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[The possibility of an 'aided' passage across the Tasman Sea should not be ruled out. Sharland (Tasmanian Birds p. 114) mentions that the Satin Flycatcher has been seen crossing Bass Strait at the widest part; and adds, "It occasionally comes to rest on ships at sea.—Ed.]

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SEA BIRDS FOUND DEAD IN NEW ZEALAND IN 1961

By P. C. BULL and B. W. BOESON*

ABSTRACT

Beach Patrols in New Zealand during 1961 covered a total distance of 857 miles and yielded 3138 birds (57 species), a record. Species are tabulated by month of occurrence and by the coastal zones in which they were found; unusual species include *Eudyptes pachyrhynchus, Procellaria cinerea, P. westlandica, Pterodroma pycrofti, P. leucoptera, P. longirostris* (first record), and *Garrodia nereis.* Major wrecks of *Puffinus griseus* in May and of *Pachyptila vittata* in July are described in detail and were probably associated with food shortage. The numbers of birds and the relative importance of different species varied from one part of the coast to another, probably in relation to wind direction and the distribution of birds at sea.

INTRODUCTION

This account corrects and expands the brief interim report already published (Bull 1962). It differs from the 1960 report (Bull and Boeson 1961b) in that records of dead birds are separated into 18 geographic zones that together cover the entire coastlines of the North and South Islands (Fig. 1); this should assist in determining more accurately the ranges of the various species.

Forty-one members took part in the year's work and sent in a total of 312 fully-completed cards for patrols covering 857 miles of beach. The cards record the finding of 3138 birds (57 species) and a further 145 were found on small islands or by people not doing patrols. Records from islands where petrels breed, though valuable, are not strictly comparable with those from normal patrols of open beaches.

The number of cards received, the length of beach examined, the number of specimens and of species found, and the number of people who helped in the work were all substantially greater than in 1960. The year 1961 was also characterised by two major "wrecks" of sea birds, discussed in a subsequent section, and by the finding of a few species that are new or very rare in New Zealand (Falla 1962).

RESULTS

Distribution of Patrols

The length of beach patrolled each month is shown in Table 1

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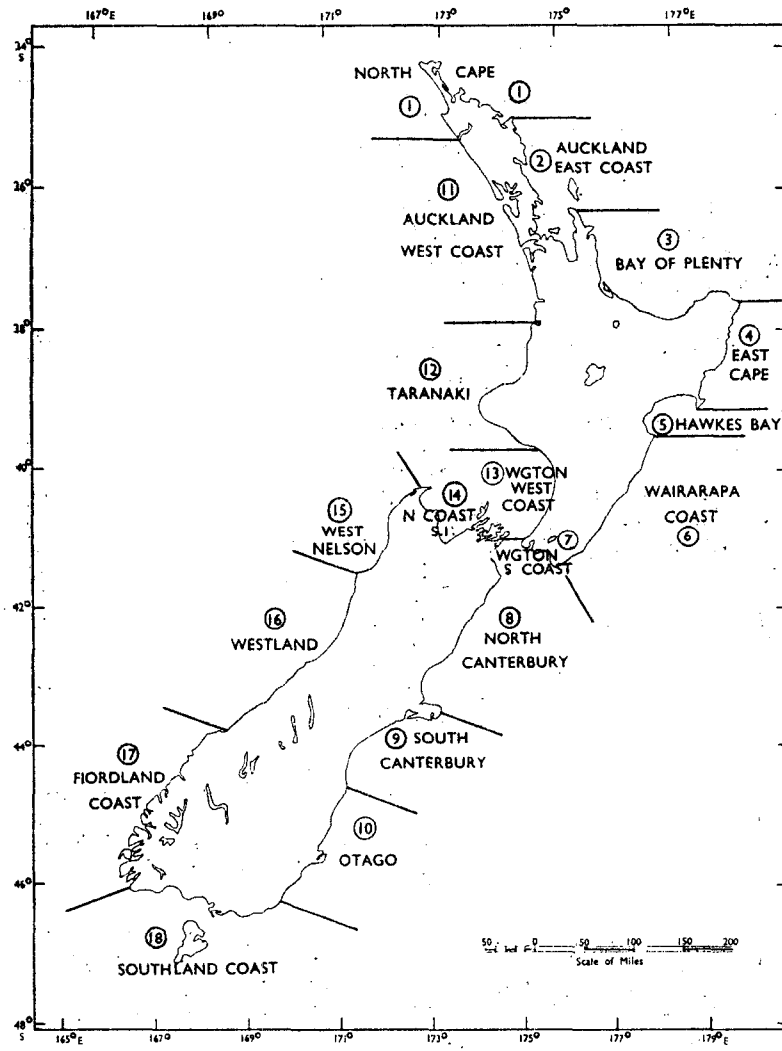

Fig. 1 — Map Showing Coastal Zones into which Beach Patrols were grouped

for each of the 10 zones in which total patrols for the year exceeded 12 miles. Patrols in two other zones have been combined under the heading "miscellaneous"; these are Westland where no birds were found on one mile of beach in February, and South Canterbury which had no birds on one mile of beach in March, but 101 birds (all but one were *Puffinus griseus*) over a similar distance in May. No patrols were reported from any of the remaining zones; namely: East Cape, Hawke's Bay, Wairarapa, West Nelson, Fiordland and Southland (Fig. 1). Patrols from Brothers and Motunau Islands (North Coast South Island

TABLE 1: Miles Patrolled and Birds Found on Different Coasts

Coastline			Number of Miles Patrolled Each Month — January-December												Total Miles	† Birds per Mile
Name (Fig. 1)	Code No.	Code Letters	J	F	M	A	M	J	J	A	S	O	N	D		
North Cape	1	NC	13											*	13	0.7
Auckland East	2	AE	15							1			9	3	28	1.1
Bay of Plenty	3	BP	31	21	10	15	14	13	7	—	*	3	—	9	123	0.9
Wellington South	7	WS	1	*	2		20	10		12	1	1	3		50	1.4
North Canterbury	8	CN	5		7			3	6			5	15	14	55	0.9
Otago	10	O	1	3	12	14	17	5	10	8	9	6	7	10	102	1.2
Auckland West	11	AW	19		1		21	4	19		6	5	5		80	18.5
Taranaki	12	T	23	18	18	18	2							2	81	0.1
Wellington West	13	WW	17	12	30	30	14	18	65	45	21	23	15	6	296	3.8
North Coast, South Is.	14	NCS	11	4	3		4			4					26	1.4
Miscellaneous (see text)	—	—		1	1		1								3	—
Total Miles	—	—	136	59	84	77	93	53	107	70	37	43	54	44	857	—
Birds per Mile	—	—	1.5	0.6	1.3	0.5	5.2	1.6	16.1	2.5	1.3	1.7	1.2	2.3		3.7

* Indicates monthly patrols totalling less than half a mile; all other values are to the nearest mile.

† The table is based on a total of 3138 birds; a further 145 birds were on cards excluded from the Table (see text).

and North Canterbury zones respectively) are excluded from Table 1 because these are breeding places; the birds found dead there, however, are recorded in Tables 2 and 4.

The continuity of monthly patrols throughout the year varied markedly from one zone to another (Table 1). The Wellington West Coast and Otago zones were the only ones with patrols for every month of the year and even in these, the patrols were sometimes too short to yield a reliable indication of bird mortality in certain months. The coverage for the remaining zones rarely exceeded two thirds of the year. In view of the uneven coverage, the number of birds found per mile (right hand column of table) is strongly influenced by whether or not patrols were made during the periods of heaviest mortality.

The mean number of birds found each month in all zones combined (bottom row of figures in Table 1) shows that mortality was relatively low during the period February to April (less than 1 bird per mile for the three months combined). A similar late summer-autumn decline in mortality was noted in 1960 (Bull and Boeson 1961b) and for *Pachyptila turtur* over the period 1951-59 (Bull and Boeson 1961a).

Kinds of Birds Found

Species of penguins, albatrosses, petrels and shearwaters found during 1961 are listed in Table 2 which also shows the frequency of occurrence by months. Other kinds of birds (mainly gulls and gannets) are grouped together as "miscellaneous species." The three most abundant species during 1961 were *Pachyptila vittata* (1385 specimens), *Puffinus griseus* (583) and *Pachyptila turtur* (342). Species that were new or very rare (less than 10 specimens to date) in the beach patrol records were *Eudyptes pachyrhynchus, Procellaria cinerea, P. westlandica, Pterodroma pycrofti, P. leucoptera, P. longirostris* (first record) and *Garrodia nereis.*

"Miscellaneous species" consisted of the following: *Sula bassana* (26 specimens), *Phalacrocorax carbo* (2), *P. varius* (1), *P. melanoleucos* (1), *P. carunculatus* (9), *P. punctatus* (15), *Phalacrocorax* sp. (1), *Circus approximans* (5), *Haematopus ostralegus* (1), *Larus dominicanus* (75), *L. novaehollandiae* (24), *L. bulleri* (4), *Larus* sp. (1), *Hydroprogne caspia* (2), *Sterna striata* (13), *Hemiphaga novaeseelandiae* (1), *Columba livia* (2), *Prunella modularis* (1), *Zosterops lateralis* (1), *Carduelis carduelis* (2), *Passer domesticus* (1) and *Gymnorhina hypoleuca* (1). The harriers, goldfinches, white eye, hedge sparrow and house sparrow were from "the Brothers" (Zone 14), and all except the harriers, which had been shot, were found near the lighthouse in August and September; this may indicate some kind of migratory movement.

Seasonal Distribution of Species

Table 2 reflects the normal seasonal occurrence of migratory species. In some months, however, certain species were far more numerous than usual: *P. gavia* in March, *P. griseus* in May and *P. vittata* and *P. turtur* in July. Data on these four species are compared in Table 3 in which the mean number of birds per mile indicates the extent of mortality for each species in certain zones. This index of mortality avoids the bias caused by variations in patrolling activity in different months and zones (Table 1).

Fluttering Shearwater *(P. gavia).*

Specimens were few (less than 0.3 birds per mile) on the Wellington West Coast, except in March when they increased about sixfold to 1.3 per mile. A three-mile patrol near Waitarere (Levin) on 12 March yielded 7.3 *P. gavia* per mile. All the birds were in heavy moult and lacked several primaries.

Sooty Shearwater *(P. griseus).*

Except in Bay of Plenty, there was a marked increase in *P. griseus* in all zones in May (Table 3). The monthly average for the Auckland West Coast was 8.6 birds per mile, but 11 per mile were recorded over 15 miles at Muriwai on 21 May. Mortality was particularly severe in South Canterbury where 100 *P. griseus* were found on a mile of beach at Wakanui (Ashburton) on 15 May. On 16 May the Christchurch Press reported an estimated 500 birds on 2 miles of coast at Wakanui and further north "hundreds" of live ones were seen over Lake Ellesmere (17/5/61). In the far north heavy casualties were reported on Ninety Mile Beach (Evening Post 7/6/61). It is interesting that few *P. griseus* were found in the Bay of Plenty in May (only 0.1 per mile on 14 miles of beach), though heavier mortality (1.2 - 2.3 per mile) was recorded later in the year. Possibly *P. griseus* passes the Bay of Plenty in numbers only during its southbound migration.

Broad-billed Prion *(P. vittata).*

A very severe wreck of Broad-billed Prions occurred along the west coast of the North Island during the week commencing 30 June. An average of 40 *P. vittata* per mile was recorded on the Auckland west coast in July, and as many as 144 birds were found on a single mile of beach at Awhitu on 3 July.

Somewhat lighter mortality was recorded on the Wellington West coast where the July average was 7.9 birds per mile; 22 per mile were recorded at Himatangi on 1 July and again at Paekakariki on 9 July. Many Wellington beaches were patrolled on several successive occasions at this time and this may partly explain why the average number of birds per mile was so much less than at Auckland where most of the beaches were patrolled only once. The three miles of the Waitarere - Hokio Beach (Levin) yielded 130 *P. vittata* but these were collected during three separate patrols thus giving an average of 14 birds per mile over 9 miles. If, however, all these birds had been found on one patrol, instead of being picked up in three batches, the figure would have been 43 per mile over 3 miles.

The first indication of the *P. vittata* "wreck" was the finding of 19 birds on 3 miles of beach at Castlecliff (Wanganui) on 30 June; on the same day the "Levin Chronicle" reported that the Manawatu district was "invaded by hundreds of sea birds" blown inland by "the gale force westerly winds which have swept the countryside recently." Beach patrollers recovered 296 *P. vittata* on Wellington west coast beaches on 1 July and a further 213 during the rest of the month. Occasional specimens were found during the following months up to the end of November (75 in all), but most of these had been dead some time, and clearly the main mortality was in the first week of July.

Fairy Prion *(P. turtur).*

Fairy Prions suffered no very severe mortality though there was a rise, particularly on the Auckland west coast in July coinciding with

TABLE 2: List of Species Found Each Month

Months Birds Found:	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total Specimens
Species of Birds													
Megadyptes antipodes					3								3
Eudyptula minor	21	12	11	7	12	5	9	8	4	1	5	6	101
E. albosignata	1	18	1									1	21
Eudyptes pachyrhynchus	1												1
Diomedea exulans				1			1						2
D. chrysostoma							3		1				4
D. bulleri				1	2				1				4
D. cauta			3		2	5	2					3	15
Diomedea sp.*				1					1				2
Phoebetria palpebrata						1		1					2
Macronectes giganteus			2			1							3
Daption capensis	1						1	8	1	3			14
Halobaena caerulea							4				1		5
Pachyptila vittata	5	1			1	24	1276	64	5	3	6		1385
P. salvini					1	1	151	9			1		163
P. desolata subspp.						1	18	23	1	1			44
P. belcheri							74	5	1				80
P. turtur	34	27	9	3	3	1	143	39	19	36	22	6	342
Pachyptila sp.*	4	10	3	2				1					20
Puffinus carneipes	3		2	1	2							2	10
P. bulleri	1	1	1	2	2	1				1	2	7	18
P. griseus	65	1	6	3	426	35	2	1	1	10	14	19	583

TABLE 2 (Continued)

Species of Birds	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total Specimens
P. tenuirostris	10				1					3	1	7	22
P. gavia gavia	24	3	39	3	17		14	1		5	2	4	112
P. gavia huttoni	6	3							3	3	3	2	20
P. assimilis subspp.							1					2	3
Procellaria cinerea										1		1	2
P. westlandica					1								1
P. aequinoctialis					4	1							5
Pterodroma macroptera	1										1	3	5
P. lessoni	1					1	1		1				4
P. inexpectata					3							1	4
P. brevirostris							1				1		2
P. pycrofti	1												1
P. leucoptera						1							1
P. cooki												1	1
P. longirostris												1	1
Garrodia nereis					1								1
Pelagodroma marina		1	1							4		5	11
Pelecanoides urinatrix	8	1	1		3	2	24	11	1	3	1	21	76
Miscellaneous species‡	29	23	31	16	13	11	11	11	16	6	4	18	189
TOTALS	216	101	110	40	497	91	1736	182	56	80	64	110	3283

* Too fragmentary to allow specific identification.
‡ Other than petrels or penguins.

TABLE 3: Number of *P. gavia*, *P. griseus*, *P. vittata* and *P. turtur* Found per Mile Each Month on Certain Coasts

Species	*P. gavia*		*P. griseus*					*P. vittata*		*P. turtur*	
ZONE*	AW	WW	BP	WS	O	AW	WW	AW	WW	AW	WW
Jan.	0.7	0.1	0	(0)	(0)	2.8	0.6	0.1	0	0.4	0.6
Feb.	–	0.2	0	–	(0.3)	–	0	–	0.1	–	0.5
March	(1.0)	1.3	0	(0)	0	(1.0)	0.1	(0)	0	(0)	0.3
April	–	< 0.1	0	–	0.1	–	0.1	–	0	–	0.1
May	0.7	0.1	0.1	2.1	3.9	8.6	2.3	0.1	0	0.1	0.1
June	(0)	0	0	0	0.2	(6.3)	0.2	(0)	1.2	(0)	0.1
July	0.5	0.1	0	–	0	0.1	0	40.0	7.9	5.2	0.6
Aug.	–	< 0.1	–	0	0	–	0	–	1.4	–	0.8
Sept.	0	0	–	(0)	0	0	0.1	0	0.2	0	0.9
Oct.	0	0.1	(2.3)	(0)	0	0	0	0	0.1	0.2	1.3
Nov.	0	0.1	–	(0.3)	0.1	1.0	0.3	0.4	0.3	0.2	1.4
Dec.	–	0.2	1.2	–	0	–	0.7	–	0	–	0.5
Year	0.5	0.2	0.2	0.9	0.7	0.3	0.2	9.5	2.1	1.4	0.6

* See Table 1.
Figures based on patrols of less than 5 miles are given in parentheses.

the wreck of *P. vittata*. Whereas mortality was low on the Auckland west coast for the rest of the year, it increased somewhat on the Wellington west coast to a level of about one bird per mile until the end of November. The maximum counts for individual patrols on the Wellington west coast were 2.7 per mile over $4\frac{1}{2}$ miles at Waikawa on 19 August and 4.8 per mile over 5 miles at Foxton on 7 October. Maximum counts on the Auckland west coast were 15.0 per mile over $1\frac{1}{2}$ miles at Awhitu on 13 July and 6.8 per mile over 4 miles on 20 July.

Differences Between Zones

The mean number of birds per mile on the Wellington west coast during 1961 (3.8) was much higher than on the Otago coast (1.2) even though both coasts were patrolled regularly throughout the year (Table 1). The numerical importance of certain species also differed markedly from one zone to the other (Table 4); for instance, prions (*Pachyptila* spp.) constituted 76% of the total birds found on the Wellington west coast; but less than 1% of those on the Otago coast ($P < 0.01$); the comparable figures for *P. griseus* were 5% and 58% respectively ($P < 0.01$). These differences may be due, at least in part, to the fact that the two coasts face in opposite directions. Thus winds blowing birds ashore on the Wellington west coast would blow them away from the Otago coast and *vice versa*. Since the prevailing wind in New Zealand is westerly, more birds would be expected on the Wellington west coast than on the east-facing Otago one.

The prevailing wind, however, is not the only factor that influences the numbers and kinds of birds found. For instance, although in July large numbers of prions were washed ashore on both the Auckland and Wellington west coasts, some of the species were found in significantly different proportions in the two areas. For example, *P. vittata* constituted 89% of the prions found on the Wellington west coast in July, but only 71% of those on the Auckland one; the comparable figures for *P. belcheri* were 1% and 6% respectively, and for *P. salvini* 2% and 13% respectively ($P < 0.01$ in each instance); the proportions of *P. turtur* (7% and 9%) and of *P. desolata* (1% and 1%) were similar in the two zones. These results suggest a difference in the species composition of the flocks of prions that were off the two coasts at that time.

Again, there were differences in the number of birds found even between different parts of the Wellington west coast zone. In July, five patrols of northern beaches, between the Turakina River and Castlecliff, totalled $8\frac{1}{2}$ miles and yielded 30 birds (3.5 per mile) whereas patrols further south at Otaki at this time covered $6\frac{3}{4}$ miles and yielded 75 birds (11.1 per mile). For all months (except July) combined, the northern area yielded 0.3 birds per mile ($19\frac{1}{2}$ miles) whereas patrols between Otaki and Waikanae (selected to match the northern ones in date and length of patrol) yielded 3.5 birds per mile ($19\frac{3}{4}$ miles). This difference is probably due to the trend of the coastline (Fig. 1). The prevailing north-westerly winds would tend to blow birds past the more northerly beaches and to bring them ashore further south where the coastline is more at right angles to the prevailing wind. If these findings are confirmed in other years, perhaps the Manawatu River, rather than the Wanganui, should be used to mark the northern limit of the Wellington west coast zone.

TABLE 4: List of Species Found on Different Coasts (Zones).

Index No. of Zone‡	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Index Letters of Zone	NC	AE	BP	EC	HB	W	WS	CN	CS	O	AW	T	WW	NCS	
Species of Birds															Total Birds
Megadyptes antipodes										3					3
Eudyptula minor	2	10	12	1			1	4		2	23	2	34	10	101
E. albosignata								21							21
Eudyptes pachyrhynchus											1				1
Diomedea exulans											1		1		2
D. chrysostoma													4		4
D. bulleri										2			2		4
D. cauta							1	2		1	5		5	1	15
Diomedea sp.*													2		2
Phoebetria palpebrata							1						1		2
Macronectes giganteus							1				1		1		3
Daption capensis			1				4	1			1		7		14
Halobaena caerulea											5				5
Pachyptila vittata			1			2	1	2			763		614	2	1385
P. salvini											140		23		163
P. desolata subspp.											12		32		44
P. belcheri											69		11		80
P. turtur	1	1	5				5	20		1	109		178	22	342
Pachyptila sp.*		1	1					10					8		20
Puffinus carneipes		1	7								2				10
P. bulleri	1		8								2		7		18
P. griseus	1	5	19				43	12	100	71	265		62	5	583

TABLE 4 (Continued)

Species of Birds / Index Letters of Zone	NC	AE	BP	EC	HB	W	WS	CN	CS	O	AW	T	WW	NCS	Total Birds
P. tenuirostris		2	7					1			7		5		22
P. gavia gavia		2	6					4			39	1	55	5	112
P. gavia huttoni								4			4		10	2	20
P. assimilis subspp.			2								1				3
Procellaria cinerea			1		1										2
P. westlandica							1								1
P. aequinoctialis							3		1		1				5
Pterodroma macroptera		1	3								1				5
P. lessoni											1		3		4
P. inexpectata			1								3				4
P. brevirostris											1		1		2
P. pycrofti		1													1
P. leucoptera													1		1
P. cooki			1												1
P. longirostris							1								1
Garrodia nereis														1	1
Pelagodroma marina		1	8										1	1	11
Pelecanoides urinatrix	3	1	24				3				13		27	5	76
Miscellaneous species†	1	7	6		2		18	33		42	17	4	38	21	189
TOTALS	9	33	113	1	3	2	83	114	101	122	1487	7	1133	75	3283

‡ See Fig. 1.
* Too fragmentary to allow specific identification.
† Other than petrels or penguins.

DISCUSSION

Whereas strong onshore winds are necessary to bring birds ashore in numbers, it is quite common to find relatively few birds even after several days of such winds. The 1961 wreck of prions was preceded by others in 1918, 1932, 1946 and 1954 (Bull and Boeson 1961a). The fact that such wrecks are separated by intervals of several years, despite the much more frequent occurrence of strong onshore winds, or of particular weather patterns, suggests that the wrecks are due to the birds being in poor physical condition. There are several reasons for believing that food shortage was an important cause of the 1961 wrecks.

On 16 May 1961, the "Christchurch Press" reported that mutton-birders considered the 1961 season the worst for 30 years; they had found "scores" of young birds dead in their burrows or on the tracks outside; others captured for marketing were so small that it took 55 instead of 40 to fill the usual tin. With so many dead or ill-conditioned young on the breeding islands, many of the birds that did manage to leave safely were probably in no condition to withstand the strong onshore winds they encountered while migrating up the Otago and Canterbury coasts.

Again the heavy mortality among *P. gavia* in March, *P. griseus* in May and *P. vittata* in July suggests some fairly widespread pre-conditioning factor such as food shortage, and this apparently extended to Tasmania where *P. tenuirostris* suffered heavy mortality in October (Evening Post 16/10/61). Moreover, 1961 was an unusually poor year for whales in Cook Strait; the Tory Channel whaling station had killed only 53 whales by 25 July compared to the 223 obtained by this date in 1960 (Evening Post 25/7/61), but this may indicate over-fishing rather than food shortage. Finally, the *P. vittata* that came ashore at Otaki in July were considerably lighter than those of breeding adults weighed alive at Whero and Herekopare Islands by Richdale (1944a). Forty freshly dead *P. vittata* from Otaki varied from 108 - 170g. (mean 130g.) compared to Richdale's figures of 161 - 235g. (mean 196g.) for 70 birds. Dr. Bernard Stonehouse weighed some of the *P. griseus* that came ashore near Ashburton, and has kindly provided the following information from a paper he is preparing. When received, the birds were slightly decomposed and, after applying a correction, the average dry-plumage weight of 69 birds was 370g. (range 290 - 430g.) which is far below the 787g. (666 - 978g.) and 659g. (430 - 970g.) found at the breeding grounds by Richdale (1944b, 1945) for healthy adult and juvenile birds respectively. The crops of the Ashburton birds were empty or contained only materials of negligible weight, and the birds were extremely emaciated (B. Stonehouse, *in litt.* 17/6/63).

The several wrecks of prions mentioned above were all on the west coast, but wrecks of other species have occurred elsewhere, for instance the present one of *P. griseus* on the east coast of the South Island and another of *D. cauta*, *P. bulleri* and *P. macroptera* in Palliser Bay (Wellington south coast) after a southerly gale in February 1947 (Cunningham 1948). Mr. M. Hodgkins of Tauranga has mentioned several interesting earlier wrecks of petrels in the Bay of Plenty. "The heaviest strandings I have ever seen here were during the war years and shortly after. Several times I noted hundreds — perhaps thousands — stranded between Papamoa and Mt. Maunganui." No records were kept at this time, but "from memory the chief species were diving

petrels, muttonbirds and [flesh]-footed shearwaters. In May 1946, after three weeks of east wind, there was an enormous deposit — running to many hundreds — of little else save diving petrels, extending for some miles at least, east of Mt. Maunganui. That was, I think, the last of the big deposits, and numbers have been generally going down ever since." (M. Hodgkins, *in litt.* Aug. 1961).

ACKNOWLEDGEMENTS

The following members took part in beach patrols during 1961 and credit is due to them for collecting the information summarised above: H. W. Austin, J. A. Bartle, B. D. Bell, Miss K. Bernrieder, B. W. Boeson, P. C. Bull, C. G. Cathie, C. Challies, E. W. Crack, D. E. Crockett, D. G. Dawson, Mrs. A. O. Edgar, A. T. Edgar, R. A. Falla, D. G. Fenwick, C. A. Fleming, Miss A. J. Goodwin, P. C. Harper, G. M. Hodgkins, M. J. Hogg, M. J. Imber, J. R. Jackson, E. B. Jones, S. R. Kennington, N. J. Ledgard, Mrs. M. McGrath, D. McGrath, Mrs. H. M. McKenzie, Mrs. R. V. McLintock, D. McMillan, K. H. Miers, R. J. Nilsson, W. T. Popplewell, V. M. Rutherford, R. A. Ringer, R. B. Sibson, P. D. G. Skegg, R. R. Wiblin, M. Williams, K. Wodzicki and A. Wright.

The preparation of this report was delayed by the senior author's preoccupation with other work, and for this he extends his sincere apologies to all the above.

The authors are grateful to Mr. F. J. Tindall (Soil Bureau D.S.I.R.), who drew Fig. 1.

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OBSERVATIONS ON CHICK MORTALITY IN A COLONY OF BLACK-BILLED GULLS IN THE THERMAL AREA AT WHAKAREWAREWA

By M. J. DANIEL

INTRODUCTION

It is well known that the Black-billed Gull *(Larus bulleri)* and the Red-billed Gull *(Larus novaehollandiae scopulinus)* breed in several areas near Rotorua on the volcanic plateau of the central north island (Oliver; 1955), the largest colony of the Black-billed Gulls being at Sulphur Point on Lake Rotorua, with other smaller colonies on the same lake and at Lake Rotomahana (Black; 1954).

This communication reports some observations taken during the 1962/63 breeding season on the many hazards facing the eggs, chicks and adults of a small colony of Black-billed Gulls (c. 125 birds),