewhere in Melanesia. Certainly the dispersal of a large flying fox colony in the hills near Joske's Thumb following the October 1972 hurricane, denuded the area of the bats which once swarmed there every evening, and coincided with the abandonment of Joske's Thumb as a Peregrine nesting and roosting cliff in 1973 and 1974.

It is possible that the Suva Peregrine, with a wide variety of bird prey available, was put off by the size and strength of the flying

fox, which weighs 700 g and more. While there is little doubt that a falcon the size of the Fiji Peregrine can kill and carry prey of this size if taken and bound to in flight (Clayton M. White, pers. comm.), the Suva Peregrine appeared to deliberately specialise in prey weighing between 100-200 g, or up to 300 g if it occurred near its feeding post. The ready availability of prey this size possibly deterred it from attacking larger and stronger animals, such as the flying fox, something it is quite physically capable of doing under less favourable conditions.

The Joske's Thumb Peregrines also took a wide range of birds, including tiny Orange-breasted Honeyeaters (*Myzomela jugularis* — 10 g) and Red-headed Parrot Finches (*Erythrura cyanovirens* — 13 g), but the Suva Peregrine never touched anything much smaller than a mynah.

Apart from two Jungle Mynah kills early in its stay in Suva, the falcon made no known attempt to attack any of the thousands of mynahs and bulbuls which were exposed to it daily, concentrating generally on birds weighing 100 g or more. The smallest birds taken with any frequency were the Collared Lory and Many-coloured Fruit Dove, both of which are fleshy, brightly coloured, and weigh 60-120 g. The two mynahs fall within this weight range, weighing 80-90 g. The Peregrine did, however, show a definite tendency towards attacking birds of this size or slightly smaller if they were relatively uncommon or unusual on her hunting range. Thus we have thousands of conspicuous mynahs and bulbuls ignored, but 5 White-collared Kingfishers, 2 Fan-tailed Cuckoos, one White-breasted Woodswallow and 4 White-browed Rails being taken within the study period. Of these the woodswallow may have been taken in anger, as they often harrassed the falcon and she was once seen to pursue and nearly catch one of three which were repeatedly diving at her, apparently in annoyance as she did not hunt that afternoon. Of the other birds, the kingfisher, while not rare in the Suva peninsula is not common, nor is it normally as exposed to Peregrine hunting methods as a mynah, while the drably coloured Fan-tailed Cuckoo is only ever present in small numbers, and very inconspicuous. Most surprising of all is the presence of no less than 4 White-browed Rails among the falcon's kills, this secretive little ground-dwelling bird never having been seen by human observers in the area most hunted by the Peregrine. The presence of Banded Rail kills could also well be attributed to this apparent attraction toward the odd and unusual, although it falls within a heavier weight range.

When the falcon first arrived in Suva she sparked off the same violent reaction among small birds as does the Fiji Goshawk, their most feared and constant avian predator. However, they soon seemed to learn that the falcon was not a danger to them, and bulbuls in particular paid no heed to her, often perching only a metre or so away from her on the GPO mast and making no attempt to mob her. Mynahs also soon abandoned their usual reaction to a hawk, which

is to gather in large groups on prominent lookouts, and swirl up en masse when it nears them. Within a few months both mynah species would give alarm calls as the falcon flew out at the target, but they made no attempt to occupy high lookouts, bunch, or take evasive action.

It is interesting to note too that the very common Malay Turtle Dove was never molested, while the much scarcer Many-coloured Fruit Dove was killed quite often. One might argue that the bright coloured plumage of this dove, the Collared Lory and kingfisher attracted the falcon to them, but this does not explain the rail and cuckoo kills, these birds being well camouflaged and normally very inconspicuous. Nor can the defensive flocking of mynahs really be seen as a deterrent factor of any importance in this regard — the Suva falcon proved herself capable of killing this species, which was also killed at Joske's Thumb, and she never hesitated to attack massed flocks of Feral Pigeons.

The large number of sea-birds killed, constituting about 34% of the prey taken, means that the falcon must commonly have hunted outside the barrier reef, and have had to carry her kills intact at least 3 km to the GPO mast to feed. To my knowledge, Audubon's Shearwaters, Collared Petrels, Sooty Terns and White Terns never venture within Suva Harbour, at least during daylight hours. The larger Crested Tern, weighing 250 - 350 g, was always easily available in the harbour, but only one was ever taken and that early in the falcon's occupation period. I never saw her pay any attention to this species. A very young male Collared Petrel recovered intact from the GPO roof weighed 119 g, and the other sea-bird prey species all fall roughly within the 100 - 250 g weight range, as do the Wandering Tattler and Golden Plover, the most common shorebird prey. The prey list reveals clearly that the falcon concentrated on birds of this size, although she would take Feral Pigeons weighing up to 300 g over the land and relatively close to the GPO mast. The Crested Terns within this weight range look much larger than Feral Pigeons, and this may have deterred the falcon from taking them even quite close inshore, with smaller prey available. With shorebirds too, the very few big Bar-tailed Godwits taken may reflect this apparent preference for smaller prey where available.

Peregrines have often been recorded hunting far out to sea; Beebe (1960: 175) mentioning that Canadian west coast fishermen see them up to 160 km from land. There are also numerous records of Peregrines joining and hunting from ships far out at sea in the annual report of the Royal Naval Bird Watching Society, the *Sea Swallow* (e.g. Tuck 1967a: 44; 1967b: 49; RNBWS 1971a: 12; 1971b: 33; Tuck 1973: 28; Casement 1974: 64). Perhaps more relevantly the island Peregrines Beebe studied commonly hunted offshore, as did the Aleutian Peregrines watched by White, Emison & Williamson (1971: 625) one of which was seen hunting 8 km offshore. There

would therefore appear to be nothing unusual in the Suva Peregrine hunting 3 km and more offshore.

Collared Petrels seem to be common in the waters off southern Viti Levu, as do Sooty Terns, both of which were killed in all months of the year, there being no seasonal peak. A Peregrine kill from Joske's Thumb misidentified earlier as *Pterodroma hypoleuca* (Clunie 1972: 315) was a Collared Petrel, and more were later discovered there. Collared Petrels were the only sea-birds known to have been captured by the Joske's Thumb falcons; and seeing one at least was probably captured over the sea, certainly being killed in the middle of the day as its blood was not fully coagulated when collected then; it seems that the Joske's Thumb Peregrines may have ventured out over the reef on occasion, returning some 9 km with their kills. The presence of the introduced mongoose (*Herpestes auro-punctatus*) throughout the hills about Joske's Thumb may possibly preclude the possibility of this petrel breeding there, but this is by no means certain.

Shorebirds are common about Suva coasts and the high incidence of tattler and plover kills reflects this, by far the greater number being taken in the shorebird season, as would be expected. An interesting point is that Ruddy Turnstones, which are also quite common in the area and of suitable size, were never taken.

The presence of rails among the Suva Peregrine's kills is of great interest, as these are commonly believed to be extinct or virtually extinct on Viti Levu, thanks to the depredations of the mongoose. (Mayr 1945: 128; Mercer 1966: 4-5). Rails by all accounts are at least rare in the area, and being ground-dwelling and rarely flying are not birds which one would normally expect to be taken by a Peregrine. This particular falcon's apparent attraction to the uncommon and unusual may have had something to do with the rail kills, as was suggested earlier.

The remains of two Banded Rails were collected from the GPO roof in December 1972 and February 1974 respectively. Banded Rails are common on Nukulau and Makaluva islets in the barrier reef, over 10 km from the GPO mast and on the other side of Suva peninsula. Banded Rails in Fiji usually weigh 190-250 g, and while Nukulau and Makaluva could well have been within the Suva Peregrine's hunting range it is difficult to envisage the falcon carrying these weights 10 km to the GPO mast, when she could land and eat them after a considerably shorter flight to the far side of the peninsula, or could eat them on the islands. This is especially so as she would have to pass other of her hunting and feeding posts to get to the GPO mast from there. The remains of one of the Banded Rails were substantial, suggesting that it was carried whole. It is, therefore, likely that this rail species may occur reasonably close to Suva city, at least on occasion, and may possibly be taken in flight over the harbour waters from one point to another. In areas where Banded

Rails are common in Fiji they are also killed by the Fiji Goshawk and Swamp Harrier, the former being quite capable of killing birds as large as itself.

The presence of four White-browed Rail kills, collected in December 1972 and December 1974, was even more unexpected, this little rail generally being considered very rare in Fiji (Mayr 1945: 163), and on Viti Levu only being known to have survived in a single swampy area at Koronivia (Mercer 1965: 5; Morgan 1965: 163) 14 km from the GPO mast. It appears from these falcon kills that White-browed Rails survive somewhere closer to the city, possibly in the coastal mangrove swamps, which they favour in Australia (MacDonald 1973: 139). Their presence as falcon kills in Suva suggests that they may not be as rare in Fiji as previously thought.

The prey of the Suva Peregrine is of value in providing rare birds or at least birds rarely seen by human observers as skeletal or even skin specimens. It suggests that falcon feeding posts and eyries in Fiji and westward into Melanesia should be investigated wherever possible by fieldworkers. In an area where fieldworkers are so few substantial potential information would appear to be being collected by the Peregrine, particularly where hunting a marine environment, and efforts should be made to collect the evidence provided by them.

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APPENDIX I

COLLARED PETREL MEASUREMENTS

The large number of Collared Petrels (*Pterodroma leucoptera brevipes*) taken by the Suva Peregrine allowed a series of measurements of this species to be taken. These petrels range quite considerably in size, older birds certainly having considerably longer measurements and being much more heavily built, especially in regard to the feet, head and bill than those only a few months old.

Culmen: av. 24.3 mm (22.1 mm - 26.9 mm). 28 specimens.

Tarsus: av. 26.9 mm (24.1 mm - 30.6 mm). 30 specimens.

Wing: av. 212 mm (201 mm - 222 mm). 16 specimens.

Tail: 97 mm. 2 specimens,

Weight: 119 g. The weight is of a very young, lightly built male bird. Adults would certainly weigh considerably more.

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BIRD OBSERVATIONS IN WESTERN SAMOA

By ANDRE DHONDT

UNDP/FAO Project for research on the control of the coconut palm
Rhinoceros Beetle, PO Box 507, Apia, Western Samoa

ABSTRACT

From January to July 1973, and again from January until September 1974, the author worked in Western Samoa and bird observations were occasionally made.

Ashmole (1963) listed 31 species of breeding land birds. Another species must be added since the Mynah (*Acridotheres tristis*) is now well established in the Apia area. A total of 29 species were observed and, of 13 of these, observations give information on breeding (nests found, nest building behaviour, adult with food or dependent juvenile).

Of the Samoan Triller (*Lalage sharpei*) a nest was found for the first time and some information on its ecology is given.

Of a few common species, numerous observations show that they probably breed all year round: the Banded Rail (*Rallus philippensis*), the White-rumped Swiftlet (*Collocalia spodiopygia*) and the Polynesian Triller (*Lalage maculosa*). Two introduced species have a seasonal breeding season: the Red-vented Bulbul (*Pycnonotus cafer*) and the Mynah (*Acridotheres tristis*).

For the other species for which observations on the breeding period were made the information available does not indicate whether breeding is seasonal or not: the Samoan Fantail (*Rhipidura nebulosa*), the Scarlet Robin (*Petroica multicolor*), the Wattled Honeyeater (*Foulehaio carunculata*), and both starlings (*Aplonis tabuensis* and *A. atrifuscus*).

INTRODUCTION

Knowledge of the birds of both Western and American Samoa is reviewed and summarized by Ashmole (1963). She lists 31 species of breeding landbirds for Western Samoa and 17 for the islands of American Samoa. Of the latter, three do not occur in Western Samoa (*Porzana tabuensis*, *Halcyon chloris* — replaced by *H. recurvirostris* endemic to Western Samoa — and *Clytorhynchus vitiensis*).

According to Ashmole, *Zosterops samoensis* and *Demigretta sacra* occur in Savai'i only and the introduced *Pycnonotus cafer* occurs in Upolu only. Further it will be shown that *Demigretta* is common both in Savai'i and Upolu and that *Pycnonotus* has now spread to Savai'i and to Tutuila. To Ashmole's list a new introduction must be added since *Acridotheres tristis* is now well established and even *Columba livia* seems to have become feral in the Apia area.

I worked in Apia, from January to July 1973 and again from January to September 1974. Especially during the second period I

made bird observations. Most excursions led me to the forest covered hills above Apia, around Afiamalu and Tiavi falls but I regularly visited other parts of Upolu and went across to Savai'i a few times.

My observations are grouped per species. The species that I have not seen are not mentioned further. These are: Bush fowl (*Gallus gallus*), the Samoan Ground Dove (*Gallicolumba stairii*) and the Samoan White-eye (*Zosterops samoensis*). Amongst the six migrating non-marine birds I did not observe the Bristle-thighed Curlew (*Numenius tahitiensis*), the Bar-tailed Godwit (*Limosa lapponica*) and the Long-tailed Cuckoo (*Urodynamis* or *Eudynamis taitiensis*) (although I observed the latter two species in Tonga).

I have tried to record systematically indications of breeding and moult (visual observations of symmetrically lacking feathers and a few mistnetted specimens).

Possibly the main breeding season — if there is such a thing in Samoa — for many species could fall in the first half of the more humid season (October to December) but I was not in Samoa during that period.

I have also summarized the few observations of marine species (including a breeding observation for *Procelsterna cerulea* for Tutuila).

Since, according to Ashmole, these two latter species are difficult to distinguish, field characteristics of both species are given. *A. tabuensis* is much smaller and has a shorter tail than *A. atrifuscus*.

The Samoan Tooth-billed Pigeon (*Didunculus strigirostris*) still exists but is rare. The Reef-Heron (*Demigretta sacra*) is common both in Upolu and Savai'i and the white colour phase is very uncommon. The Barn Owl (*Tyto alba*) is widely distributed and is active in day time.

The White-browed Rail (*Poliolimnas cinereus*) is not common but its distribution is not limited to marshy areas.

Of the five migratory waders in Samoa only 3 species were observed. The Pacific Golden Plover (*Pluvialis dominica*) and the American Wandering Tattler (*Heteroscelus incanus*) are very common. The Turnstone (*Arenaria interpres*) was observed twice.

Several species of marine birds were observed.

The Fairy Tern (*Gygis alba*), the Brown Noddy (*Anous stolidus*) and the White-tailed Tropicbird (*Phaeton lepturus*) are common over land and some data on the breeding of the Fairy Tern are given.

Nesting of the Blue-grey Noddy (*Procelsterna cerulea*) and of the Brown Noddy was observed in Tutuila, American Samoa.

MARINE BIRDS

Wedge-tailed Shearwater, *Puffinus pacificus*

Identified a few times when crossing between islands: in March 1973 between Upolu and Savai'i and in August 1974 between Upolu and Tutuila.

Audubon's Shearwater, *Puffinus lherminieri*

On 10 February 1973 at 7 p.m. an individual of this species was found sitting on a small stone wall against a house along the sea at Mulinu'u. The bird was picked up and since it seemed in good condition, released the next day. Its overall length was 270 mm. The wing chord was 185 mm, the bill 26 mm. The plumage seemed fresh and no moult was seen. The bill was black above and grey underneath. The legs and webs were flesh coloured; the outer toe and the outside of the middle toe were black.

The upperparts were black, underparts white with an incomplete breast band. The colour of the undertail coverts is variable in this species (King 1967). In this specimen they were white.

White-tailed Tropic-bird, *Phaethon lepturus*

This species is common in Samoa and could be observed flying above the island at any time. It was seen to settle on trees close to Apia and at Vanimonimo where it probably breeds.

Frigate Birds, *Fregata sp.*

Single Frigate Birds were observed a few times flying above Upolu. On 21 February 1974, 4 were observed above Alafua.

Black-naped Tern, *Sterna sumatrana*

Although this species is said to breed in Samoa (Ashmole 1963) it was only observed once. On 4 June 1973, 10 were fishing in the lagoon at Mulinu'u with a few Fairy Terns. Apparently they were taking small fishes of which a whole school jumped at times out of the water. A few had mottled grey upperparts and were thus immature.

Sooty Tern, *Sterna fuscata*

Flocks were observed between Upolu and Manono on 8 March 1973 and between Upolu and Savai'i on 8 May 1973.

Blue-grey Noddy, *Procelsterna cerulea*

This species was never observed in Western Samoa but was found nesting in Larson's bay (Tutuila) on a cliff together with Brown Noddies (*Anous stolidus*) on 10 August 1974.

Fairy Tern, *Gygis alba*

A common species above and around Upolu. It breeds at Tiavi falls where adults holding a fish were observed on 9, 10 and 23 February 1974 and on 14 April 1974.

Although Ashmole writes that it was recorded flying around trees at an altitude of over 1000 feet (probably referring to Tiavi falls) between December and April, I have recorded it there also in June, July and August. On 12 March 1974 I saw some above Savai'i.

Brown Noddy, *Anous stolidus*

A common species above and around Upolu. At Tiavi falls this species, also, was always present but adults with fish were not recorded. It was seen nesting on a cliff at Larson's bay (Tutuila) on 10 August 1974.

LAND BIRDS

Pacific Golden Plover, *Pluvialis dominica*

One of the two common waders present in large numbers on mudflats but mainly feeding one by one on lawns (e.g. on the golf course at Fagali'i). It is the only wader which is regularly encountered inland in coconut plantations or on roads up to 1000 feet.

Turnstone, *Arenaria interpres*

Does not seem common and was observed only twice. On 15 February 1973 a group of 25 feeding on mudflats at Faleolo and on 17 February 1974 one with a group of Golden Plovers on the beach at Fagali'i.

American Wandering Tattler, *Heteroscelus incanus*

Also a common wader but usually seen on mudflats, in mangrove and emerging reefs where it hunts prey by sight. On 17 February 1974 one was seen chasing a small fish that jumped out of the water several times but was finally caught.

Reef Heron, *Demigretta sacra*

Surprisingly, Ashmole (1963) noted the reef heron as common on American Samoa and probably on Savai'i but not as occurring in Upolu. On both Upolu and Savai'i this species is common. The grey phase is the only one I observed but Dr Karl Joseph Marshall has observed white phase birds too. This colour phase must be very rare. It hunts by sight on emerging reefs, mangrove, etc.

Grey Duck, *Anas superciliosa*

Probably uncommon since I made only one observation of a Grey Duck flying around Vanimonimo on 1 May 1973. Yaldwyn (1952: 28) stated: "They are reported as widespread but not common throughout Upolu . . . Neither Armstrong nor Mayr record them on Savai'i, but I have seen them on the freshwater lagoon at Safune . . . They are highly prized as food by the Samoans, whose hunting of them keeps the numbers down locally. The shooting season is from July 1 to December 31."

Banded Rail, *Rallus philippensis*

It is certainly true that this species is widely distributed and common as Ashmole stated. On 17 March 1974 I counted 9 along 1.5 km of road in Afiamalu. She thinks it may have two breeding periods, one in March/April, a second one in August. The following observations, however, do not support this but suggest continuous breeding all year round.

- 9/1/73 — adult and 4 or 5 halfgrown young — Alafua.
- 23/1/74 — 2 adults and 2 small chicks — Sinamoga.
- 30/1/74 — adult and young along the South Coast of Upolu.
- 31/1/74 — adult and young — Apia.
- 5/2/73 — adult and 4 downy young — Afiamalu (Jan Lint).

- 20/2/74 — adult and two halfgrown young — Alafua.
 — 2 adults and 1 halfgrown young — Alafua.
- 4/4/73 — Lefaga: twice 1 adult + 1 halfgrown chick; 1 adult and 1 small chick, 2 adults + 1 halfgrown chick.
- 6/3/73 — 6 eggshells in a nest in a hollow of a rotting log — Togitogina (Katie Maddison).
- 17/3/73 — Adult and small chick — Afiamalu.
- 17/3/74 — 2 adults and small chick — Afiamalu.
- 20/3/73 — adult and one halfgrown juvenile — Alafua.
- 6/4/73 — adult and downy chick — Alafua.
 — adult and 2 halfgrown juveniles — Alafua.
- 19/6/74 — 2 adults and 2 downy young — Alafua.
 On 24 July an adult and an almost fullgrown juvenile were observed on the same place. On both occasions a deep grunting sound was made by the adult.
- 21/6/74 — 2 adults and 2 halfgrown juveniles — Afiamalu.
- 21/7/74 — Halfgrown young — Alafua.
- November 1973 — Small juveniles (Jan Lint).
- December 1973 — 5 eggs in a nest in high grass of a garden in Vaivase (Katie Maddison).
- 27/12/73 — Copulation of adults — Alafua (Jan Lint).

(I was not in Samoa from August to December 1973 and left in September 1974).

Since most observations were of birds along roads the number of juveniles observed is probably often less than the number of young really present.

White-browed Rail, *Ptilinopus cinereus*

I agree with Ashmole that this is not a common species but I did not observe it in swampy areas.

On 17 February 1974 and 29 June 1974 I saw this small rail in Afiamalu at about 200 m crossing the road towards a humid meadow.

In July and August 1974 one was regularly observed in Alafua. Twice it was observed sitting on top of long grass calling: “(k)i-kiu.” A few times it was observed to climb into a small hedge bordering the patch of long grass where it seemed to live.

Purple Swamphen, *Porphyrio porphyrio*

Observed only a few times.

- 20/2/73 — 1 on a taro patch — Alafua.
- 30/6/74 — two along the road up in the hills.
- 10/7/74 — 1 on the road towards Alafua.

Yaldwyn (1952: 29) wrote of its occurrence in 1950: “Generally distributed throughout both islands . . . does extensive damage to young taro crop and is commonly shot for food . . . from July 1 to December 31.”

Pigeons

Pigeons were often heard but only rarely seen and identified. All species, except the Samoan Ground Dove were observed, the Tooth-billed pigeon (*Didunculus strigirostris*) only once. On 17 April 1974 along the cross-island road past Tiavi falls one crossed the road flying. It settled in a small tree along the side of the road. On my approach it flew a bit further in a cluster of bushes where it remained long enough to be filmed. It is a remarkable animal, that, according to, amongst others, Dr K. J. Marshall, is not so rare in the forest. Samoans still hunt it since an American friend told me that a few years ago he ate one in Savai'i.

Yaldwyn (1952: 29) has given other notes on the status of Samoan pigeons and doves in 1950.

Blue-crowned Lory, *Vini australis*

Regularly observed flying above the forest in small groups. Once noted feeding in an inflorescence of a coconut palm (28 May 1973). On 17 March 1974 in a tree covered with red flowers several dozen lory were feeding alongside a large number of Wattled Honey-eaters.

Barn Owl, *Tyto alba*

The owl is the only bird of prey in Samoa and has apparently shifted its activity pattern so that it is also very active in day time. I have recorded it at all times of the day and also a few times at night. It occurs regularly in coconut plantations but seems most numerous in the hills where pastures have been established. During a car drive lasting 3 hours through such country on 16 March 1973 six individuals were counted. According to Samoans, rats take an important place in its diet.

White-rumped Swiftlet, *Collocalia spodiopygia*

This species is very common above Samoa. On 24 June 1974 a nesting cave was visited near Aleisa.

The number of nests was estimated at 50 to 100 and it was estimated that about 1 in 5 was occupied. 10 could be looked into from the ground. They were glued against the wall and at least in part supported by a small ledge. One measured had a diameter of 9 cm and was 5 cm thick. The lower part was brown, the upper half still green moss. The centre was slightly depressed. Twice an adult sat on an empty nest. Four nests contained one egg. Of these three had no adult and one two adults. Four nests contained 1 nestling (one with unopened feather quills, three almost fully grown). The normal clutch-size seems to be one.

The four adults were checked for broodpatch and moult: adult in first empty nest: broodpatch not very developed. Outer primary (P 10) in pin; P 9 almost fully grown — no tail nor body moult. Adult on second empty nest: broodpatch. P 8, 9 and 10 almost full-grown (with quills still attached).

Two adults on one egg: both had a broodpatch. One was not moulting. The second one had P 10: 3/4, central tail feather T1: 3/4.

According to Stresemann (1966), *Collocalia* has a descendant primary moult and a centripetal tail moult, and P 10 and T 1 grow simultaneously. This is corroborated here. Further in this bird moult and breeding overlap.

Armstrong (1932, *vide* Ashmole 1963) found eggs in April and young in February and June and Whitmee (1875, *vide* Ashmole 1963) reported many nests containing one young in November. Possibly the White-rumped Swiftlet breeds all year round in Samoa.

Flat-billed Kingfisher, *Halcyon recurvirostris*

This species, endemic to Western Samoa, is widespread but not numerous on both main islands. It was observed in gardens, villages, coconut plantations, meadows and along the edge of the forest in the hills. It can often be observed sitting on telephone wires.

In Alafua 2 individuals were regularly observed all year round. Often a bird would be seen in the lower branches of a tree diving into the grass, picking-up something and returning to its perch. In Tonga one was seen fishing over the reef where it was close to the forest edge. The call, which Ashmole (1963) described as a saw-sharpening noise, was noted as: a loud "keree-keree-keree" (the first syllable being short, the second somewhat longer and accentuated).

The call is different from that of *Halcyon chloris* in American Samoa in being slower. Yaldwyn (1952: 29-30) remarked on the distribution of these two species.

Polynesian Triller, *Lalage maculosa*

Two species of cuckoo shrikes occur in Samoa, *Lalage maculosa* and *L. sharpei*.

The first one is common throughout the S.W. Pacific and there are 16 subspecies according to Mayr (1945). The second one, *Lalage sharpei*, is endemic to Western Samoa, and hardly anything is known about its habits.

As stated by Ashmole (1963), the Polynesian Triller is a very common and conspicuous bird around villages and gardens. It is also common in forest clearings and along the roads in the primary forest in the hills on both islands. It very often feeds on the ground, hopping around on lawns. Ashmole, quoting Mayr (1945), said that the nest is cup-shaped usually in trees from 5 to 15 feet up. Young have been recorded in December.

I can add some observations on the breeding:

23/1/73: Alafua — a dependent juvenile begging for food and one adult.

18/2/73: Moto'otua — 2 adults feeding one dependent juvenile.

17/3/74: Afiamalu — adult with food.

- 23/4/73: 2 young in nest in dead flame tree — Moto'otua in my garden (see further).
- 20/6/74: Adult feeds dependent juvenile — Alafua.
- 24/6/74: Adult feeds dependent juvenile — Alafua (same place as 20 June).
- 29/6/74: Along the Cross Islands roads past Tiavi falls: 2 adults and 2 dependent juveniles.
- 4/7/74: Adult feeds dependent juvenile — Alafua (different place 20 June).
- 18/7/74: Alafua — one adult on the lawn followed by a begging juvenile hopping behind.
- 24/7/74: Pesega — adult with food.
- 28/7/74: Afiamalu — on clearing in forest at the end of a side road of Cross Island Road: 1 adult and dependent juvenile.
- 1/8/74: Alafua — 1 adult and 1 intensively begging juvenile.
- 8/8/74: Alafua — 1 adult and 1 dependent juvenile.

The nest which contained two nestlings on 23 April 1973 in my garden was situated at ca. 10 metres up in a horizontal fork in the upper half of the crown of a dead flame tree. The nest was cup-shaped. On 23 April the nest was first seen. The young were estimated to be between 1-2 weeks (10 days). Both adults must incubate as the male was mistnetted on 20 April and found to have a well developed broodpatch. Its wing chord measured 95 mm. It was not in moult (a female caught on 9 March 1974 measured 94 mm). On 25 April it was raining very hard and one adult sat on the nest most of the time. Sometimes it was seen to keep its wings open to protect the nestlings. An adult was observed to sleep on the nest until 30 April when the young were already feathered. The two young fledged on 6 May and were fed by both adults in a neighbouring breadfruit tree.

One month later, on 6 June, two Polynesian Trillers were regularly visiting the nest tree. The male, by then moulting its central pair of tail feathers, chased away bulbuls from the vicinity of the nest. On 15 June the same pair flew calling towards the nest. The female sat on the nest. The male hopped around it on the branches and regularly pecked her in the neck. They did not copulate. The male then displayed with open wings and spread tail closely to the female and flew away. (The male was also moulting its wing feathers). The female chased the male with some nesting material in the beak. They both settled in a coconut palm. The female then returned to the nest, still carrying the nest material, and made with the tail half-circular movements towards the male; this is probably an invitation for copulation. When the male did not follow, the female went through some nest building behaviour and flew away. (This same behaviour was also observed in Alafua on 25 July 1973: one triller,

the female presumably, flew towards a low bush and made these same semi-circular movements with the tail, the male following, but no copulation was observed.)

On 30 June the female was incubating on a new clutch. She sometimes brought a fine twig when returning to the nest. She also slept on the nest. On 10 July she was still incubating, but since I then left Samoa for a few months, I do not know what happened later.

The interesting aspect about all this is that after the young fledged the male started to moult but the female did not. Nevertheless, a second clutch was started. The female possibly moulted 6 months later, since on 21 January 1974 I observed a Polynesian Triller in my garden in full tail moult (central feathers almost new, the other tail feathers progressively smaller outwards).

The observations also show that breeding probably occurs all year round: dependent juveniles or adults with food were observed in January (1), February (1), March (1), June (2), July (4), August (2) and nesting was observed between 23 April and 6 May again from 30 June onwards.

Moult clearly is not seasonal since it was observed in January and June/July and the male and female of the same pair moulted at different times.

Samoan Triller, *Lalage sharpei*

Contrary to what Ashmole (1963) wrote, the Samoan Triller is the smaller of the two species of trillers occurring in Western Samoa. This is clear when one compares measurements given by Armstrong (1932).

Everybody agrees that this species is very rare and that its habits are unknown.

To describe what the birds look like I will quote from different descriptions and add my own.

Armstrong (1932: 77) —

“Upper-surface greyish brown, sides of rump white, remiges deep brown, edged with dirty white, tail deep brown, all the feathers except the central pair, tipped with white, the two outer pairs white for the apical third, underside white with many pale-brown cross-bars on sides of breast and flanks . . . bill yellow, tip brownish; iris white, wing 77-81 mm [compare with my measurement of 94 and 95 mm for *L. maculosa*, and Armstrong's 93 ♂ and 90 ♀]. “The bill of *Lalage sharpei* is longer, narrower and more flattened than in *Lalage pacifica*” (Rothschild).”

Mayr (1945: 118) gave a shortened description stating:

“. . . the iris is white, the bill is yellow, the upperparts are brown, and the underparts faintly or more strongly, barred with brown.”

Ashmole said:

"This is larger [sic] than the Polynesian Triller and is a much darker bird. The upperparts are brown and the underparts whitish with brown bars."

The latter description is very misleading since *sharppei* is smaller, not darker and has no bars.

My field notes give the following description:

sitting; a warbler like bird (i.e. much more gracious than the Polynesian Triller) — upperparts uniformly grey brown to brown — throat and breast white, underparts white; flanks *finely* banded with brown — the transition from the brown cheeks to the white throat is sharp and lies just under the eyes.

Tail short with white endings especially on the outer feathers. Bill orange-yellow, strong but rather fine. Male and female alike. The iris is conspicuously white and forms an excellent field character.

Flying, it has rather broad wings with conspicuous white endings to the tail feathers.

The bird is somewhat smaller but much more *gracious* than *L. maculosa*.

On 9 February 1974 I found a nest situated in a forest tree well covered with epiphytes about 5 m inside the forest from the Cross Islands Road on the plateau. It was cup-shaped and covered with mosses and lichens and built almost at the end of a horizontal branch, about 5 m high, and leaning against a vertical fork. Both adults were observed incubating and feeding the young. I visited the nest almost every week. On 17 February, judging by the behaviour of the adults, there were still eggs. On 23 February the adults brought small food items.

From my notes:

the breeding bird is changed three times in 10 minutes. The orientation of the head is different each time. At 10.20 a.m., after more than 5 minutes absence an adult comes with a small black item in its beak. At 10.28 a.m. it is relieved and again, the bird has a small black item in its beak which it puts under itself. I conclude then that a small nestling must be present. On 2 March one feathered nestling is seen. Both adults feed it. On 10 March a big nestling is seen sitting in the nest. The adults feed green caterpillars (5 times in 30 minutes). On 17 March the nest is empty but an adult calls in the neighbourhood (a short tweet-tweet).

Summarizing: the adults were incubating on 9 and 17 February 1974. The eggs hatched before 23 February and the only young fledged between 10 and 17 March. The nestling stage can then be estimated to be about 3 weeks (estimating that the eggs hatched 20 February and the young fledged 15 March). When approaching the incubating bird it left the nest in silence without any alarm calls. On the whole the adults were rather tame. When the young was

already quite big I took some colour slides of the adults feeding it by standing almost under the nesting tree only partly hidden by the undergrowth.

Other observations about the breeding of the Samoan Triller:

9/2/74: adult with dependent juvenile begging for food with flapping wings.

10/2/74: adult with 2 dependent juveniles that are calling close to the nest described above. The bill of the juvenile is less orange.

Some observations show that the Samoan Triller feeds in the crowns of trees: on 14 April 1974 two were observed feeding on twigs and leaves in the forest in the Tiavi region.

On 30 June 1974 one was seen searching for food amongst leaves. It caught a caterpillar and knocked it against a thicker branch before eating it. This was one of the observations made outside the forest itself in Afiamalu where some trees and bushes are left amongst meadows. That day another two were observed in the crown of a big tree at the edge of a taro clearing in Tiavi.

On the whole, it was observed about every second excursion made in the hills but it did not confine itself to the forest itself since it was observed several times in clearings along the forest edge or on the hills where the forest has long disappeared.

It is not a common bird but is certainly not very rare and has in the Tiavi-Afiamalu region a rarity status comparable to the Samoan Broadbill or the Samoan Whistler.

Red-vented Bulbul, *Pycnonotus cafer*

This species which arrived in Samoa in the early fifties, is widespread in Upolu and has reached Savai'i, where small numbers were observed in the Salelologa and Asau area, and Tutuila. Molt and breeding are discussed separately (Dhondt, in prep.).

Island Thrush, *Turdus poliocephalus*

This species is common in the forest but since it lives in the understorey it is hard to see there. It can, however, easily be watched in taro-clearings, or where the understorey has been destroyed. It looks very much like the male of the European Blackbird (*Turdus merula*) but its legs are bright yellow (like the bill and the eye ring) and gave the impression of being somewhat longer than in *T. merula*. On 1 July 1974 in Afiamalu a call very similar to that of a begging fledgling *T. merula* was heard and it is assumed that fledgling Island Thrush uttered it.

Samoan Fantail, *Rhipidura nebulosa*

A very common and tame bird, as Ashmole (1963) wrote, more numerous on the hillsides than down by the sea. The song is a high, fine phrase reminding me of that of the European Robin (*Erithacus rubecula*). Katie Maddison observed dependent young being fed on 18 April 1973.

On 30 June 1974 I saw a fantail which was moulting the central tail feathers.

Samoan Broadbill, *Myiagra albiventris*

This species was encountered regularly in Afiamalu in small bushes and trees lower than the forest and also in the forest itself. A few times it was seen feeding as follows: the bird flies up from a branch inside the crown of the tree, picks up a food item from the underside of a leaf and settles again on the branch. The tail often quivers after settling. In February, April and June 1974 song was heard which sounded like a fluid "tseweet-tseweet" or "twee-twee."

Scarlet Robin, *Petroica multicolor*

This pretty little bird is quite conspicuous and was noted on each excursion in the hills. Song was recorded especially in February and March but individual birds were also singing at other times. Different individuals would use slightly different song types, a common one being "teetu-teetutui" (the last syllable accentuated and rising again at the end). At the end of August I observed an adult feeding a dependent juvenile and a pair feeding another one.

Maybe breeding is seasonal in this species since Ashmole (1963) reported a nest at the end of August also.

Samoan Whistler, *Pachycephala flavifrons*

This bird, which Ashmole reported as being common, was not encountered more often than, for example, the Samoan Broadbill. It could only be observed well in places where the undergrowth of the forest had somewhat been cleared away. The song is a short melodious phrase that remains at the same height. It reminded me of the song of the European Blackcap (*Sylvia atricapilla*).

Mao, *Gymnomyza samoensis*

I never saw this species but I think I heard its loud calls twice: once near Tiavi falls on 23 June 1974, a second time in the forest near Tiavi on 30 July 1974.

Wattled Honey-eater, *Foulehaio carunculata*

This is one of the most common birds in Samoa as it is common both in gardens and plantations and in primary forest.

Ashmole writes that the nest is cup-shaped and placed in a fork about ten feet up the tree. No dates on reproduction are given. A few observations on nest building were made in January and February 1974. On 26 January 1974 two adults were building a nest high in the crown of a mango tree in Moto'otua at least 15 m up. One adult was seen to collect cocoons of spiders from the underside of mango leaves and flying into the mango tree where the other one was constantly present.

On 2 February 1974 an adult was watched searching between bushes and on the ground. It carried a dry fibre of about 150 mm towards its presumed nest-site. On 6 February the mango tree was cut down by Public Works Department and the unfinished nest was

found. It was cup-shaped, built from dry roots, fibres and egg cocoons and placed amongst fine twigs. It was woven around the bases of mango leaves. The length of a few fibres measured varied between 80 and 260 mm.

Other observations on breeding:

2/4/73: male with broodpatch — no moult, wing chord: 100 mm — Moto'otua.

14/6/73: adults feed dependent juvenile — Moto'otua.

24/2/74: mistnetted adult male has big broodpatch — wing chord 97 mm — no moult.

A very large concentration of Wattled Honey-eaters was seen on 17 March 1974 where several dozen were feeding, with many cries in a flowering tree (Afiamalu).

Cardinal Honey-eater, *Myzomela cardinalis*

The Cardinal Honey-eater is common in gardens, villages, coconut plantations and along the forest edge in the hills.

On 11 March 1974 a male with a broodpatch and swollen cloacal gland was caught in Moto'otua — no moult — wing chord 67 mm.

On 25 June 1974 a female in Alafua in a worn plumage but with no moult had a well developed broodpatch. The wing measured only 57 mm. Dependent young were also observed that day.

Red-headed Parrot-finch, *Erythrura cyanovirens*

In and above the forest at Afiamalu and Tiavi this species was regularly observed but never in large numbers. Two were observed searching for food on thick branches covered with epiphytes in Afiamalu on 2 March 1974.

One observation along the coast concerns a single individual in a garden in Levili on 20 January 1973.

Polynesian Starling, *Aplonis tabuensis*

The smaller of the two starlings occurring in Samoa is not a common bird. Contrary to what Ashmole (1963) wrote, this species is easily distinguished from the Samoan Starling.

It is much smaller and has a much shorter tail than *A. atrifusus*. From close by we can see the conspicuous yellow iris, the pale line along the edge of the closed wing. The colouration of the underparts is entirely different. In the Polynesian Starling these are pale and streaked with broad dark lines. In the Samoan Starling they are entirely dark.

This species is widespread in small numbers. I have recorded it both in my garden at Moto'otua on 10 March 1974 with a small twig, probably nestbuilding, in coconut plantations on Savai'i and in the primary forest. There it seems to occur also in the lower stages. It was observed once feeding on small fruits. However, I would usually not encounter this species more than once or twice during

any excursion in the Afiamalu region, giving it a rarity status comparable to the Samoan Broadbill or Samoan Triller.

Samoan Starling, *Aplonis atrifuscus*

The Samoan Starling is a common and conspicuous bird all over Upolu and Savai'i. It is a large bird with a conspicuously long tail, which often flies in small parties high above the canopy calling loudly.

It is completely dark brown with a brown iris and black, slightly decurved bill. I do not understand how it could be mistaken for a Polynesian Starling. (Ashmole wrote: "Published descriptions do not seem to be adequate to distinguish this bird from the Polynesian Starling in the field").

Some observations on breeding and moult:

- 18/5/73: Saleloga (Savai'i), one flying overhead with food in its beak.
- 23/6/74: several birds in tail and wing moult around Tiavi falls.
- 30/6/74: Afiamalu, amongst other birds one is seen with moult in the middle of the wing; another one with food in its bill.
- 6/7/74: Moto'otua: one flying overhead holding a rather long twig in its bill.

Mynah, *Acridotheres tristis*

This species has recently arrived in Upolu where it can be seen occasionally in small flocks. According to Dr Peter Maddison, it has been in Samoa since at least 1972. He also observed dependent young being fed on 18 February 1973 in Vailele.

I have observed it in the Apia area only:

- Moto'otua: 30/1/74: one.
- Fagali'i: 7/2/74: 7 in a few old coconut palms.
- Vailele: 21/2/74: several feeding amongst cows.
- Moto'otua: 5/3/74: 1 adult and two dependent juveniles feeding in a pawpaw tree.
- Faleata: 7/3/74: 2 in a coconut plantation.
- Moto'otua: 7/3/74: 4 flying by.
- Pesega: 13/3/74: 2.
- Moto'otua: 16/3/74: 4.

It was remarkable that, during a short period at the end of February and in March, I observed this species quite often whereas afterwards I did not encounter it any more.

Possibly this period coincided with the post breeding dispersal. This new introduction seems well established and will probably spread rapidly as it has done in Fiji.

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EXTANT TYPES OF NEW ZEALAND BIRDS FROM COOK'S VOYAGES

By DAVID G. MEDWAY
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[Part I: Historical, and the type paintings]

ABSTRACT

Recent research has shown that there are 19 extant types of New Zealand birds collected on Captain James Cook's three voyages of circumnavigation. Of these 9 are type paintings, the species concerned being *Tadorna variegata*, *Anas superciliosa superciliosa*, *Aythya novaeseelandiae*, *Sterna striata*, *Chalcites lucidus lucidus*, *Xenicus longipes longipes*, *Anthus novaeseelandiae novaeseelandiae*, *Finschia novaseelandiae* and *Mohoua ocreocephala*. The remaining 10 are type specimens, the species concerned being *Stictocarbo punctatus punctatus*, *Falco novaeseelandiae*, *Nestor meridionalis meridionalis*, *Cyanoramphus novaeseelandiae novaeseelandiae*, *Prosthemadera novaeseelandiae novaeseelandiae*, *Callaeas cinerea cinerea* and *Turnagra capensis capensis*.

The type paintings are preserved in the Zoology Library of the British Museum (Natural History) and the type specimens in the Merseyside County Museum at Liverpool, the Naturhistoriska riksmuseet at Stockholm, and the Naturhistorisches Museum at Vienna.

A brief account is given of some aspects of the history of bird specimens collected on the voyages and the history of the New Zealand type specimens is more specifically traced. Appropriate references are made to J. R. Forster's as yet unpublished Journal kept by him on the *Resolution* on Cook's second voyage, and other relevant literature is referred to.

INTRODUCTION

In the course of research on the South Pacific and Hawaiian ornithology of Cook's voyages a number of extant types of species first described from specimens collected, or paintings executed, on such voyages were located and identified. I believe, as did Pelzeln in 1873, that it is of importance to science that the existence of type specimens and the place where they are deposited should be known (Pelzeln 1873: 14-15). For this reason it has been decided to contribute this paper on the known extant types of New Zealand birds from the voyages.

A number of the extant types described in this paper are paintings executed on the second and third voyages by George Forster and William Ellis. These paintings are now in the Zoology Library of the British Museum (Natural History). In several cases the noted 18th century English ornithologist, John Latham, in his monumental *General Synopsis of Birds* (1781-1785), based his descriptions of certain

species from Cook's voyages on paintings of such species, which paintings were at that time in the library of Sir Joseph Banks. In this work Latham gave English names to the species described. J. F. Gmelin shortly afterwards, in his edition of the *Systema Naturae* (1788-93), gave scientific binomials to a great number of the new species described by Latham. Where Latham's descriptions were based on paintings, those paintings became, by virtue of Gmelin's latinisations, the types of the species depicted therein. The bird paintings once in the library of Sir Joseph Banks have been fully described by Lysaght (1959) who identified the types among them.

In addition to the type paintings there are a number of extant type specimens of New Zealand birds collected on Cook's voyages, which specimens are in the Merseyside County Museum at Liverpool, the Naturhistoriska riksmuseet at Stockholm and the Naturhistorisches Museum at Vienna. Some of these specimens were first validly described by Anders Sparrman in his *Museum Carlsonianum* (1786-1789) and others by Gmelin on the basis of Latham's descriptions as already mentioned. The existence of the majority of the type specimens dealt with in this paper has previously been noted from time to time. But the existence of some type specimens from Cook's voyages, particularly those in the Merseyside County Museum at Liverpool, appears to have been overlooked at least in literature. However this default is partly remedied in this paper and will, it is hoped, be fully remedied in other papers at present in preparation.

Some appropriate observations are warranted here about the New Zealand species represented by the extant types. Such observations are based principally on the as yet unpublished holograph 'Journal' kept by J. R. Forster in English as naturalist on the *Resolution* on Cook's second voyage. This very important Journal is in the Staatsbibliothek, Preussischer Kulturbesitz, Archivstrasse 12-14, Dahlem, West Berlin (see Hoare 1972: 171-173). It is at present being edited by Dr Michael E. Hoare for publication by the Hakluyt Society. The references to such Journal in this paper are to the volumes of the typescript copy in the General Library of the British Museum (Natural History).

SOME ASPECTS OF THE HISTORY OF BIRD SPECIMENS COLLECTED ON COOK'S VOYAGES

A considerable number of the new species of birds described by Latham (1781-1785) in the three volumes of his *General Synopsis of Birds* were based on specimens then in the Leverian Museum, Latham's own collection and the collection of Sir Joseph Banks. Because of the dates in question many of the species so described could only have been based on specimens collected on Cook's voyages. Although Whitehead (1969) has recently given a detailed and valuable general account of the history and fate of zoological specimens from such voyages, it seems appropriate to place on record here a somewhat

more detailed account of how so many birds from the voyages came to be in the possession of Banks, Lever, and Latham at the period referred to.

It is certain that Sir Joseph Banks was by far the principal recipient of the ornithological specimens collected on all three of Cook's voyages. Banks had, of course, accompanied Cook on the first voyage, and on 6 December 1771, he wrote to Count Lauraguais that "the Number of Natural productions discover'd in this Voyage is incredible: about 1000 Species of Plants that have not been at all describ'd by any Botanical author; 500 fish, as many Birds, and insects Sea and Land innumerable." (Cameron 1952, App.G.: 319; Wilkins 1955: 79; Beaglehole 1963, II: 328; Whitehead 1969: 185).

It should be particularly noted that Banks, in the extract quoted, is talking only about the number of bird species *discovered* on the voyage and that the letter does not, in fact, give any indication of the number of bird specimens which were actually preserved and taken back to England. Banks was primarily interested in botany. Writing of the botany of Tierra del Fuego in January 1769 he said that "probably No botanist has ever enjoyed more pleasure in the contemplation of his Favourite pursuit than Dr Solander and myself among these plants," and in 1782 he wrote, "Botany has been my favourite Science since my childhood" (Cameron 1952: 74; Beaglehole 1963, I: 120, 226). It is quite clear from many entries in Banks's Journal that at the various landfalls botanical collecting took precedence and that great care was taken to preserve the botanical specimens collected (see, e.g. Beaglehole 1963, I: 225; II: 58, 59, 84, 87). A large botanical collection was taken back to England by him.

Nonetheless it is beyond doubt that many bird specimens were also collected during the course of the voyage. One has only to read Banks's Journal to realise just how many (probably several hundred) oceanic birds were collected. For example, on one day alone, 3 March 1769, Banks records having killed 69 oceanic birds of seven species (Beaglehole 1963, I: 236). Iredale (1913: 133) has suggested that because no studies in botanical science were possible at sea, full attention was at those times given to zoological items. This seems to be correct. Of the 54 species of birds described by Solander (see Lysaght 1959: 359-362) all but five of the descriptions were of oceanic species and of these five one was of a duck (*Anas flavirostris*) from Tierra del Fuego and three were based on land birds (*Volatinia jacarina*, *Motacilla flava* and *Oenanthe oenanthe*) which were collected when they flew aboard the *Endeavour* at sea. Furthermore, Banks, in his Journal, gave Solander's scientific names to the oceanic species shot by him but no scientific names appear in the Journal for any of the new land birds collected probably because such birds were neither described nor given scientific names by Solander. Parkinson's extant zoological drawings include 35 bird paintings, 23 of which are of oceanic species (Lysaght 1959: 272-80). It has been suggested

(Beaglehole 1963, I: 416n) that a folio of bird sketches by Parkinson may have been mislaid on the voyage but Parkinson was employed by Banks primarily as a botanical draughtsman and a very considerable number of plants were illustrated by him in such capacity. It is not surprising that Parkinson found little time to illustrate birds, in particular land birds, for, as Banks records on 12 May 1770, "This evening we finished Drawing the plants got in the last harbour, which had been kept fresh till this time by means of tin chests and wet cloths. In 14 days just, one draughtsman has made 94 sketch drawings, so quick a hand has he acquir'd by use" (Beaglehole 1963, II: 62).

But it is beyond doubt that many land birds were also collected during the voyage. For example, in New Zealand "some most beautiful birds" were shot at Anaura Bay and more birds were later shot at Tolaga Bay and Queen Charlotte Sound. In Australia, many land birds were killed at Botany Bay, Thirsty Sound and at the Endeavour river (see e.g., Beaglehole 1963, I: 416, 419; II: 83, 118).

Although there were on the *Endeavour* "many bottles with ground stoppers, of several sizes, to preserve animals in spirits" (Cameron 1952: 15; Beaglehole 1963, I: 30), it is most doubtful that many of the birds collected actually went into such bottles. On 5 February 1769, Banks wrote that he was "a little better than yesterday, well enough to eat part of the Albatrosses shot on the third, which were so good that every body commended and Eat heartily of them tho there was fresh pork upon the table." The Gannets shot near the Three Kings Islands on 24 December 1769 were made into a "Gocse pye" for Christmas dinner; birds shot at Botany Bay and the Endeavour River were eaten and the Plain Turkey (*Ardeotis australis*) taken at Bustard Bay — the only Australian land bird described by Solander — was eaten (see Beaglehole 1963, I: 233, 449; II: 67; Parkinson 1784: 136, 144-5). In addition we find Banks writing on 10 November 1769 at Mercury Bay — "Hunger is certainly most excellent sauce, but since our fowls and ducks have been gone we find ourselves able to eat any kind of Birds (for indeed we throw away none) without even that kind of seasoning" and, in August 1770 when writing of New South Wales, "Birds, fish &c. I shall say no more than that we had some time ago learned to eat every identical species which came in our way: a hawk or a crow was to us as delicate and perhaps a better relished meal than a partridge or Pheasant to those who have plenty of dainties: we wanted nothing to recommend any food but its not being salt, that alone was sufficient to make it a delicacy. Shags, Sea gulls and all that tribe of sea fowl which are recond bad for their trainy or fishy taste were to us an agreeable food, we did not at all taste the rankness, which no doubt has been and possibly will again be highly nauseous to us whenever we have plenty of Beef and mutton &c." (Beaglehole 1963, I: 430; II: 116).

Although Banks considered the first specimens of *Puffinus assimilis* and *Puffinus griseus* collected by him on 15 February 1769 to be "a great acquisition to our bird collection" (Beaglehole 1963, I: 234) this does not confirm that a bird collection as such was intentionally being made by him. In view of the foregoing these *Puffinus* specimens, having (as they were in this case) been described by Solander and drawn by Parkinson, were probably also, to quote Iredale's (1913: 133) words, "consigned to the pot."

Despite all of this there is, however, some evidence that Parkinson, at the time of his death on 26th January 1771, had a collection of birds preserved in spirits (Parkinson 1784, preface: x-xi) but we do not know what ultimately became of any such collection. Neither do we know whether any of the birds preserved in spirits which were seen by Sheffield at Banks's house in London in late 1772 included any specimens from the voyage (Lysaght 1971: 255). But we do know that some bird specimens did find their way to England. "Some beautiful birds from the South Sea Islands" were presented to King George III by Banks and Solander in August 1771 (Rauschenberg 1968: 41), and although Iredale (1913: 132) has said that "no specimen can be traced, even in literature, which can honestly be said to have been procured on this first voyage," some such specimens can in fact be so traced and a careful search of the literature might reveal a few more. At the present time I know of five species which were represented by first voyage specimens which reached England and, as all are Australian and New Zealand species, it does seem appropriate to place the evidence on record here (see Appendix). Unfortunately none of these first voyage bird specimens now exists. Historical evidence indicates that it is extremely unlikely that the much discussed White Gallinule at Liverpool, said to have been collected in New Zealand by Banks (see e.g. Forbes 1901: 62; Oliver 1955: 18, 371), was, in fact, collected in New Zealand on any of Cook's voyages, let alone by Banks (Greenway 1967: 251 and Medway in prep.). Furthermore William Bullock's claim that he had in his Museum the entire collection of birds made by Banks and Cook on the first voyage (Bullock 1817: 32) is clearly quite erroneous, and it is also impossible to substantiate his later claims (Bullock 1819) that he had in his collection at the time of its sale various first voyage specimens collected by Banks (Medway in prep.).

The majority of bird specimens from the second voyage, which were not eaten (see e.g. Forster 1777, II: 451) and reached Europe, almost certainly went to Banks. On 1 August 1775 Solander wrote advising Banks that Cook had some birds in spirits of vinum for him (Beaglehole 1963, I: 105; 1961: 957). On 22 August 1775, he wrote further that "Several of the Resolution's Men have called at Your house, to offer you their curiosities:— Tyrrell was here this Morning . . . Capt Cook has sent all his curiosities to my apartments at the Museum. All his Shells is to go to Lord Bristol — 4 Casks

have your name on them and I understand they contain Birds & fish &c . . ." (Smith 1911: 45; Dance 1971: 368; Beaglehole 1963, I: 108n; 1961: 960-1; Whitehead 1969: 163). John Marra, Gunner's mate, wrote to Banks from on board the Resolution in 1775 to say that ". . . from many strange Isles I have procured your Honour a few curiosities as good as could be expected from a person of my capacity. Together with a small assortment of shells," and some bird specimens may well have been included (Smith 1911: 45; Whitehead 1969: 192; Dance 1966: 99; Dance 1971: 368). Banks also received a number of second voyage bird specimens from Furneaux (Banks *rd*).

According to Beaglehole (1963, I: 110) the Forsters were, after the return of the second voyage ships, given the run of Banks's library and collections. But Hoare has said, in his recent biography of the elder Forster (1976), that "Nothing in this research has shown conclusively that the Forsters ever had access to Banks's and Solander's collections and manuscripts after the voyage. No such hint or statement appears in even the most private correspondence." However, in September 1775 Banks seems to have received some of Forster's insects (Whitehead 1969: 163) and in August 1776 he bought George Forster's paintings for 400 guineas (Dawson 1958: 339). In October 1777 the elder Forster advised Banks that as soon as his son returned from Paris "he shall wait on you with my whole collection, which is not yet searched, and you may have whatever you shall want of it" (Beaglehole 1963, I: 109n). It was no doubt further to this promise that, in January 1778, the Forsters presented Banks with a large collection of plants. Probably at the same time they also presented him with a considerable collection of animals (no doubt including birds) for it is stated in a memorandum by Banks that "on their [the Forsters] return they did me the favour to present me with very many specimens, both of plants and animals which they had collected in the different countries they had visited" (Britten 1885: 363). In just the month following, February 1778, Forster is writing to Banks appealing for financial assistance and mentioning that he is negotiating the sale of his collections to a foreign sovereign (Dawson 1958: 339). The collections referred to would no doubt have been what remained after the presentation to Banks (and probably presentations to others also) but I do not know that any such sale ever took place as, for example, in September 1778 Banks appears to have refused a "presentation" by Forster of shells collected by him on the voyage (Dawson 1958: 339; Whitehead 1969: 186; Beaglehole 1963, I: 110-111). From this brief summary it seems probable that Banks received the bulk of the Forster ornithological specimens from the voyage.

Banks clearly received most of the bird specimens collected on the third voyage. On 16 June 1780 Barrington wrote to Lord Sandwich informing him "that the specimens of Natural History collected in this last voyage were destin'd both by Capt. Cook & the late Capt.

Clerke for Sr Ashton Lever's Museum" and begged that Captains Gore and King be directed to give such specimens at least as were collected during the lives of Captain Cook and Captain Clerke to that museum. On 3 October 1780 Barrington renewed his plea that the curiosities from the voyage may go to Sir Ashton Lever (Beaglehole 1967: 1558-9).

Barrington, however, was mistaken, at least so far as Clerke's collections were concerned, for Clerke in his final letter of 10 August 1779 to Banks wrote that "I have made you the best collections of all kinds of matter I could that have fallen in our way in the course of the voyage, but they are by no means so compleat as they would have been had my health enabled me to pay more attention to them; I hope however you will find many among them worthy of your attention and acceptance, in my will I have bequeathed you the whole of every kind, there are great abundance so that you will have ample choice," and, further, "I must beg leave to recommend to your notice Mr. Will. Ellis one of the Surgeon's mates who will furnish you with some drawings & accounts of the various birds which will come to your possession" (Beaglehole 1967: 1543).

William Anderson also left his collections to Banks. Samwell, in his Journal under date 3 August 1778, wrote that Anderson "left his Collection of Plants & other Curiosities which he had procured this Voyage both natural and artificial to Mr. Banks" (Beaglehole 1967: 1130).

In October 1780, after the return of the ships, some natural curiosities were purchased for Miss Anna Blackburne who had a natural history museum at Fairfield, near Warrington. We do not know what such "natural curiosities" were nor do we know what ultimately became of them or, indeed, of Blackburne's collection (Wystrach 1974: 89). Sir Ashton Lever apparently received some birds — we do not know what — from William Bayly ("who had saved a few tolerable good articles") of whose collection he had the first choice. The balance of Bayly's collection seems to have been disposed of by sale advertised in the newspaper (Beaglehole 1967: 1560-1). Daniel Bculter, proprietor of a museum at Great Yarmouth, is said to have spent a day on Cook's ship and purchased many articles, which may have included some birds (Southwell 1908: 116). An unknown officer of the *Discovery* sold a collection of 248 lots from the South Seas by public auction in London in June 1781, but the only birds included in such sale were Lots 40 and 245 consisting of nine birds from the Sandwich Islands (Anon 1781).

Of those on the ships of the last voyage Anderson and Clerke are most likely to have had the largest collections of natural history specimens and, as we have seen, these all went to Banks. Although Samwell wrote on 1 November 1780 that "very few Natural Curiosities have been brought home in our two Ships" (Beaglehole 1967: 1561),

the number of birds so obtained was, nonetheless, significant for Banks is recorded as having received from the voyage some 220 specimens representative of some 159 species (Dryander n.d.). Included were a considerable number of specimens from the Hawaiian Islands which almost certainly came principally from Clerke as Anderson had died in 1778 and no substantial collecting took place at the Hawaiian Islands until the second visit there in 1779. The Dryander manuscript list just referred to provides the only comprehensive account of bird specimens received by Banks from any one of the three voyages. Such other manuscript lists as exist (Banks n.d.) seem to be incomplete for there is some evidence that Banks had, in fact, disposed of many bird specimens from the voyages before such lists were compiled (Medway in prep.).

The birds which Banks received were widely dispersed by him. For example, some may have been included in his donations to Alstromer (Ryden 1965) and, as will be seen, many appear to have passed, by sale or gift, to Lever and Latham. His friend Marmaduke Tunstall received at least a few of his first voyage birds (see Appendix). In 1792 Banks divided a great portion of his then remaining collection between Sir John Hunter and the British Museum (Whitehead 1969: 165-7; Burton 1969; Medway in prep.). He may also later have given a few remaining voyage birds to William Bullock (Medway in prep.).

Lever's collection, the history of which has been well documented (see e.g., Mullens 1915; Whitehead 1969: 167-169), was of outstanding ornithological importance, containing as it did a great many bird specimens including many from Cook's voyages which became types by virtue of Latham's and Gmelin's descriptions. Lever's collection was subsequently sold by public auction in London in 1806 and the specimens were widely dispersed, most of the types having now been lost forever and the few known remaining ones (largely New Zealand and Hawaiian) being almost exclusively in the Naturhistorisches Museum at Vienna and the Merseyside County Museum at Liverpool.

Since Sir Ashton Lever did not move his museum to London until 1775, it is unlikely that he received any Cook voyage specimens before then and it further seems that the second voyage material which came into his possession did so indirectly. For example, through Solander in September 1775 he seems to have received some of Forster's insects (Whitehead 1969: 163) and his much discussed Imperial Sun Shell (*Astraea heliotropium*, from New Zealand) was purchased by him from dealer George Humphrey (who bought the bulk of the second voyage shell specimens) who, in turn, had earlier purchased it from an officer of the *Adventure* (Dance 1966: 99, 110). As we have seen, the amount of third voyage ornithological material received by Lever from William Bayly was probably insignificant. However, we know that a considerable number of ornithological specimens which

must have been collected on Cook's second and third voyages were in Lever's Museum at the time Latham wrote the three volumes of his *Synopsis*. It seems that the majority of these were probably presented or sold to Lever by Sir Joseph Banks who, as we have seen, had been by far the principal recipient of ornithological specimens from the voyages.

At the time Latham wrote his *Synopsis* he had in his own collection a number of specimens (e.g. from New Zealand and Hawaii) which could only at those dates have been collected on Cook's voyages. Latham in 1785 (preface, i-ii) drew attention to the specimens in his own collection but their presence seems to have been overlooked since (see e.g., Stresemann 1949, 1950, 1953; Lysaght 1959; Whitehead 1969). Such specimens were of considerable importance for Latham based his descriptions of the species to which they related at least partly on them. Of the species mentioned in this paper the Kaka, Kokako and Tui were represented by specimens in Latham's collection.

Latham was permitted by the elder Forster shortly before the latter's departure from England in 1780 to see and to copy his drawings of birds and he was supplied some notes by Forster (Forster 1790: 2; and, e.g., Latham 1781: 365). The drawings were presumably those intended for presentation to King George III as the younger Forster's paintings had been sold to Sir Joseph Banks in 1776. However, there is no evidence that Latham received any of the Forsters' birds direct from them and, in all probability, Latham obtained his specimens principally, if not entirely, from Sir Joseph Banks to whom he acknowledged his indebtedness (Latham 1781: preface, iv). But he may have obtained a few such specimens from Lever (who probably, as we have seen, obtained his principally from Banks) to whom Latham also acknowledged his indebtedness (Latham 1781: preface, iv) and with whom he had been exchanging specimens as early as 1773 (Mathews 1931: 467).

The ultimate fate of Latham's specimens is not known. He himself wrote in 1831 that his birds were, in general, dispersed when he left Kent in 1796 (Mathews 1931: 473) but he retained some specimens at that time. In 1806 he purchased at the sale of the Leverian Museum, including Lots 2790 and 3070 which were specimens of *Drepanis pacifica* and *Vestiaria coccinea* from Hawaii. The latter species was represented in Latham's collection at the time he originally described it in 1781 under the name Hook-billed Red Creeper (Latham 1781: 704). His acquisition of further specimens in 1806 might indicate, perhaps, that he had, by then, disposed of his earlier specimen. The Earl of Derby (then Lord Stanley) purchased a number of specimens from Latham between 1811 and 1815 but none of these appear to have been from Cook's voyages (Derby Ms. lists). Latham's collection of British birds was purchased by Edward Donovan (1817: 6) whose own collection was sold by public auction in London in 1818 (Mullens & Swann 1917: 172-174).

Several extant type specimens of birds collected on Cook's second voyage are in the Naturhistoriska riksmuseet at Stockholm. These had been obtained by Anders Sparrman who joined the *Resolution* at Cape Town in November 1772 as a paid assistant to the elder Forster, an assistant who was to receive, as Sparrman himself later wrote (1786, I: 84), "part of such natural curiosities as they (the Forsters) might chance to collect." Sparrman left the *Resolution* in April 1775 on its return to Cape Town to continue his interrupted African studies, arriving back in Sweden in July 1776.

On his return to Sweden at least some of the bird specimens which he had obtained found their way into the private museum of Johan Gustaf von Carlson where they were when Sparrman published the four fascicules of his *Museum Carlsonianum* between 1786 and 1789. In this work he described in Latin (and illustrated) a number of birds from the voyages, of which eight species had been collected in New Zealand. All of the New Zealand species so described by Sparrman had previously been described in English and given English names by Latham in his *Synopsis*. However, Sparrman gave them scientific binomials which, thus, have priority over the scientific binomials shortly afterwards given to the same species by Gmelin on the basis of Latham's descriptions. The specimens on which Sparrman based his descriptions are, therefore, the types of the species concerned.

The subsequent history and fate of Sparrman's type specimens can be traced through extant manuscript lists in the Naturhistoriska riksmuseet and in the Kungl.Svenska Vetenskapsakademiens at Stockholm. On Carlson's death in 1801 about one hundred bird specimens from his collection went to the Vetenskapsakademiens while the remainder went to the private museums of A. U. Grill and Gustaf Paykull and to the University of Uppsala. Many of such specimens which survived subsequently went to the Naturhistoriska riksmuseet where Sparrman's remaining types were identified by Sundevall in 1857 and Gyldenstolpe in 1926. Several of Sparrman's types from Cook's second voyage (including the types of three New Zealand species) are still in that museum. The New Zealand types are dealt with in this paper. The writer hopes in due course to publish an account of Sparrman's total contribution to the ornithology of Cook's second voyage for, as has been said, "posterity has not yet given him the place he deserves" (Rutter 1953: xx).

THE EXTANT TYPE PAINTINGS

PARADISE DUCK *Tadorna variegata* (Gmelin, 1789)

The Paradise Duck was first seen at Duck Cove, Dusky Sound, on 6 April 1773, where the elder Forster recorded "a large Duck and Drake blackish white Covers of the wings & one of them had a white head; but they were so shy, that we could get none of them" (Forster 1772-1775: I, 98). On 7 April 1773 he described the species in his Journal under the name *Anas cheneros* (later formally published

in 1844: 92-93, No. 97). Further specimens were taken at Dusky Sound where the species was also noted by Cook and Wales, the latter writing that one of the duck species met with there "on account of its variegated plumage, we called the painted Duck was the most beautiful bird I ever saw" (Beaglehole 1961: 136, 786).

Forster recorded that "one kind of Duck, namely the large Painted Duck" was seen at Queen Charlotte Sound in May - June 1773 (Forster 1772-1775: II, 32) and the "Shel-drakes" found there by Bayly in April - May 1773 may well have been Paradise Ducks (McNab 1914: 207).

Latham (1785: 441-2: No. 6) based his 1785 description of the Variegated Goose on George Forster's painting of a female specimen executed at Dusky Bay in April 1773 (Folio 67; Lysaght 1959: 288). Latham wrote that the species was found at Dusky Bay. Gmelin (1789, I: 505) based his description of *Anas variegata* on Latham's account. Forster's painting is, therefore, the type and the type locality is Dusky Sound. The type painting has been reproduced by the Beggs (1966, 1968, 1975: Plate 48).

GREY DUCK *Anas superciliosa superciliosa* (Gmelin, 1789)

The first Grey Ducks known to have been collected by Europeans were taken in 1773 on the second voyage at Dusky Sound where they were noted by both the younger Forster and Cook (Forster 1777, II: 156; Beaglehole, 1961: 136). The elder Forster's undated description (1844: 93-4, No. 98) of *Anas leucophrys* recorded that the species inhabited the southern island of New Zealand, being found both at Dusky Bay and Queen Charlotte Sound. His son's painting (Folio 77) was drawn at Dusky Bay (Lysaght 1959: 290).

Latham (1785: 497: No. 45) based his description of the Supercilious Duck on Forster's painting and said that the species inhabited New Zealand where it was found both in Queen Charlotte Sound and Dusky Bay. Gmelin's (1789, I: 537) description of *Anas superciliosa* was based on Latham's description. Forster's painting is therefore the type. The type painting has recently been reproduced by the Beggs (1966, 1968, 1975, Plate 48; 1969: Plate 135). The type locality is Dusky Sound.

NEW ZEALAND SCAUP *Aythya novaeseelandiae* (Gmelin, 1789)

On 20 April 1773, about a mile up the Seaforth River from Supper Cove in Dusky Sound, the elder Forster's party found and shot the first specimens of the New Zealand Scaup known to have been collected by Europeans (Forster 1772-1775, I: 118-9; Forster 1777, I: 168; Beaglehole 1961: 136). One of the birds taken on this occasion, a male, was painted by George Forster (Folio 79; Lysaght 1959: 290) and his father described the species as *Anas atricilla* from Dusky Sound (Forster 1844: 95-96: 100).

Latham (1785: 543: No. 80) founded his description of the New Zealand Duck on Forster's painting, giving the habitat as Dusky Bay. Gmelin (1789, I: 541) based his *Anas novae Seelandiae* on Latham's description. Forster's painting is, therefore, the type and the type locality is Dusky Sound. The painting has not yet been published.

WHITE-FRONTED TERN *Sterna striata* (Gmelin, 1789)

Oliver (1955: 338) was not correct when he said that "Sir Joseph Banks collected an immature specimen of the White-fronted Tern in New Zealand during Cook's first voyage, and from a drawing made by Parkinson, Latham described his Striated Tern." Latham, in fact, described his Striated Tern from a painting by William Ellis of a bird said to have been collected between New Zealand and the Cook Islands on the third voyage (Ellis folio 57: Latham 1785: 358: No. 10, Plate 98; Lysaght 1959: 331). However, Ellis's painting was undoubtedly of the bird collected close to the south-east coast of the North Island on 28 February 1777, an incident described by Anderson as follows ". . . in the evening an Eggbird or Tern which lighted on the ship was caught but differ'd from all any of us had seen before. It was about the size of the common Tern or sea swallow with the head, back and coverts of the wings finely variegated with black and white, the rest of the body nearly white and the Bill and feet black" (Beaglehole 1967: 819). Anderson, himself, elsewhere described this bird as *Sterna variegata* (Anderson 1776-1777: 9).

Gmelin (1789, I: 609) based his description of *Sterna striata* on Latham's Striated Tern. Latham's Plate 98 (original Latham drawing 953, still surviving) was based on Ellis's painting. The type painting is here reproduced as Fig. 1.

SHINING CUCKOO *Chalcites lucidus lucidus* (Gmelin, 1788)

"A fine green new Cuckoo with a white belly, barred transversally with green" shot by Omai, the native from Tahiti, at Queen Charlotte Sound on 5 November 1773 formed the subject of George Forster's painting (Folio 57; Lysaght 1959: 286) and his father's description of *Cuculus nitens* (Forster, 1844: 151: No. 139), both dated 5 November 1773.

This is the only record of the Shining Cuckoo from Cook's second voyage and, although the species was met with again at Queen Charlotte Sound in February 1777 on the third voyage (Beaglehole 1967: 806), no specimens seem to have been taken back to England. Latham's (1782, 528: No. 24, Plate 23) Shining Cuckoo was based on the Forster painting and Gmelin's (1788, I: 421) *Cuculus lucidus* was based on Latham's description. Latham's plate 23 (original Latham drawing No. 279, still surviving) was based on Forster's painting. Another Forster painting of the Shining Cuckoo has been twice reproduced recently (Kunst 1969; Steiner & Baege 1971: Plate 2) but it is not the type, which is his above folio 57. The type locality is Queen Charlotte Sound.



FIGURE 1 — Type painting of White-fronted Tern (*Sterna striata*) by W. Ellis, 1777. By permission of the Trustees of the British Museum (Natural History).

SOUTH ISLAND BUSH WREN *Xenicus longipes longipes* (Gmelin, 1789)

The Bush Wren is not specifically mentioned in Forster's Journal but the elder Forster's description (1844, 88-89: No. 92) of *Motacilla longipes* is dated 21 April 1773 when the *Resolution* was at Dusky Sound and he gave the habitat as the southern island of New Zealand. His son's painting (Folio 165; see Lysaght 1959: 309) is undated but was executed at Dusky Sound.

Latham's (1783, 456: No. 74) description of the Long-legged Warbler was based on the Forster painting and he said that the species inhabited Dusky Bay. His previously unpublished drawing (original Latham drawing no. 657, still surviving) is also based on such painting. Latham's drawing is here reproduced as Fig. 2.

Gmelin's (1789, I: 979) *Motacilla longipes* was founded on Latham's Long-legged Warbler. The Forster painting is, therefore, the type, the type locality being Dusky Sound. Oliver (1955: 453) said that Forster's painting was later reproduced in the report of the *Erebus* and *Terror* (Richardson & Gray 1844-75). But the plate to which Oliver referred (Plate 3, fig. 1) is not a reproduction of Forster's painting, although based on it. The Forster painting has recently been published for the first time by the Beggs (1973: Plate 28).

NEW ZEALAND PIPIT *Anthus novaeseelandiae novaeseelandiae* (Gmelin, 1789)

Under date 21 May 1773 Forster described as *Alauda littorea* "a new lark" which had been collected in Queen Charlotte Sound (1844: 90-91: 95; 1772-1775, II: 13) and on 30 May 1773 George Forster shot "two sand-larks" on Long Island (Forster 1772-1775, II: 20). One of these specimens formed the basis of George Forster's folio 143 (Lysaght 1959: 305). The species was also recorded on the second voyage by Anderson (1772-1775: 10) under the name *Alauda littoræa*.

The pipit was met with again at Queen Charlotte Sound in February 1777 on the third voyage (Beaglehole, 1967: 807) but Latham's (1783: 384) description of the New Zealand Lark which he said inhabited Charlotte Sound was based on the Forster drawing itself executed at Queen Charlotte Sound. Latham's plate 51 (original Latham drawing No. 621, still surviving) was based on Forster's painting. Gmelin (1789, I: 799) founded his *Alauda novae Seelandiae* on Latham's description. Forster's painting is, therefore, the type and the type locality is Queen Charlotte Sound.

BROWN CREEPER *Finschia novaeseelandiae* (Gmelin, 1789)

The Brown Creeper is not specifically mentioned in Forster's Journal and his description of *Parus urostigma* (1844: 90: No. 94) is undated. He gave the habitat as the southern island of New Zealand. George Forster's painting (folio 166; Lysaght 1959: 310) was done



FIGURE 2 — Latham drawing (1783) of South Island Bush Wren (*Xenicus longipes longipes*) based on type painting by Forster. By permission of the Trustees of the British Museum (Natural History).

at Dusky Sound and is, undoubtedly, of the specimen on which his father founded his description.

There is no evidence that any specimens found their way to England from the voyages and Latham's (1783: 558: No. 26) description of the New Zealand Titmouse (in which he gave the locality as Dusky Bay), and Gmelin's (1789, I: 1013) *Parus novae Seelandiae* were based on Forster's drawing which is, therefore, the type with the type locality as Dusky Sound. Forster's painting has been reproduced by the Beggs (1966, 1968, 1975: Plate 48) who originally mistakenly thought it represented the Long-tailed Cuckoo (*Eudynamis taitensis*). But Forster's Folio 56 is of the Long-tailed Cuckoo and was based on a specimen collected at Tahiti in 1773 (Lysaght 1959: 286).

YELLOWHEAD *Mohoua ochrocephala* (Gmelin, 1789)

The Beggs (1966, 1968, 1975: 161) stated that Cook's party did not mention Yellowheads at Dusky Sound in 1773. But Forster's (1844: 87-88: No. 91) description of *Muscicapa chloris* was dated 4 April 1773 (while the *Resolution* was at Dusky Sound) and must have been based on "some new Yellow Headed flycatchers" which had been shot at Cascade Cove on 2 April 1773 (Forster 1772-1775, I: 95).

The species was also met with at Queen Charlotte Sound in June 1773 (Forster 1772-1775, II: 32) but it was a specimen shot at Grass Cove (now Whareunga Bay), Queen Charlotte Sound on 2 November 1774 (Forster 1772-1775, V: 51) which formed the basis of George Forster's painting of 3 November 1774 (Folio 157; Lysaght 1959: 308).

There is no evidence that any specimens of Yellowheads found their way to England from Cook's voyages. Latham's (1783: 342: No. 37) description of the Yellow-headed Flycatcher was based on the Forster painting and the habitat was given as Queen Charlotte Sound. Gmelin (1789, I: 944) founded his *Muscicapa ochrocephala* on Latham's description. Forster's painting is, therefore, the type of the species and the type locality is Queen Charlotte Sound. Forster's type painting is here reproduced as Fig. 3.

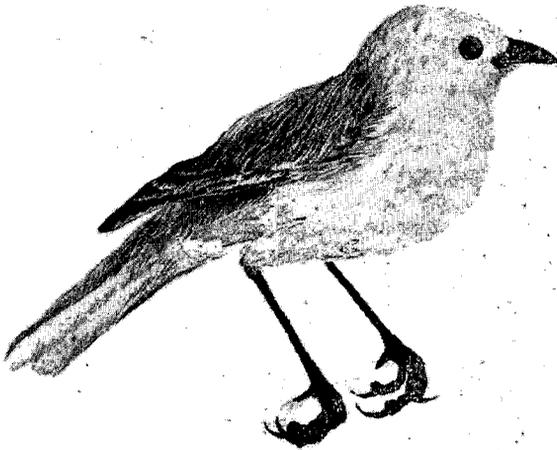


FIGURE 3 — Type painting of Yellowhead (*Mohoua ochrocephala*) by G. Forster, 1774. By permission of the Trustees of the British Museum (Natural History).

[To be continued in *Notornis* 23 (2), June 1976]

BEHAVIOUR AND NESTING OF FIJIAN WHITE-BREASTED WOODSWALLOWS

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ABSTRACT

White-breasted Woodswallows in Fiji nest in trees and on cliffs. Small sexually-mixed groups select the site, build a series of preliminary nests and the nest proper, copulate indiscriminately, and cooperate in incubation and raising the young. Detailed descriptions are given of observations of behaviour (including preening, scratching, hunting for food, song, roosting and defence) and of nesting (including site selection and building, copulation, incubation and care of young).

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INTRODUCTION

Woodswallows (Artamidae) occur from India through southeast Asia and the Australian region eastward into the southwest Pacific to Fiji. The White-breasted Woodswallow (*Artamus leucorhynchus mentalis*) is present in Fiji, other races being found in New Caledonia and the New Hebrides through Australia to Borneo and the Philippines.

All woodswallows exhibit highly developed social behaviour. Some years ago, Immelmann (1966) discussed this for *Artamus leucorhynchus*, *A. cinereus* and *A. minor* in Australia, many of his observations being applicable to *A. leucorhynchus* in Fiji. However, there appear to be major differences in breeding behaviour between Fijian White-breasted Woodswallows and Australian ones.

METHODS

A group of White-breasted Woodswallows was studied between 8 May to 5 June 1973, 21 June to 5 July 1973, and from 20 August to 7 November 1973. The breaks between study periods and the limited time available — usually from late afternoon until dark — means the information gained is only an outline of nesting behaviour. Some 80 hours were spent observing the birds. The semi-tameness of these urban-dwelling woodswallows enabled close observation without undue disturbance.

Sexing was based on copulatory behaviour, this woodswallow species not exhibiting sexual dimorphism. I was, thus, never aware of the sex of any individual for more than a few minutes. Sufficient definite observations were made of two males interacting with one or more females, and vice-versa, for some positive general conclusions to be drawn.

HABITAT

White-breasted Woodswallows occur in all habitats on many minor and most major Fijian islands. They are absent from Kadavu in the south, and the Lau islands of eastern Fiji.

The Suva peninsula in southern Viti Levu with a population of some 70,000 people is well wooded with trees and gardens. It has a heavy average annual rainfall of 3,000 mm without really marked wet or dry seasons.

Several small woodswallow groups occur in Suva. A large raintree (*Samanea saman*) overhanging a major crossroad just outside the commercial heart of the city has been the night roost and nesting tree for the group of woodswallows studied here for at least five years (Clunie 1973). From this they venture out at least 1.5 km and probably further.

COMPOSITION OF WOODSWALLOW GROUP

In Fiji White-breasted Woodswallows occur in groups of three to nine birds, large groups being common in Australia (Immelmann 1966).

The group studied varied in numbers, five birds being present from 5 to 22 May, six from 23 to 29 May, five from 30 May to 24 September, and only four thereafter. All were in adult plumage, although there are often juveniles in such groups. Two males and two females were always present, the sex of the other two birds being unknown. I could not determine if more than four birds ever took part in nesting activities.

BEHAVIOUR

Allo-preening

The woodswallows allo-preened frequently and indiscriminately within the group. Two flanking birds often preened a middle one simultaneously. Allo-preening was usually restricted to the head, upper back, throat and breast but unlike Immelmann's (1966) Australian woodswallows they also quite frequently preened each other's flight feathers. Two birds occasionally perched head to tail to preen one another's tail feathers.

Headscratching

They invariably scratched their heads by the indirect method; first lowering one wing, then bringing the leg on that side of the body up behind and over it.

Casting

White-breasted Woodswallows cast small food-remain pellets, coughing them out with a slow head-shaking which continues for a moment afterwards. The ground beneath favoured perches is often littered with these pellets.

Hunting and food

The woodswallows fed on a variety of insects with moths, butterflies, dragonflies and grasshoppers as staples. Large hawk moths, a butterfly (*Hypolimna bolina*), the American Cockroach (*Periplaneta americana*), and a hornet (*Polistes olivaceus*) were common prey.

Detailed records were kept of 329 attacks on insects, 101 or over 30% being successful.

The basic hunting method was to hawk after flying insects from a prominent lookout. Most attacks took place well clear of the ground and obstructions, but many were made just above the ground, the birds almost brushing the grass. Another method was to sweep low over blossoming mango (*Mangifera indica*) trees to snap at insects, the birds' bellies scraping the flowers. Similar flights were made along building walls, whereas hovering was used to pick an insect off a wall, when attacking a slow-flying insect, and before banana flowers. Rarely a woodswallow landed on a branch to peck at insects, and once one landed in grass to search for a moth sheltering there.

If the first pass failed the woodswallow often attacked repeatedly, pursuing its quarry many metres. Two or more birds frequently converged on a single target, criss-crossing skilfully as they made their passes, unsuccessful individuals sometimes following successful ones to beg for the prey. Insects were taken with an audible snap of mandibles and if very small were sometimes swallowed in flight, but were usually carried to a perch and eaten. Large insects were often transferred to the feet and carried struggling to a perch, the bird sometimes repeatedly dropping and recatching them or transferring them from bill to feet as it flew.

Most prey was swallowed whole but large and active insects were battered against a branch or held in the feet and pecked to death. Particularly large prey was held in the foot against the perch and dismembered with the bill. Dragonflies were usually plucked before being swallowed, the bird sometimes removing and discarding all the wings and legs, but more often only one wing or the wings from one side of the body.

Having fed the woodswallow wiped its beak on its perch, unsuccessful begging birds doing likewise.

Mutual feeding and food theft

Mutual feeding occurred throughout the long nesting period and was not linked with pre or post-copulatory behaviour. I have seen woodswallows feed each other in most months and do not regard it as courtship feeding. A wounded bird incapable of capturing prey must have been fed by other members of the group despite the presence of young in the nest, for it survived. The feeding of sick woodswallows by other adults has been recorded elsewhere (Immelmann 1966).

Typically a bird hawked out and returned with an insect, whereupon another cheeped and fluttered like a nestling. Often the bird with the insect approached to feed the beggar, first battering the insect if it were large, and then sometimes flying out for another insect and again feeding the beggar. Frequently begging birds were ignored, and flew to the successful one, pursuing it from wire to wire, begging plaintively. A persistent beggar usually attracted another, which begged and pursued as industriously. One bird which had been pursued and begged for several minutes hovered over its beggar with its butterfly dangling from its bill as if to encourage further pursuit, before landing to eat the butterfly. This suggests an element of play, the tempting birds perhaps wanting to be chased, and food theft may be related to this. It is possible that birds repeatedly dropping and recatching large prey in flight, or transferring it from bill to feet, may have been trying to attract attention. Other woodswallows often circled them as they approached, landing beside them, begging and pursuing them from wire to wire. Two cases of prey theft may have been in play. Two woodswallows converged on a hawk moth near the nest tree, one seizing it and flying towards the tree. The unsuccessful bird pursued the other in a wild aerial chase, the latter dodging and transferring the moth to its feet. The pursuer snapped unsuccessfully at it, came in again, and snatched it from the other's feet, transferring it to its own as it fled. The robbed bird chased it around the tree and nearby buildings repeatedly trying to seize the moth. Suddenly a third woodswallow darted from the nest tree and in a clean sweep seized the moth in its bill, transferred it to its feet, and fled. The other two did not pursue but landed in the tree, even though the fresh robber slowed and transferred the moth from bill to feet several times as if luring pursuit, before making off.

In the second case a woodswallow leaned forward to feed a begging companion. A third woodswallow swept between them, seized the insect, and flew to the other side of the tree to eat it. The begging bird continued soliciting and was soon joined in this by the robber bird which returned after it had fed and begged from the original captor for several seconds.

Attempts at food theft also occurred if a woodswallow dropped an insect, others darting in immediately to seize it. They also seized prey being clumsily pursued by pedestrian mynahs (*Acridotheres fuscus* and *A. tristis*) and hawking Red-vented Bulbuls (*Pycnonotus cafer*).

Song

Immelmann (1966) discussed woodswallow song and its possible motivations. I only heard a woodswallow sing once. On the evening of 16 May a lone woodswallow sang between hawking sorties from powerlines near the nesting tree. The song was very soft and continuous, being a medley of chortles and whistles faintly reminiscent of the Australian magpies (*Gymnorhina sp.*) and quite unlike the usual harsh chattering call notes.

Clustering

White-breasted Woodswallows frequently cluster in tightly packed rows along branches or power-lines. The woodswallows of the study group perched in pairs or clusters on prominent lookouts. Clustering or cuddling took place at any time, in sunlight or drizzle, and with no apparent regard to sex. Individuals often seemed reluctant to cuddle and hopped away a metre or so when approached. The approaching bird then hopped over and gently nudged the other in the side with its bill, and moved away a little, at which it invariably hopped over and cuddled up. The middle birds of clusters often jumped out to join the end of the line, while individuals broke ranks and hawked out at will.

Roosting

The woodswallow group roosted nightly in a tight cluster, all roosts except those used in storms being near the nest fork. Storm roosts were further down in the tree, which is used as a roost all year. Roosts were located either in a bend of a branch or crotch of a fork, the birds clustering about the bend so that they faced outward in a slight semi-circle. This gave the group as a whole a far wider view of the tree's approaches, and could feasibly serve as a defence against predators, Fijian raptors hunting until dark.

As the evening darkened the woodswallows closed in to hunt near the roosting tree, one or two eventually flying up to a roosting branch, cuddling and calling, gradually being joined by the others. Individuals and sometimes the entire group frequently flew noisily out then returned to cluster. Each newcomer was met with a chorus of calls. After some movement and adjusting of positions the birds fell silent. Clustering to roost usually took about ten minutes, but

if the birds returned late to the roost in a body they clustered immediately with little ceremony.

Often the woodswallows were settled just after or even before sunset, at other times not until it was dark. If only one bird was there at dark it grew agitated, calling and moving about in the tree as if trying to attract its companions. A lone bird often sailed over the canopy or perched calling nearby for several minutes after the group clustered, eventually joining the cluster to a welcoming chorus.

On the evening of 3 June most or all of the birds took strands of dead grass to the roost and clustered there holding them in their feet. Black-faced Woodswallows (*Artamus melanops*) in Australia frequently carry twigs to their night roosts and drop them on arrival. Immelmann (1960), discussing this, mentioned that African social weaver birds carry nest materials to the roost, an act of obvious significance in communal nesting birds. He thought the reason less clear in Black-faced Woodswallows, which build individual nests. It is significant that White-breasted Woodswallows in Fiji, which build communal nests, should also carry nest materials to the roost sometimes.

Night roosts centred on a traditional roosting branch near the nest fork, which was used repeatedly through the study period, although it was often abandoned for nearby branches for several nights in succession. When a new roosting branch was selected, several of the birds congregated in the general roosting area, flying from branch to branch and clustering noisily on each momentarily (c.f. nest site selection). They seemed torn between the new roost thus selected and the traditional roost, one or two birds often perching at the old roost long after the rest had settled on the new branch, only joining the cluster at dark.

After the start of incubation the birds invariably clustered on a branch about 1 m from the nest.

Defence

From the early stages of nestbuilding onwards I recorded details of over 100 attacks by the woodswallows on birds and mammals which ventured near the nest tree. Other attacks occurred but I could not determine the species involved.

Repeated passes over long periods were made against predators, fierce attacks on raptors being typical of woodswallows (Immelmann 1966). Seven series of attacks on Fiji Goshawks (*Accipiter rufitorques*) were recorded, hawks invariably being attacked within 150 m of the nest tree. A woodswallow flew up with a loud "wit wit wit wit wit" of alarm on sighting goshawks or on hearing a Wattled Honeyeater (*Foulehaio carunculata*) alarm call. This immediately brought in all woodswallows in the vicinity to jointly attack the hawk in flight, driving it away. Perched hawks were harder to shift and were methodically harrassed, the woodswallows circling overhead and peeling

off one after the other, diving low over its head or back, chattering harshly as they pulled up, then peeling off and diving again. Individuals proved especially aggressive, almost striking the hawk.

Alternatively the woodswallows perched on a prominent lookout and attacked from there, occasionally regrouping on it before re-attacking. Individuals broke off to hunt, sometimes leaving a lone bird to continue the harrassing, but rejoining it regularly to dive and chatter at the hawk. Hawks responded to close passes by ducking violently, and were generally nervous and agitated when under attack. After a series of attacks a hawk either flew off or moved into thicker cover. One, however, flew directly at a diving woodswallow and attempted to seize it, the other woodswallows converging on the hawk and driving it away.

Cats were attacked within 50 m of the nest tree, dogs when passing directly beneath it. The same "wit wit wit wit wit" alarm call as given for hawks was used when rallying to attack cats, but rarely for other species. Attacks on cats usually involved the entire group and were as hard-pressed as those on hawks. One cat fled, but others leapt and clawed at the woodswallows. Eight attacks on dogs were seen, the dogs usually trotting on unperturbed, but two snapped at the birds.

Such reckless attacks against dangerous enemies seem to keep them away from the nest tree, but they probably cause occasional casualties among the woodswallows. Goshawks and Peregrines (*Falco peregrinus*) pursue and nearly capture attacking woodswallows, and one of the woodswallows from the nest was badly wounded when attacking a cat, losing the inner primaries and outer secondaries from one wing.

Attacks on raptors are not confined to the nesting area — they are harrassed wherever they appear.

People were generally ignored by these semi-tame urban woodswallows — one bird made a single pass at me as I stood near the nest tree during 80 hours of observations.

More than 80% of defensive attacks were against small birds, chiefly passerines. Red-vented Bulbuls, Indian and Jungle Mynahs, Malay Turtle Doves (*Streptopelia chinensis*), Wattled Honeyeaters, Vanikoro Broadbills (*Myiagra vanikorensis*) and tiny Orange-breasted Honeyeaters (*Myzomela jugularis*) were regularly attacked and driven from the nest tree. These attacks occurred within 25 m of the tree, and usually within a few metres of the nest. A bird 2 m from the nest would sometimes be ignored, another of the same species 5 m away viciously attacked. Individual woodswallows were especially aggressive, repeatedly attacking birds the others ignored. Not all attacks were pressed home, but some, particularly on the very aggressive Wattled Honeyeater, and on mynahs and bulbuls, were as fierce as those against hawks. Birds had to leap aside to avoid collision, take

shelter on the ground or under bushes, or flee closely pursued for 100 m or more into another tree. The Orange-breasted Honeyeater was frightened of woodswallows, and gave loud alarm calls when one pursued other birds. One Indian Mynah, forced to earth by repeated attacks, leapt hawk-like with feet extended at a diving woodswallow, and was not reattacked. Once a woodswallow collided and grappled with a bulbul, the birds falling struggling to the ground, where they separated. The entire woodswallow group closed in and drove the bulbul into dense cover.

Despite repeated attacks a pair of Indian Mynahs and a pair of bulbuls established nests in the same tree as the woodswallows.

NESTING

Nest site selection and nest building

August to September has been regarded as the nesting season for Fijian White-breasted Woodswallows (Layard 1875; Belcher 1931; Blackburn 1971). My observations suggest it begins in May continuing to November, when the young fledge but are still dependent. Other woodswallows in Suva gathered nest materials in May, while on 29 and 30 June, 1974, two groups of four woodswallows were seen building nests on Vorovoro and Mali islands off the north coast of Varua Levu. The nesting season therefore extends over half the year, eggs only being laid in its later stages. Nest records for December (Clunie 1973) were probably the result of a hurricane destroying earlier broods.

Woodswallows in Fiji nest exposed to the sun on top of pandanus trees (Wood 1926) and also sheltered in the canopy of large, fairly open foliated trees. The Vorovoro and Mali woodswallows built in small holes in coastal cliffs (cf *Artamus minor* according to Immelmann 1966).

The woodswallow group studied here built their nest 15 m above ground level in the under canopy of a large raintree overhanging a busy highway. The nest was built in the same fork used in December 1972 (Clunie 1973), another nest being built in it in 1974.

On 8 May 1973 a woodswallow demolished the rotting remains of the previous year's nest, tugging at it with its bill, dropping the fragments as they came free.

Early on 10 May, four woodswallows examined potential nest sites in the tree. They moved about the under canopy from branch to branch, one with a twig in its bill. Each moved independently, then they clustered in a branch fork, chattered, and broke apart, only to regroup in another fork. This was repeated several times, the birds seeming attracted to the previous year's nest fork. Individuals frequently flew to the old nest fork, nestling in it in an incubating position. If a bird settled there, the others performed a procession about the tree, one flying to a branch and calling, being joined by the others, flying to another branch and so on. Occasionally one flew

over and replaced the bird lying in the old nest fork, which immediately joined the others for a "follow the leader" procession from branch to branch. After 20 minutes of this they clustered on a branch near the nest fork, fell silent and allo-preened. They showed a similar attraction to the old nest site as they did to the traditional night roost when engaged in selecting an alternative one.

Next day four woodswallows began building the first of a series of preliminary nests in the old nest fork. They came singly with strands of dead grass, laying them in the fork and weaving them together with the bill. The nest was seen substantial enough for the birds to stand in while they worked. On that day copulation was seen for the first time.

On 12 May no nesting activity was seen, but on 13 May at least three birds were attracted to the nest fork, despite the disappearance of all nesting materials. They nested in the fork as if incubating, relieving each other there from time to time and defending the area against other bird species.

On 14 May three woodswallows moved restlessly about the tree, one nestling in the nest fork as a fourth flew in with a strand of nesting material and landed beside it, when all congregated about the fork. The bird with the nesting material sidled close to the nest then back along the branch, as the other three hopped over each other's backs excitedly. All four then flew out, returning to the tree individually, one to nestle in the nest fork. The last bird to return brought in a strand of dead grass and joined the bird in the nest fork, the other two joining them immediately. The procession or "follow the leader" activity of 10 May was repeated, one bird flying from branch to branch followed by the others, clustering and calling on each branch. This was repeated several times, the birds breaking up for a few minutes then returning to the tree for another procession. A fifth woodswallow hunting in the area took no part in proceedings.

On 15 May at least two woodswallows were hanging about the nest fork, settling in it occasionally, but no further nesting activity was seen until 21 May, when a woodswallow came calling to the nest fork with a strand of dead grass, but flew off without depositing it. No further nesting activity was seen until 24 May, when three birds proceeded noisily about the branches near the nest fork, congregating and "following the leader" in the way already described. Nest building began again on 27th May, at least three individuals bringing in materials, two sometimes working on the nest together. Nothing further was seen until 2 June, when two woodswallows at least worked actively on the nest as they did next day, the birds roosting that evening with strands of dry grass clutched in their feet. Next day building was still in progress and one bird settled on the nest as if incubating. Despite frequent copulation no nest building occurred on 5 June, and I was away until 20 June. A considerable nest was built on 21 June by at least three birds. This disappeared next

day and no further nesting activity was seen till 25 June, when the basic makings of a nest were present, and no nest making activity was seen for four more days. On 1 July nest building was again in progress, but the only sign of it during the next three days was on 3 July, when a bird brought in a strand of grass but did not deposit it.

I was away from 6 July to 24 August but on 25 August at least three woodswallows were bringing materials to a substantial nest which proved to be the nest proper. Nest building continued daily until 31 August and irregularly after that until 10 September, when all building activity ceased. Birds bringing in materials often lay in the cup as they worked on the nest rim.

The woodswallows had built quite a substantial cupped nest in a forked branch, supported from below by the branches of the fork, the rim standing firmly upright. It was well sheltered by the foliage of the tree canopy. Materials used included strands of dead grass, coconut fibre, small twigs, fern rootlets, and cotton thread. Nesting materials were collected within 200 m of the nest tree, most from within 50 m. When collecting materials the woodswallows usually hovered to pick them up with the bill, but they also landed to pick up materials, and settled on branches to tug free fern rootlets. Strands of dead grass were sometimes picked up in the bill in a long low swoop, the bird hardly pausing in flight. Material was usually carried in the bill but the feet were used for larger pieces.

When adjusting materials at the nest, loose strands often fell free, but were invariably caught as they fell and returned. The birds often hovered about the nest and pulled free loose strands, replacing them in the nest or flying with them to a branch, holding them in the feet, and pulling at them with the bill. Freshly gathered strands of material were likewise pulled and pecked at, being rejected or carried to the nest. Once a bird took a strand from the nest to a nearby branch. Another bird took the other end of the strand in its bill. After a few seconds both dropped the strand, which was not retrieved. In another incident, a woodswallow removed a strand from the nest and flew to a nearby powerline, holding it in its bill. One of the others flew down, took the strand gently in its own bill, pulled it free, and took it back to the nest.

Copulation

Copulation occurred on branches near the nest and on nearby powerlines, first being seen on 11 May and continuing until the young hatched. There was an upsurge in the frequency of copulation and intensity of sexual display after the first week in September, when the woodswallows were working on the final nest. Sexual display and copulation revealed that there were always at least two males and two females in the group.

Females invited copulation by extending the wings over the back in a V and quivering them, while wagging the tail and usually

calling "eep eep eep eep eep" quietly. Louder calls were often used at the beginning of the display, perhaps to attract male attention, but early in the nesting season it was usually given in silence. During the first few weeks males often attempted unsolicited copulation, mounting but invariably being shrugged off their partner's back.

The female sexual display was usually given as a male or several woodswallows flew or landed near a perched female, but was sometimes given by a female on landing beside a perched bird. Often she displayed for a minute or more before attracting a male, which would either land on her back without ceremony and copulate, or, more usually, land nearby, watch her display for a few seconds, then mount her. Males sometimes spread their wings slightly and quivered them before mounting but this was unusual. During copulation the female either looked straight ahead or flung her head back with her bill pointing straight up at the downward pointing bill of the male, who fluttered his wings to keep balance. Afterwards the male usually perched beside the female for a short while, whereupon she often repeated the sexual display and was mounted again up to four times in succession. Either or both birds often flew off separately without further ado, however, one female flying out from under a male before he dismounted. Rarely, copulating birds stayed together for several minutes afterwards allopreening, but each was as likely to fly over and preen another woodswallow, abandoning its sexual partner immediately they had copulated. Immelmann's (1966) White-breasted Woodswallow males sometimes fed females after copulation, but the Suva males never did. A male would eat a moth then mount a displaying female, hawk off, and eat another moth.

It soon became clear that the birds were promiscuous, unlike Australian woodswallows (Immelmann 1966), which maintain a strong pair bond. A female would display to a male who had just copulated with another female only a few metres away, and would be mounted by him, both females sometimes displaying simultaneously to the same male. Likewise, two males would copulate with a single female in quick succession and in view of each other. Some aggression was noted, a third bird flying up with a harsh cry as a male approached a displaying female, and once one dashed up and knocked a copulating male off the back of a female. The birds flew up and circled above the nest tree calling, but did not clash further.

Sexual displays were often given between two females, perhaps in confusion, and two homosexual attempts at copulation were seen. Once a female gave the sexual display to a companion which jumped on her head facing her tail, hopped down beside her, and gave the same display.

Copulation frequently took place in the evening on branches near the night roost, but although the sexual display was nearly always given on the roosting branch as the birds clustered, they never copulated then. Sexual display ceased once there were young in the nest.

Incubation

The position of the nest meant I could not determine the incubation period, clutch size, or dates of laying and hatching. In tropical Australia woodswallow eggs generally appear to hatch on the thirteenth morning after the start of incubation (Immelmann 1966), but I suspect it takes longer in Fiji.

All four birds incubated. Individuals settled on the nest in an incubating position for periods of several minutes from 31 August, when the nest was still being built. This continued irregularly until 10 September, when all building ceased. Birds bringing materials to the nest sometimes wove it into the rim while another nestled in the cup. The woodswallows continued to sit irregularly until 27 September, when there was a marked change. They then sat far more frequently for periods of up to 15 minutes, and the nest was never vacant for more than 20 minutes. From next day until 15 October they sat almost continuously, the cup never being vacant for longer than 7 minutes. Feeding of sitting birds also began on 28 September. In daylight individuals incubated for periods of less than one to 27 minutes duration, with a 13 minute average.

Incubating birds were visited by others, which conversed quietly with them, but were often left alone for several minutes, when they cheeped quietly. After being relieved at the nest a bird usually preened nearby for a few minutes before hawking out.

A relief usually landed near the nest, wagging its tail and calling, the incubating bird flying off and being replaced. A sitting bird was often reluctant to leave the nest, the relief prodding it with the bill or hovering over it to shift it. Copulation occurred only inches from incubating birds. Once a couple copulated on the nest branch, the female relieving the incubating bird straight afterwards. The latter moved towards the male, gave the female sexual display, and was herself mounted within inches of the nest.

Would-be reliefs frequently settled on the nest beside a stubbornly incubating bird and attempted to force or "elbow" it off the nest. Once a woodswallow forced itself between the incubating bird and the upward curve of the branch fork, settled down as if incubating itself, then shoved strongly with its flank and one leg, attempting to push the incubating bird off the nest. After a short struggle the newcomer spread one wing over the incubating bird for a few seconds, then climbed on top of it and attempted to settle in as incubating position, at which the lower bird flew off and was replaced.

More often two birds sat side by side on the nest, as if dual-incubating, until one flew off.

Incubating birds were fed on the nest, begging with quivering wings, and then either remained on it or were replaced by their feeder. Should a third bird visit the nest it was likely to beg too, and was sometimes fed instead of the begging incubator. An incubating bird once begged a known female.

The sexual display and a less pronounced one where the relief called and quivered its wings slightly, were used when incubating birds refused to leave the nest, with varied success. Visiting birds also begged the incubating bird as if for food. One visitor fed the begging incubator then begged it in turn, at which the incubator flew off with the moth and was replaced on the nest by the new bird.

A marked increase in the regularity of feeding incubating birds, plus an increasing reluctance of incubating birds to leave the nest was noticed from 11 October, and on 15 October nestlings were present and being fed.

Care of young

On 15 October the adult birds approached and left the nest in silence, without the calls which had marked their movements previously, and which did again from the next day on. The three nestlings, which could just raise their heads, were fed by all four adults, all birds sharing in the care of the young. Brooding was more or less continuous for the next four days, after which the young were left alone for long intervals except in bad weather, rarely being brooded after 24 October.

The young were usually fed every few minutes, three adults sometimes queuing at the nest to feed them. When this happened a brooding bird usually moved to a nearby branch, resuming brooding when the others left. Sometimes a brooding adult would beg and be fed by one of the others.

Occasionally a brooding bird would still have to be forced off the nest but it usually flew off calling as the relief appeared carrying food. Once two woodswallows tugged in unison on a dragonfly to dismember it for the young, which were fed by its original captor.

After a few days faeces were removed from the anus of the young by visiting adults, usually immediately after feeding, being carried to a perch 30 m away and dropped. By 7 November the nestlings were defaecating over the nest rim.

The nestlings grew quickly and by 25 October begged loudly if an adult approached the nest. That day they were very active and one of them fell out, being killed instantly on hitting the pavement beneath. The adult birds, returning a few minutes later, did not seem to notice its absence.

By 29 October the two surviving young were only brooded in rain, the adult bird lying half across them and sheltering them beneath an outstretched wing. The nestlings grew increasingly more active and vocal, often standing and fluttering their wings, and perching on the nest rim, but had not left the nest by 7 November, except for short excursions to nearby branches. Unfortunately I had to break off observations then, but it is clear that White-breasted Woodswallows in Fiji remain in and about the nest longer than their Australian

counterparts (cf. Immeimann 1966). By 20 November the two surviving fledglings were flying about the nesting tree in pursuit of their parents, and appeared quite independent of the nest.

CONCLUSIONS

White-breasted Woodswallows in Fiji predictably behave much like their Australian relatives, but there appears on present evidence to be marked differences in nesting behaviour.

Not being subjected to the extreme climatic conditions faced by the northern Australian woodswallows studied by Immelmann (1966), the Fijian birds are remarkably sedentary, a group occupying a traditional roosting and nesting tree for several years on end. The nesting season of Fijian woodswallows extends from early May, when the first of a series of preliminary nests is built in a selected nest fork, and continues until November when the young fledge. Up to four birds, two males and two females in the case of the nest studied here, select the nest site, build the preliminary nests and nest proper, copulate apparently indiscriminately within the group, and co-operate in incubating and raising the young. Evidence that similar breeding groups occur generally in Fiji comes from Vorovoro and Mali islands, where two groups of four birds built nests in holes in cliffs. It is not known whether both females actually lay, or whether one of the males tends to dominate.

In Australia, on the other hand, woodswallows establish a strong pair bond (Immelmann 1966) and nest as a pair, although no proper breeding territory is set up and neighbouring pairs visit each other's nests and co-operate in raising the young once they hatch. Harrison (1969) recently summarised knowledge of helpers at the nest in Australian passerines, several species of which appear to behave similarly at the nest to Fiji woodswallows. Probably the most relevant of these are two members of the Grallinidae, the White-winged Chough (*Corccrax melanorhamphus*) and Apostlebird (*Struthidea cinerea*), small groups of which build and defend a nest and feed the young. In the White-winged Chough the immature young of earlier seasons help the adults, and more than one hen may lay in a nest.

Further and more detailed studies of White-breasted Woodswallows using marked birds are necessary, before any really profound conclusions can be drawn about their nesting, the composition of the breeding groups, and the exact relationship between the sexes in such groups.

ACKNOWLEDGEMENTS

I am grateful to the Australian CSIRO for providing me with a translation of Immelmann's (1966) paper on Woodswallows, and to Mr Ian Rowley for critically reading the manuscript.

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Fergus Clunie,
Fiji Museum,
P.O. Box 2023,
Suva,
Fiji



SHORT NOTE

DUCKS' TAKE-OFF

In the northern hemisphere, ducks take off from their water in a north-westerly direction, no matter in which direction their final destination lies; in the southern hemisphere, they take off to the north-east.

Is it more than a coincidence that this matches the Coriolis force ?

Perhaps it is. For the Coriolis force acts *to the right* of all moving objects in the northern hemisphere, *to the left* in the southern. So that in each case the ducks would, as it were, lean against the Coriolis force until they had found their orientation against the frame of reference of the fixed stars.

R. FRASER

Woburn Masonic Village,
Wai-iti Crescent,
Lower Hutt

[Comments are invited — Ed.]

SHORT NOTES

DUCKS UNLIMITED (N.Z.) INC.

After just over one year in existence Ducks Unlimited (N.Z.) is firmly established as a major waterfowl and wetland conservation group. Membership, of which there are seven categories, is open to any person, society, or company which wishes to support the aims and objects of the organisation.

DU's first major project, which is to raise the number of Grey Teal (*Anas gibberifrons*) in New Zealand to 100,000 over a ten year period, is off to a good start and over one hundred specially designed nesting boxes have already been erected in well known Grey Teal areas — mainly in the Hamilton district. Three different designs of nesting boxes are being used; the designs being based on studies in Australia where nesting boxes have been used for both the Chestnut Teal (*Anas castanea*) and the Grey Teal, with excellent results; the study of the Grey Teal's nesting habits in New Zealand waterfowl collections, and on the study of the Grey Teal's natural breeding habitat in Australia — which consists mainly of hollows in trees. Similar habitat is not available in New Zealand and the DU Directors are convinced that this is the reason why the N.Z. population has failed to expand. (Current numbers are thought to be about 18,000). In appropriate areas the DU boxes will provide suitable predator free nesting habitat, and the construction of the boxes is designed to give twenty to thirty years' life.

For the first project valuable assistance has been gained from the Lands and Survey Department, the Wildlife Service, acclimatisation societies and farmers.

Details of DU's second major project have recently been finalised and the Wildlife Service has approved the project, which will involve the hand rearing and subsequent liberation of 1,000 Brown Teal (*Anas castanea chlorotis*) over the next ten years. The Brown Teal is endemic to New Zealand and is among the rare birds of the world, numbering only about 2,000, and confined to a few outlying islands. Dr Murray Williams of the Wildlife Service, and DU's Honorary Scientific Adviser, is in charge of the project.

The Brown Teal has previously been hand reared in New Zealand on a limited scale, with reasonable success and several trial liberations of hand reared and wild caught birds have been made. The bird is very adaptable and if liberated in sufficient numbers could possibly be induced back into its former range.

Fifteen pairs of Brown Teal are currently held by DU members and the Mt Bruce Native Bird Reserve, and, as birds are reared, other DU members will be given the opportunity to try their hand in this major conservation project.

F. N. HAYES

17 Wise Street,
Wainui-o-mata

JUNGLE MYNAH "ANTING" WITH A MILLIPEDE

At 1315 hours on 11 March, 1974, 5 metres above sea level in the city of Suva, Fiji Islands, I saw a Jungle Mynah (*Acridotheres fuscus*) take a red millipede (*Trigoniulus lumbricinus*) from a grassy road verge, and, holding it in its bill, rub it against the plumage of its breast; then, raising each wing individually, it rubbed it under the wings and against the flanks. The mynah next dabbed the millipede on the ground several times, and recommenced rubbing it against the plumage of its breast, then its belly. Disturbed by my close approach, the bird flew to a nearby tree, perching on a branch some 5 metres above the ground, against which it dabbed the millipede several times, then again rubbed it against the plumage of its breast, belly, underwing and flanks. This basic action of dabbing followed by rubbing was repeated several times in the next two minutes; and from a range of about 5 metres I could clearly smell the acrid juices secreted by the millipede. The mynah then flew off, still carrying the millipede in its bill.

The above behaviour took place on the fringe of a badly overgrown suburban garden in light drizzle. The millipede concerned is quite common in Suva gardens. The mynah was wet and bedraggled, probably having just bathed in one of several road-side puddles, in which several other mynahs were bathing.

It should be noted that this is the second record of a passerine in Fiji actively anting with a millipede, the Black-faced Shrikebill (*Clytorhynchus nigrogularis*) having been seen anting with another species of millipede in dense forest understorey about 300 metres above sea-level in southern Viti Levu (Clunie 1974, *Notornis* 21: 80-81).

I would like to thank Mr Satya R. Singh of Koronivia Research Station, and Dr R. G. Fennah, Director of the Commonwealth Institute of Entomology, for identifying the millipede concerned.

FERGUS CLUNIE

Fiji Museum,
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Fiji

LETTERS

The Editor,
Sir,

EXTINCT RAILS

In his latest paper, "A Review of the Extinct Rails of the New Zealand Region (Aves: Rallidae)" — *National Museum of New Zealand Records* Vol. 1, No. 3, November 27 1975, my friend Storrs Olson places the rail I described originally as *Rallus hodgeni* and subsequently as *Capellirallus hodgeni* as a *Tribonyx*. It is now *Gallinula (Tribonyx) hodgeni*. This follows Storrs Olson's discovery of the bill of this bird, an element which was lacking in the material with which I was working, in the National Museum. He showed it to me, and I am in thorough agreement with him on this point. However, I disagree strongly with Olson when he regards *Gallirallus hartreei* as a synonym of *hodgeni*. I have re-examined the material, and still maintain that *hartreei* is related to the Weka, and is *not* a *Tribonyx*.

The fact that some of the bones of *Tribonyx hodgeni* and *Gallirallus hartreei* have similarities in size and shape does not mean that they are identical. There are subtle differences, apparent to the eye, but not always susceptible to measurement, that distinguish the two.

After all close resemblance between certain limb bones is not uncommon in birds of different species: e.g. the tibio-tarsi of the upper range of *Emeus crassus* and lower range of *Euryapteryx gravis* strongly resemble each other, as do those of the upper range of *gravis* and the lower range of *Pachyornis elephantopus*.

The femora of *Tadorna variegata* and *Euryanas finschi* also bear a very strong resemblance to one another, but not even Storrs would regard them as the one species.

This seems an appropriate place to place on record another discovery of *Gallirallus hartreei*. On 11 November 1975 Christopher Wiffen and I found a right humerus, and a right ulna which I also tentatively assign to *hartreei*, among bones which had weathered from a Moahunter Maori midden in the dunes of Ocean Beach, Hawkes Bay.

The measurements in centimetres are:

Humerus: L. 4.210: P. 0.890: M. 0.3 D. 0.6

Ulna: L. 3.15: P. 0.4: M. 0.2 D. 0.4

The ulna is more curved than in *hodgeni*.

This extends the time range of *Gallirallus hartreei* considerably, as the new bones are unlikely to be more than 5 or 6 hundred years old, if that.

I must leave the rest of Storrs Olson's stimulating paper for later comment.

RON SCARLETT

Osteologist,
Canterbury Museum
19 December 1975

Dr Olson has replied as follows:

In response to Mr Scarlett's letter I would point out that the lengths he gives for the two new elements attributed to "*Gallirallus hartreei*" fall well within the range of variation of *Gallinula (Tribonyx) hodgeni* (see Olson, *Nat. Mus. N.Z. Recs.* 1 (3): 66, table 1). Beyond this we are told that only certain unspecified "subtle differences" distinguish these two species. Yet Mr Scarlett places them in different genera! To accept *Gallirallus hartreei* as a valid species would appear to require faith; in this instance I do not count myself among the faithful.

STORRS L. OLSON

Smithsonian Institution
Washington, D.C., U.S.A.
12 March 1976

The Editor,
Sir,

MOREPORK TELEMETRY

The extreme simplicity of the telemetry equipment and the crudity of the procedures involved during the exercise concerned with tracking Moreporks (*Notornis* 22: 222 *et seq.*) came as a considerable surprise to me in view of the degree of sophistication readily achievable at that date.

It would appear obvious that the inclusion of a number of additional features in the electronics could have resulted in the acquisition of considerably more information by the investigator, and reduced a number of his mentioned difficulties.

Firstly, the addition of a few extra, very small and light, components to the transmitter board attached to the bird would have made it possible to turn the transmitter on by command, or to have it transmit in some pulse mode; either technique or some combination, resulting in greatly reduced battery drain and hence much longer life.

Secondly, the idea of attempting to secure position lines with hand held directional aerials seems ludicrous. Surely a pair of direction finders, preferably of the automatic type, could have been set up at right angles and simultaneous bearings measured from the two sites either at prescribed intervals, or on command (e.g. when the bird's transmitter came on). Some such regime could have provided a series of plots during the night which would give a track which could then be investigated at leisure during the daylight hours, and not in real time.

Perhaps it should be pointed out that the techniques here advocated have been common practice since the beginning of 1915, and suitable surplus military equipment, notably the AD 7092 ADF ex-RNZAF aircraft, was fairly readily available through the Stores Board about that time. Alternatively a pair of the older AN/ARN-7 automatic radio compass receivers used by NAC on their DC-3 aircraft could have been equally easily modified.

Thirdly, since everything is computerised today this whole set-up surely lent itself to total automation; in which case the required data could have been presented hour by hour on sheets from an X-Y plotter!

Finally, and, in my opinion, not the least important result of some such sophistication would have been additional knowledge of the position and habits of each bird such as to considerably reduce the task of recapture and removal of its transmitter, so permitting the resumption of the normal degree of freedom. Clearly, the birds were aware of and resented the presence of the alien equipment and its harness.

P. A. G. HOWELL, M.N.Z.E.I.

*Physics Department,
University of Canterbury,
Christchurch
15 January 1976*

Dr R. E. Brockie, Section Leader, Orongorongo group, Ecology Division, DSIR, has replied on behalf of Dr Imboden (who has now returned to Switzerland) as follows:—

Dr Imboden's study on morepork movements was never conceived as a far-reaching or exhaustive investigation. Rather, he had a short time at his disposal and put to use some slightly modified telemetric equipment which had been designed for tracking opossums.

Hand-held aerials may seem ludicrously crude to Mr Howell but, in thick bush, these were found to give the best results (see G. D. Ward, 1972: *N.Z. Journal of Science* 15 (4): 628-36). The fixed aerials advocated by Mr Howell work well on flat ground and in the open forests of the northern hemisphere but have proved useless in the hilly country and dense, usually wet, New Zealand mixed broadleaf-podocarp forest, unless built on a vast and unacceptable scale. Hand-held aerials also enjoy the advantage of enabling an observer to approach and study an animal directly. Recent tests both here and overseas have shown that very high frequencies give reliable fixes in dense bush using directional aerials but Dr Imboden had neither the time nor money to exploit these techniques.

The Editor,
Sir,

SHUNTOV'S "SEABIRDS" IN TRANSLATION

I have looked into the possibility of printing or xeroxing The Interior Department's Tunisian translation of V. P. Shuntov's *Seabirds and the Biological Structure of the Oceans*. I cannot find a method to do it more cheaply than can NTIS. You can order it from the U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia 22151; for \$15.50 for foreign orders (including Canada). Ask for TT 74-55032. I do not know the quality of their reproductions but the copy we have is only a carbon and gives poor reproduction.

GEORGE E. WATSON

*Curator,
Division of Birds,
National Museum of Natural History,
Smithsonians Institution,
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4 June 1975*

REVIEW

Birds of Tahiti, by J. C. Thibault and Cl. Rives; English version by D. T. Holyoak. 112 pp. and 70 coloured illustrations. Papeete; Les Editions du Pacifique.

Eastern Polynesia has been until recently practically without publications describing its ornithofauna. The results of the recent exploration of French Polynesia by Jean Claude Thibault, David Holyoak and others are now put together in this very handsomely published and readable account.

The introduction gives a general outline of this publication's contents and is accompanied by a map of the Society Islands together with brief lists of birds peculiar to the single islands. This is followed by a chapter briefly describing the origin and the main features of Tahiti's bird fauna, including the breeding land- and sea birds migrants and introduced birds; the latter appear particularly important as some of them are held responsible for the disappearance of some native species. Next, the main causes of extinction of some bird species and of the ways the bird habitat can be improved are described together with hints on bird observation.

The fifth and main chapter is devoted to the description of the birds, their voices, habitat and field observations of the 33 species of birds found on Tahiti. Both scientific, vernacular and Polynesian names of the birds are given. All the bird species are illustrated by magnificent colour photographs, most of which taken in their habitat. A comprehensive index concludes the book. The book is almost luxuriously illustrated as it contains 70 illustrations in 111 pages of the text.

The main quandary of the reviewer is to decide whether the "Birds of Tahiti" are mainly for the tourist or the ornithologist. My personal impression is that the authors tried to produce a book that would satisfy both visiting tourists and students of birds. Illustrations, if they are too numerous, reduce the space available for the descriptive text, particularly in the most important fifth chapter of the book. Here the text has been reduced to a narrow, half-a-page long band. It is almost irritating to see in some species the lower part of this band blank, while the description of a species is terse in its brevity. The illustration on pp. 24-25 is supposed to represent the Tahiti Kingfisher; in fact it appears to represent a passerine. Twenty-seven illustrations out of a total of 70 include irrelevant parts of background or just plain air or water that could be cut without any damage to the illustrations, and thus supply more space for the text. The list of birds referred to the island of Moorea presumably pertains to Tahiti.

Finally, an ornithologist interested in birds of French Polynesia will sadly miss the absence of further references, particularly as he will find 4½ blank pages at the end of the book.

Despite the above shortcomings, the "Birds of Tahiti" presents an important and beautifully set contribution to our knowledge of the birds found in Eastern Polynesia. This little volume deserves a place on the bookshelves of all who are interested in the birds of Polynesia.

KAZIMIERZ WODZICKI

ABOUT OUR AUTHORS

DAVID HOLYOAK was born in England in 1949. A schoolboy interest in British birds was later extended by work at bird observatories and studies of the biology of Crows. He is currently studying the birds of the south-east Pacific, following field work there in 1972 and 1973, and preparing a handbook to the birds of this region in collaboration with French ornithologists.

ANDRÉ DHONDT was educated at Ghent State University (Belgium) where he obtained a degree in Zoology and later a doctor's degree in 1970 with a study on the population dynamics of the Great Tit (*Parus major* L.), a small hole nesting passerine.

Between 1971 and 1974 he worked with FAO, first in Madagascar and later in Western Samoa. In both places he found nests for the first time: in Madagascar of an endemic nightjar, in Samoa of the endemic triller. In 1965 he took part in an expedition to Spitsbergen to study the arctic avifauna. Since October 1974 he has been at the new University of Antwerp and is studying moult of some African bird species from material collected in West Africa and in Zaire.

FERGUS CLUNIE was introduced to readers in the December 1972 issue of *Notornis*. He is now living for some years, at least, in Wellington where he hopes to undertake studies at Victoria University.

DAVID MEDWAY is a barrister and solicitor in private practice in New Plymouth. He says of himself: "I have been a member of the OSNZ since 1955. I am also a member of the RAOU and an associate of the Cornell Laboratory of Ornithology. I serve on the National Parks Authority of New Zealand, on the Fauna Protection Advisory Council and on the Executive of the Royal Forest and Bird Protection Society. Other interests include membership of the Hakluyt Society and the Society for the Bibliography of Natural History. Over recent years my ornithological interests have been, primarily, subfossil avifauna, the New Zealand Thrushes (Turnagridae) — research completed but results not yet written up — the early avifauna of Stephens Island and factors affecting exterminations and reductions therein (research again completed but not yet published). As a result of these studies, I became interested in the New Zealand ornithology of Cook's Voyages, an interest which extended to the South Pacific and Hawaiian ornithology of such voyages in the course of research in Europe in 1974. I have a number of projects in various stages of completion in connection with such research."

NOTES & NEWS

XVII INTERNATIONAL ORNITHOLOGICAL CONGRESS First Announcement

On the occasion of the XVI International Congress in Canberra the International Ornithological Committee accepted the invitation of the Deutsche Ornithologen-Gesellschaft to hold the XVII Congress in Germany. It elected Professor Donald S. Farner (Seattle) as president of the Congress. In consultation with the President the German members of the International Ornithological Committee decided to hold the Congress in the Kongresshalle in Berlin (West) from June 4-11, 1978; Mr. Rolf Nohring of the Berlin Zoological Garden was designated as Secretary-General.

For the first time, the Scientific Program Committee is an international one. Its members are Immelmann (Bielefeld) Chairman, Berthold (Moggingen), Bock (New York), Dorst (Paris), Gwinner (Erling-Andechs), Ilyichev (Moscow), Snow (Tring) and Wiltshcko (Frankfurt/Main).

Five *plenary sessions* are planned. There will be about 30 *symposia* arranged in four parallel sessions. *Contributed papers* will be presented as *poster papers* for which the Kongresshalle has excellent facilities. Instructions for preparations of materials for poster papers will be available later. Time and space for *round-table* discussions will be assigned to appropriate individuals or groups, on application to the Secretary-General. The themes and structures of these discussions are prerogatives of the organizers or organizing groups in consultation with the Chairman of the Scientific Program Committee. These themes as well as those of the poster papers will be announced in the program of the Congress. An extensive *film program* is being arranged by a committee chaired by Georg Ruppell (Erlangen). All-day and evening sessions are projected together for "replays" of those that prove to be most popular.

Excursions, no longer restricted to the inviting country, but leading to several European countries, will precede and follow the Congress. Details will be included in the *second announcement*.

The *second announcement* will be available for mailing in August 1976. It will contain forms for preliminary registration for the Congress and excursions.

Those interested in participating in the Congress are urged to inform the Secretariate as early as possible in order to obtain the second announcement and communications concerning the Congress.

Communications should be addressed to —
Secretary-General Rolf Nohring
Zoologischer Garten
Hardenbergplatz 8
1 Berlin 30, Germany

REGIONAL REPRESENTATIVES

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LITERATURE AVAILABLE

From all bookshops:

- Annotated checklist of the birds of New Zealand. (OSNZ) \$4.95
A field guide to the birds of New Zealand, by R. A. Falla,
R. B. Sibson and E. G. Turbott, 2nd rev. ed. \$5.00

From B. D. Heather, 10 Jocelyn Crescent, Pinehaven, Upper Hutt:

- A biology of birds, by B. D. Heather. \$1.33

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

- Field guide to the waders, by H. T. Condon & A. R.
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*The following are available from Mrs J. F. Skinner, P.O. Box 60083,
Titirangi, Auckland 7:*

- Back numbers of 'Notornis' at 75c (Vols 2-13) and \$1 (Vols
14-21) and \$1.50 (Vol 22-) per part. Complete sets available.

- OSNZ Library catalogue, 70 pp. 50c

Banding reports, Nos 8-14, 50c each.

Nos 1-7 are incorporated in early issues of Notornis.

Kermadec Expedition, 1964, by A. T. Edgar.

45c