THE BIRDS OF THE NOISES ISLANDS, HAURAKI GULF

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ABSTRACT

An annotated list of the 52 species of bird seen on and around the Noises Islands in Hauraki Gulf is presented, incorporating information from unpublished field notes from the 1930s onwards and the authors' own observations, which began in 1977. Eight of the 20 species of seabird and 13 of the 32 species of land bird breed at the islands. The only breeding species of native forest bird are Grey Warblers, Fantails and Silvereyes. We review the breeding history of White-faced Storm Petrels and Spotted Shags.

Analysis of Australasian Harrier pellets showed that passerines were the most frequent prey and that carrion was taken from islands at least 2.3 km from the Noises. The contents of 13 Blackbird and four Song Thrush gizzards were also analysed. Houpara fruit was present in 12 Blackbird gizzards and insects (mainly beetles) in eight. The thrushes had fed mainly on small snails and insects.

INTRODUCTION

The Noises are a group of small islands on the western side of the Hauraki Gulf about 24 km north-east of Auckland city (Fig. 1). Being reasonably close to Auckland they have often been visited by ornithologists, mainly to observe seabirds. Some of these observations have been published, but many more have remained in field notebooks. We have been fortunate in being given access to much of this unpublished material to supplement and compare with our own observations between 1977 and 1983.

Our information was collected during regular trips to the Noises Islands to study Norway rats *(Rattus norvegicus)*, which colonised the group in 1956-57 (Moors 1985, in press). Our study of birds was part of a collaborative investigation in which scientists from the New Zealand Wildlife Service and Botany and Entomology Divisions, Department of Scientific and Industrial Research, studied the rats, birds, insects, vegetation and soils of the islands. The aims of our study were to establish the composition of the past and present avifauna of the Noises Islands and to collect information on breeding and diet.

DESCRIPTION OF THE NOISES ISLANDS

The main islands in the Noises group (36°42'S, 174°58'E; Fig. 1) are Otata (21.8 ha) (Fig. 2), Motuhoropapa (9.5 ha) (Fig. 3), Maria (2.0 ha) and the David Rocks (2.0 ha). In addition there are five islets, the largest being Scott (0.6 ha). The islands are composed mainly of argillite and greywacke

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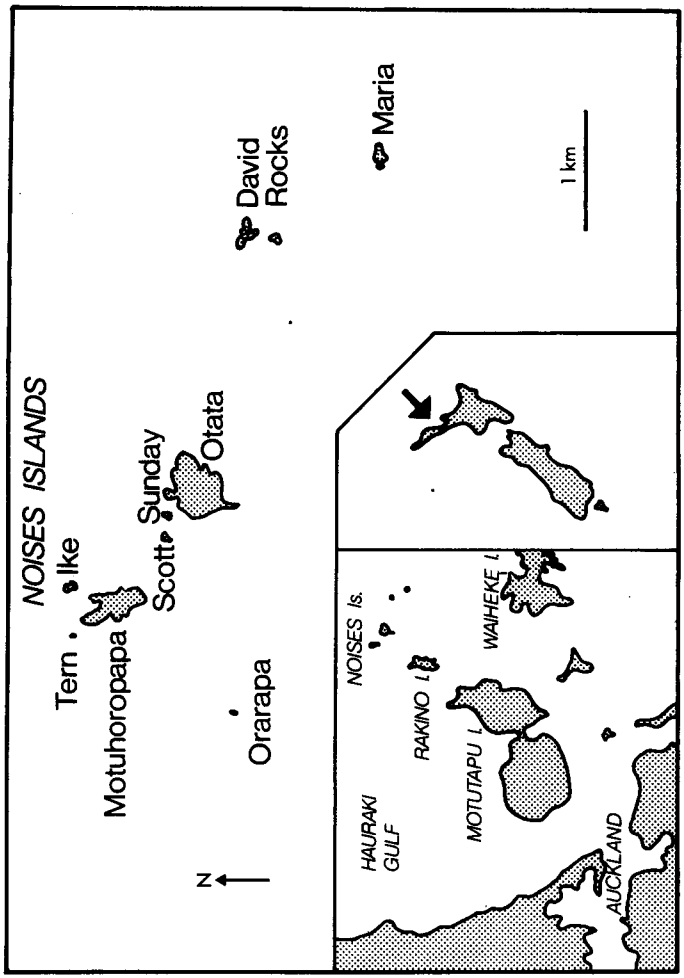

FIGURE 1 — The Noises Islands and their location in Hauraki Gulf

(Mayer 1968). The shorelines are heavily indented and have substantial rock platforms exposed at low tide. Sand and shingle beaches are present on Otata, Motuhoropapa and Scott. The islands all lack permanent fresh water, although rock pools and seepages provide temporary supplies after rain. A cottage on Otata was occupied for a decade or so until 1957 but is now used only for holidays. In summer Otata is often visited during the day by boating parties. The other islands are uninhabited and rarely landed on.

Otata is mostly covered with scrub and forest regenerating after a fire sometime between 1925 and 1930. Pohutukawa (*Metrosideros excelsa*) and karo (*Pittosporum crassifolium*) are now common around the edges of the island, often forming a closed canopy up to 15 m high. The major components of the regenerating scrub are mapou (*Myrsine australis*), coastal karamu (*Coprosma macrocarpa*), houpara (*Pseudopanax lessonii*) and mahoe (*Melicytus ramiflorus*). The scrub canopy is generally closed and 4-8 m high. On the north-western side of Otata lie two islets, Sunday and Scott. Both are covered with tall woody vegetation, mainly pohutukawa, karo and houpara.

Motuhoropapa Island, 700 m to the north-west of Otata, is covered with mature forest about 100 years old, typically 6-10 m high. The closed canopy consists mainly of pohutukawa, karo, houpara, wharangi (*Melicope ternata*), and mahoe. In the southern two-thirds of the island there is an understorey of kohekohe (*Dysoxylum spectabile*), and in the northern third one of houpara, wharangi and coastal karamu.

Tern Rock and Ike Island lie to the north and north-east of Motuhoropapa, respectively. Tern Rock is a very small islet about 10 m high supporting only four species of plant. Ike Island is larger and partly vegetated with 20 species, including pohutukawa, karo and stunted ngaio (*Myoporum laetum*). Orarapa is a tiny isolated stack 1.1 km south-west of Motuhoropapa capped with a prostrate vegetation mainly of taupata (*Coprosma repens*) and *Muehlenbeckia complexa*.

The David Rocks lie 1.8 km east of Otata and consist of five islets, four of which are joined at low tide. The separate islet lies about 100 m to the south of the main group. Vegetation covers about half of the total area and is mainly karo, houpara, taupata and boxthorn (*Lycium ferocissimum*). Pohutukawa is lacking.

Maria Island is 1.0 km south-east of the David Rocks. Here, too, pohutukawa is lacking, but there is a dense cover mainly of taupata and *Melicytus (Hymenanthera) novae-zelandiae*. Boxthorn has invaded the lower slopes, and bracken (*Pteridium esculentum*) covers the cleared top, where a navigation light was installed in 1953. The pea-vine (*Dipogon lignosus*) is throughout the bracken and many other open sites on the island and in some places is blanketing the low taupata canopy.

METHODS

Our bird information was collected during 34 trips to the Noises Islands between August 1977 and August 1983. There were no visits in March, May or July. Most observations were made by us in the course of the rat study and related projects, and sometimes these commitments limited the attention

which could be given to birds. We spent most time on Motuhoropapa and Otata and their nearby islets, and so information for the David Rocks and Maria Island is less comprehensive. On each trip we noted new species and also the presence or absence of species previously recorded, together with data on abundance, food habits and breeding. We were able to confirm breeding more easily for seabirds than for land birds because seabird nests were usually more conspicuous or more readily discovered.

Moynihan & Imboden (in prep.) carried out an intensive programme of banding and censuses on Motuhoropapa between December 1977 and March 1979 to collect information on the numbers and movements of forest passerines for comparison with mainland populations. We are grateful for permission to include some of their data in this paper.

Copies of unpublished field notes are held on Wildlife Service file WIL 30/3/35.

PREVIOUS ORNITHOLOGICAL VISITS TO THE NOISES ISLANDS

During pre-European times the Noises Islands were visited by the Maori to collect birds, presumably Grey-faced Petrels, and seafood (*New Zealand Herald*, 27 November 1866).

Table 1 lists the dates of all ornithological visits to the Noises Islands made before 1977 for which we have field notes or published references. The earliest specifically ornithological reference is by Falla (1932), who refers to Spotted Shags (*Stictocarbo punctatus*) nesting there in 1910.

Falla's later visits between 1918 and 1938 were also concerned with Spotted Shags nesting on Otata Island and the David Rocks and with White-faced Storm Petrels (*Pelagodroma marina*) breeding on Maria Island. His visits in the 1930s overlapped those of the Auckland University Field Club.

The Field Club made four day-trips to the Noises between 1933 and 1938, and on each occasion members recorded their observations in the Club's Trip Book. They landed on Otata on each trip but usually viewed the other islands only from their boat. The Spotted Shag colony on the David Rocks was checked on two trips. The account of the trip on 13 May 1933 contains a description of Otata's vegetation, still in the early stages of recovery from the fire several years previously (see Mason & Trevarthen 1950). The top of the island was thickly covered with bracken and tutu (*Coriaria arborea*) and extensively burrowed by rabbits (*Oryctolagus cuniculus*) and petrels. Sunday Island was also explored on this trip and found to be heavily burrowed by Grey-faced Petrels. Small burrows presumed to be of "stormy petrels" were seen during the next expedition on 23 June 1934. This is the only record we have found suggesting that storm petrels once bred or attempted to do so on Otata. The islands were visited again on 16 April 1935 but no bird observations were entered in the Trip Book. The description of the visit on 3 April 1938 concentrates on the Grey-faced Petrel colonies on Scott and Sunday Islands.

Fleming's (1940a) report of Spotted Shags breeding in October 1939 is the last record we have located until after the war. However, before the end of 1946, Cox (1946), Buddle (1951), and Sibson (1948a, b, unpubl.) had

TABLE 1 — Dates of visits to the Noises Islands between 1910 and 1971 for which we have found published or unpublished ornithological records

Date	Visitor	Island[1]	Source	Date	Visitor	Island	Source
1910	Falla	N	Falla 1932	21.12.48	Sibson	T,O,D	Sibson 1950, unpubl.
1923	Falla	O	Skegg unpubl.[2]				
1925	Falla	O	Falla 1932	2.04.50	Davenport	O	Davenport 1951
1928	Falla	O	Falla 1932	23.07.53	Turbott	H,D	Turbott unpubl.
31.08.31	Falla	O,D	Falla 1932, Skegg unpubl.	4.04.54	Macdonald	O	Turbott 1956
				Aug 1954	Moynihan	O	Turbott 1956
Nov 1932	Fleming	M	Fleming 1978	3.03.56	Turbott	O	Turbott 1956
13.05.33	AUFC[3]	O,Su,D	AUFC Records	24.03.56	Turbott	O,D	Turbott 1956
2.12.33	Falla	M or D	Falla 1934	1957	Gillham	H,T,O, D,M	Gillham 1960, 1965
3.03.34	Falla	M or D	Falla 1934				
23.06.34	AUFC	O,D	AUFC Records	14.01.60	Brown	D,M	Brown unpubl.
31.12.34	Falla	M	Skegg unpubl.	Aug 1960	Burns	D,M?	Burns 1960
11.05.35	Turbott	D	Turbott 1956	26.11.60	Merton	D,M	Merton unpubl.
19.09.37	Buddle	D	Auck. Mus. Photo Coll.	1.07.61	Merton	M	Merton 1961
				25.01.62	McDonald	M	Banding Records[4]
3.04.38	AUFC	Sc,Su	AUFC Records				
1.05.38	Fleming	N	Fleming pers. comm.	10.02.62	Sibson	M	Sibson unpubl.
				17.11.62	Skegg	M,D,O, H,T	Skegg unpubl.
6.08.38	Fleming	Su,H,D	Fleming 1940b				
Oct 1939	Fleming	N	Fleming 1940a	9.03.63	Sibson	M,D	Sibson unpubl.
31.07.46	Cox	D	Cox 1946	20.04.83	Bishop	O	Bishop unpubl.
14.10.46	Buddle	D?	Auck. Mus. Photo Coll.	28.09.63	Merton	M,D,O,H	Merton unpubl.
				5.12.64	Merton	M	OSNZ Nest Records[5]
1.12.46	Sibson	I,O,D	Sibson 1948, unpubl.	21.03.70	Millener	O,D	Millener 1970
11.11.47	Sibson	D	Sibson 1949, unpubl.	12.04.70	Millener	O,D	Millener 1970
				3.05.70	Gaunt	O	Gaunt pers. comm.
7.11.48	Buddle	D	Auck. Mus. Photo Coll.	11.12.71	Gaunt	O	Gaunt pers. comm.

1. N = Noises Islands
   H = Motuhoropapa Island
   T = Tern Rock
   I = Ike Island
   O = Otata Island
   Sc = Scott Island
   Su = Sunday Island
   D = David Rocks
   M = Maria Island
2. Copies of all unpublished material are in Wildlife Service file WIL 30/3/35.
3. Auckland University Field Club. Copies of the relevant pages of the Trip Book are in Wildlife Service file WIL 30/3/35.
4. Records of the New Zealand National Bird Banding Scheme.
5. Data from the Nest Record Scheme of the Ornithological Society of New Zealand.

all been to the islands and made observations on Spotted Shags and White-faced Storm Petrels. Many ornithologists visited the islands in the 1950s, and the discovery that Norway rats had colonised the islands led to increased interest during 1960-1964. A. McDonald (*in litt.*) noted severe rat predation on White-faced Storm Petrels on Maria Island and the David Rocks in late 1959, prompting him to organise a rat eradication campaign which Merton (unpubl. 1960, 1961, unpubl. 1963) continued until September 1963. Ornithological interest in the islands seems to have slackened after this, and the reports by Millener (1970) and J. Gaunt (*in litt.*) are the only ones we have found for the period 1964-1977.

ANNOTATED LIST OF BIRDS FROM THE NOISES ISLANDS

The 52 species of bird seen on or near the Noises Islands are listed in Table 2. The records are grouped into four periods, the first three corresponding to years when adequate historical information is available and the fourth to the time when we were making observations. The lists for 1923-1938 and 1946-1957 are dominated by species seen on Otata, where early visitors usually landed and spent most time.

The following annotated checklist contains information mostly collected between 1977 and 1983, supplemented where appropriate with earlier records of distribution and breeding.

TABLE 2 — History of distribution and breeding status of the birds of the Noises Islands, 1923-1983. The information presented for each period is condensed from the sources given in Table 1

Species	1923-1938	1946-1957	1960-1964	1977-1983
A. Birds seen on the Noises Islands				
Northern Blue Penguin	O		H*O*D M*	H*O*D*M*
Grey-faced Petrel	H*O*		O*	H*O* M*
White-faced Storm Petrel	M*	D*	D*M*	H M*
Northern Diving Petrel			D	H M*
Black Shag	O			H O
Pied Shag	O D M	O+	H O*D	H O*D
Little Shag		O		H O D M
Spotted Shag	O*D*	O*D*	H D*	H O*D M
White-faced Heron				H
Reef Heron	O			H O
Grey Duck				H
Australasian Harrier	O	H O D	H O M*	H*O *M
Brown Quail	O+	O+	O	
South Island Pied Oystercatcher				O
Variable Oystercatcher				O
Southern Black-backed Gull	O	O D*	H*O*D*M*	H*O*D*M*
Red-billed Gull	O		H	H O D
White-fronted Tern	O M	H* D*	H* D*	H*O D*M
North Island Kaka			H	
Parakeet sp.				H O
Shining Cuckoo				H O
Long-tailed Cuckoo				O
Morepork	O			H O
Kingfisher	O	O	O	H+O*D M
Kookaburra				H
Skylark	O	H	D	O
Welcome Swallow				H*O*D M*
Pipit	O			
Hedgesparrow		O	H O D M	H*O+D M
Grey Warbler	O	H O*	H O D M	H*O+D M
Fantail	O	H O	H O M	H*O*
Song Thrush			M?	H*O*
Blackbird	O M	H*O*D	H O D*M	H*O*D M
Silvereye	O M	H O	H O M	H*O+D M
Tui			H	H O M
Yellowhammer		O		O M
Chaffinch	O M	H O	H D M	H*O+D M
Greenfinch				H*O*
Goldfinch		H O	H	H*O+D M
House Sparrow				O
Starling	O M	O	H O D M	H*O+D M
Myna			H	H O
Magpie				H O
B. Birds seen only at sea near the Noises Islands				
Northern Giant Petrel				S
Flesh-footed Shearwater				S
Buller's Shearwater			S	S
Fluttering Shearwater			S	S
Little Shearwater				S
Australasian Gannet	S	S		S
Southern Great Skua			S	
Arctic Skua	S	S		S
Caspian Tern	S			S
Total species	24	20	28	48

H = Motuhoropapa (including observations from Tern Rock and Ike Island)
O = Otata (including observations from Scott and Sunday Islands)
D = David Rocks
M = Maria
S = At sea near the Noises Islands
• = Breeding
+ = Breeding likely but not confirmed

NORTHERN BLUE PENGUIN *Eudyptula minor*

A conspicuous species observed throughout the year, mostly when moulting or breeding. It was also seen at sea as solitary birds or pairs and occasionally in greater numbers feeding among flocks of White-fronted Terns (*Sterna striata*) and Fluttering Shearwaters (*Puffinus gavia*).

Most penguins nested in burrows, some of which had previously been occupied by breeding Grey-faced Petrels. Other sites used were rock crevices, beneath clumps of *Astelia banksii* or dead fronds from phoenix palms (*Phoenix canariensis*), and beneath the house on Otata. Our earliest record of incubation was 4 October and our latest 2 November. The mean dimensions of seven eggs were 53.7 mm x 41.1 mm and the average weight of five was 46.8 g. The heaviest (56 g) was a single fresh egg, probably the first of the clutch because older eggs with more advanced embryos weighed markedly less, the lightest being 39 g. These measurements are similar to the averages reported by Jones (1978) for Northern Blue Penguins on Tiritiri Island 10.3 km north-west of Motuhoropapa.

Moulting birds or shed feathers were seen by us mainly in January and February, although a moulting adult was found on Motuhoropapa as late as 22 April 1979. One burrow on Otata which held a well-grown petrel chick in mid-December 1980 was occupied by two moulting penguins on 24 January 1981.

The penguins were very vocal between April and August. Monosyllabic "yapping" in waters close inshore was particularly common in April, mainly in the afternoon.

GREY-FACED PETREL *Pterodroma macroptera gouldi*

Common during autumn and winter and often found on the ground or heard at night during April and June. It nests in burrows, usually in small colonies, on Motuhoropapa, Scott, Sunday, Otata and Maria Islands. Incubating petrels were found in August and early September, and chicks were present from mid-September until late December.

The localities and approximate sizes of the colonies on Motuhoropapa and Otata are shown in Figures 2 and 3. We estimated that there were about 75 burrows on Motuhoropapa and 150 on Otata, mostly in colonies of 10-20 burrows. However, the numbers of breeding pairs were much fewer than these totals because repeated inspections revealed that fewer than half of the burrows held active petrel nests. The other burrows were apparently kept open by prospecting petrels and sometimes by penguins. In April 1963, Lois Bishop (unpubl.) and the Selwyn College Biology Club noted the distribution of petrel burrows on Otata. Based on a count of "cleared" burrows, they estimated a breeding population of 200 pairs. However, their map does not show any burrows in the north-east sector of the island where we discovered several colonies (Fig. 2).

In April 1938 members of the Auckland University Field Club visited Scott and Sunday Islands and found dead petrels at the entrances to burrows.

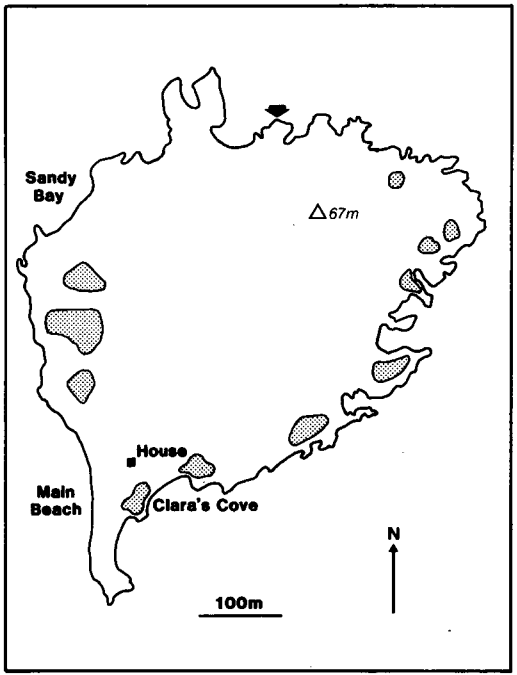

FIGURE 2 — Localities on Otata Island and the distribution of Grey-faced Petrel burrows. Arrow indicates the nesting ledges used by Spotted Shags (see text)

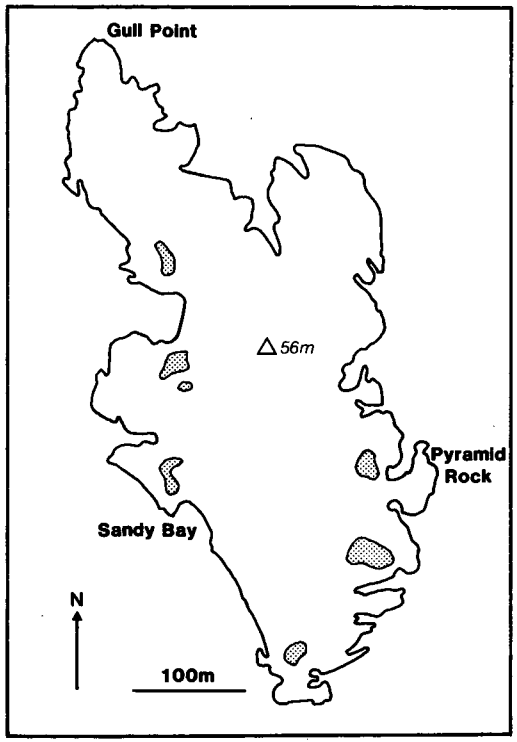

FIGURE 3 — Localities on Motuhoropapa Island and the distribution of Grey-faced Petrel burrows

According to the author of the Field Club notes the carcasses "lay rotting, with the appearance of having been killed by a mammalian predator." Stoats (*Mustela erminea*) were temporarily present on Otata in the 1950s (B. P. Neureuter, pers. comm.), but there is no evidence that these mustelids or other carnivores inhabited the Noises at an earlier date.

NORTHERN GIANT PETREL *Macronectes halli*

A beached carcass was found on Otata in December 1981, and a bird was seen 200 m north of Tern Rock on 19 August 1983.

FLESH-FOOTED SHEARWATER *Puffinus carneipes*

Seen from February to April, occasionally in the company of Buller's Shearwaters, feeding over schools of kahawai (*Arripis trutta*). In mid-February 1983 large numbers were sighted passing to the north of Motuhoropapa.

BULLER'S SHEARWATER *Puffinus bulleri*

Seen mainly in mid to late summer, but one observed in June 1980. Usually solitary, but twice observed feeding over schools of fish with White-fronted Terns and Fluttering Shearwaters. Between 29 January and 3 February 1982 and also in February 1983, large numbers were seen most mornings flying eastward in a constant stream to the north of Ike.

FLUTTERING SHEARWATER *Puffinus gavia*

Very common during autumn and winter, often in flocks of several hundred in June and August. They were usually seen feeding among kahawai shoals, often with White-fronted Terns, Red-billed Gulls (*Larus novaehollandiae*) and Australasian Gannets (*Sula serrator*).

Fluttering Shearwaters begin returning to their breeding colonies in August (Falla *et al.* 1979), but very few were seen near the Noises between September and April. Breeding has not been confirmed at these islands, although Skegg (unpubl.) observed birds landing on Maria in November 1962. He noted "at least 20 birds coming in, possibly many more. Best area appears to be just around from the landing". A sketch in his notes shows an area on the south side of the island east of the track leading to the navigation light.

LITTLE SHEARWATER *Puffinus assimilis*

Heard calling over Maria Island on 27 April 1979.

WHITE-FACED STORM PETREL *Pelagodroma marina*

Not recorded at sea by us, but found breeding in variable numbers on Maria Island, where in the past there was a large colony (Falla 1978; C. A. Fleming, pers. comm.).

In northern New Zealand, White-faced Storm Petrels begin laying in the second half of October (Falla *et al.* 1979). We inspected about 30 burrows on Maria on 25 October 1979, but all were empty except one containing a lone adult. Sixty-five burrows checked on 16 December 1980 yielded only

two small downy chicks, an additional moribund chick and a desiccated chick carcass. Most of these burrows had been cleaned out and gave off the typical petrel odour, but there appeared to have been very little successful breeding. About half the 70 burrows inspected on 18 November 1981 contained adults incubating a single egg. Three weeks later on 11 December a third of 37 burrows held either a chick or an incubating adult.

Periodic visits to the David Rocks during 1977-1983 failed to produce any evidence of breeding there. The only storm petrel records for Motuhoropapa are an old skull found on Pyramid Rock in June 1980 and an adult caught at a light on 17 November 1981.

Falla (1978) visited Maria Island many times between 1918 and 1938. On 3 March 1934 he found that two-thirds of the burrows were empty and the youngest chick was within a week of fledging (Falla 1934). According to Falla's field notes (P. D. G. Skegg, pers. comm.), on 31 December 1934 chicks were 8-10 days old with feather tracts just showing under the down. The colony suffered a setback in the summer of 1959-60 when recently introduced Norway rats killed several hundred storm petrels (J. Brown, *in litt.*). A Junior Royal Forest and Bird Protection Society party from Waiheke Island led by A. McDonald laid warfarin rat poison in January 1960, and again later in the year (Burns 1960). D. V. Merton from the New Zealand Wildlife Service continued the poisoning and by 1964 had eliminated the rats. During this period the storm petrels continued breeding in large numbers. Merton (unpubl. 1960) reported that about 50% of burrows held incubating adults in November 1960. In the same month in 1962 Skegg (unpubl. 1963) found large numbers breeding and banded over 60 in three hours one evening. Burrows had been "cleaned and lined" in late September 1963 (Merton unpubl. 1963), and on 5 December 1964 Merton estimated that more than 2000 birds were incubating (OSNZ Nest Records Scheme). The storm petrels on Maria suffer occasional predation from Southern Black-backed Gulls (*Larus dominicanus*) and Australasian Harriers (*Circus approximans*). In November 1962 Skegg (unpubl. 1963) found 33 birds killed by gulls, and in January 1979 C. R. Veitch (pers. comm.) found 29 carcasses from predation by gulls or harriers.

Incubating storm petrels were found on the David Rocks in December 1946 and November 1947 (Sibson 1948a, 1949, unpubl.). In November 1962, Skegg (unpubl. 1963) found three cleaned-out burrows and dead storm petrels apparently eaten by rats. Sibson (unpubl.) also landed on Ike Island in December 1946 and was able to locate the burrows, then old and deserted, where storm petrels had previously been found breeding by Mr M. Johnson.

NORTHERN DIVING PETREL *Pelecanoides urinatrix*

A dead, recently fledged juvenile was found floating between Motuhoropapa and Ike on 19 December 1978, and a skull fragment was found on top of Orarapa on 23 October 1980. The only evidence of breeding was a large downy chick found dead at a burrow entrance on Maria on 18 November 1981. Other burrows nearby were searched without success on 11 December 1981, by which time most chicks would have left (Thoresen 1969). McDonald

(pers. comm.) recalls diving petrels occasionally landing on Maria during the mid-1950s. In November 1962 Skegg (unpubl. 1963) found eight carcasses on the southernmost David Rock, the skulls of which appeared to have been eaten by rats.

AUSTRALASIAN GANNET *Sula serrator*

Seen frequently at sea throughout the year. Gannets do not breed at the Noises, the nearest colony being on Horuhoru Rock 18 km to the east.

BLACK SHAG *Phalacrocorax carbo*

Seen in autumn and winter 1979 at roost trees on Otata and Motuhoropapa. They are probably only occasional visitors to the Noises.

PIED SHAG *P. varius*

Common on the reefs around Motuhoropapa, Otata and the David Rocks. There is a breeding colony in pohutukawa trees above Clara's Cove at the south-eastern corner of Otata. A roost in pohutukawa at the north end of Sandy Bay on Motuhoropapa is used intermittently.

Breeding at the Otata colony was recorded in 1962 and 1963 by Skegg (unpubl.), Bishop (unpubl.) and Merton (unpubl. 1963), and it continued until about 1970 when many of the birds were illegally shot (B. P. Neureuter, pers. comm.). Our counts of Pied Shags roosting at Clara's Cove increased steadily and breeding had resumed by September 1981. Ten nests and 24 chicks of various sizes were counted on 12 December 1981. Since 1981 the maximum number of adults counted at the colony has been 35, although not all were breeding. The number of nests has not increased.

LITTLE SHAG *P. melanoleucos*

Usually single birds were seen perched on reefs or small rock stacks around Motuhoropapa and Otata, although up to 10 birds roosted at high tide on the stack at the southern end of Scott Island and in pohutukawa north-east of the Pied Shag colony at Clara's Cove. This species does not breed at the Noises Islands.

SPOTTED SHAG *Stictocarbo punctatus*

Seen intermittently by us on the Noises and at sea nearby, but seen more often and in greater numbers by earlier observers. We saw 11 birds roosting on the separated David Rock on 18 February 1978. A few days later, 30-40 were roosting on the reefs at Sandy Bay, Motuhoropapa, and 70-100 flew past heading southwards. In August 1982 about 50 were roosting at high tide on the northern end of Ike Island.

Turbott (1956) reviewed the breeding of Spotted Shags at the Noises between 1920 and 1956, and Millener (1970) reported observations from the 1970 breeding season. Additional information covering the period 1923-1962 has since come to light from sources listed in Table 1, and the following account summarises the known breeding history of this shag at the Noises.

According to Falla (1932), there were Spotted Shag colonies throughout much of the Hauraki Gulf in 1910. Shooting by boating parties dramatically reduced the number of colonies (Buddle 1951) so that, by 1931, only one remained in the western part of the gulf "in a narrow tunnel that pierces a small islet" (Falla 1932). This is an accurate description of the cave in the separated David Rock, where subsequent observers regularly found nests. At least 50 birds were nesting in this cave on 31 August 1931 (Falla, unpubl.), and an Auckland University Field Club party found nests there in May 1933. By the late 1940s, numbers at the David Rocks had increased to apparent saturation point (Cox 1946, Sibson 1948b) and they remained at this level well into the 1950s. A maximum of 200 birds (juveniles and adults) was recorded by Turbott (1956) on 3 March 1956. About a year later Gillham (1960a) saw 60-70 birds roosting at the cave, but numbers seem to have dwindled thereafter. In November 1962 Skegg (unpubl.) saw only 15 birds. Sibson (unpubl.) found about 20 in March 1963, and it may be significant that he also found spent cartridge cases. Merton (unpubl. 1963) noted six nests in September 1963, Millener (1970) counted 25 birds on 22 March 1970 and seven occupied nests inside the cave on 12 April 1970, and Gaunt (*in. litt.*) found chicks on 11 December 1971. Since then there have been no records of breeding at the David Rocks.

The colony on the northern cliffs of Otata Island was reported by Falla (1932) as having 100 birds in 1923, but it had disappeared by 1931. A breeding attempt in 1934 was apparently thwarted by shooting (Falla, *in* Turbott 1956). Breeding on Otata was not observed again until December 1946 (Sibson 1948b). Records from 1946 onwards show that this colony thrived until at least 1957 (Gillham 1960a), although it never became as large as the one on the David Rocks. Shags were absent in November 1962 (Skegg, unpubl.), and Merton (unpubl. 1963) did not report any in September 1963. Millener (1970) found 100 birds and 24 nests in March 1970, but the nests had gone on 3 May 1970 (J. Gaunt, pers. comm). The shags did not breed between 1977 and 1982, and we did not see any roosting at the old colony site. However, three nests were present on 28 April 1983, one nest containing three eggs and the other two nests being in the course of construction. About 50 birds were roosting on the nesting ledge and nearby reefs. No trace of the nests or roosting shags remained when we next inspected the site in August 1983.

Similar variation in the numbers and breeding of Spotted Shags has also been noted in the past at other colonies in the region (e.g. see Millener 1970). Illegal shooting and other disturbances have caused some of the changes, and the increasingly heavy boating and fishing pressure on Hauraki Gulf waters may also be responsible. More information about distribution and breeding performance would help clarify the status of the Gulf population and the significance of fluctuations at particular colonies.

WHITE-FACED HERON *Ardea novaehollandiae*

One bird was on the reefs at Sandy Bay, Motuhoropapa, at low tide on 27 April 1982.

REEF HERON *Egretta sacra*

Single birds were occasionally seen around the reefs and beaches of Otata and Motuhoropapa, and two were seen on the rock platform of Orarapa in February 1979. No evidence of breeding.

GREY DUCK *Anas superciliosa*

First recorded on 28 August 1979, when a pair flew southwards between Ike Islet and Motuhoropapa. On 23 Sepetmber 1979, two birds took off from the edge of a large pool of rainwater on Ike; no nest was found.

AUSTRALASIAN HARRIER *Circus approximans*

Seen and heard throughout the year. Most observations were of 1-4 birds circling Motuhoropapa or Otata and occasionally the intervening islets. Harriers were also observed on three occasions flying over the sea up to 1 km from the nearest island. Dark juveniles were seen in January and February.

A. McDonald (pers. comm.) reported that a chick was raised on Maria in the mid to late 1950s. Breeding was not recorded again until this study, when we found three nests. The first (8 December 1977) was built among dense shrubs on Motuhoropapa. It was supported by a 50 cm pedestal of dead bracken fronds and stems and contained three downy chicks, the smallest of which disappeared within four days. The second nest (17 December 1980) was sited on the ground among clumps of *Gahnia lacera* on Otata. It held three chicks and a cold egg, and the smallest chick disappeared within 24 hours. The third nest (18 November 1981), also on Otata, was similar in siting and construction to the previous one. It initially contained four eggs and when checked on 12 December had three small chicks and a cold egg.

Table 3 lists the foods identified in the 26 Harrier pellets, 23 of which were collected from Motuhoropapa, two from Maria (in association with several White-faced Storm Petrel carcasses) and one from Orarapa. Eighteen pellets contained more than 90% feathers, and bird remains were present in all but two, which were 99% wool. Passerine birds, mainly finches and Blackbirds (*Turdus merula*), were the most frequent prey. The rails were probably Pukeko (*Porphyrio porphyrio*) because remains of adults and juveniles were found at plucking stations on Motuhoropapa and Otata in January 1982. Pukeko are not at the Noises but occur on Rakino and Motutapu Islands, 2.3 km and 4.5 km respectively to the south-west. Petrel remains were from White-faced Storm Petrels; a leg was also found at a plucking site of Otata in December 1981. Fragments of tern feathers were found in two pellets, and in January 1978 a White-fronted Tern wing was collected from the Harrier nest on Motuhoropapa. Larger bird prey such as adult Pukeko and gannets are probably able to defend themselves against Harriers and are therefore likely to be taken only as carrion. Mammalian remains were found in 14 pellets, generally in small amounts. Norway rats were the only mammals on the Noises Islands and were present in low numbers. The other mammalian prey must have been captured on neighbouring islands. Rats, house mice (*Mus musculus*) and sheep (*Ovis aries*) occur on Rakino and Motutapu, and possums (*Trichosurus vulpecula*)

on Motutapu. The repeated presence of wool, mice and Pukeko in the diet demonstrates that the Harriers hunted for food over a much larger area than the Noises Islands.

BROWN QUAIL *Synoicus ypsilophorus*

Common on Otata in the 1920s and 1930s, and last recorded about 1960 (B.P. Neureuter, pers. comm.).

SOUTH ISLAND PIED OYSTERCATCHER *Haematopus ostralegus*

Present on Sunday Island in September 1979 and on Otata in June 1980.

VARIABLE OYSTERCATCHER *H. unicolor*

One seen in August 1979 on Scott Island. Two were foraging along the shoreline of Sunday Island in September 1981, and a pair was seen periodically after that on Otata and Scott.

SOUTHERN GREAT SKUA *Stercorarius skua lonnbergi*

One seen chasing White-fronted Terns south of Otata on 21 April 1963 (L.J. Bishop, unpubl.).

ARCTIC SKUA *S. parasiticus*

Regularly encountered at sea around the Noises between November and April harassing White-fronted Terns and once a juvenile Black-backed Gull on the fringes of feeding flocks. Both the light and the intermediate colour phases of plumage have been recorded.

TABLE 3 — Prey identified in 26 Harrier pellets collected on the Noises Islands

Prey	Occurrence in pellets	
	n	%
Bird	24	92.3
Petrel	4	15.3
Rail	2	7.7
Gannet	1	3.8
Tern	2	7.7
Passerine	18	69.2
Mammal	12	46.1
Possum	1	3.8
Rat	3	11.5
Mouse	2	7.7
Sheep (wool)	4	15.3
Unidentified	4	15.3
Insect	16	61.5
Beetle	10	38.5
Unidentified	8	31.0

SOUTHERN BLACK-BACKED GULL *Larus dominicanus*

Present throughout the year and common from June to January. It breeds on all islands and most vegetated rock stacks. Small colonies occur at Gull Point on the northern tip of Motuhoropapa and on the northern part of Ike.

Gulls first occupied breeding sites in the middle of September and began nest building by mid-October. Nests were composed mostly of grass and pieces of ice plant (*Disphyma australe*). Clutch size varied from one to three eggs and was typically two. Mean dimensions of 13 eggs were 68.8 mm x 46.3 mm, with a mean weight of 75.0 g. In 1957 Gillham (1965) noted Black-backed Gulls nesting at Gull Point, and on Ike with White-fronted Terns. Skegg (unpubl.) counted nine nests at Gull Point and 10 on Maria in November 1962.

RED-BILLED GULL *L. novaehollandiae*

Common between April and September, but not known to breed at the Noises Islands. The gulls were most abundant in winter when groups of up to 30, mostly adults, were observed feeding on schools of fish with Fluttering Shearwaters and White-fronted Terns. The largest flock encountered was of about 500 birds feeding at the top of the tide off the southern end of Ike on 4 August 1981.

CASPIAN TERN *Hydroprogne caspia*

One seen near the David Rocks and two at the southern tip of Otata in February 1983.

WHITE-FRONTED TERN *Sterna striata*

Seen in nearly every month of the year during our study, the largest numbers occurring from April until August.

White-fronted Terns bred at the Noises in the past, but they are notoriously fickle in their choice of colony sites and we did not find them breeding until 1981. On 12 December, 133 nests were present on the southern face of Ike Island and 20 on Tern Rock. Two days later we counted about 30 nests on the David Rocks and found an additional 60 fresh nests on Ike and 10 on Tern Rock. On 30 January 1982, two large chicks and a large area of guano-covered rock on the northern part of Ike indicated that more birds had bred there. The colonies on southern Ike and Tern Rock were no longer present, and we were unable to determine if breeding had been successful there.

Two nests had clutches of two eggs and the rest had single eggs. Mean measurements of 10 eggs were 46.3 mm x 32.2 mm, with a mean weight of 25.8 g. These measurements are similar to those reported by Mills & Shaw (1980) for White-fronted Terns on the east coast of the South Island.

At least 150 pairs were breeding on Ike when Gillham (1960b) visited the Noises late in 1957, and a larger colony was present on the David Rocks.

In November 1962 Skegg (unpubl.) found 12 pairs breeding on the central islet of the David Rocks and 20-25 pairs preparing to breed on Tern Rock. According to B. P. Neureuter (pers. comm.), terns bred on Ike in 1975 or 1976.

NORTH ISLAND KAKA *Nestor meridionalis*

Skegg (unpubl.) observed a Kaka "ripping bark off pohutukawa" on Motuhoropapa in November 1962. This is a most unexpected record because suitable forest is not present and the nearest Kaka are on the Coromandel Peninsula, 38 km to the north-east.

PARAKEET *Cyanoramphus* sp.

The chattering of parakeets was heard twice on Motuhoropapa early on the afternoon of 24 February 1979. About 10 minutes later they were heard and fleetingly seen flying rapidly over Otata. The nearest population of Red-crowned Parakeets (*C. novaezelandiae*) is on Tiritiri Island, and the nearest Yellow-crowned Parakeets *(C. auriceps)* are on Little Barrier Island, 47 km to the north.

SHINING CUCKOO *Chrysococcyx lucidus*

Heard in October 1978 on Scott, Sunday, Motuhoropapa and Otata Islands, and again on Otata in September and October 1979. One was seen briefly at the north end of Motuhoropapa in February 1982.

LONG-TAILED CUCKOO *Eudynamys taitensis*

The characteristic call of this bird was heard on Otata on 24 February 1980, and the bird was later seen perched in a small tree above Sandy Bay.

MOREPORK *Ninox novaeseelandiae*

One was mist-netted during the day in April 1978 on Motuhoropapa, and another was heard and seen on Otata in August 1979. In April 1980, one was found roosting near the ground in forest above Sandy Bay on Motuhoropapa. The bird was unperturbed by mobbing from Silvereyes, Fantails and a Blackbird.

KINGFISHER *Halcyon sancta*

Recorded throughout the year on Motuhoropapa and Otata and less frequently on the other islands. Usually single birds were seen, often revealing their presence by their characteristic call. A pair bred successfully in January 1982 in a traditional nest-hole on Otata (B.P. Neureuter, pers. comm.).

KOOKABURRA *Dacelo novaeguineae*

One observed on 26 October 1979 in a pohutukawa above Pyramid Rock on Motuhoropapa. Kookaburras occur on the western shores of the Hauraki Gulf between Cape Rodney and Whangaparoa Peninsula and are occasionally reported on Little Barrier Island (Falla *et al.* 1979).

SKYLARK *Alauda arvensis*

One seen hovering over a grassy slope north of the Otata trig in September 1979 may have been blown from grassland on Rakino by a strong south-westerly wind the previous day. The Auckland University Field Club reported Skylarks on Otata in May 1933.

WELCOME SWALLOW *Hirundo tahitica neoxena*

Observed in most months except June and very common from August to February. It was common to see swallows hawking above the canopy or quartering the slopes and coastal coves on all islands in the group. Nests were found on Otata in November 1977, on Maria in December 1978, and on Motuhoropapa in December 1981 and February 1983. All were in inaccessible sites, usually sea caves.

NEW ZEALAND PIPIT *Anthus novaeseelandiae*

Recorded by the Auckland University Field Club on Otata on 23 June 1934.

HEDGESPARROW *Prunella modularis*

Common on all islands except Scott, where it is probably present. Breeding has been recorded for Motuhoropapa and is likely to occur throughout the group.

GREY WARBLER *Gerygone igata*

Seen throughout the year on all islands and islets except Orarapa. Grey Warblers definitely breed on Motuhoropapa and probably do so throughout the group. Thirteen were colour-banded on Motuhoropapa by Moynihan & Imboden (in prep.) between December 1977 and November 1978. Their censuses and sightings of banded Grey Warblers showed that 13 or 14 territories were on the island with boundaries which altered little from year to year. Juvenile recruitment was very low and residents survived for several years. One banded as a juvenile and two banded as adults were at least four and a half years old when last sighted.

NORTH ISLAND FANTAIL *Rhipidura fuliginosa placabilis*

Very conspicuous at all times of the year on Motuhoropapa and Otata; less common elsewhere and not recorded from Orarapa or the David Rocks. Fantails breed on both Motuhoropapa and Otata.

Fantails used every kind of habitat from rock platforms at low tide to the forest canopy. They were regularly seen hawking insects above open slopes, rocky coves and reefs, and open water. On 16 June 1980 at least 15 birds were hawking above a sunny slope on Motuhoropapa. They were in varying stages of moult, including one with no tail feathers at all.

Fantails are naturally curious and highly mobile, and it was easy to get the impression that they were abundant. However, only 17 were banded by Moynihan & Imboden (in prep.) between December 1977 and November

1978, compared with 42 Blackbirds, 80 Silvereyes and 13 Grey Warblers during the same period. Nevertheless, Fantails accounted for about half of all sightings of colour-banded birds. There were only three Fantail territories on Motuhoropapa, and these appeared to be held by the same adults in successive years. An adult normally resident in the central and eastern parts of the island was seen on Ike Island in June 1981 after crossing 150 m of open water. When next sighted the bird had returned to its previous territory. Three banded birds were known to be at least three and a half years old when last seen.

SONG THRUSH *Turdus philomelos*

Heard often and nests found on both Motuhoropapa and Otata. Their presence was usually revealed by song or a thin high-pitched *seep* emitted on flight. Song was heard in winter and spring. There was no sign of thrushes on the other islands, except for a rat-gnawed egg found on Scott in October 1978.

Houpara fruit and remains of terrestrial snails, cicadas and flies were found in the gizzards of four thrushes caught in rat traps on Motuhoropapa and Otata (Table 4).

TABLE 4 — Foods identified in the gizzards of Blackbirds (n = 13) and Song Thrushes (n = 4) from the Noises Islands

Food	Occurrence in gizzards	
	Blackbird	Thrush
Fruit and seeds	13	2
Pseudopanax lessonii	12	2
Leucopogon fasciculatus	3	-
Tetragonia trigyna	1	-
Pimelea prostrata	1	-
Melicope ternata	1	-
Pseudopanax arboreum	1	-
Coprosma macrocarpa	1	-
Myoporum laetum	1	-
Molluscs	5	3
Laoma poecilosticta	2	-
Laoma glabriuscula	1	1
Oxychillus cellerius	1	-
Therasia sp.	1	-
Risellopsis varius	1	-
Estea zosterophila	1	-
Insects	13	4
Coleoptera	8	1
Hymenoptera	6	1
Hemiptera	5	2
Diptera	3	3
Lepidoptera	1	1
Dermaptera	1	-
Other Invertebrates	9	3
Arachnida	6	1
Crustacea	3	-
Myriapoda	2	-
Annelida	1	-

BLACKBIRD *Turdus merula*

Very common throughout the Noises Islands. Nests were found and juveniles seen on Otata and Motuhoropapa. Blackbirds were very shy, making sightings difficult. However, other signs of their presence such as song, alarm calls, diggings and captures in rat traps and mist-nets clearly showed that Blackbirds were abundant. The longest period of residence was five and a half years for a male originally banded as a juvenile.

Many Blackbirds were accidentally killed in traps set for Norway rats. Gizzards were collected from 13 birds, and food remains identified in them are listed in Table 4. Houpara berries, available in varying stages of ripeness from February to October, were the most commonly taken fruit. They were in 12 gizzards, one of which contained 14 berries. Mingimingi (*Leucopogon fasciculatus*) was the only other fruit or seed found in more than one gizzard.

Invertebrate remains, especially insects, were in all the gizzards. Beetles (order Coleoptera) were the most frequent prey, being present in eight gizzards. Six gizzards contained ants (order Hymenoptera), of which two species, *Amblyopone australis* and *Mesoponera castanea*, could be identified. Hemipterans, mostly cicadas *Amphisalta* sp., and small terrestrial snails were each present in five gizzards. Blackbirds were occasionally seen foraging on the shoreline at low tide. One gizzard from Otata contained the marine snails *Risellopsis varia* and *Estea zosterophila* and a barnacle *Chamaesipho* sp.

SILVEREYE *Zosterops lateralis*

Probably the most abundant forest bird on the Noises group, being present everywhere except Orarapa, it almost certainly breeds on all the main islands. We often encountered foraging Silvereyes in small noisy flocks, and they were observed feeding on houpara and karamu fruit and visiting the flowers of flaxs (*Phormium tenax*).

TUI *Prosthemadera novaeseelandiae*

An irregular visitor, usually in small numbers except between April and August.

Between April 1978 and June 1980 eight colour-banded birds from Tiritiri Island (10.3 km north-west) were seen on Motuhoropapa, four on Otata and two on Maria. Only one was seen more than once — on Motuhoropapa on 16 June 1980 and on Otata three days later. Most had been banded between February 1977 and January 1979 (M. J. Douglas, pers. comm.), except for an adult seen in June 1980 and banded in November 1974. Three birds had been banded as juveniles but none crossed to the Noises in their natal year.

Tuis were most often seen feeding among kohekohe trees, either on the flowers or among the fruit clusters. Green and ripe houpara berries and occasionally those of five-finger (*Pseudopanax arborea*) were also eaten, and we saw them visiting flowers of karo and whau (*Entelea arborescens*).

In November 1962 Skegg (pers. comm.) recorded in field notes for Motuhoropapa "bellbird: quite a number present". However, he only heard the birds singing and now considers that he misidentified Tui song.

YELLOWHAMMER *Emberiza citrinella*

Present on Maria in August 1977. An adult male was seen on the west side of Otata in December 1981 and another was heard singing at sunset above Sandy Bay, Otata, in late February 1983.

CHAFFINCH *Fringilla coelebs*

Common throughout the Noises and recorded on all our visits. It is known to breed on at least Motuhoropapa, where a nest with young chicks was found in October 1978. Although seen and heard in most habitat types, Chaffinches preferred vegetation dominated by pohutukawa. A male trapped on Motuhoropapa in February 1983 had been banded there as an adult in October 1978.

GREENFINCH *Carduelis chloris*

Two males and a female were mist-netted on Motuhoropapa in June and August 1978, and an adult male was seen with a juvenile on Motuhoropapa in February 1982.

GOLDFINCH *C. carduelis*

Common throughout spring and summer and observed on every island. We found no proof of breeding, but the agitated behaviour of a pair on Otata in October 1979 suggested a nest was nearby. The presence of singing males between October and December also indicated that breeding was likely.

Goldfinches were mainly seen in pairs or small noisy flocks. They often fed in open sites covered with sow thistle *(Sonchus oleraceus)*, groundsel *(Senecio lautus)* or ice-plant.

HOUSE SPARROW *Passer domesticus*

One heard chirping near the house on Otata in October 1979. A female was in the same area on 17-20 February 1983.

STARLING *Sturnus vulgaris*

Frequently seen in small numbers on all islands and islets. Breeding was confirmed only on Motuhoropapa, where single nests in rock holes were found in November 1981 and February 1983. Flocks were occasionally seen, including one of 10 and another of 40 on Maria in February 1979 and 1983 respectively and one of 50+ high over Otata in June 1980.

Starlings preferred cliff tops, rocky outcrops and the smaller islands such as Orarapa, the David Rocks and Maria. Starlings from Waiheke Island and possibly further afield roosted on Maria during 1918-1938 (Falla 1978), but we found no evidence that this roost still existed.

MYNA *Acridotheres tristis*

Mynas visited only the larger islands and nearby islets, mainly in winter. They were never seen on Orarapa, the David Rocks or Maria. Pairs or small

groups used a variety of habitats, including beaches, cliffs and the forest canopy. The Myna is not known to breed at the Noises Islands.

MAGPIE *Gymnorhina tibicen*

One was seen near the summit of Otata in October 1979 and another at Gull Point on Motuhoropapa in August 1982.

DISCUSSION

Of the 52 bird species listed, 37 had been recorded by 1964. Most of the 15 species added since 1977 can be attributed to our being regularly on the islands and so being able to observe infrequent vagrants. However, two species, the White-faced Heron and the Welcome Swallow, were uncommon and absent respectively in the Auckland region during the three earlier periods of observation. White-faced Herons had only just become established by 1960 (Carroll 1970), and Welcome Swallows were not reported from the district until the early 1960s (Edgar 1966). Both are now common, the swallow also being well established on the Noises. A similar sequence of events has occurred at the Cavalli Islands off the north-east coast of Northland. Millener (1980) first saw White-faced Herons there in 1980 and confirmed Crockett's report of a dramatic increase in Welcome Swallows from the single pair seen in 1969 (*in* Millener 1980).

Four species seen at the Noises before 1964 have not been recorded since: the North Island Kaka and Southern Great Skua are only rare vagrants at the islands, and the Brown Quail and pipit no longer inhabit Otata. Quail favour the grassy margins of saltmarsh and scrub, and pipits prefer rough, open country (Falla *et al.* 1979), all of which Otata does not have. More favourable habitats existed after the fire in the late 1920s, but vegetational succession has now made the island largely unsuitable for these birds. The disappearance of quail in about 1960 may also have been associated with the introduction of Norway rats a few years earlier. Vegetational changes may be responsible for the disappearance of both these birds from Tawhiti Rahi in the Poor Knights Islands (McCallum 1981) and for the decline of pipits on the Cavalli Islands (Millener 1980).

Twenty-one species breed at the Noises, including eight of the 20 species of seabird and 13 of the 32 species of land bird. The breeding land birds comprise six native species and seven introduced ones. Past visitors to the islands had recorded breeding by only three of the land birds — the Harrier, Grey Warbler and Blackbird. These ornithologists usually spent only a few hours ashore and tended to concentrate on the numbers and breeding status of Spotted Shags and White-faced Storm Petrels.

Grey Warblers, Fantails and Silvereyes are the only native forest birds which breed on the Noises Islands. Such a low number of species would be predicted on island biogeographic grounds, given the small size of the islands and the lack of diversity in species composition, age and structure of the forest. The presence of these species also agrees with recent analyses of the distribution of native forest birds on islands. They are the only species (together with the Morepork) which East & Williams (1984) reported as breeding on islands

less than 20 ha in area, and they are three of the four species which Diamond (1984) characterised as being the most likely colonisers of islands less than 100 ha in area. Grey Warblers, Silvereyes and Fantails readily cross water and also have high population densities, which favour migration and the consequent colonisation of islands (Diamond 1984). As East & Williams (1984) pointed out, they also have versatile habitat requirements, enabling them to survive in simplified habitats on small islands.

Birds were not an important item in the diet of Norway rats on the Noises Islands (Moors, in press). Small amounts of feathers were present in six of the 36 rat stomachs. Feathers in two stomachs belonged to a Little Blue Penguin and a Grey-faced Petrel chick. A partly eaten Grey-faced Petrel chick was found on Motuhoropapa, and rat-bitten eggs were found on four occasions. It was not possible to tell whether the rats had killed the birds or had merely scavenged carrion. Although rats seem to have had no recent effects on bird numbers, they may have had a major impact in the past on White-faced Storm Petrels at the David Rocks. Storm petrels have not re-established there since the eradication of Norway rats in the early 1960s (Merton unpubl. 1963). Imber (1975) has suggested that a petrel colony is endangered when invaded by a species of rat whose adult weight approaches or exceeds that of the petrel. The average weight of New Zealand White-faced Storm Petrels is 47 g (Richdale 1965), compared with a mean of 258 g for adult Norway rats from the Noises (Moors, in press). This is a massive difference, and according to Imber's rule of thumb, the storm petrels on the David Rocks would have been at serious risk. Norway rats are known to have preyed on 26 other species of seabird, causing declines in the populations of at least five species breeding on islands (Atkinson 1985).

ACKNOWLEDGEMENTS

We are grateful to the Neureuter family for permission to work on the Noises Islands and for their information and generous hospitality. We are indebted to Dick Sibson and Peter Skegg for permission to quote from their detailed field notes made during the 1940s and 1960s respectively. Unpublished information was also kindly provided by the Auckland University Field Club, Murray Douglas, Sir Charles Fleming, Joe Gaunt, Alistair McDonald, Kevin Moynihan, Christoph Imboden, Graham Turbott and Lois Wagener (nee Bishop). Ross Pickard identified food remains in the Harrier pellets and Tony Cairns those in the Blackbird and Thrush gizzards. We thank Ian McFadden for indispensable field and technical assistance and superb scones, and Ian Atkinson for his enthusiastic help. We extend our gratitude to past and present Wildlife Service staff and volunteers who contibuted to the work, and to Marten Meenken, Joe Gaunt and the late Arthur Calvert for their reliable boat transport, often in difficult conditions. Ralph Powlesland, Mike Imber and Malcolm Crawley commented on the manuscript.

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