SEABIRDS FOUND DEAD ON NEW ZEALAND BEACHES IN 1985, AND A REVIEW OF *PTERODROMA* SPECIES RECOVERIES SINCE 1960

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ABSTRACT

In 1985, 5967 kilometres of coast were patrolled and 28,304 dead seabirds were found, both new records for the Beach Patrol Scheme. A new species for the Scheme was a White-bellied Storm Petrel *(Fregetta grallaria)*. Ten species were found in greater numbers in 1985 than in any previous year: Little Blue Penguin *(Eudyptula minor)*, Buller's Mollymawk *(Diomedea bulleri)*, White-headed Petrel *(Pterodroma lessonii)*, Fairy Prion *(Pachyptila turtur)*, Fulmar Prion *(P. crassirostris)*, Fluttering Shearwater *(Puffinus gavia)*, Australasian Gannet *(Sula bassana)*, Pied Shag *(Phalacrocorax varius)*, Red-billed Gull *(Larus novaehollandiae scopulinus)* and White-fronted Tern *(Sterna striata)*. The record numbers of Fairy Prions, Fulmar Prions and Fluttering Shearwaters were the result of wrecks of these species in August-September, mainly along the western and southern coasts of the North Island.

A summary is given of the coastal and monthly distributions for most *Pterodroma* species found during the 1960-1984 period. The most frequently found species was the White-headed Petrel, a result of 50-100 being found in spring of most years.

INTRODUCTION

This paper records the results of the Ornithological Society of New Zealand's Beach Patrol Scheme for 1985. All sections were patrolled except Fiordland. Westland is not included in Table 1; patrols there were done in March (4 km), August (6 km) and October (6 km), two Fairy Prions and one White-fronted Tern being found. Some beaches on the Chatham Islands were patrolled, the results being given under the heading Outlying Islands. In total, 847 Beach Patrol Cards and 8 Specimen Record Crads were submitted.

Kilometres "travelled" are the total lengths of coast patrolled; kilometres "covered" are the lengths of coast patrolled monthly. Hence, if 1 km of beach is patrolled twice in one month, 2 km have been travelled but only 1 km covered per month.

The nomenclature used is that of Kinsky (1970, 1980), except that I have followed that suggested by Imber (1985a) for the Kerguelen Petrel *(Lugensa brevirostris)*.

RESULTS AND DISCUSSION

In 1985, several records were established, including the total distance of coast travelled (5967 km) and the number of seabirds found dead (28,304). The previous highest totals were 5600 km travelled in 1978 and 24,747 seabirds found in 1974. The number of members of the Ornithological Society of New Zealand and their friends that did the patrols in 1985 was 287, and they found 5.56 birds per kilometre of coast covered (Table 1).

TABLE 1 — Numbers of dead seabirds recovered and kilometres covered on each coast in 1985

COAST	CODE		MONTH												TOTAL		BIRDS/KM /COAST
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	KM	BIRDS	
AUCKLAND WEST	AW	KM	186	176	184	187	222	207	225	227	309	231	235	236	2625		
		BIRDS	403	219	603	621	500	351	801	1262	10477	1324	2365	1300		20226	7.71
TARANAKI	TA	KM	26	9	15	2	17	26	32	65	42	20	68	24	346		
		BIRDS	73	12	5	-	10	22	118	161	78	44	76	73		672	1.94
WELLINGTON WEST	WW	KM	30	20	41	19	40	9	59	69	67	35	47	4	440		
		BIRDS	131	161	131	21	99	8	227	182	123	92	188	6		1369	3.11
AUCKLAND EAST	AE	KM	64	42	36	50	32	23	36	69	58	47	101	30	588		
		BIRDS	311	336	171	68	87	13	28	319	222	311	1353	253		3472	5.90
BAY OF PLENTY	BP	KM	2	22	25	12	13	21	51	46	30	19	40	29	310		
		BIRDS	16	52	98	28	17	9	83	154	86	54	307	136		1040	3.35
EAST COAST NI	EC	KM	-	11	6	12	6	15	17	19	6	15	9	8	124		
		BIRDS	-	6	5	13	4	10	34	23	-	10	5	29		139	1.12
WAIRARAPA	WA	KM	6	4	-	-	6	7	-	18	-	2	1	5	49		
		BIRDS	2	2	-	-	3	11	-	74	-	3	2	1		98	2.00
WELLINGTON SOUTH	WS	KM	-	-	4	2	40	-	19	86	10	-	19	-	180		
		BIRDS	-	-	8	1	100	-	87	325	6	-	83	-		610	3.39
NORTH COAST SI	NC	KM	-	-	15	-	-	46	-	-	-	-	-	21	82		
		BIRDS	-	-	5	-	-	42	-	-	-	-	-	54		101	1.23
CANTERBURY NORTH	CN	KM	-	5	5	6	6	8	8	6	6	-	6	6	62		
		BIRDS	-	9	10	3	3	1	5	1	18	-	11	15		76	1.23
CANTERBURY SOUTH	CS	KM	6	8	10	8	8	8	9	35	9	8	8	-	117		
		BIRDS	7	13	25	9	17	14	6	86	15	9	7	-		208	1.78
OTAGO	OT	KM	2	7	16	10	16	16	7	6	6	10	7	8	111		
		BIRDS	2	6	22	14	49	8	2	-	2	4	6	6		121	1.09
SOUTHLAND	SD	KM	4	-	8	4	1	1	-	-	14	-	-	-	32		
		BIRDS	2	-	71	1	1	1	-	-	85	-	-	-		161	5.03
OUTLYING ISLANDS	OI	KM	2	1	-	-	-	-	-	-	-	4	-	-	7		
		BIRDS	3	3	-	-	-	-	-	-	-	2	-	-		8	1.14
TOTAL KILOMETRES TRAVELLED			360	356	484	408	486	460	507	842	646	414	588	400	5951		
TOTAL KILOMETRES COVERED			328	305	365	312	407	387	463	646	557	391	541	371	5073		
TOTAL SEABIRDS RECOVERED			950	819	1154	779	890	490	1391	2587	11112	1853	4403	1873		28301	
BIRDS/KM COVERED/MONTH			2.90	2.69	3.16	2.50	2.19	1.27	3.00	4.00	19.95	4.74	8.14	5.05			5.58

This rate of finding dead seabirds is surpassed only by the 1974 (8.5) and 1975 (5.8) results. Table 1 also gives the kilometres covered and the number of seabirds found per month and in total for the various coasts, plus the number of birds picked up per kilometre covered for each coast. Table 2

gives the coastal and monthly distributions of the less commonly found seabirds (1-20 birds in 1985), and Tables 3 and 4 give these for the more commonly found seabirds.

Unusual finds

A new species for the Beach Patrol Scheme is the White-bellied Storm Petrel, a specimen of which was found on Piha Beach (AW) in May (Table 2). Two other beach-wrecked White-bellied Storm Petrels have been found

TABLE 2 — Seabirds of which 1 to 20 specimens were found in 1985

SPECIES OR SUBSPECIES	NUMBER FOUND	COAST(S)	MONTH(S)
Megadyptes antipodes	3	CS(2), OT.	JUL, SEP, NOV.
Eudyptula minor albosignata	9	CN(2), CS(5), NC.	FEB, APR(2), JUN, AUG(3), DEC(2).
Eudyptes pachyrhynchus sclateri	1	SD.	MAR.
	1	CS.	JUL.
Diomedea exulans	10	AW(5), AE, WS(3), EC.	FEB, MAY, JUN, JUL(3), AUG(2), NOV, DEC.
epomophora	7	AW, TA, WS(5).	MAY(6), NOV
melanophrys	9	AW(4), BP(2), EC, WW, OI.	MAY(2), JUN(2), JUL, AUG, OCT(2), NOV.
chlororhynchos	1	AE.	AUG.
cauta subspp.*	6	AW(5), EC.	JUN, JUL(2), SEP, OCT(2).
Phoebetria palpebrata	10	AW(4), AE(3), TA, WS(2).	JAN, AUG(4), SEP(3), OCT(2).
Thalassoica antarctica	2	AW, WW.	SEP(2).
Pterodroma pycrofti	1	AE.	APR.
leucoptera	2	AW, TA.	JAN, DEC.
nigripennis	3	AW, AE, CS.	MAR, MAY, NOV.
Procellaria cinerea	8	AW(5), AE, BP, WW.	JAN, FEB(3), MAR, JUL, SEP, NOV.
parkinsoni	20	AE(20).	FEB, APR, NOV(18).
westlandica	3	AW(2), WW.	JAN, SEP, DEC.
aequinoctialis	8	AW(4), AE, BP(2), WW.	JAN(4), MAR, NOV(2), DEC.
Puffinus puffinus	1	WW.	JAN.
gavia/huttoni	1	WW.	AUG.
Garrodia nereis	2	WS(2).	AUG(2).
Pregetta grallaria	1	AW.	MAY.
Phaethon lepturus	1	AE.	DEC.
Phalacrocorax spp.*	4	AW(3), AE.	JAN, JUN, JUL, AUG.
carbo	18	AW(5), AE(2), TA(3), BP, WW(4), NC, CN, OT.	APR, MAY, JUN(2), JUL(4), AUG(3), SEP(4), OCT, DEC(2).
sulcirostris	4	EC, WW, WA, WS.	MAY(2), AUG, DEC.
brevirostris	9	AW(4), AE(3), TA, NC.	JAN, MAY, JUN(2), JUL, AUG(2), NOV(2).
Leucocarbo carunculatus chalconotus	6	OT(4), SD(2).	MAR(3), MAY, JUN, NOV.
Stictocarbo punctatus featherstoni	1	OI.	FEB.
Stercorarius spp.*	1	AW.	MAR.
skua lonnbergi	4	AW, WS(2), SD.	JUL, AUG, SEP(2).
longicaudus	1	WW.	JUL.
Larus spp.*	2	OT(2).	MAR(2).
bulleri	20	EC(6), CS(4), OT(9), SD.	JAN, FEB(3), MAR(10), MAY(2), JUN(4).
Hydroprogne caspia	17	AW(14), AE(2), TA.	JAN(2), MAR, JUN(3), JUL, AUG(4), SEP(3), OCT(3).
Sterna spp.*	1	WA.	OCT.
striatisaea	1	BP.	NOV.
fuscata	1	AW.	SEP.
TOTAL	200		

* Species or subspecies was not identified by the patroller.

on mainland beaches but not reported on beach patrol cards: one on Waikawa Beach (WW) in July 1975 (Edgar 1975) and the other on Ninety Mile Beach (AW) in April 1978 (Sibson 1978). As well, three White-bellied Storm Petrels were seen near the coast in 1969: two birds seen west of Cape Farewell

TABLE 3 — Coastal distribution of the seabirds more commonly found dead in 1985

SPECIES OR SUBSPECIES	COASTS														TOTAL BIRDS
	AW	TA	WW	AE	BP	EC	WA	WS	NC	CN	CS	OT	SD	OI	
Eudyptula minor subspp.*	3445	38	48	1574	193	5	1	9	24	6	3	6	13	3	5368
Diomedea spp.*	17	2	6	2	-	-	1	6	-	-	-	-	5	-	40
chrysostoma	28	-	2	1	1	-	-	1	-	-	-	-	-	-	33
bulleri	7	-	-	-	1	-	-	1	1	-	-	-	45	-	54
cauta cauta	12	2	1	-	1	-	-	9	2	-	-	-	-	-	27
Macronectes spp.*	68	4	6	2	2	-	-	-	-	-	-	-	-	2	84
Fulmarus glacialoides	330	7	20	2	1	-	-	-	-	-	-	-	6	-	366
Daption capense	95	6	10	10	12	2	-	12	-	2	4	-	1	-	154
Lugensa brevirostris	111	1	7	-	2	-	-	-	-	-	1	-	-	-	122
Pterodroma spp.*	6	-	-	4	17	-	-	-	-	1	-	-	-	-	28
macroptera	60	2	1	24	14	-	1	4	-	-	-	-	2	-	106
lessonii	250	11	16	2	2	-	-	3	-	-	2	-	-	-	288
inexpectata	18	4	2	-	1	-	1	1	-	-	9	-	-	-	36
cookii	9	-	1	19	-	-	1	-	-	-	-	-	-	-	29
Halobaena caerulea	394	17	43	24	25	2	2	6	-	-	1	-	13	-	527
Pachyptila spp.*	662	42	385	26	-	2	30	22	3	1	-	1	4	1	1179
vittata	20	2	7	1	-	-	-	3	-	-	7	-	-	-	40
salvini	35	2	4	-	-	1	-	1	-	-	-	-	-	-	44
desolata	94	-	5	3	3	3	-	1	-	-	-	-	-	-	109
belcheri	245	40	34	6	15	1	1	23	-	-	9	-	-	-	374
turtur	9839	126	335	187	53	43	40	243	4	7	50	-	2	-	10929
crassirostris	22	1	6	8	1	1	1	21	-	-	2	-	-	-	63
Puffinus spp.*	25	2	11	-	-	-	-	2	1	-	-	21	-	-	62
carneipes	31	2	4	99	29	-	-	1	-	-	-	-	-	-	166
bulleri	277	11	26	95	23	2	2	15	1	1	-	-	-	-	453
griseus	963	57	91	366	213	23	6	90	8	15	6	4	45	-	1887
tenuirostris	231	22	7	77	27	3	-	8	-	9	2	1	4	-	379
gavia	1497	114	88	436	214	6	3	20	4	2	7	-	-	-	2391
huttoni	37	-	7	7	5	-	-	5	-	9	2	-	-	-	72
assimilis	36	2	3	23	13	1	-	-	-	-	-	-	-	-	78
Pelagodroma marina	16	1	-	6	13	-	-	-	-	-	-2	-	-	-	48
Pelecanoides urinatrix	568	57	88	133	59	-	5	63	2	3	1	-	9	-	988
Sula bassana	296	17	9	117	39	10	-	-	6	1	-	1	-	-	496
Phalacrocorax varius	14	-	-	11	18	-	-	-	-	1	-	-	-	-	44
Stictocarbo punctatus punctatus	1	1	-	-	-	-	-	1	-	14	51	24	3	-	95
Larus dominicanus	229	65	63	48	13	25	2	26	5	6	18	31	3	-	534
novaehollandiae	97	4	9	109	18	1	-	7	1	20	4	6	1	-	277
Sterna striata	78	12	11	12	6	-	-	-	-	-	3	9	-	-	131
TOTALS	20163	664	1356	3434	1033	129	96	595	72	98	195	104	156	6	28101

* Species or subspecies was not identified by the patroller.

in November (Jenkins 1970) and one near the Poor Knights Islands in December (Croxall 1970).

In the New Zealand region, the White-bellied Storm Petrel nests on Macauley and Curtis Islands of the Kermadec group. Elsewhere in the South Pacific Ocean, it breeds on Lord Howe, Rapa and Juan Fernandez Islands. In the South Atlantic Ocean it breeds on Gough and Tristan da Cunha Islands (Imber 1985b). The species is a late summer breeder, laying in January-February and the chicks leaving the burrows from late April to July (Serventy

TABLE 4 — Monthly distribution of the seabirds more commonly found dead in 1985

SPECIES OR SUBSPECIES	MONTH												TOTAL BIRDS
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Pudyptula minor subspp.*	231	293	757	591	417	162	107	74	204	232	1919	381	5368
Diomedea spp.*	3	1	3	-	3	1	7	3	7	3	7	2	40
chrysostoma	-	2	1	-	1	1	5	5	7	6	2	4	33
bulleri	-	-	1	-	2	3	-	2	44	2	-	-	54
cauta cauta	1	1	-	1	8	3	3	4	-	4	2	-	27
Macronectes spp.*	1	2	-	-	-	5	36	20	10	3	5	2	84
Fulmarus glacialoides	-	-	-	-	-	-	-	4	210	124	22	6	366
Daption capense	3	1	-	-	2	2	49	40	20	19	16	2	154
Lugensa brevirostris	-	-	1	1	-	-	1	4	102	9	1	3	122
Pterodroma spp.*	1	5	-	3	2	-	1	1	4	1	8	2	28
macroptera	25	15	1	-	3	1	8	13	8	2	3	20	106
lessonii	13	2	2	-	1	2	8	14	35	171	31	9	288
inexpectata	14	7	1	5	2	-	1	3	-	-	1	2	36
cookii	4	1	-	4	-	-	-	-	-	-	5	15	29
Halobaena caerulea	1	-	-	-	-	4	17	61	241	173	22	8	527
Pachyptilla spp.*	48	87	80	13	49	13	95	180	321	140	104	49	1179
vittata	2	-	1	-	3	6	6	7	2	5	7	1	40
salvini	-	-	-	-	1	-	16	13	8	-	2	1	44
desolata	-	-	-	1	20	6	23	18	36	2	2	1	109
belcheri	2	-	-	-	1	2	81	223	57	5	3	-	374
turtur	125	45	30	4	38	24	326	737	8955	274	272	99	10929
crassirostris	-	-	-	-	1	-	-	55	7	-	-	-	63
Puffinus spp.*	5	1	5	-	26	4	4	2	2	3	3	7	62
carneipes	13	37	9	8	6	3	2	-	-	3	44	41	166
bulleri	42	28	11	9	25	5	4	5	25	180	66	53	453
griseus	50	28	57	8	47	16	11	8	16	113	1145	388	1887
tenuirostris	15	4	6	-	41	25	5	1	1	3	10	268	379
gavia	97	78	44	27	22	35	162	735	398	193	365	235	2391
huttoni	8	1	3	-	-	-	2	1	10	8	25	14	72
assimilis	4	2	2	1	2	2	5	14	21	4	14	7	78
Pelagodroma marina	2	3	4	2	5	-	-	1	13	6	6	6	48
Pelecanoides urinatrix	48	9	1	3	26	48	291	213	131	45	85	88	988
Sula bassana	27	54	10	10	10	15	15	29	145	48	77	56	496
Phalacrocorax varius	-	7	2	2	7	1	6	3	2	5	2	7	44
Stictocarbo punctatus punctatus	2	15	22	7	15	4	7	6	6	6	4	1	95
Larus dominicanus	26	54	56	55	60	67	51	45	20	25	33	42	534
novaehollandiae	119	22	19	5	8	8	11	13	21	10	21	20	277
Sterna striata	4	4	5	6	13	4	7	7	8	11	44	18	131
TOTALS	936	809	1133	774	869	472	1373	2564	11097	1838	4378	1658	28101

* Species or subspecies was not identified by the patroller.

et al. 1971, Imber 1985b). Outside the breeding season the birds are thought to disperse into the tropics.

A Manx Shearwater picked up from Waikanae Beach (WW) in January is only the second record for the Scheme (Table 2). The first specimen was found near Pukerua Bay (WW) in June 1973. Tennyson (1986) provided a detailed description of the 1985 bird and a useful list of features that distinguish the species from the Fluttering Shearwater and Hutton's Shearwater *(Puffinus huttoni)*.

Several species were found in greater numbers in 1985 than in any previous year. Since 1969 the number of Little Blue Penguins found per year has ranged from 219 in 1970 to 4741 in 1974. By comparison, 5368 were found in 1985. Most of the birds were found on Auckland West (3445) and Auckland East (1574) beaches (Table 3). The main months of mortality were March-April (1348) and November (1919). The increased mortality in autumn is quite common for the Little Blue Penguin. It coincides with fledglings first entering the sea, when adults attempt to accumulate fat reserves to sustain their moult fast and when they try to regain condition after the moult (Powlesland 1984). Thus, the increased penguin mortality in autumn occurs, presumably, because some fledglings have difficulty catching enough food and because poor foraging conditions for adults coincide with their increased food requirements associated with the moult. The reason for the unusually high mortality in November 1985 is not known. At that time, breeding birds along the Auckland coasts would have been incubating or raising young chicks.

In 1985, 54 Buller's Mollymawks were found dead, many more than the previous highest annual total of 16 in 1982. Of the 54 birds found, 44 were found in September on Mason Bay, Stewart Island (SD). Many were assessed to have been on the beach for more than a month and so the 44 may have come ashore over several months. An estimated 10,000-11,000 pairs of Southern Buller's Mollymawk *(Diomedea b. bulleri)* breed near Stewart Island on the Solander Islands and The Snares (Cooper *et al.* 1986), but it is unusual to find so many washed ashore on the south-west coast of Stewart Island.

Usually 50-100 White-headed Petrels are found each year, but 288 were picked up in 1985. The previous highest annual total was 213 in 1984. Most of the 1985 White-headed Petrels (250) were picked up from Auckland West beaches (Table 3) in spring (Table 4). This spring peak in mortality of White-headed Petrels is typical for New Zealand; see the review section later.

As for the previous species, more Australasian Gannets and Pied Shags were found in 1985 than in previous years. Of the 496 gannets picked up in 1985, most were found on Auckland West (296) and Auckland East (117) beaches. Generally, 10-60 gannets were found each month in 1985, except in September when 145 were picked up (Table 4). It seems unlikely that incubation, the stage of the breeding cycle for most gannets in September (Robertson 1985), would have increased their mortality so much. Possibly, the mortality was a consequence of the south-east gales that passed over the North Island in August.

All but one of the Pied Shags found in 1985 were picked up from Auckland West (14), Auckland East (11) and Bay of Plenty (18) beaches

There was no seasonal pattern to the mortality, a few shags being found in each month, except January (Table 4).

Usually, 100-200 Red-billed Gulls are found each year, but the total was 277 in 1985. The previous highest annual total was 245 in 1977. Most of the 1985 gulls were found on Auckland West (97) and Auckland East (109) beaches. Each month, 10-20 birds were found, but in January 119 were found (Table 4). In January, fledglings are leaving the colonies (Mills 1985) and having to learn to forage. Thus, the increased mortality in January 1985 was probably mainly the result of these inexperienced foragers dying of starvation.

The 1985 tally of White-fronted Terns was 131, surpassing the previous highest annual total of 112 in 1982. Most of the 1985 terns were found on Auckland West beaches (78), and the largest number per month was picked up in November (44). During November nesting terns lay and incubate (MacCulloch 1985), activities unlikely to increase mortality. The reason for the higher numbers than usual found dead in 1985 is not obvious.

Wreck

A feature of the 1985 results was a wreck of Fairy Prions, Fulmar Prions and Fluttering Shearwaters in August-September (Table 4), resulting in the highest annual totals for these species. In addition, large numbers of Diving Petrels *(Pelecanoides urinatrix)* were picked up, but they began arriving on the beaches in July.

On 26 July easterly winds of up to 55 km/h developed at the Chathams Islands. By the next day a low of 985 mb, centred just north of the Chathams, resulted in hurricane-force easterly winds averaging 100 km/h lashing the islands. Elderly residents at the Chathams could not recall a worse storm; it caused much damage to buildings and fishing boats. Gale-force easterly winds extended across to New Zealand, battering the coastline from East Cape to the Otago Peninsula with high seas and heavy rain. On 28 July the winds continued to blow at 30-60 km/h, but by 29 July the storm had passed and light winds then blew from the westerly quarter on to the North Island west coast.

During the first 10 days of August, predominantly light easterly winds blew on to the northern North Island. This was followed by nearly a fortnight of westerly winds on to the Auckland West coast, which reached 70 km/h on 19 August. Similarly, from 3 to 9 September, westerly winds of up to 60 km/h blew persistently on to that coast.

The total of 10,931 Fairy Prions found in 1985 is about double the previous highest annual total of 5118 in 1975. Over 90% of the Fairy Prions in 1985 were picked up from Auckland West beaches (Table 3). Although slightly more Fairy Prions than usual were picked up in August from these beaches, it was not until the second week of September that patrollers found very large numbers. For example, 24 Fairy Prions per kilometre were picked up from 35 km of Muriwai Beach on 8 September and 34 per kilometre from 88 km of Ninety Mile Beach and north of Herekino Harbour on 14 September.

The Fairy Prion breeds on many islands in the New Zealand region, including some of the subantarctic islands, and is circumpolar in its distribution (Harper 1980). It is a numerous species, with a huge population breeding on Stephens Island alone (D. G. Newman, pers. comm.). During the non-breeding season (March-August), the birds remain about New Zealand, the largest concentrations being east of Northland and in the Cook Strait-South Taranaki Bight and Foveaux Strait areas (Harper 1985, J. A. F. Jenkins, pers. comm.).

Wrecks of Fairy Prions are relatively common along the North Island west coast. It seems that poor food supplies or rough seas, which reduce access to prey, result in a loss of fat reserves, particularly when the birds have to battle against persistent westerly winds that would otherwise force them inland. These factors contribute to the wrecks, and it is likely that the latter factor brought about the 1985 wreck. Although a record number of Fairy Prions was found, it represents a very small proportion of the total New Zealand population.

In total, 63 Fulmar Prions were found in 1985. That this is a remarkable occurrence is evident when one recalls that the first Fulmar Prions were reported by patrollers only in 1970 and that only 22 specimens were found from 1970 to 1984. Although many of the 1985 Fulmar Prions were found on the Auckland West and Wellington South coasts, some came from the other North Island coasts (Table 3). Unlike the Fairy Prions, 87% of the Fulmar Prions were found in August, not September (Table 4). Many of the Wellington South birds came ashore in the first week of August, suggesting that they were Chatham Island birds blown on to mainland beaches by the easterly gales.

As well as nesting at the Chatham Islands, Fulmar Prions breed on the Western Chain of The Snares and on the Bounty, Auckland and Heard Islands (Harper 1980). The population associated with each island is not large, and the birds do not seem to disperse far from their breeding sites at any time of year (Harper 1980). This sedentary habit and relative scarceness of the Fulmar Prion are probably the main reasons why so few are found by beach patrollers.

In 1985, 2391 Fluttering Shearwaters were found, compared with the previous highest annual total of 1538 in 1978. Generally, 200-500 were found each year from 1970 to 1984. Nearly all the Fluttering Shearwaters in 1985 were found on beaches of the North Island, particularly Auckland West (1497) and Auckland East beaches (436). Unlike the monthly results for the Fairy Prion and Fulmar Prion, although there was a peak in recoveries of Fluttering Shearwaters in August, large numbers were also found from September to December (Table 4). Presumably, the large number of birds found in August resulted from the stormy conditions, but why so many were found subsequently is not known.

The Fluttering Shearwater breeds only about New Zealand, nesting on numerous islands and islets from the Three Kings Islands in the north to as far south as Cook Strait. It inhabits inshore and continental shelf waters rather than the deep sea (Imber 1985b).

Nearly a thousand Diving Petrels were picked up in 1985, two-thirds

of these coming from Auckland West beaches. The 1985 total (988) is the second highest annual total for the species, but the 1975 wreck (3580) was far larger. Most of the Diving Petrels in 1985 were found in July-August. Many of them came ashore in the first fortnight of July, when westerly winds blew on to the west coast of the North Island on most days. However, the winds were always less than 20 knots, and so weather was probably not a major factor in the death of the birds.

Miscellaneous birds

Birds other than seabirds recovered in 1985 totalled 292. There were 62 magpies, 26 Black Swan, 18 each of Mallard and Starling, 17 Blackbird, 14 Rock Pigeon, 11 duck species, nine each of Grey Duck, Australasian Harrier and Indian Myna, eight each of Pheasant and Pied Stilt, seven each of Paradise Shelduck and South Island Pied Oystercatcher, five each of domestic geese, domestic turkeys, Pukeko, Bar-tailed Godwit, passerine species and Song Thrush, four each of White-faced Heron and domestic fowl, three each of California Quail, New Zealand Pigeon and New Zealand Kingfisher, two each of Variable Oystercatcher, Golden Plover, Chaffinch and House Sparrow, and one each of Grey Teal, New Zealand Shoveler, Spur-winged Plover, Knot, North Island Kaka, Red-crowned Parakeet, Shining Cuckoo, Morepork, Little Owl, Welcome Swallow, New Zealand Pipit, Yellowhammer, Greenfinch and Goldfinch.

Pterodroma RECOVERIES 1960-1984

The following is a summary of the coastal and monthly distributions of some of the *Pterodroma* species found by patrollers during the past 25 years. Only one Kermadec Petrel *(P. neglecta)* (Powlesland 1983) and one Bird of Providence *(P. solandri)* (Powlesland 1986) have been found to date. The data for the six Stejneger's Petrels *(P. longirostris)* and 90 Black-winged Petrels *(P. nigripennis)* found during 1960-1983 were described and discussed by Powlesland (1985)

To test whether the annual pattern of recovery for each species depicted in Figure 1 differed from the theoretical situation whereby an equal number of birds were found each month, I used the Kolmogorov-Smirnov one-sample test (Siegel 1956, p.47).

GREY-FACED PETREL *P. macroptera*

Two subspecies of this petrel are recognised, but patrollers did not distinguish between them. *P. m. gouldi* nests on and around the North Island, from the Three Kings south along the west coast as far as New Plymouth (TA), and as far south as Gisborne (EC) on the east coast. The main colonies occur on islands to the east of the North Island: Mokohinau Islands, Mercury and Alderman Islands, White Island, Whale Island and the Hen and Chicken group (Imber 1985b). This subspecies is fairly sedentary, remaining throughout the year in the South Pacific Ocean and Tasman Sea from 30°S to at least 47°S, and from the east coast of Australia to at least 145°W (Imber 1985b). This sedentary habit relates to the long breeding cycle of the species; successful breeders feed young until December, then moult and return to the colonies in March or April to prepare their burrows for the next breeding cycle (Imber 1985b).

The nominate subspecies *(P. m. macroptera)* breeds on several islands in the South Atlantic and Southern Indian Oceans, as well as islands off the south coast of Western Australia (Harrison 1983). A few birds from Western Australia may well be washed ashore on New Zealand beaches.

During 1960-1984, patrollers found 919 Grey-faced Petrels. About 60 petrels were found in most years from 1970 to 1984, the highest annual total being 119 in 1981. Overall, the average rate of recovery was 1.68 birds per 100 km of coast covered. Of the coastal regions, Auckland East had the

TABLE 5 — Rate of recovery (number of petrels found per 100 km of beach covered) of five species of *Pterodroma* on each coast during 1960-1984

SPECIES	AW	TA	WW	AE	BP	EC	WS	NC	WD	CN	CS	OT	SD	OI	Total
P. macroptera	1.74	0.65	0.09	4.33	3.89	-	0.27	-	-	0.16	-	-	0.17	-	1.68
P. lessonii	4.91	1.36	1.69	0.20	0.31	0.61	0.27	0.85	0.56	0.11	1.03	0.07	0.34	-	2.67
P. inexpectata	1.23	0.38	0.29	0.08	0.22	-	0.10	0.17	0.19	0.05	0.82	0.13	9.57	0.66	0.89
P. pycrofti	0.04	-	0.01	0.13	0.04	0.15	-	-	-	-	-	-	-	-	0.04
P. cooki	0.47	0.17	0.08	3.48	0.44	-	-	0.17	-	-	-	-	0.26	-	0.79

greatest rate of recovery (4.33 birds/100 km of coast covered), followed by Bay of Plenty (3.89) and Auckland West (1.74) (Table 5). These results are as expected from the bird's breeding distribution about the northern half of the North Island.

Figure 1 shows that the monthly rate of recovery changed during the year ($p<0.01$), being greatest in summer and least in autumn. The Grey-faced Petrel is a winter breeder, laying in late June-July and the chicks leaving the colonies mainly in late December (Imber 1985b). Thus, the summer peak in mortality is probably the result of recently fledged young dying about the northern coasts because of their poor foraging ability. The reduced mortality in March-April occurs because only breeders are present at the colonies, and many of these desert the colonies after mating in April to feed at sea for about two months before returning to lay (Imber 1985b). The non-breeders do not return in large numbers to the colonies until late May.

WHITE-HEADED PETREL *P. lessonii*

In the New Zealand region, this petrel breeds on the Antipodes Islands, Auckland Islands and Macquarie Island (Falla *et al.* 1979). In addition, it nests on Iles Crozet and Kerguelen Island in the Southern Indian Ocean (Warham 1985). As in the Grey-faced Petrel, the breeding adults are not markedly migratory, being absent from Macquarie Island for only about 11 weeks between breeding cycles (Warham 1985). However, adults range far from the nest to feed (Warham 1985) and immatures have a more-or-less circumpolar range from about 30°S to Antarctica (Harrison 1983).

In total, 1465 White-headed Petrels have been found, making it the most numerous *Pterodroma* species picked up by patrollers. The species was found at a rate of 2.67 birds per 100 km of beach covered from 1960 to 1984. It was found most on beaches of the western North Island, Auckland West

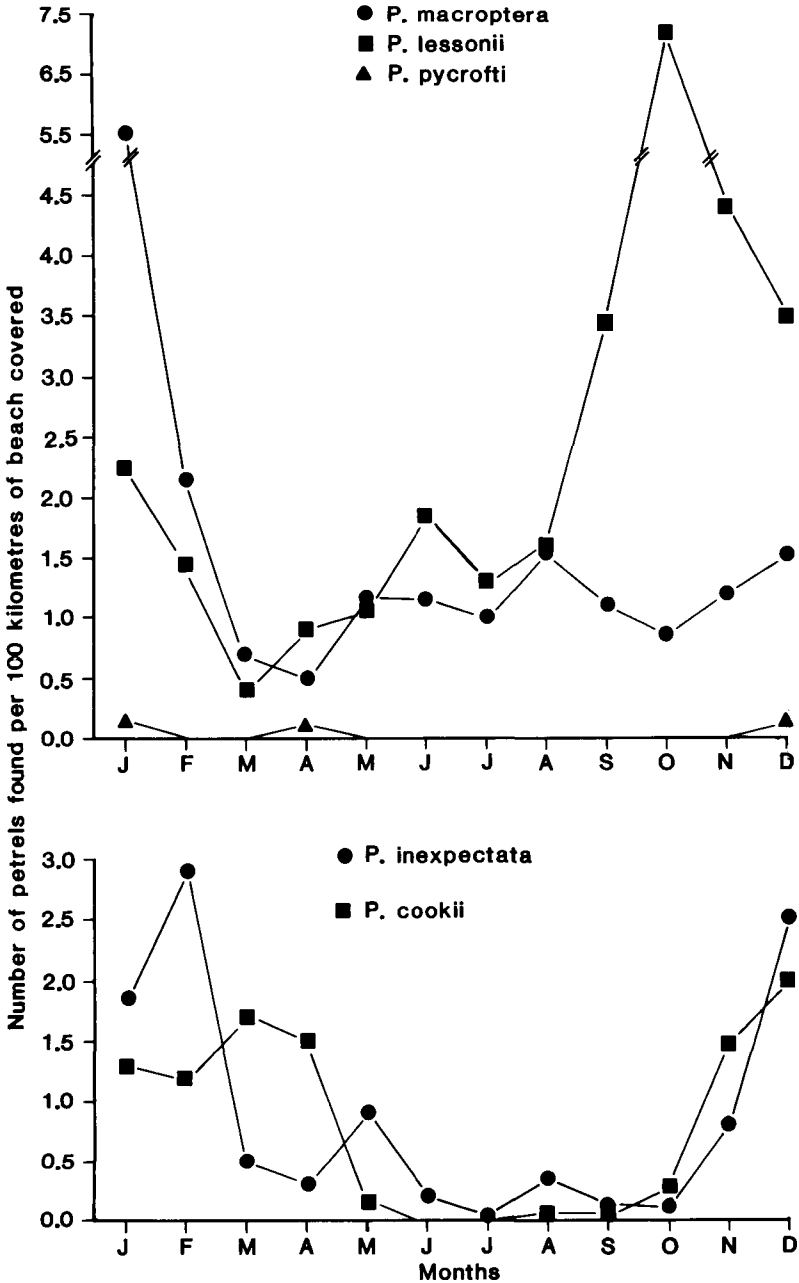

FIGURE 1 — Monthly rate of recovery (number found dead per 100 km of beach covered), of five *Petrodroma* petrels during 1960-1984

having a much higher rate of recovery (4.91 per 100 km of beach covered) than Taranaki (1.36) or Wellington West (1.69) (Table 5). This distribution probably reflects the influence and prevalence of on-shore winds and suitable currents for casting the dead birds ashore, rather than the relative abundance of White-headed Petrels in waters adjacent to Auckland West, Taranaki and Wellington West beaches (Warham 1985).

The monthly rate of recovery of White-headed Petrels changed markedly during the year ($p<0.01$). From a low in March of 0.4 birds per 100 km of beach covered, the mortality rose gradually in winter to a peak of 7.3 birds in September and remained relatively high in summer (Figure 1). As the birds lay from late November to mid-December and the eggs hatch in February (Warham 1967), the spring-summer mortality is probably the result of non-breeders dying. A high proportion of White-headed Petrels beach-wrecked in August-September are in primary moult and so have a reduced flying capability. Probably these are birds 1-5 years old as the older (breeding) birds would moult in July-August (M. J. Imber, pers. comm.). Jenkins (1982) reported regular sightings of flocks of White-headed Petrels feeding and rafting in the Tasman Sea at about 35°S, 155°E in July and August. It is not known whether these birds remain in the Tasman Sea during spring and summer and so are relatively close to our shores, or whether the peak in mortality results from spring gales forcing the birds north from about the breeding islands south of New Zealand.

MOTTLED PETREL *P. inexpectata*

Although this petrel probably used to breed on some ranges and hills of the North and South Islands, it now breeds mainly at The Snares and on the islands about Stewart Island (Warham 1985). The birds return from their Northern Hemisphere wintering grounds to The Snares in late October (Warham 1985). Laying occurs in December and the fledglings depart in May-early June. Once the raising of fledglings is completed, the Mottled Petrel undertakes a transequatorial migration in April-June to its wintering grounds in the subarctic waters of the North Pacific Ocean (Nakamura & Tanaka 1977).

Generally, patrollers find about 30 Mottled Petrels annually, the greatest number being 68 in 1982. During 1960-1984, 487 of these petrels were found at an average rate of 0.9 birds per 100 km of beach covered. As expected from the distribution of its breeding colonies, most Mottled Petrels were found on Southland beaches (9.57 birds per 100 km of coast covered). The coast with the next highest rate of recovery was Auckland West (1.23) (Table 5).

The monthly rate of recovery, as shown in Figure 1, changes significantly through the year ($p<0.01$). The return time of the Mottled Petrel to the New Zealand region is evident from the marked increase in the rate of recovery in November over that of the previous two months (Figure 1). The mortality remains high from December (laying) to February (hatching) but is much reduced from March to June. In the latter period breeders are rearing chicks; the chicks leaving in May and early June (Warham 1985).

The greater mortality of the Mottled Petrel in summer, rather than in autumn, may be related to the presence of non-breeders about the colonies.

Many of these birds may be weakened by the migration and be inexperienced at foraging in New Zealand waters, and so probably succumb when conditions prevent ready access to prey. By March these non-breeders, and perhaps unsuccessful breeders, start departing from the colonies on their rapid transequatorial migration. Thus, in autumn, mainly birds feeding chicks are present about New Zealand (which, as a class, are likely to be successful foragers), resulting in the low rate of recovery from March to May. During June, the last nestlings and adults leave, and so few Mottled Petrels are found on beaches from July to October. The slight increase in recoveries in August is mainly the result of 15 of the August birds being found in 1978 on Mason Bay, Stewart Island (SD), more than a month after being washed ashore.

SOFT-PLUMAGED PETREL *P. mollis*

This petrel has a wide distribution, breeding on the Tristan da Cunha group and Gough Island in the South Atlantic Ocean and on Crozet, Marion and Prince Edward Islands, and probably on Kerguelen Island, in the Southern Indian Ocean (Imber 1983, Warham 1985). The species was first seen in the New Zealand region in February 1969, when a few were captured flying over Antipodes Island (Warham & Bell 1979). From the observations of Imber (1983) at Antipodes Island in November-December 1978 it is likely that the species breeds there. Elsewhere in the Southern Hemisphere this petrel returns to its colonies in August-September, lays in November-December, and the young leave the islands in May.

Presumably because of its rarity in New Zealand coastal waters, only four Soft-plumaged Petrels have been found by patrollers. The results for these birds are: 1971, BP, November; 1974, AE, December; 1978, WS, June and 1984, BP, November. In addition, there are three other records of Soft-plumaged Petrels in New Zealand. Two birds were found alive; one in the Hutt Valley (WS) in May 1971 (Warham 1985) and the other on Petone Beach (WS) in June 1983. The third bird was found dead, also on Petone Beach, in June 1983 (Booth 1984). That at least one, and probably all three, were fledglings, virtually confirms breeding in the New Zealand region (M. J. Imber, pers. comm.).

PYCROFT'S PETREL *P. pycrofti*

This species has a restricted breeding distribution, nesting only on islands along the north-eastern coast of the North Island: Stephenson Island, Aorangi Island, Hen Island, Lady Alice Island and Red Mercury Island (Bartle 1968, Williams & Given 1981). Birds return to their colonies in October, the eggs are laid in November-early December, and the chicks leave in late March-April (Bartle 1968, Dunnet 1985). Pycroft's Petrel probably spends the non-breeding season (May-September) over the North Pacific Ocean.

To date, patrollers have found only 23 Pycroft's Petrels. This is not surprising considering its rarity, the world population numbering only a thousand or so (Williams & Given 1981). The most Pycroft's Petrels found beach-wrecked in any year was five in 1971. During 1960-1984, only one Pycroft's Petrel was picked up for every 2500 km of beach covered. This petrel has been found only on North Island beaches, mainly on Auckland East and East Coast North Island beaches (Table 5).

The monthly rate of recovery did not change significantly through the year (Figure 1). Almost all the birds were picked up in the breeding season (November-April). The mortality is greatest in December and January, when non-breeders are very evident at the colonies (Bartle 1968, Dunnet 1985).

NEW CALEDONIAN PETREL *P. leucoptera caledonica*

Patrollers did not distinguish between the two subspecies of *P. leucoptera.* However, all specimens submitted to museums for critical examination have proved to be New Caledonian Petrels rather than Gould's Petrels *(P. l. leucoptera)* (Imber & Jenkins 1981). Therefore, all specimens found beach-wrecked are assumed for the purposes of this paper to have been of the *caledonica* subspecies.

The New Caledonian Petrel nests along the central mountain range of New Caledonia. Although no study has described the timing of the petrel's breeding cycle, it is known to lay in late December and the chicks probably leave the burrows in May (Imber 1985b).

Before 1960, 11 New Caledonian Petrels were found beach-wrecked, all on Muriwai Beach (AW) (Bull 1943, 1946). From 1960 to 1984, 13 of these petrels were found. Most were found on North Island west coast beaches (AW 8, TA 1, WW 2), the other two being from Auckland East beaches. That most birds were found on western beaches is to be expected, because all sightings of *P. leucoptera* made by J. A. F. Jenkins have been to the west of New Zealand (Imber & Jenkins 1981). Sightings of the species in the Tasman Sea extended as far south as Foveaux Strait (SD) (Imber & Jenkins 1981), and so corpses can be expected on western South Island beaches also.

Beach-wrecked New Caledonian Petrels have been found in January (5), April (10), May (3), June (1), November (1) and December (3). The timing corresponds broadly with that of sightings of *P. leucoptera* in the Tasman Sea; December to April inclusive (Imber & Jenkins 1981). As nesting New Caledonian Petrels would be confined to the seas about New Caledonia from November to May, most of the birds found on New Zealand beaches were probably non-breeders. Corpses are lacking on New Zealand beaches from July to October because the birds are then in the eastern tropical Pacific (Imber & Jenkins 1981).

COOK'S PETREL *P. cookii*

In winter this petrel inhabits the eastern central Pacific, mainly between 13°S and 23°N (Imber 1985b). However, not all birds desert the colonies; a few can usually be heard calling on dark nights in June over Little Barrier Island *(pers. obs.).* Those that migrate to the central Pacific Ocean begin returning to their nesting islands in late August. Cook's Petrels nest on three islands around New Zealand: up to 50,000 pairs on Little Barrier Island (AE), fewer than 20 pairs on Great Barrier Island (AE) and about 100 pairs on Codfish Island (SD) (Imber 1985b). Formerly, about 20,000 pairs bred on Codfish Island, and this population may grow to its former abundance now that the introduced weka *(Gallirallus australis)* has been eradicated from the island. Laying occurs from late October to early December on Little Barrier Island but is up to a month later on Codfish Island (Imber 1985b.)

On the northern islands the chicks hatch mainly in late December and depart from the island from mid-March to mid-April.

Generally, about 25 Cook's Petrels have been found annually during the past 10 years, 92 in 1981 being the highest annual total. From 1960 to 1984, 434 petrels were found at a rate of 0.8 birds per 100 km of beach covered. This rate of recovery seems low, considering the large number that breeds on Little Barrier Island. Presumably this result relates, in part, to the adjacent coastline (AE) not having currents and winds which regularly force dead seabirds ashore, as happens on the west coast of the North Island. Even so, Auckland East had the highest rate of Cook's Petrel recoveries at 3.48 birds per 100 km of beach covered, followed by Auckland West (0.47) and Bay of Plenty (0.44) (Table 5).

The monthly rate of recovery of the Cook's Petrel changed markedly through the year ($p < 0.01$) (Figure 1). After August the mortality increased gradually, when the birds started returning to Little Barrier Island, reaching a peak in December. The rate of recovery dropped in January and February but increased again in March and April, coinciding with the departure of the nestlings. In May, immediately after the breeding season, very few Cook's Petrels were found beach-wrecked, and none has been picked up in June or July.

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