ECOLOGICAL OBSERVATIONS ON STANLEY AND GREEN ISLANDS MERCURY GROUP

By A. C. THORESEN

INTRODUCTION

The geology, topography, botany, and species of bird present during the first week of September have been described for Stanley Island by Edgar (1962), and for Green Island by Skegg (1963), and Atkinson (1964). However, no reports for longer periods during the later spring and early summer have been published. Complete knowledge of the annual sea bird activity on islands would be dependent upon visits made almost every week of the year.

It was my privilege to camp on Stanley Island (Kawhitihu) from 14 September to 9 October, and on Green Island from 11 October to 17 December, 1966. Visits were also made to Green Island every second week from the first of April to mid July, 1967.

METHODS

My purpose in visiting the Mercury Islands was to study the Diving Petrels. I discovered that the small colony previously reported by Edgar to be on Stanley no longer existed, and since we could not contact transportation until the prearranged date, we spent time exploring every corner of the island in search of the Divers. We found only a very few widely scattered occupied burrows and none were in a position to study in detail. However, a few observations on other species are of interest. Later, I returned to spend the night of 27 November on Stanley Island.

On 9 October, Mr. Dave Clark of Whitianga arrived to move us to Green Island. Instead, we spent a day in Whitianga to reorganize and replenish supplies and I went to Green Island alone on 10 October. My arrival was just in time to find many Diving Petrel's eggs beginning to hatch. Some chicks up to ten or twelve days old were also found in burrows at this time. Then, if the suggestions that the incubation period is about 55 days is correct, the earliest eggs were laid in mid August.

My movements around the islands were now inhibited only by the weather. I had rented a small dinghy to enable me to contact fishing boats in good weather and I soon made several new friends among the fishermen who watched over my welfare with interest.

My camp on Green was set up on the terrace at the foot of the western slope in a position from which I could view an area dense with burrows. Vegetation cover included kawakawa (*Macropiper excelsum*), karo (*Pittosporum crassifolium*), taupata (*Coprosma* sp.), pohutukawa (*Metrosideros excelsa*), mahoe (*Melicytus ramiflorus*), and milk tree (*Paratrophis banksii*).

The populations of Divers and Shearwaters were estimated by first counting the numbers of occupied burrows in a measured area and multiplying for the total estimated burrowed area, and secondly, by counting individual adults which entered about a $\frac{1}{4}$ acre area during the evening. The two methods gave figures fairly close to each other.

Plate XXVIII — An adult Diving Petrel taken in July on Green Island. [Asa C. Thoresen

THE BIRDS

NORTHERN BLUE PENGUIN (*Eudyptula minor*)

This species was found to be common on Stanley Island. At least seventeen different birds left tracks on the sandy beach on the west side of the island every night. The number of tracks was the same on 27 November on which date they were found incubating eggs. In September pairs were sometimes found in cavities under flax bushes during the day and at night pairs were so engrossed in courtship and copulation that we could watch them in the light of our head lamps. Only eight pairs nested on Green Island.

Plate XXIX — View of the Northern aspect and Western shoulder of Pohutukawa and mahoe groves dominate and many burrows of Grey-faced Petrels and Fluttering Shearwaters are located in this area. Diving Petrels Blue Penguins nest on the rock stacks at the North end. [Asa C. Thoresen of Stanley Island.

FLESH-FOOTED SHEARWATER (*Puffinus carneipes*)

Skegg (1963: 160) indicates that this species was probably active on Ohena Island of the Mercury group on 25 November, 1962, but did not find any in the burrows. The reason for this I was able to discover on Green is due to a temporary evacuation from the breeding area.

The species was very active at night on Green Island when I arrived on 11 October and during the day individuals or pairs were occasionally discovered in the burrows. Nocturnal activity begins very

soon after sundown and is rather general all night although they tend to sleep between 11.00 p.m. and 2.30 a.m. Their noise is deafening as soon as they touch the ground. I was able to identify 15 different variations of vocalizations which made in chorus gave the impression that a hundred children were loose in a doll shop — all squeezing the "ma-ma" dolls simultaneously. The sounds are made by alternating forcing air inward and outward.

1. A choking "kuk-kuk-kuk-kuk-kuk" (with several variations).
2. A low "hi-cup-kukuku" uttered at different speeds.
3. A loud "ku-hoowoo-kuhoowoo, - kuhoowa-kuhoowa."
4. "Kuhooowa-ooowa-kahoowa, - kahoowa."
5. A soft gutteral "ghu ghu-ha-ha."
6. A low soft "hicup-hicup-hicup."
7. A quiet cooing sound during active billing.
8. A low "ghu-ooha-ghuoowa-wha-wha."
9. "Gra-gra-gra-kuhoowa-kuhoowa."
10. "Gha-ha-gha-a-ha."
11. A high pig-like squeal when fighting.
12. "Aah-aah-aah-aah."
13. "Karaka-kiterel-karaka-kiterel." This sound was first heard by a bird flying and was immediately copied by others on the ground.
14. "Ka-ka-ree-el." Also heard from birds in flight.
15. A loud mixture of many sounds when disputes between two birds take place.

The silence was welcomed when the first light of dawn enticed them from the island.

In the $\frac{1}{4}$ acre area behind my tent I counted 52 burrows of Flesh-footed Shearwater size. A few seemed to be vacant, but underneath, the soil was riddled with old tunnels with no entrances. Most of the birds arrived within a half hour after sundown. On 22 October I counted 36 drop through the canopy to the ground within the area. A few of these were greeted by mates in burrows. Others came in pairs. According to my estimate about three acres of the total six or seven on Green is utilized by Flesh-footed Shearwaters. If there are 50 per $\frac{1}{4}$ acre we have a total of about 600 birds on the island. I believe this to be a fairly liberal estimation of the total number nesting there.

Activity during October includes vigorous burrow digging with bill and feet (the debris is kicked as far as 3 or 4 meters). Others engaged in territorial squabbles, copulation, billing and nibbling neck feathers.

By the middle of November only a few individuals were coming to the island. By 28 November it was rare to hear one and except for the softer noises of the Diving Petrels the nights were restfully silent. Suddenly, on 9 December, they all returned again and on 12 December fresh eggs were found for the first time. One wonders why the temporary evacuation, also apparent in other species, is necessary. Some observers have suggested it to be a "build-up" feeding period spent at sea. On 27 April, 1967, four pairs were found still raising young which still retained considerable quantities of down.

Plate XXX — The Eastern side of Stanley Island as viewed from the Saddle. The dark trees are pohutukawa. Lighter patches of mahoe and mixed scrub fill in the spaces. The mahoe groves were particularly favoured by the Grey-faced Petrels for burrow territory. Double Island is seen in the background. [Asa C. Thoresen

FLUTTERING SHEARWATER (*Puffinus gavia*)

This species was seen frequently on Stanley, but I did not find it to be present in large numbers. Four pairs had burrows along the bank behind the west beach, and scattered nests were located in the mahoe groves on the island.

On Green two pairs were noted in October and early November. On 7 December the species was numerous all over Green Island and many were scratching in burrows or sitting in pairs in or just outside their holes. However, by 14 December only an occasional bird was

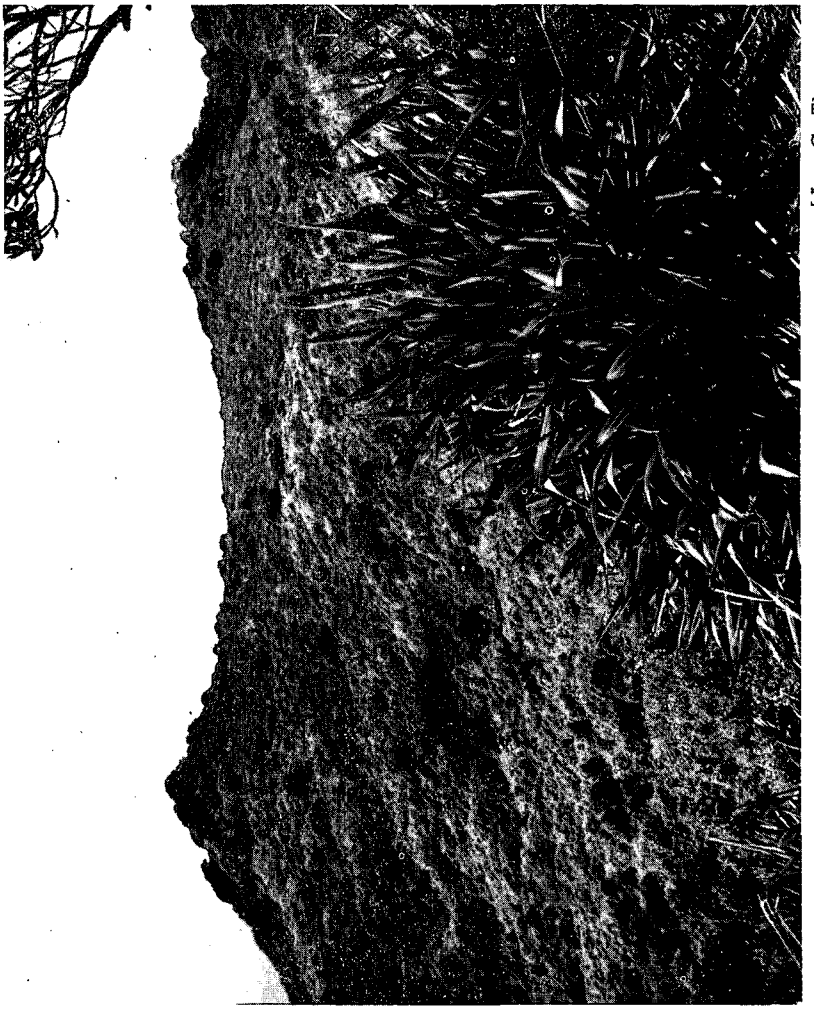

Plate XXXI — Southeast view from a high midpoint on Stanley Island. Dense manuka and Kohuhu predominates this area with very few burrows present. [Asa C. Thoresen

seen or heard. I was unable to determine the reason for these periodic invasions. Two were banded by Mr. John Jenkins and me on the night of 26 April.

ALLIED SHEARWATER (*Puffinus assimilis*)

Although considered to be a winter breeder I discovered an occasional bird on Stanley and on Green Islands in September and October. Early in November it was usual to see 3 or 4 individuals on the saddle of Green Island at night. They proved to be a quiet

Plate XXXII — A Fluttering Shearwater visits its burrow on Green Island. [Asa C. Thoresen

amiable bird and I was able to stroke one of them after photographing it. None were observed on Green Island between April and the middle of July.

GREY-FACED PETRELS (*Pterodroma macroptera*)

The Mercury Islands are well known for the large numbers of Grey-faced Petrels which nest there. They are numerous on Stanley Island and their burrows were of greatest density in the clear spaces in mahoe groves. The young were leaving Stanley at the end of November. Only two individuals were discovered on Green Island

in October. One was heard on Green on 10 April and on 25 April. Six pairs were seen on Green Island. One pair was attempting to copulate on that date and this behaviour was frequent through July.

After rains the soil in the burrow areas became sticky and adhered drastically to the feathers of the birds. Some were so caked with balls of mud, I did not see how it was possible for them to fly. One sad looking specimen was found gradually making its way down to the sea where I imagine it took considerable bathing and preening before it could fly efficiently again. Diving Petrels also had the same problem in June and July.

WHITE-FACED STORM PETREL (*Pelagrodroma marina*)

Skegg (1963: 161) found no evidence of this species breeding on Green Island. Although I found no live birds, the dried remains of six specimens was found in the burrowed area on the saddle of the island.

DIVING PETREL (*Pelecanoides u. urinatrix*)

Edgar (1962: 12) reported that a colony of over 100 burrows was located on Stanley Island just south of the eastern landing and on a steep slope. I found no trace of this colony in 1966 and no sighting or sound of the Diving Petrel could be found on the main part of Stanley although I searched very diligently for it. A few widely scattered pairs may still attempt to nest there.

Two empty shells of fresh eggs were found, one at the south end and one at the north end of the western beach. Both shells were almost complete, but with a hole in one end and the shell membrane very moist with egg-white. It seemed evident to me that these were not hatched eggs but that some animal had robbed them and sucked out the contents. I suspected the kiore rats (*Rattus exulans*) that were also eating our groceries. They chewed on everything we left exposed including two bars of soap which they completely consumed. A freshly caught fish was voraciously chewed one night and hen's eggs were eaten when left cracked open as bait. Walker (1964: 904) also mentions the omnivouous habits of this rat which is commonly reported to eat only vegetable matter and Kepler (1967: 426) more recently mentions rather drastic predation by *Rattus exulans* on Laysan Albatrosses and other birds.

Just north of Stanley are two rocky stacks one of which is accessible at low tide. I found Divers nesting on both of these stacks but rats were also present on the one connected by the reef. On this stack about 25 pairs of Divers were located under slide rock and soil beneath taupata scrub. Early one evening I was sitting quietly waiting for the birds to return when I saw a kiore come out of a Diver's burrow. It scuttled down by my feet and disappeared between some boulders. I examined the burrow and extracted a Diving Petrel adult with a wet empty shell adhering to its feathers. There was no trace of the spilled egg contents in the burrow. This has lead me to suspect that it is possible for a rat to suck on eggs while the bird incubates.

On the second stack off Stanley I estimated more than 100 occupied burrows.

It has been indicated by Skegg (1963: 161-2) that the species is abundant on Green Island. He estimated about 15,000 pairs. My figures for 1966-67 are considerably more conservative.

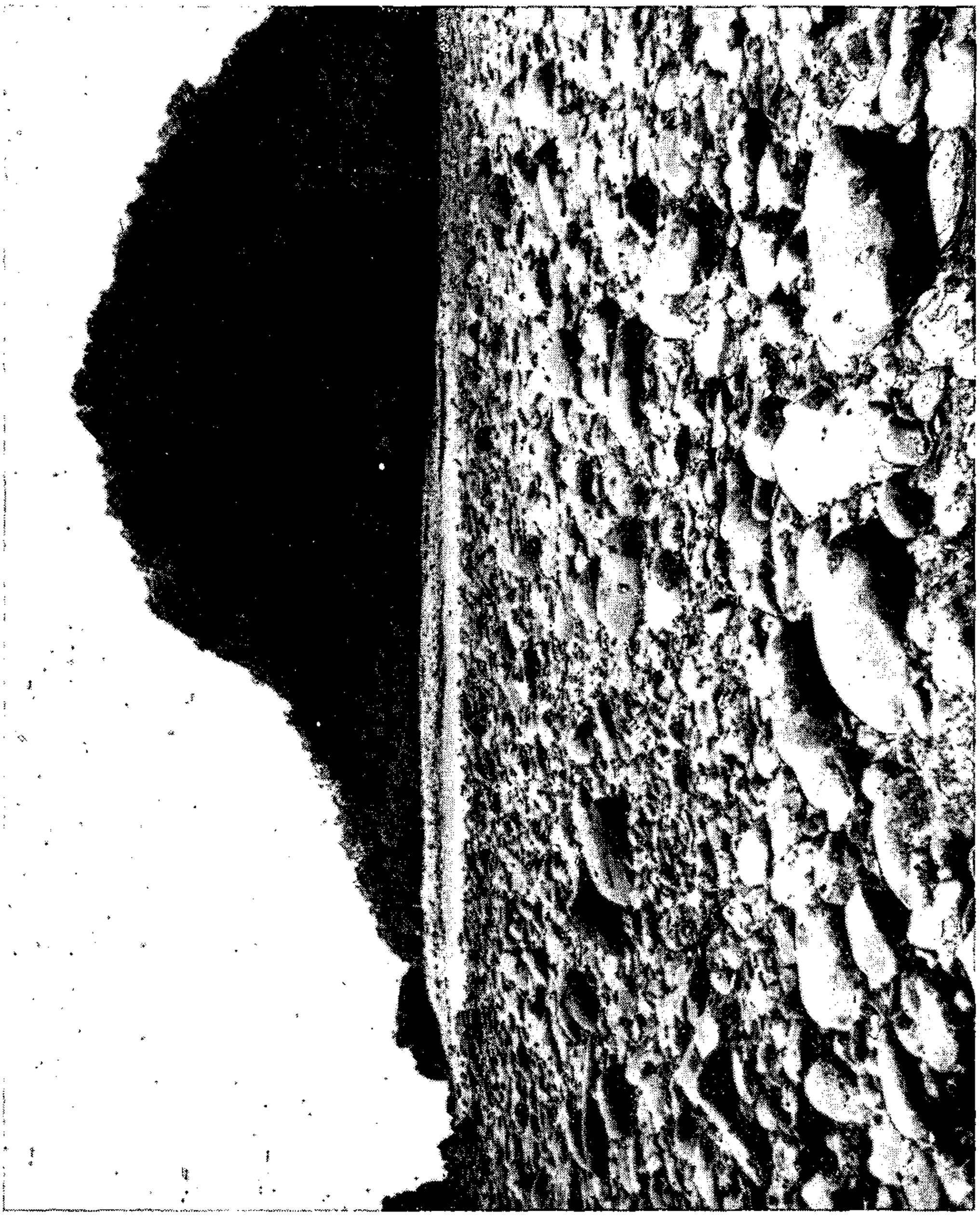

Plate XXXIII — The Western Slope of Green Island viewed from the reef at low tide. The study area and camp site were located under the trees on flat ground at the foot of the slope. [Asa C. Thoresen

There is no doubt that up to 200 holes to 100 square meters may be found on Green and that an average of 50 is a reasonable figure. However, I discovered that more than one third of the holes are unused and estimated that approximately one third of the island is uninhabited or not suitable for Diving Petrels.

On 24 October I divided the island into six zones and estimated the numbers of occupied burrows for each sector.

Sector	*Approximate number occupied burrows*
1. Western slope and terrace	250
2. Northern - northwest cliffs	25
3. Southwest talus slope	25
4. Eastern slopes and cliffs (including shoulders)	500
5. Saddle	100
6. Plateau (including northern and northeastern shoulder)	250
TOTAL	1150

This total represents the entire island and is the figure for the number of pairs or a total population of about 2300 individuals.

Using the second method during the incoming flight time on the evening of 21 October, I counted 129 Divers that dropped to the ground in about a $\frac{1}{4}$ acre area. At this date most of the birds were feeding young so the 129 probably represents both male and female birds. Assuming that about 5 acres is inhabited more or less uniformly, then 2580 birds come to the island each night during the last week in October.

By 17 December only a very few adults were coming to the island at night and most of the juvenals had left for the sea.

On 10 April, 1967, a few adults were back on Green clearing out burrows. I counted only 40 birds within the first hour of the evening arrival around the N. W. -S. perimeter of the island and all seemed to be present as individuals, not as pairs, and all were in new plumage with the moult complete. On 26 April, 110 individuals were counted in the same area in approximately the same unit of time. On this date pairs were active billing and burrowing and one bird was found in a burrow during the day on 26 April. This activity continued all through June and July. Although the burrows were complete with fresh nesting material no eggs could be located up to 17 July. The frequency index had stabilized to 270-290 birds during July.

PIED SHAG (*Phalacrocorax varius*)

On the western side of Stanley Island Edgar (1962: 12) records four nests of this species. In 1966 the number of nests had increased to twenty-eight. Our interest developed in a flightless bird that roosted alone in low trees along the west beach quite close to our camp. It became quite tame and would walk within a few feet of us and clamber every evening to a pohutukawa tree, perch about 8 or 9 feet above the rocks and would leave for the sea in the mornings just after sunrise. On 27 November it was still flightless and coming to roost in the same trees. It watched with interest other members of its species flying high and perching on trees overhanging the cliff nearby. I also noticed that it played with twigs, plucking them and attempting to place them in the forks of the branches as if to satisfy the nest-building urge. It looked quite frustrated when a twig fell to the ground, peering at it for several minutes before plucking another one. Apart from a few unoccupied birds which rested on small off-shore rocks, no shags nest on Green Island.

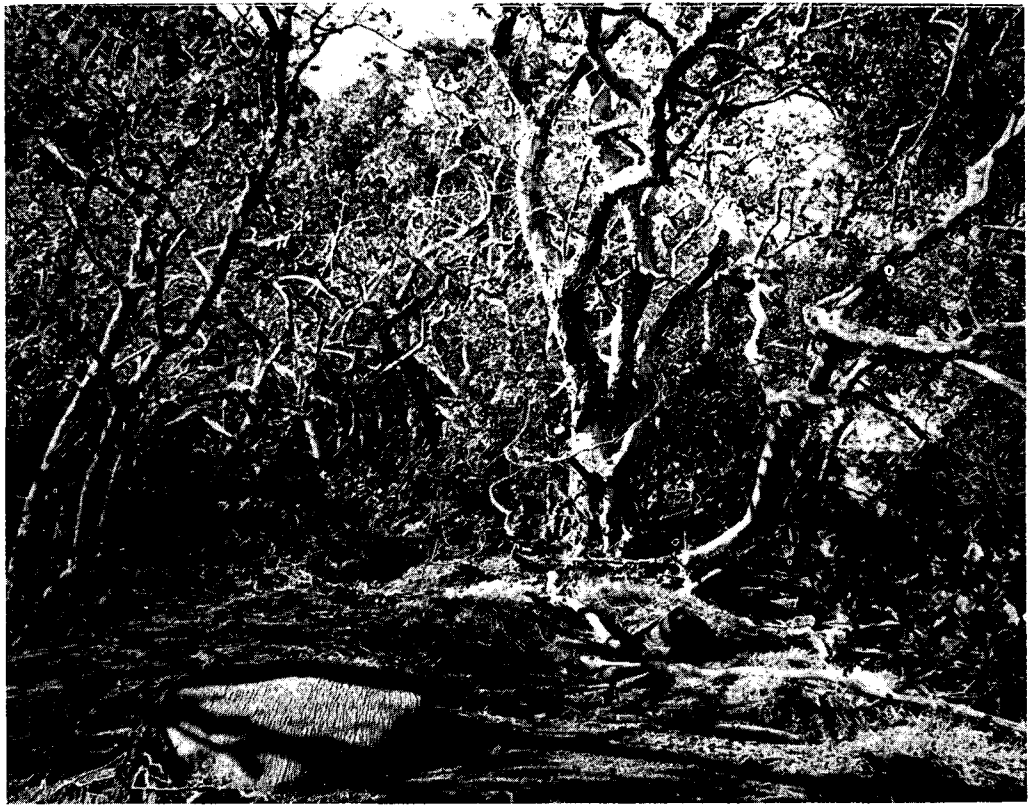

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Plate XXXIV — Dead and dying karo and taupata trees on the Western Slope of Green Island. Notice the claw marks on the rock in the foreground.

SOUTHERN BLACK-BACKED GULL (*Larus dominicanus*)

Twelve nests were built in various locations around the edge of the island but possibly due to my presence only two nests had eggs deposited in them. One of these contained two, the other only one, well incubated eggs on 17 December when I left the island. Three other pairs of birds remained in the area but did not continue nesting activities while I was present.

WHITE-FRONTED TERN (*Sterna striata*)

It has been reported by Michael Delamore in Skegg (1963: 164) that this species nested in large numbers on the rocks at the western most point of Green Island. In 1966, although they frequented the rocks for roosting, none nested. However, they nested abundantly on an ice-plant covered rock at the north end of Korapuki (Rabbit Island). Here I estimated a colony of at least 300 pairs.

THE LAND BIRDS

Previous reports on land birds seen on the Mercury Islands have been made (Edgar 1962 and Skegg 1963) so it is sufficient here to list the species and numbers seen on Green Island during my stay.

Red-fronted Parakeet	8 pairs, resident.
Long-tailed Cuckoo	1 seen on 10, 11 and 14 December.
Kingfisher	1 pair, resident. 5 individuals in April - July.
Fantail	1 seen on 14 December and 2 seen frequently between 10 April and 17 July.
Grey Warbler	4 pairs, resident.
Blackbird	6 individuals seen frequently.
Dunnock (Hedge Sparrow)	2 pairs with 7 young seen being fed.
Bellbird	8 pairs appear to be resident.
Tui	2 individuals were feeding on pohutukawa blossoms on December 12 and 13. I watched both Tuis attempt to fly against a strong wind toward Great Mercury on the evening of 12 December and both were blown back on to Green. I did not see them after the wind calmed during the night of 13 December.
Silvereye	Frequent in small flocks but I am not sure if they bred on Green Island.
Goldfinches	A small flock occasionally visited the southern slopes.
Chaffinch	An occasional one or two were seen.
Starling	A flock of up to 100 roosted in the taller trees on the saddle and some nested in the rocky cavities along the cliffs.
Harrier	One pair frequented Green Island and feasted upon the occasional Diving Petrel. Remains of petrels were found often on the ground at the summit especially in December when juvenals were leaving their burrows.

Plate XXXV — A mud-balled Grey-faced Petrel on Green Island after July rains. One wonders how it is possible for birds to survive under such conditions.

[Asa C. Thoresen

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Plate XXXVI — Dead karo trees along the edge of Green Island where burrowing is also very dense.

Plate XXXVII — Grey-faced Petrel in clean normal plumage. [Asa C. Thoresen

OTHER VERTEBRATES

Rats and rabbits are numerous on Stanley but none exist on Green. However, on the westerly terraces of Green, tuataras, geckos and skinks are conspicuous. Atkinson (1964: 399) has made mention of the species present. The most abundant species is the black skink which has a very high population along the edge of the terraces. Two species of skinks are less common and found more under the scrubby taupata, under loose rocks and among the leaf litter higher up the slopes. A large grey gecko (*Hoplodactylus duvauceli*) is sometimes seen and under almost every flat piece of rock on the upper terrace the common Pacific gecko is numerous.

Thirty individual tuataras were counted on Green Island. I found them in both Shearwater and Diving Petrel burrows and in one instance an 18-inch specimen was found in the same burrow as a 10-day old Diving Petrel chick. I found no evidence that they bother the birds or their eggs although they may on occasions, as commonly suggested.

A Flesh-footed Shearwater dashed off in fear when a Sphenodon scuttled towards it one night, and on 10 April, I saw a tuatara walk over a sleeping Diving Petrel which jumped about 3 feet in the air with fright. Hen's eggs placed near the dens of several tuataras were ignored during a week's test to see if they would take them. After that, I opened several eggs to expose the contents, but they were still ignored by the tuataras. Black skinks ravenously cleaned out eggs when exposed to them.

One day I set up my camera to photograph a tuatara sunning itself near one of the opened eggs in case it took interest in it. It peered at the slowly spilling contents of the egg shell but dashed quickly after a passing skink, but missed it. I captured three skinks and placed them one by one in a partly stunned condition near the den entrance. Within seconds they were devoured even to the wiggling tail of one which dropped off from the body when I tossed it in front of the Sphenodon. Sharell (1966: 32) also mentions that tuataras in Cook Strait eat geckos and skinks.

Each night the tuataras were found foraging among the rocks of the exposed terraces where thousands of these skinks lived, but I was never able to witness a tuatara actually catching one at night. A few fecal pellets found contained parts of the exoskeleton of beetles.

One tuatara I noticed had an open sore on its body just anterior to the right rear leg. A whitish fungus was advancing into the sore around the edges and yet the animal's mobility did not seem to be impeded. Tuataras were also active through the winter months and showed no indication of hibernations.

INTERSPECIFIC RELATIONSHIPS AMONG THE SEA BIRDS

Very little active competition exists between the birds using the island for burrowing. Competition for burrow space is relatively passive since the various species have fairly staggered nesting periods. The larger shearwaters obviously destroy some of the cavities made by smaller birds by digging them bigger and deeper. Blue Penguins were found inside burrows of the shearwater holes. However, I believe these to be accidental associations. Shearwaters digging on burrows in October and November would easily break through an occupied Diver's tunnel and per chance continue digging on beyond, either creating a side branch situation, or in some instances, kicking the young diver chicks

Plate XXXVIII — An argument session between Flesh-footed Shearwater neighbours on Green Island. [Asa C. Thoresen

Plate XXIX — Tuatara eating a Black Skink on Green Island. [Asa C. Thoresen

out of the holes with the debris. I found seven young Diving Petrel chicks destroyed in this manner in my study area.

Individuals of either species, plunging through the foliage suddenly, may cause momentary panic and a scuttle among those on the ground, but apart from this, I saw no active threats between species.

Black-backed Gulls, of course, will torment and kill Diving Petrels if the opportunity arises. This is especially true with juvenal divers, which do not fly well, when they fall from cliffs and become food for the gulls. Dead ones floating are also pecked to pieces by the gulls or swallowed by fish. Twice I caught snapper with whole juvenal Diving Petrels in their stomachs and once a large fish, which I thought looked like a snapper, took a dead diver from between two gulls which were attempting to peck it apart in the water. The surprised gulls immediately took to flight. Men at the fisheries processing plant in Whitianga informed me that Diving Petrels were frequently found in the stomachs of fish.

EFFECTS OF THE BIRDS ON VEGETATION

Heavy burrow density about the roots was the obvious cause of the death of a large number of karo and taupata trees. During my stay on Green Island I witnessed at least six karo trees gradually wilting and many taupatas were barely able to produce a green leaf. Others lay uprooted and rotting on the ground. Even in areas on the summit where burrow density was not great very little regeneration of seedling trees is apparent but this is probably due to the density of the thick canopy above. It seems apparent that if the burrow density continues to develop it will not be long before the virgin vegetation on Green Island succumbs and the soils which are so attractive to the burrowing petrels will erode quickly into the sea. Then surface nesting seabirds utilizing the denuded rocks will begin the cycle over again.

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