

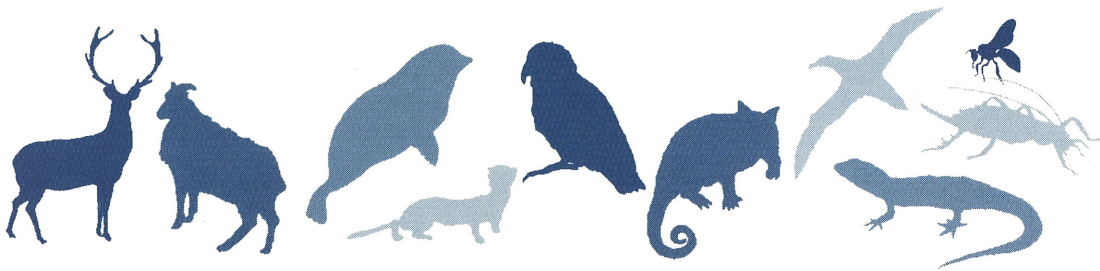


A survey of the birds, lizards and mammals  
of Motunau Island, Canterbury,  
New Zealand. With emphasis on the effects  
of vegetation change on the breeding  
success of burrowing seabirds

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Prepared for: Canterbury Conservancy, Department of Conservation



**Lincoln University**  
**Wildlife Management Report**

**No. 14**

Lincoln University Wildlife Management Report 14

**A SURVEY OF BIRDS, LIZARDS AND MAMMALS  
OF MOTUNAU ISLAND, CANTERBURY,  
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OF VEGETATION CHANGE ON THE BREEDING  
SUCCESS OF BURROWING SEABIRDS**

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**Prepared for:**  
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Department of Conservation

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## ABSTRACT

An ecological survey of Motunau Island was carried out between 1958 and 1962 at the time rabbits were exterminated from the island. Since then the vegetation has changed from one dominated by native plants, to one dominated by exotics. Birds, lizards and vegetation were resurveyed in 1996/97. This report describes the distribution of burrows and nests of seabirds and shore-birds breeding on Motunau Island, and records all other birds and mammals seen on or at sea close to the island. The status of lizards was determined in the quadrat used in the previous survey. Data from the 1996/97 survey is compared with that of 1958-62. A survey of present vegetation is underway. While burrowing seabird numbers appear stable, vegetation change may be effecting the ability of the small petrels to utilise certain areas of the island resulting in distributional change of their breeding sites on the island. Sixteen of the *Hoplodactylus maculatus* toe-clipped during the previous survey were recovered in 1996/97. An increase in the density of both species of skinks was recorded.

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## 1.0 INTRODUCTION

Motunau Island is a small (3.5 ha.) nature reserve located 1.5 km off-shore from the Motunau River mouth, North Canterbury. It is the only island in Canterbury with large numbers of breeding seabirds. Rabbits were introduced to Motunau Island in the 1850s. By the 1950s rabbits together with periodic burning were perceived to pose a threat to the native animal animals and vegetation. A plan to eradicate rabbits from the island was implemented in 1958, and successfully completed by 1963 (Cox, Taylor & Mason, 1967). As rabbit eradication could lead to vegetation change, which in turn could effect the breeding seabirds, five permanent survey plots were established in 1958 in order to study possible long-term changes in the abundance and distribution of breeding seabirds (Cox, *et al.*, 1967). Since 1963 the vegetation has changed markedly and now after 40 years without rabbits the vegetation is dominated by exotic weeds.

The ecological survey reported here was commissioned by the Department of Conservation to determine the impact of vegetation change on the seabirds and lizards which the reserve was gazetted to protect.

In this study a systematic survey was made of burrow nesting and surface nesting sea and shore birds and lizards. All other birds and mammals seen were recorded. At the same time the vegetation on the island was surveyed. This report outlines work carried out by the Lincoln University Ecology Group during the 1996/7 summer season, and is an introduction to the current study and a record of progress so far.

## 2.0 BACKGROUND

Motunau Island has been a Wildlife Refuge since 1935, and a Reserve for the Preservation of Flora and Fauna since 1958. The island is now a Nature Reserve administered by the Department of Conservation. The island is comprised of a flat plateau surrounded by cliffs. Thirty eight species of bird had been recorded on or near the island, and 11 species breeding or roosting there (Cox, *et al.*, 1967). It is the only island with a significant population of breeding seabirds off the Canterbury coast, supporting in excess of 23,000 birds (Cox, *et al.*, 1967). Motunau Island has the only White-faced Storm Petrel (*Pelagodroma marina*) colony and the only sizeable Sooty Shearwater (*Puffinus griseus*) and Fairy Prion (*Pachyptila turtur*) colonies between Cook Strait and Otago. Along with Banks Peninsula it is the only breeding area for Little Blue Penguins (*Eudyptula minor*) in Canterbury, as there has been a 60-70% decline in this species on the Peninsula in recent years. Motunau Island is important for the regional viability of this species (C. Challies, pers. comm., 1996).

An ecological survey of Motunau Island was conducted between 1958 and 1962 (Cox, *et al.*, 1967). Since the original survey there have been periodic trips to the island by members of the DSIR and others. Dr. Chris Challies has been conducting a long-term study of the Little Blue Penguins. Study of the other seabirds, lizards and vegetation has been sporadic, and nothing has been published.

### 3.0 BIRDS AND MAMMALS

#### 3.1 METHODS

Permanent survey plots were established in 1958, that at the time were representative of the islands landforms and vegetation. Counts of seabird burrows in those plots were conducted in 1958, 1959, 1961 and 1962, and all surface nesting birds, and birds on or near the island were recorded (Cox, *et al.*, 1967).

During the 1996-97 summer four field trips were made to Motunau Island on, 18-20 November, 2-6 December 1996, 6-9 January and 10-13 February 1997. The first trip was a reconnaissance with its major objective being to find and remark the permanent plots. The permanent plots when established in 1958 were marked with numbered aluminium corner pegs. All but one of the plateau plot markers were located, but all the slope markers were missing, probably due to erosion in these areas. Where markers were missing the plots were remeasured, and remarked with wooden corner stakes in as close a position to the original as could be determined from the maps (refer Figure 1). The north-west corner of quadrat 3A in 1958 slipped into the sea, with the loss of approximately 5 sq. metres of the plot (Thomas, 1979). Part of the bottom half of Plot 2 has eroded away and the plot is completely covered in boxthorn (*Lycium ferocissimum*) making burrow counts in that plot impossible.

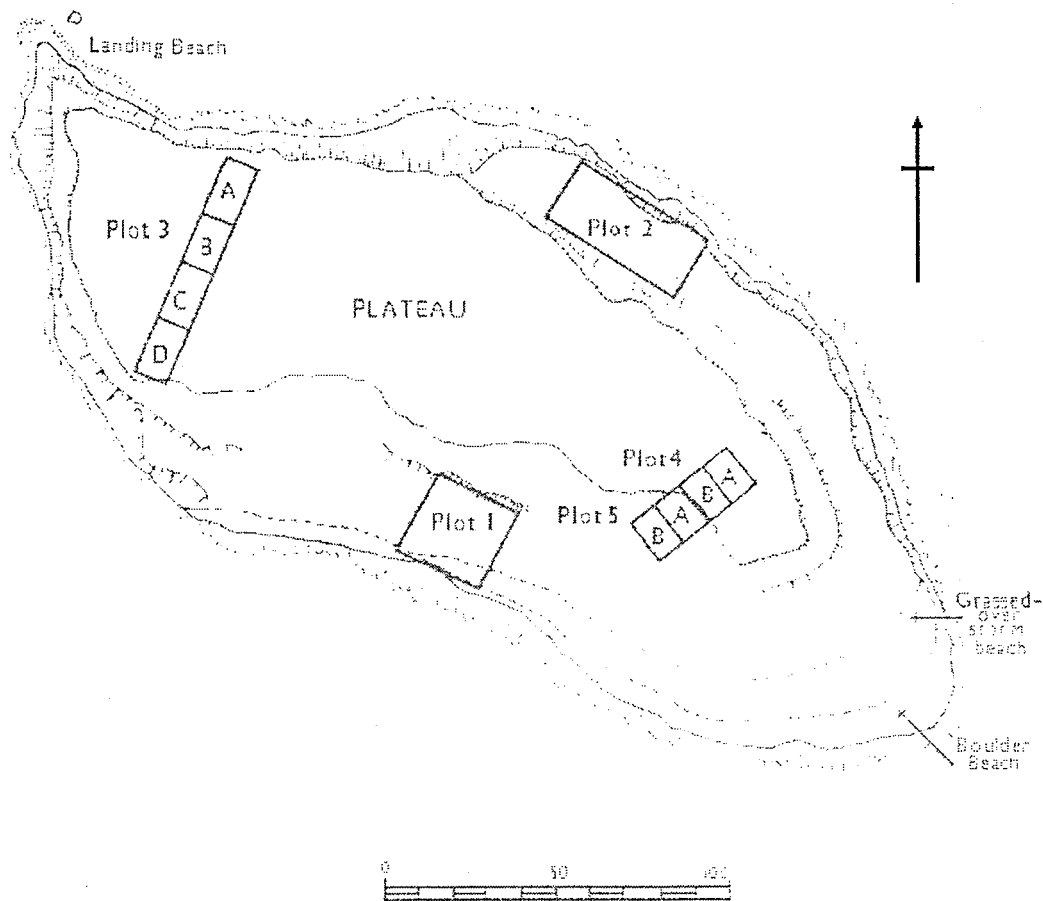


Figure 1: Motunau Island: Location of Permanent Plots for Seabird Burrow Counts.

During the December visit all burrows in the permanent plots with the exception of Plot 2 were counted (refer Surveying Burrows). In January, five quadrats (quadrats 3A, 3B, 3C, 5A & 5B) were recounted to assess the accuracy of the original counts, and in 3 quadrats (quadrats 3A, 3B, & 3C) occupancy rates were established. In these plots the occupancy confirmed data is used as the 2nd count (refer Table 2). In addition all plots were surveyed to establish their dominant vegetation types (refer Appendix 1). The February trip was primarily to plan study strategies for the continuing assessment of the effects of vegetation change on the breeding seabirds, and is not covered in this report.

### 3.1.1 BURROW SURVEYS

When fixed quadrats were counted burrow entrances were always temporarily marked to avoid double counting.

The species using each burrow was determined by the entrance size. Size categories were as follows: <60mm diameter, White-faced Storm Petrel; 60-125mm diameter, Fairy Prion; 125-200mm diameter, Sooty Shearwater; >200mm diameter, Little Blue Penguin. As small birds may use large burrow entrances we are likely to have underestimated the numbers of small birds and over-estimated numbers of large species.

Burrow occupancy, burrows were recorded as used if they had a clean entrance free of plant litter. Used entrances often had evidence of fresh digging and/or the presence of feathers and broken shell. Burrows were recorded as unused if their entrances were blocked by plant litter or other debris.

More accurate estimates of burrow occupancy were made in quadrats 3A, 3B and 3C. Most of these burrows were either too long, or the entrances too small for a hand to reach the nesting chamber without causing unnecessary damage. Therefore a piece of flexible wire with a loop on the end was fed into the burrow to try and find the nest chamber, either the call of a chick or adult, or the presence of down on the end of the wire was considered evidence of occupancy.

All nests of Black-backed Gulls (*Larus dominicanus*), Variable Oystercatchers (*Haematopus unicolor*), Red-billed Gulls (*Larus novaehollandiae*), and White-fronted Terns (*Sterna striata*), were mapped, counted and their contents recorded. Records were kept on the 16 other bird and three mammal species observed on or in the vicinity of the island.

## 3.2 RESULTS

As one of the main objectives of this study was to repeat counts made in the 1958-62 survey, where appropriate our data is presented in the same way as the earlier study. In the 1958-62 study the species of petrels using each burrow was not determined when counts were made but the number of each species using the island was estimated later (Cox, *et al.*, 1967). To enable a direct comparison with the previous study an aggregate of all petrel burrows is presented in Table 1. Where quadrats were counted twice in 1996, the mean of the two counts is used. Table 2 presents the 1996/97 burrow count data, where the petrel burrows are identified by species. A total of 100 burrows were investigated for occupancy, this was to

gauge the accuracy of the used/unused burrow occupancy methods. The results were encouraging, with 90% of the initial burrow use assessment being confirmed. When the difficulty of reaching the nesting chamber is taken into account, the figure for used burrows may be higher. The confirmed burrow occupancy data for quadrats 3A, 3B and 3C is used for the second count in Table 2.

On 7 January 1997 a count was made of petrel carcasses (mainly Fairy Prion) caught in boxthorn, and the distribution of boxthorn on the island was mapped (refer Figure 4).

### 3.2.1 SYSTEMATIC LIST OF BIRDS

#### **Sooty Shearwater** (*Puffinus griseus*)

A few Sooty Shearwaters were seen or heard on all but the December trip. One banded bird (Z4978, banded on Motunau Island, 17 December 1979) was caught at the eastern end of the plateau on 10 February 1997. Based on the number of burrows in the quadrats we estimated there were approximately 230 Shearwater sized burrows, this compares with an estimate of 80 Shearwater burrows in 1958-62. The paucity of Shearwater sightings on trips in 1996/7 suggest our 1996 figure is probably an over-estimate. Problems arise from the smaller petrels using shearwater size burrows (refer Methods), and lack of methodology from the 1958-62 survey makes comparing the two data sets difficult.

#### **Huttons Shearwater** (*Puffinus huttoni*)

A probable Huttons Shearwater was sighted 500m. south of the island on the 19 November 1996. 300+ brown and white Shearwaters believed to be mainly Huttons were observed in large groups between 200 and 1,000m from the eastern end of the island on 11 February 1997.

#### **Fairy Prion** (*Pachyptila turtur*)

Fairy Prions were present on all visits to the island except February 1997. They could be seen after dark, in large numbers all over the plateau and slopes. They clearly remain the most abundant bird species on the island. Their burrows occur all over the island but are concentrated on the slopes and plateau edge. Without being able to assess Plot 2, we are uncertain about the status of the North-east and West slopes. Counts of the other Plots indicate approximately 14,000 Fairy Prion burrows which is comparable with totals of 9,900 estimated in 1958, and 14,000 in 1962 (Cox, *et al.*, 1967). If the North-East and West slopes are no longer being used because of their boxthorn cover, and total prion numbers are stable, then the birds must have redistributed themselves around the island.

#### **White-faced Storm Petrel** (*Pelagodroma marina*)

Storm Petrels were readily observed each evening flying above the plateau, on all visits except February 1997. They are could be heard when landing and on the ground, and were easily located as they moved through the grass. They seem to be restricted to the central and western parts of the plateau, a distribution which is similar to that observed by Taylor in 1958-62. A total of 425 burrows was estimated in 1958-62, but only 134 in 1996. The 1996 figure could be an under-estimate due to Storm Petrels using larger burrows which were attributed to Fairy Prions.



**Table 1:** Burrow Counts on Permanent Seabird Plots, Motunau Island, 1958-62 and 1996.

Plot	Burrow Type	1958		1959		1961	
		Number	Density	Number	Density	Number	Density
1 (900 sq. yds.) (752 sq. m.)	Penguin	45	5	41	4.5	48	5.3
	Petrel	749	83.2	887	98.5	1058	117.5
2 (1250 sq. yds.) (1045 sq. m.)	Penguin	12	0.9	11	0.9	12	0.9
	Petrel	206	16.5	163	13	288	23
3A (200 sq. yds.) (167 sq. m.)	Penguin	0	0	3	1.5	4	2
	Petrel	24	12	23	11.5	35	17.5
3B (170 sq. yds.) (142 sq. m.)	Penguin	0	0	0	0	1	0.6
	Petrel	19	11.2	16	9.4	40	23.5
3C (200 sq. yds.) (167 sq. m.)	Penguin	2	1	2	1	2	1
	Petrel	19	9.5	22	11	41	20.5
3D (200 sq. yds.) (167 sq. m.)	Penguin	1	0.5	1	0.5	0	0
	Petrel	10	5	6	3	12	6
3: Total (770 sq. yds.) (644 sq. m.)	Penguin	3	0.4	6	0.8	7	0.9
	Petrel	72	9.4	67	8.7	128	16.6
4A (150 sq. yds.) (125 sq. m.)	Penguin	2	1.3	3	2	0	0
	Petrel	1	0.7	5	3.3	15	10
4B (150 sq. yds.) (125 sq. m.)	Penguin	1	0.7	4	2.6	4	2.6
	Petrel	21	14	20	13.3	49	32.6
4: Total (300 sq. yds.) (250 sq. m.)	Penguin	3	1	7	2.3	4	1.3
	Petrel	22	7.3	25	8.3	64	21.3
5A (150 sq. yds.) (125 sq. m.)	Penguin	6	4	5	3.3	1	0.7
	Petrel	64	42.6	73	48.6	108	72
5B (150 sq. yds.) (125 sq. m.)	Penguin	3	2	2	1.3	0	0
	Petrel	101	67.3	126	84	147	98
5: Total (300 sq. yds.) (250 sq. m.)	Penguin	9	3	7	2.3	1	0.3
	Petrel	165	55	199	66.3	255	85
Grand Total (3520 sq. yds.) (2943 sq. m.)	Penguin	72	2	72	2	72	2
	Petrel	1214	34.5	1341	38.1	1793	50.9

N.B.: Density Expressed as Number Per 100 sq. yds.

**Table 1: Burrow Counts on Permanent Seabird Plots, 1958-62 and 1996 (Cont.).**

Plot	Burrow Type	1962		1958-62		1996	
		Number	Density	Mean	Mean Density	Number	Density
1 (900 sq. yds.) (752 sq. m.)	Penguin	48	5.3	45.5	5	126	14
	Petrel	838	93.1	883	98.1	879	97.6
2 (1250 sq. yds.) (1045 sq. m.)	Penguin	17	1.3	13	1		
	Petrel	241	19.3	229	18		
3A (200 sq. yds.) (167 sq. m.)	Penguin	3	1.5	2.5	1.2	2	1
	Petrel	56	28	34.5	17.2	23	11.5
3B (170 sq. yds.) (142 sq. m.)	Penguin	1	0.6	0.5	0.3	0	0
	Petrel	36	21.2	27.8	16	12	7
3C (200 sq. yds.) (167 sq. m.)	Penguin	2	1	2	1	2	1
	Petrel	40	20	30.5	15.2	8	4
3D (200 sq. yds.) (167 sq. m.)	Penguin	1	0.5	0.8	0.4	4	2
	Petrel	21	10.5	12.3	6.1	18	9
3: Total (770 sq. yds.) (643 sq. m.)	Penguin	7	0.9	5.8	0.8	8	1
	Petrel	153	19.9	105	13.6	61	7.9
4A (150 sq. yds.) (125 sq. m.)	Penguin	4	2.6	2.3	1.5	5	3.3
	Petrel	6	4	6.8	4.5	42	28
4B (150 sq. yds.) (125 sq. m.)	Penguin	5	3.3	3.5	2.3	1	0.6
	Petrel	40	26.6	32.5	21.6	71	47.3
4: Total (300 sq. yds.) (250 sq. m.)	Penguin	9	3	5.8	1.9	6	2
	Petrel	46	15.3	39.3	13.1	113	37.6
5A (150 sq. yds.) (125 sq. m.)	Penguin	1	0.7	3.3	2.2	6	4
	Petrel	117	78	90.5	60.3	173	115.3
5B (150 sq. yds.) (125 sq. m.)	Penguin	0	0	1.3	0.9	11	7.3
	Petrel	164	109.3	134.5	89.6	233	155.3
5: Total (300 sq. yds.) (250 sq. m.)	Penguin	1	0.3	4.5	1.5	17	5.6
	Petrel	281	93.7	225	75	406	135.3
Grand Total (3520 sq. yds.) (2942 sq. m.)	Penguin	82	2.3	74.5	2.1		
	Petrel	1559	44.3	1481.3	42.4		
Grand Total without Plot 2 (2270 sq. yds.) (1898 sq. m.)	Penguin	65	2.8	61.5	2.7	188	8.3
	Petrel	1318	58	1252.3	55.1	2039	89.8

N.B.: Density Expressed as Number Per 100 sq. yds.

**Table 2:** Seabird Burrow Counts on Permanent Plots, Motunau Island, 1996.

Plot	Burrow type	1st Count Used	1st Count Unused	2nd Count Used	2nd Count Unused	Mean Used	Mean Unused
1. (900 sq. yd.) (752 sq. m.)	Penguin	126	17			126	17
	Fairy Prion	879	34			879	34
3.A. (200 sq. yd.) (167 sq. m.)	Penguin	2	2	2	2	2	2
	Fairy Prion	19	20	19	21	19	20.5
	W.F.Storm Petrel	10	0	4	4	7	2
	S. Shearwater	0	0	0	0	0	0
	<b>Total Petrels</b>	<b>29</b>	<b>20</b>	<b>23</b>	<b>25</b>	<b>26</b>	<b>22.5</b>
3.B. (170 sq. yd.) (142 sq. m.)	Penguin	0	1	0	1	0	1
	Fairy Prion	13	8	11	10	12	9
	W.F.Storm Petrel	3	0	1	1	2	0.5
	S. Shearwater	0	0	0	0	0	0
	<b>Total Petrels</b>	<b>16</b>	<b>8</b>	<b>12</b>	<b>11</b>	<b>14</b>	<b>10.5</b>
3.C. (200 sq. yd.) (167 sq. m.)	Penguin	2	5	2	5	2	5
	Fairy Prion	7	8	7	9	7	8.5
	W.F.Storm Petrel	0	1	0	1	0	1
	S. Shearwater	1	3	1	4	1	3.5
	<b>Total Petrels</b>	<b>8</b>	<b>12</b>	<b>8</b>	<b>14</b>	<b>8</b>	<b>13</b>
3.D. (200 sq. yd.) (167 sq. m.)	Penguin	4	4			4	4
	Fairy Prion	15	7			15	7
	W.F.Storm Petrel	1	2			1	2
	S. Shearwater	2	3			2	3
	<b>Total Petrels</b>	<b>18</b>	<b>12</b>			<b>18</b>	<b>12</b>
3.Total. (770 sq. yd.) (644 sq. m.)	Penguin	8	12			8	12
	Fairy Prion	52	47			53	45
	W.F.Storm Petrel	6	8			10	5.5
	S. Shearwater	3	7			3	6.5
	<b>Total Petrels</b>	<b>61</b>	<b>62</b>			<b>66</b>	<b>57</b>
4.A. (150 sq. yd.) (125 sq. m.)	Penguin	5	4			5	4
	Fairy Prion	33	11			33	11
	S. Shearwater	9	2			9	2
	<b>Total Petrels</b>	<b>42</b>	<b>13</b>			<b>42</b>	<b>13</b>
4.B. (150 sq. yd.) (125 sq. m.)	Penguin	1	4			1	4
	Fairy Prion	71	21			71	21
	S. Shearwater	0	0			0	0
	<b>Total Petrels</b>	<b>71</b>	<b>21</b>			<b>71</b>	<b>21</b>
4.Total. (300 sq. yd.) (250 sq. m.)	Penguin	6	8			6	8
	Fairy Prion	104	33			104	33
	S. Shearwater	9	2			9	2
	<b>Total Petrels</b>	<b>113</b>	<b>35</b>			<b>113</b>	<b>35</b>
5.A. (150 sq. yd.) (125 sq. m.)	Penguin	6	1	6	1	6	1
	Fairy Prion	171	30	173	31	172	30.5
	S. Shearwater	0	0	0	0	0	0
	<b>Total Petrels</b>	<b>171</b>	<b>30</b>	<b>173</b>	<b>31</b>	<b>172</b>	<b>30.5</b>
5.B. (150 sq. yd.) (125 sq. m.)	Penguin	10	9	11	9	10.5	9
	Fairy Prion	223	42	229	45	226	43.5
	S. Shearwater	4	0	4	1	4	0.5
	<b>Total Petrels</b>	<b>227</b>	<b>42</b>	<b>233</b>	<b>46</b>	<b>230</b>	<b>44</b>
5.Total. (300 sq. yd.) (250 sq. m.)	Penguin	16	10	17	10	16.5	10
	Fairy Prion	394	72	402	76	398	74
	S. Shearwater	4	0	4	1	4	0.5
	<b>Total Petrels</b>	<b>398</b>	<b>72</b>	<b>406</b>	<b>77</b>	<b>402</b>	<b>74.5</b>

**Little Blue Penguin** (*Eudyptula minor*)

Penguins were present on all visits to the island, including February 1997 when many birds were in moult. Their burrows can be found on all parts of the slopes and plateau. Individuals were often present under coastal rocks during the day, and large numbers start to come ashore an hour or more before sunset. They congregate in groups on the shore until dark and then most disperse to their burrows. If we assume that numbers of penguin burrows in Plot 2 have remained constant since 1962, then the number of burrows on the island is approximately 1,550. This is considerably more than figures of 800-850 in 1958 and 1,100 in 1962.

**Gannet** (*Morus serrator*)

Four were recorded less than 200 metres offshore from the campsite on 19 November 1996.

**Pied Shag** (*Phalacrocorax varius*)

Pied Shags were observed on all visits to the island, either roosting on or near the landing beach, or in the waters around the northern shoreline. Numbers ranged from 20 on 3 December 1996, to 42 on 6 January 1997.

**Little Shag** (*Phalacrocorax melanoleucos*)

One was seen just offshore on 19 November 1996.

**Spotted Shag** (*Stictocarbo punctatus*)

Spotted Shags were recorded on all visits to the island often in association with Pied Shags. They were seen roosting on all parts of the shoreline, but mainly congregated on the landing beach and on rocks on the SW coast. The minimum count was nine on 18 November 1996, and maximum count 52 on 19 November 1996.

**White-faced Heron** (*Ardea novaehollandiae*)

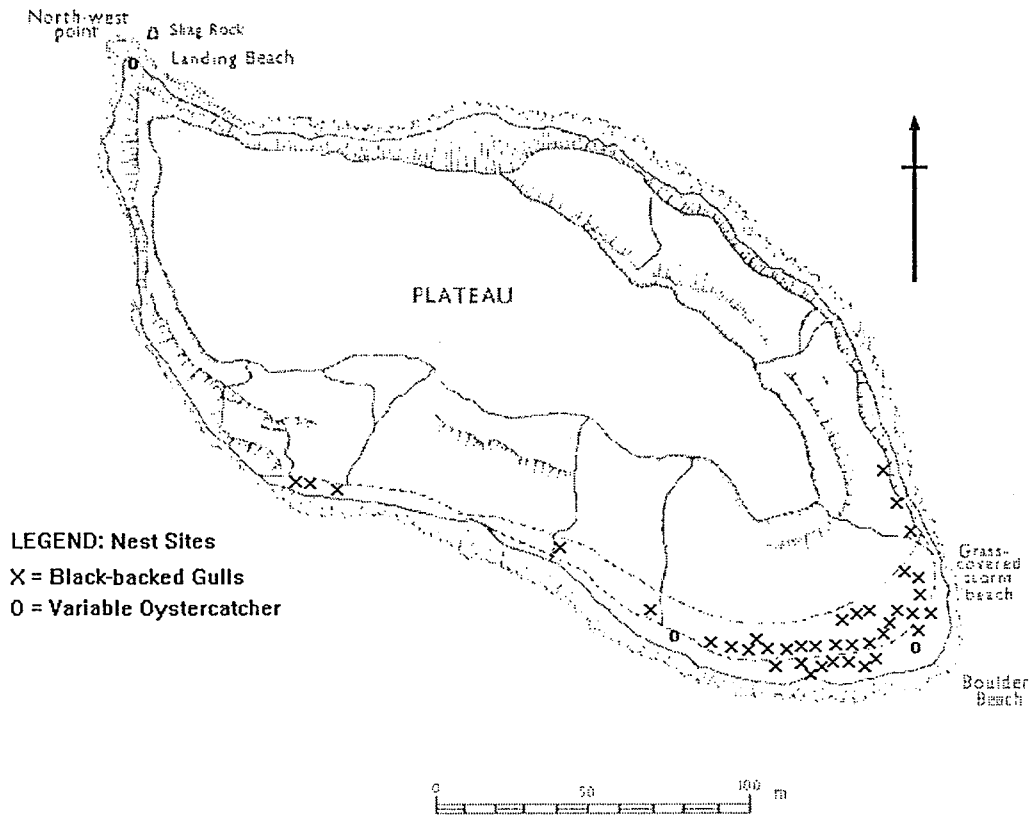
Two herons were observed flying away from the island mid-afternoon on 18 November 1996. One was recorded on the south side of the island at 1800 hrs the same day.

**Harrier** (*Circus approximans*)

One was seen in flight over the island on the 18 November 1996 and again on 19 November 1996. Two were disturbed on the plateau and flew towards the mainland on 2 December 1996, and one again on 3 December 1996. Two were seen flying around the edge of the plateau on 4 December 1996.

**Variable Oystercatcher** (*Haematopus unicolor*).

Four pairs of birds were observed on the island, one pair nested on a raised platform just above the landing beach, their nest contained three eggs on 3 December 1996. The other three pairs were all on the southern side of the island, two further nests were recorded with two eggs in each on 3 December 1996 (refer Figure 2). The final pair of birds may have been non-nesting juveniles because of their relative lack of defensive behaviour.



**Figure 2:** Motunau Island: Location of Black-backed Gull and Variable Oystercatcher Nests, 1996. Each symbol represents one nest.

**Black-backed Gull (*Larus dominicanus*)**

Black-backed Gulls were present on all visits to the island, mainly congregating around the NE point and South beach areas. Location of nests are shown in Figure 2, and nest counts and contents in Table 4. The total of 39 nests on 5 December 1996 is well below the range of 121 to 151 nests recorded between 1960 and 1963.

**Table 3:** Contents of Black-backed Gull Nests on Motunau Island, 5 December 1996.

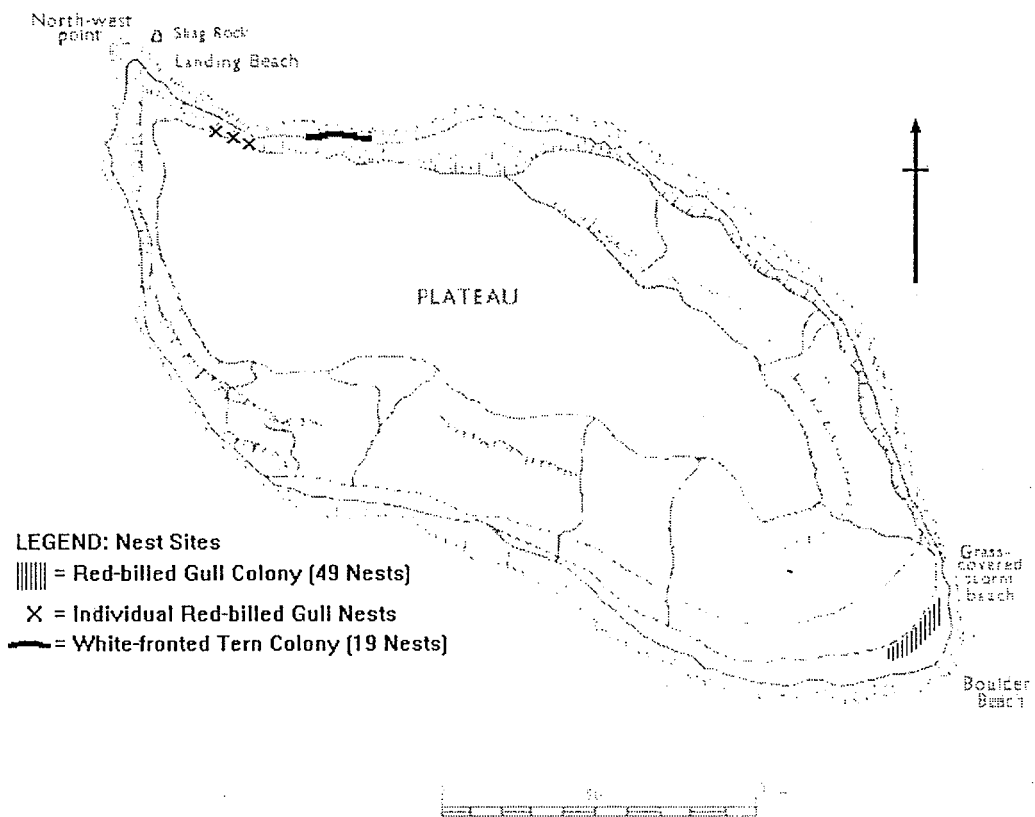
Nest Contents, Total 39 Nests.	
Empty -----	16
1 Egg -----	7
2 Eggs -----	12
3 Eggs -----	4
5 live chicks were recorded in the vicinity of empty nests.	

**Red-billed Gull (*Larus novaehollandiae*).**

Forty nine nests, all with eggs, were counted on the boulder beach by the grassy flat at the east end of the island on 4 December 1996 (C. Challies, pers. comm., 1996) A further three nests were seen on the cliffs above the landing beach. Twelve chicks were counted in the nesting area on 8 January 1997.

**Table 4: Contents of Red-billed Gull Nests on Motunau Island, 5 December 1996.**

Nest Contents, Total 52 Nests	
1 Egg -----	12
2 Eggs -----	35
3 Eggs -----	4
4 Eggs -----	1
12 live chicks were recorded at main nesting site on, 7 January 1997.	



**Figure 3: Motunau Island: Location of Red-billed Gull and White-fronted Tern Colonies and Nests, 1997.**

**White-fronted Terns (*Sterna striata*).**

Small groups of terns were observed offshore on 18 and 19 November 1996. Large numbers of terns (est. 200+) were observed on and around the island between 6 and 9 January 1997. In excess of 50 could be found roosting or nesting on the NW beach area, 19 nests all with one egg were recorded on January 6th 1997. Most nests failed, as a further check of this nesting area on 16 January 1997 revealed only one chick and three nests (Challies pers. comm., 1997). One tern fledgling was recorded in the colony area on 11 February 1997, no other sign of nests or young was seen.

**Rock Pigeon (*Columba livia*)**

Large numbers roost or nest around the cliffs and boulder beach. 60+ were recorded roosting and probably nesting on cliffs around the island on 18 and 19 November 1996. Flocks of 50+ were seen returning from the mainland each evening on all trips.

**Skylark (*Alauda arvensis*)**

One was seen flying over the plateau on 18 November 1996, and a further two on 19 November 1996.

**Dunnoek (*Prunella modularis*)**

One was seen on the plateau on 19 November 1996, two on 5 December 1996 and one on 7 January 1997.

**Blackbird (*Turdus merula*)**

Single birds were recorded on the plateau on 19 November 1996, and SW point on 4 December 1996. Two were seen at the SW point on 5 December 1996.

**South Island Fantail (*Rhipidura fuliginosa*)**

One seen on plateau 7 January 1997.

**Greenfinch (*Chloris chloris*)**

Greenfinches were recorded on the November and December 1996 trips, with approximately 50 feeding on tree mallow (*Lavatera arborea*) on the plateau on November 18th 1996. Five were observed around the SW point on December 5th 1996.

**Goldfinch (*Carduelis carduelis*)**

Two were recorded on the plateau on 18 November 1996; and three were recorded flying around the South cliffs, and two on the plateau on 7 January 1997.

**House Sparrow (*Passer domesticus*)**

Between one and four house sparrows were observed on all trips, normally flying around the cliffs.

**Starling (*Sturnus vulgaris*)**

One was seen flying SW point on 4 December 1996, and one seen flying South beach area on 7 January 1997. Starlings were far more common in 1958-62 (Cox *et al.*, 1967).

### 3.2.2 SYSTEMATIC LIST OF MAMMALS

#### Elephant Seal (*Mirounga leonina*)

One juvenile male was recorded on the North side of the island on 18 November 1996. Its nose to tail length was approximately 1.3m. Minor injuries to its rear flippers were observed.

#### Hookers Sealion (*Phocarctos hookeri*)

One female was seen in rocks at the SW beach on 6 December 1996.

#### New Zealand Fur Seal (*Arctocephalus forsteri*)

Fur seals were recorded on the island on most trips. Four were recorded on 2 December 1996, one on 3 December 1996, one on 6 January 1997, and one on 11 February 1997.

### 3.2.3 FAIRY PRIONS CAUGHT IN BOXTHORN (*Lycium ferocissimum*)

Carcasses of 17 dead Fairy Prions were recorded entangled in boxthorn on the coastal cliffs and slopes on 7 January 1997. Boxthorn cover on the island was visually assessed and is shown in Figure 4.

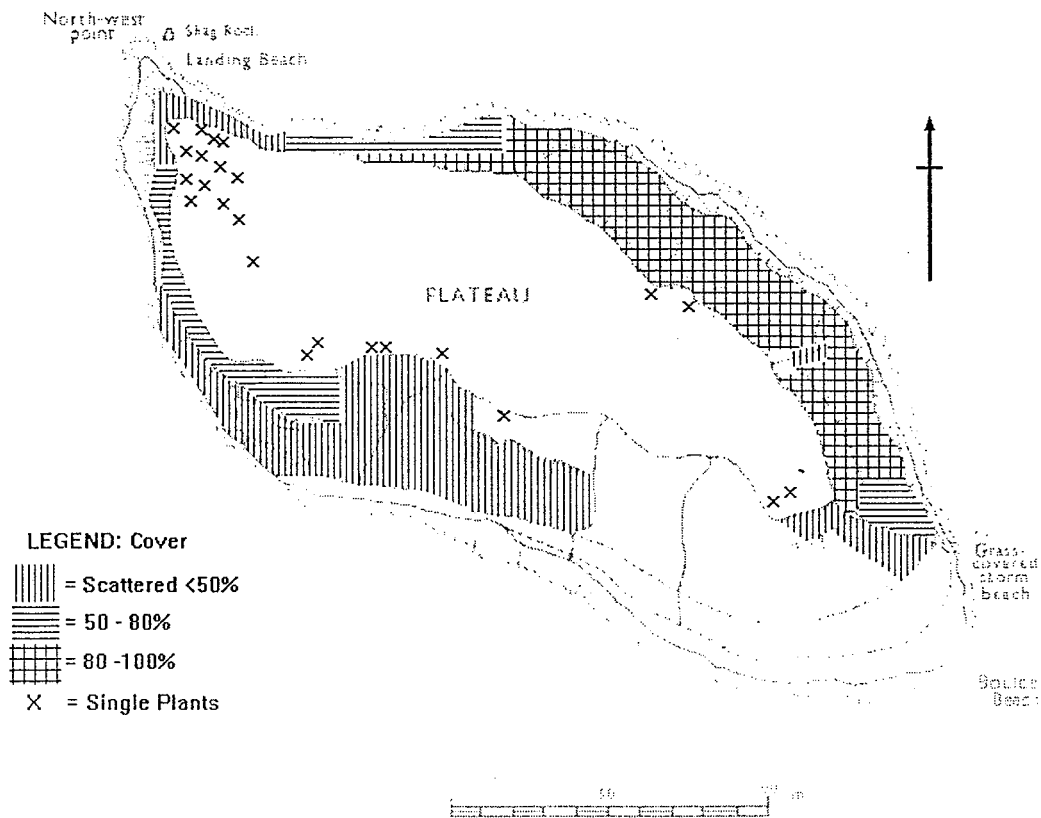


Figure 4: Motunau Island: Approximate cover of Boxthorn, 7 January 1997.



## 4.0 LIZARDS

### 4.1 INTRODUCTION

Annual surveys of lizards on Motunau Island were carried out by DSIR between November and February, from 1967 to 1975. Three species of lizard on Motunau Island, the spotted skink (*Oligosoma lineocellatum*), common skink (*O. nigriplantare polychroma*) and the common gecko (*Hoplodactylus maculatus*).

Lizards were sampled on a 20 x 20 m grid of 25 pitfalls traps, spaced at 5 m intervals. The grid was situated at the south-east end of the island's plateau. Lizards caught were weighed, measured and permanently marked by toe-clipping. Habitat in the plot was mapped in February and December 1967, and March 1975.

In November 1996 the original pegs marking the lizard grid were located and pitfall traps placed where they had been in the previous surveys. Five trips were made to the Island between November 1996 and March 1997 on each trip. The pitfall traps were set and checked daily for four days. Lizards trapped were weighed, measured, sexed and toe-clipped. Vegetation on the grid was mapped.

### 4.2 PRELIMINARY RESULTS

A total 265 lizards were caught on the grid between December 1996 and February 1997. Table 1 shows the number of each species caught in the 1996-97 period and the number caught and marked by the DSIR in 1967, as well as the number of each species caught in total over all the surveys.

**Table 5:** Number of individual lizards marked on the DSIR grid on Motunau Island in 1967, all the DSIR surveys and 1996-1997.

	1967	1967-75	1996-97
<i>H. maculatus</i>	58	133	63
<i>O. lineocellatum</i>	24	48	95
<i>O. n. polychroma</i>	84	339	111

Of the 63 *H. maculatus* caught on the DSIR grid in 1996-97 16 individuals had been toe-clipped in the 1967-1975 study. Two of the animals that were caught in the 1996-97 survey were toe-clipped in 1967 as adults, making them at least 34 years old. This is a record for longevity in the wild for this species. Data on the longevity of free-living New Zealand geckos are scarce. Barwick (1982) recorded an adult female *Hoplodactylus duvauceli* recaptured after 12 years, giving a minimum age of 19 years. Whitaker (1982) reported two *H. maculatus* at 10 and 11 years. In captivity there is a record for one *H. maculatus* being 37 years old (Newman, 1982).

Analysis of lizard abundance shows a highly significant increase in the numbers of *O. lineocellatum* ( $p = 0.013$ ) and *O. n. polychroma* ( $p = 0.015$ ) on the grid. There was no significant increase in the number of *H. maculatus* caught ( $p = 0.32$ ). Habitat preference of lizards on Motunau Island will be investigated.

## 5.0 DISCUSSION

The vegetation in the permanent plots has changed markedly since 1962, and the reduction in the numbers of petrels nesting on the plateau is perhaps a result of this vegetation change.

At the time of the original ecological survey the plateau was dominated by silver tussock (*Poa cita*) with plentiful *Scirpus nodosus* and rushes (*Juncus distegus*). Bracken (*Pteridium esculentum*) was common, in a stand, and mixed with the tussock at the western end. Iceplant (*Disphyma australe*) commonly occurred at the plateau edges. The slopes were more varied than the plateau, there was an almost complete cover of iceplant on the North-east slopes of Plot 2. The southern slopes around Plot 1 consisted of mixed tussock and iceplant at the top with much bare ground. The bottom of the slope was mainly iceplant mixed with varying amounts of nettle (*Urtica ferox*), barleygrass (*Hordeum murinum*) and winged thistle (*Carduus tenuiflorus*) (Cox, *et al.*, 1967).

In Plot 1 penguin numbers have more than doubled, while petrel numbers have remained similar to 1958-62 levels. The vegetation has changed to one dominated by tree mallow and barley grass, but still contains a large percentage of bare ground. Why penguin numbers should have increased is unclear, as numbers on the island appear stable. Plot 1 is still clear of boxthorn, suggesting penguins may have moved away from boxthorn infested areas.

Plot 2 is now covered in a dense growth of boxthorn which made counting the burrows in this plot impossible. Observations around the edge of the boxthorn near Plot 2 indicated that the petrels did not burrow under this vegetation. The boxthorn is dangerous to the small petrels especially, and would make landing and take-off from this area impossible. Petrels still nest along the plateau edge of boxthorn covered slopes, and penguins are still using trails underneath the boxthorn and probably still burrowing there as well. It should be noted that prior to the removal of rabbits boxthorn was restricted to a few plants on the beach flat. The rabbits may have been controlling it, as its subsequent rapid spread occurred after rabbit eradication.

In Plot 3 penguin burrow numbers have remained low but stable, while petrels have declined to around half the 1958-62 number. The only quadrat in Plot 3 which has maintained its petrel numbers is 3D, this quadrat is relatively bare of vegetation and incorporates part of the upper slope/plateau edge where petrel density is highest. The plateau quadrats 3A, 3B and 3C are covered by a dense grass sward of mainly cocksfoot (*Dactylis glomerata*) with clumps of tree mallow around burrow entrances. The vegetation now found in these quadrats is representative of most of the plateau. Studies have shown that petrels struggle to penetrate dense vegetation (Gillham, 1960, 1961). This would especially apply to the Fairy Prions and White-faced Storm Petrels, whose number in this vegetation type appear to have declined. Penguins are known to open out or kill vegetation in and around their burrows, and studies have shown an often close association of petrel burrows with those of penguins (Gillham, 1962). The opening up of the vegetation by the more robust penguins may allow the petrels easier access to ground level. Petrels may also utilise unused penguin burrows (Gillham, 1963).

In Plot 4 penguin numbers have remained similar to 1958/62, but petrel numbers have more than doubled. Plot 4 now supports a mixture of iceplant, tree mallow, ryegrass (*Lolium perenne*), cocksfoot, silver tussock and introduced annuals, with patches of bare ground. In

general the vegetation is far less dense than the western end of the plateau, and is indicative of only 10 to 20% of the plateau. Whether the change in petrel numbers is related to changes in the vegetation is unclear. It may reflect a distributional change in petrel numbers due to other parts of the island (eg. Plots 2 & 3) becoming unsuitable for burrowing.

In Plot 5 numbers of burrows have increased fourfold for penguins and almost doubled for petrels. Plot 5 has a similar mix of plant species to Plot 4, but contains more bare ground. These cliff edge/upper slope areas are favoured burrowing areas offering easy access and take-off for the petrels. Why numbers have increased to the extent they have could be due to the greater area of bare ground offering easy burrowing, or a distributional change. Or conversely the greater area of bare ground may reflect the extra wear caused by higher bird traffic in these areas. Previous studies show that penguins and petrels can cause destruction of plants in and around their burrows (Gillham, 1961), and initiate local erosion (Norman, 1967, 1970a).

When rabbits were present they may have maintained a less dense vegetation which was beneficial to the small petrels. Grazing by mammals can be beneficial to burrowing birds, as ungrazed vegetation may block burrows, prevent construction of new burrows or trap birds (Gillham, 1957; Norman, 1970a). Fleming suggested that a shorter vegetation as maintained by sheep may benefit the breeding of White-faced Storm Petrels (Fleming, 1939 cited in Norman, 1970b). The distributional change in petrel burrows from the plateau to the slopes may reflect a response to the current vegetation's difficulty for burrowing.

The petrels may have been impacted less by the presence of rabbits than they are by the grass sward and boxthorn that has established in their absence.

## 6.0 RECOMMENDATIONS

- Boxthorn clearance work should be a priority. This would result in a reduction in the mortality of small petrels, and open up the slopes which are preferred nesting areas for petrels, where they remain free of boxthorn.
- Further study is needed of the effect the introduced grass sward has on the ability of the small petrels to burrow. Thinning of the grass sward may be desirable.
- Experimental plots should be established to study the effects of grass sward clearance on burrowing petrels.

## 7.0 REFERENCES

- Barwick, R.E. 1982. The growth and ecology of the gecko *Hoplodactylus duvauceli* at The Brothers Island. In: Newman, D.G. (Editor), *New Zealand Victoria University, Wellington*. pp 377 - 391. Occasional Publication 2, New Zealand Wildlife Service, Department of Internal Affairs, Wellington.
- Cox, J.E.; Taylor, R.H.; Mason, R. 1967. Motunau Island Canterbury, New Zealand. An Ecological Survey. *New Zealand Department of Scientific and Industrial Research, Bulletin 178*.
- Gillham, M.E. 1957. Ecology of some New Zealand seabird colonies. *Proceedings of the New Zealand Ecological Society* 5: 9-10.
- Gillham, M.E. 1960. Plant communities of the Mokohinau Islands, Northern N.Z. *Transactions of the Royal Society of New Zealand* 88(1): 79-98.
- Gillham, M.E. 1962. Granite islands of South-east Victoria as a seabird habitat. *Proceedings of the Royal Society of Victoria* 75: 45-63.
- Gillham, M.E. 1963. Breeding Habitats of the White-faced Storm Petrel (*Pelagodroma Marina*) in Eastern Bass Strait. *Papers and Proceedings of the Royal Society of Tasmania* 97: 33-41.
- Newman, D.G. 1982. (Editor) *New Zealand Herpetology: Proceedings of a symposium, Victoria University, Wellington*. Occasional Publication 2, New Zealand Wildlife Service, Department of Internal Affairs, Wellington.
- Norman, F.I. 1967. The Interaction of Plants and Animals on Rabbit Island, Wilson's Promontory, Victoria. *Proceedings of the Royal Society of Victoria* 80: 193-200.
- Norman, F.I. 1970a. Ecological effects of rabbit reduction on Rabbit Island, Wilson's Promontory, Victoria. *Proceedings of the Royal Society of Victoria* 83: 235-252.
- Norman, F.I. 1970b. The effects of sheep on the breeding success and habitat of the Short-tailed Shearwater, *Puffinus Tenuirostris* (Temminck). *Australian Journal of Zoology* 18: 215-29.
- Thomas, B.W. 1979 (unpublished). Ecology Division, DSIR, Visit to Motunau Island, November 1978.
- Whitaker, A.H. 1982. Interim results from a study of *Hoplodactylus maculatus* (Boulenger) at Turakirae Head, Wellington. In: Newman, D.G. (Editor) *New Zealand Herpetology: Proceedings of a Symposium, Victoria University, Wellington*. pp. 363-374. Occasional Publication 2, New Zealand Wildlife Service, Department of Internal Affairs, Wellington.

8.0 APPENDIX: Major Vegetation types recorded in Permanent Plots on  
Motunau Island, 1996.

Plot 1. (900 sq.yds.) (752 sq. m.)	Tree Mallow ( <i>Lavatera arborea</i> ) 40% Barley Grass ( <i>Hordeum murinum</i> ) 25% <5%: Tall fescue ( <i>Bromus wildinowii</i> ) Iceplant ( <i>Disphyma australe</i> ) Winged thistle ( <i>Carduus tenuiflorus</i> ) Wild turnip ( <i>Brassica rapa</i> ) Sow thistle ( <i>Sonchus oleraceus</i> ) Bare ground: 25%
Plot 3A. (200 sq.yds.) (167 sq. m.)	Cocksfoot ( <i>Dactylis glomerata</i> ) 70% Tree Mallow ( <i>Lavatera arborea</i> ) 20% <5%: Tall fescue ( <i>Bromus wildinowii</i> ) Iceplant ( <i>Disphyma australe</i> ) Catsear ( <i>Hypochoeris radicata</i> ) Rush ( <i>Juncus distegus</i> ) Silver tussock ( <i>Poa cita</i> ) Boxthorn ( <i>Lycium ferocissimum</i> ), 2 plants Bare Ground: <2%
Plot 3B. (170 sq. yds.) (142 sq. m.)	Cocksfoot ( <i>Dactylis glomerata</i> ) 70% Tree Mallow ( <i>Lavatera arborea</i> ) 15% Silver tussock ( <i>Poa cita</i> ) 5-10% <5%: Iceplant ( <i>Disphyma australe</i> ) Catsear ( <i>Hypochoeris radicata</i> ) Pohuehue ( <i>Muehlenbeckia complexa</i> ) Mahoe ( <i>Meliccytus ramiflorus</i> ) Bare Ground: <2%
Plot 3C. (200 sq. yds.) (167 sq. m.)	Cocksfoot ( <i>Dactylis glomerata</i> ) 75% Tree Mallow ( <i>Lavatera arborea</i> ) 20% <5%: Iceplant ( <i>Disphyma australe</i> ) Catsear ( <i>Hypochoeris radicata</i> ) Pohuehue ( <i>Muehlenbeckia complexa</i> ) Winged thistle ( <i>Carduus tenuiflorus</i> ) Rush ( <i>Juncus distega</i> ) Silver tussock ( <i>Poa cita</i> ) Ryegrass ( <i>Lolium perenne</i> ) Wild turnip ( <i>Brassica rapa</i> ) Boxthorn ( <i>Lycium ferocissimum</i> ), 1 plant Bare Ground: 2%
Plot 3D. (200 sq. yds.) (167 sq. m.)	Cocksfoot ( <i>Dactylis glomerata</i> ) 70% Tree Mallow ( <i>Lavatera arborea</i> ) 15% <5%: Catsear ( <i>Hypochoeris radicata</i> ) Wild turnip ( <i>Brassica rapa</i> ) Winged thistle ( <i>Carduus tenuiflorus</i> ) Bracken ( <i>Pteridium esculentum</i> ) Bare Ground: 5%

**8.0 APPENDIX: Major Vegetation types recorded in Permanent Plots on  
Motunau Island, 1996.**

<b>Plot 4A.</b> (150 sq. yds.) (125 sq. m.)	Iceplant ( <i>Disphyma australe</i> ) 50% Tree Mallow ( <i>Lavatera arborea</i> ) 5-10% Silver tussock ( <i>Poa cita</i> ) 5% <5%: Winged thistle ( <i>Carduus tenuiflorus</i> ) Cocksfoot ( <i>Dactylis glomerata</i> ) Bare Ground: 10%
<b>Plot 4B.</b> (150 sq. yds.) (125 sq. m.)	Iceplant ( <i>Disphyma australe</i> ) 20% Tree Mallow ( <i>Lavatera arborea</i> ) 20% Ryegrass ( <i>Lolium perenne</i> ) 20% <5%: Winged thistle ( <i>Carduus tenuiflorus</i> ) Cocksfoot ( <i>Dactylis glomerata</i> ) Catsear ( <i>Hypochoeris radicata</i> ) Bare Ground: 15%
<b>Plot 5A.</b> (150 sq. yds.) (125 sq. m.)	Iceplant ( <i>Disphyma australe</i> ) 20% Tree Mallow ( <i>Lavatera arborea</i> ) 5-10% <5%: Ryegrass ( <i>Lolium perenne</i> ) Cocksfoot ( <i>Dactylis glomerata</i> ) Catsear ( <i>Hypochoeris radicata</i> ) Bare Ground: 50%
<b>Plot 5B.</b> (150 sq. yds.) (125 sq. m.)	Iceplant ( <i>Disphyma australe</i> ) 10% Tree Mallow ( <i>Lavatera arborea</i> ) 15% <5%: Ryegrass ( <i>Lolium perenne</i> ) Cocksfoot ( <i>Dactylis glomerata</i> ) Tall fescue ( <i>Bromus wildinowii</i> ) Barley grass ( <i>Hordeum murinum</i> ) Winged thistle ( <i>Carduus tenuiflorus</i> ) <i>Senecio lautus</i> Bare Ground: 40%