

Distribution and numbers of waders in New Zealand, 1983-1994

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ABSTRACT

Population sizes and distribution of waders in New Zealand were determined for the first time during summer and winter, 1983-1994. In winter (June/early July), 163 000 New Zealand breeding and 21 000 Arctic migrant waders were recorded, and in summer (November/early December) 37 000 New Zealand breeding and 166 000 Arctic migrant waders were recorded. Species accounts, including seasonal totals for each year 1983-1994, average counts at favoured sites, and distribution maps are presented for the most abundant New Zealand breeding and Arctic migrant waders. The Pied Oystercatcher *Haematopus ostralegus* was the most abundant New Zealand breeding wader; the estimated winter total of over 112 000 birds showed that the population had increased by about 128% since 1970-71. Counts of Pied Stilt *Himantopus himantopus* (estimated winter total c. 28 000 birds) and Banded Dotterel *Charadrius bicinctus* (c. 11 000 birds) provided the first population estimates for these species during winter in New Zealand. However, both are significantly underestimated because many overwinter inland in sites not counted. Also, most of the Banded Dotterel population migrates to Australia following the breeding season. Wrybill *Anarhynchus frontalis* (c. 3900 birds) was next most abundant native species counted in winter, with most birds recorded in the North Island. Counts of Spur-winged Plover *Vanellus miles*, Variable Oystercatcher *Haematopus unicolor*, New Zealand Dotterel *Charadrius obscurus*, Black-fronted Dotterel *Charadrius melanops*, and Black Stilt *H. novaeseelandiae* also substantially underestimated population sizes because most birds of these species do not use estuarine sites during winter. During summer, Bar-tailed Godwit *Limosa lapponica*, Lesser Knot *Calidris canutus*, and Turnstone *Arenaria interpres* were the most abundant of the Northern Hemisphere migrants with estimated populations of c. 102 000, 59 000 and 5100 birds, respectively, representing significant proportions of the East Asian-Australasian flyway populations of these species. Less than 700 birds were recorded during summer for each of the other Northern Hemisphere migrants, including (in decreasing order of abundance) Pacific Golden Plover *Pluvialis fulva*, Red-necked Stint *Calidris ruficollis*, Whimbrel *Numenius phaeopus*, Curlew Sandpiper *C. ferruginea*, Sharp-tailed Sandpiper *C. acuminata*, and Eastern Curlew *N. madagascariensis*. Counts of uncommon Arctic migrants (i.e. those which reach New Zealand in most years) are also given.

KEYWORDS: Charadrii, New Zealand, populations, distribution, estuaries.

INTRODUCTION

Worldwide, coastal areas face increasing pressure from a variety of human uses, such as transport, food-gathering, aquaculture, recreation, effluent disposal, and reclamation. Population centres are often near estuaries with the result that many are now ring-fenced by urban development, leaving only intertidal areas relatively free of direct encroachment. Even intertidal areas are threatened as a result of the downstream effects of land-use changes within catchments. Within

New Zealand, a variety of human-induced pressures on coastal areas has put some estuaries under stress, particularly those estuaries near larger towns and cities (Ministry for the Environment 1997).

Waders are important, abundant and highly visible components of coastal areas, particularly estuaries, and this group of birds has been particularly affected by a variety of human activities. For example, recreational use of estuaries is now considered to be one of the major concerns for nationally and internationally important waders which depend upon estuarine habitats (Davidson & Rothwell 1993). The vulnerability of waders to human influences on estuarine areas may be further increased by additional threats from events such as global warming, changes in sea-level, and adverse factors in other parts of their range. For example, waders migrating to New Zealand from the Northern Hemisphere mainly belong to the East Asian-Australasian flyway population (Watkins 1993), and at stop-over sites in Asia they are under increasing pressure from hunting as well as habitat loss and degradation caused by human settlement and encroachment, drainage for agriculture, pollution, and fishing and associated disturbance (Parish *et al.* 1987, Scott & Poole 1989).

In New Zealand, waders have received a lot of attention from birdwatchers, and reports of counts from a variety of estuaries can be found in the earliest issues of *NZ Bird Notes* and *Notornis* (e.g., Kirk & Wodzicki 1943, Cunningham 1947, Guy 1949). In addition, species composition, abundance over several years and seasonal occurrence at specific sites have been recorded (e.g., Waikanae Estuary - Wodzicki 1946 and Wodzicki *et al.* 1978; Washdyke Lagoon - Sagar 1976; Manukau Harbour - Veitch 1978; Lake Ki-Wainono - Pierce 1980). Counts of particular species at specific sites, for example, Pacific Golden Plover, Turnstone, Lesser Knot and Bar-tailed Godwit at the Firth of Thames and Manukau Harbour (McKenzie 1967a, 1968, 1967b, 1967c respectively), while providing valuable information about trends in numbers at these sites, do not provide sufficient evidence of overall changes in population size.

In an inventory of some New Zealand wetlands, Cromarty & Scott (1996) list 19 species of wader which are of conservation concern (see Appendix 1). These comprise five endemic species, and 14 Northern Hemisphere migratory species which are rare in New Zealand. While nationwide population studies are available for four of these endemic waders - Black Stilt (Reed 1998), Variable Oystercatcher (Baker 1973), NZ Dotterel (Edgar 1969; Dowding 1994), and Wrybill (Sibson 1963; Davies 1997), none has been reported for Banded Dotterel and the Northern Hemisphere migratory species.

In view of the increased impacts of human influences on wader habitats and the lack of information about wader populations nationwide, the Ornithological Society of New Zealand (OSNZ) initiated the National Wader Count scheme in 1983, whereby teams of experienced volunteers carried out counts of waders, in specified months, at coastal sites throughout the country. The aims of the study were to determine (1) the numbers and distribution of waders occurring at coastal sites throughout New Zealand, (2) seasonal changes in the distribution and num

bers of waders, and (3) annual changes in the numbers of waders. Here we present an analysis of the numbers and distribution of waders in New Zealand during the period 1983 - 1994. Analyses of habitat associations and of trends in population size will be published separately.

STUDY AREAS

There are about 300 estuaries widely distributed about the coast of New Zealand and offshore islands with an average of one per 32 km of coastline (McLay 1976). New Zealand estuaries may be classified into four types, based on topography (McLay 1976). Over half of the estuaries are bar-built i.e., typically shallow, with a bar across the mouth and an outlet which may shift position; 65 are lagoonal i.e., semi-enclosed and having a free connection to the open sea; 56 are drowned rivers resulting from changes in sea level; and fiords, which are frequently deep, long and narrow. These estuaries occupy an area of over 100 000 ha and range in size from a few hectares to over 15 000 ha (McLay 1976); the median size is 200 ha. During the 11 years of this study waders were counted at least once at all estuaries larger than 75 ha, plus a number of non-estuarine areas where waders were known to congregate (e.g., sandy beaches, reef areas such as Kaikoura Peninsula, and lake shores). The locations of the 263 sites covered during the study are shown in Fig. 1.

METHODS

Organisation and accuracy

Counts were carried out during the months of November/early December (summer) and June/early July (winter) each year 1983 - 1994. In addition, specific trips to the Chatham Islands were undertaken during November 1994 and June 1995 to count waders at Te Whanga Lagoon. The prime objective of the summer counts was to record the numbers of Northern Hemisphere migrants, and those of the winter counts were to record the numbers of native species which moved to coastal areas following breeding, and to record the numbers of non-breeding Northern Hemisphere migrants (see Appendix 1 for a list of the status of each wader species). November and June were chosen as the best periods in which to achieve the objectives of the study on the basis of the results of a long-term study of wader numbers at the Firth of Thames (C.R. Veitch, pers. comm.). This study showed that although numbers of Northern Hemisphere migrants were greatest during January and February, numbers were most stable during November; native species have been traditionally counted there in late June.

The counts, by teams containing experienced volunteer observers, were organised on a regional basis and synchronised to minimise errors resulting from movements of birds between sites. Counts were carried out on a range of dates within the specified months between regions, but within a region, organisers ensured that as many sites as possible were counted on the same day. A number of factors resulted in not all sites within a region being counted on one day. These included insufficient numbers of observers, unsuitable tides, or unsuitable weather. This

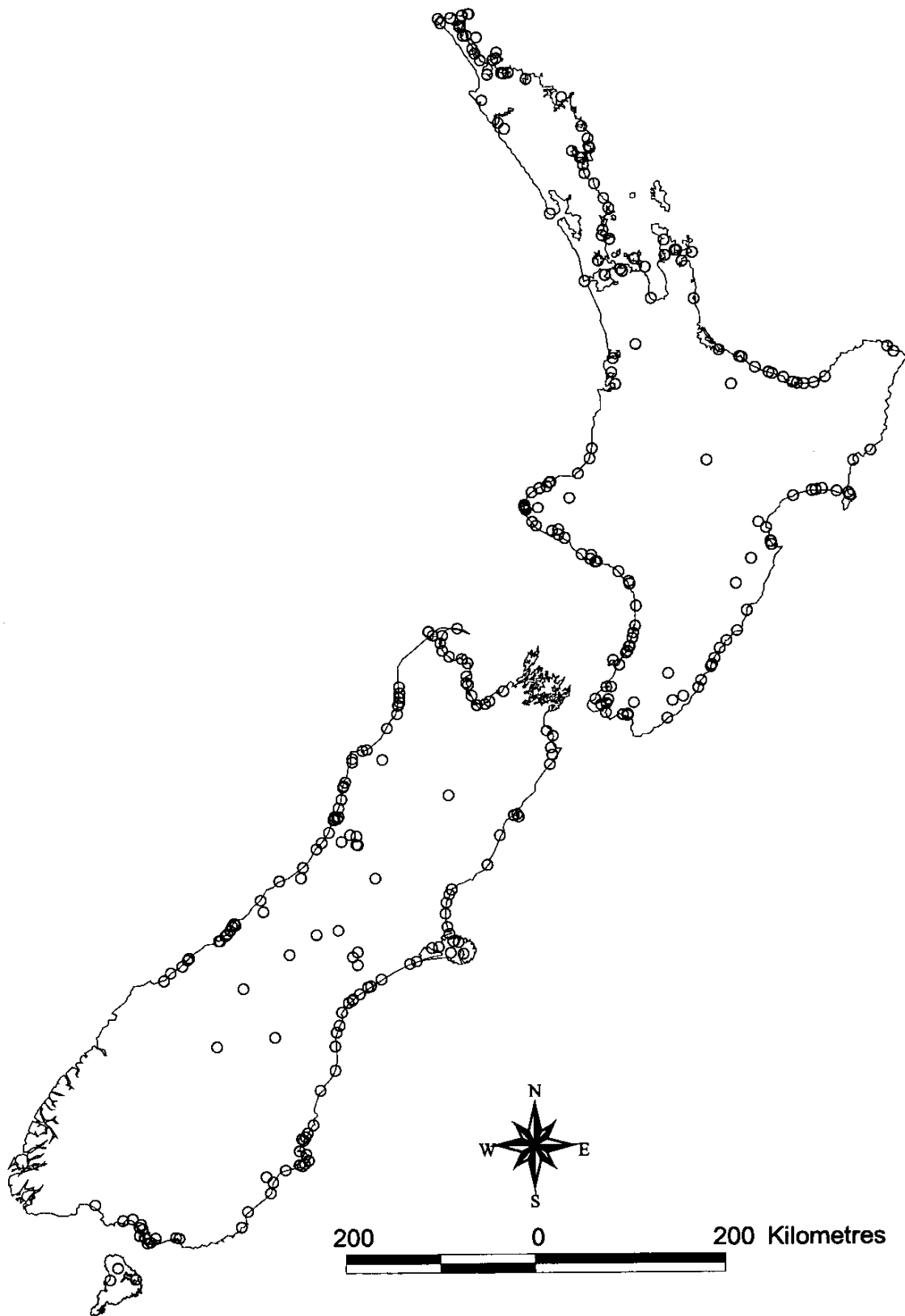


FIGURE 1 – Locations of sites (circles) where at least one count of waders was made during summer or winter, 1983-1994.

meant that some sites were counted on a date as close as possible to that of the main count. In all cases, counts of at a particular estuary or harbour were completed in one day to minimise the risk of duplicating counts of birds which moved.

In tidal areas, counts were made at high tide, when waders congregated on traditional roosts where they could be more easily counted. At some sites, for example, Farewell Spit, high spring tides were necessary to ensure that all waders congregated at well-known roosts and were not scattered in smaller flocks elsewhere. Most of the major wader roosts around New Zealand are well known, however, during the period of this scheme the OSNZ undertook aerial surveys of Golden Bay and Kaipara Harbour with the specific aims of identifying roosting sites (H.A. Robertson, pers. comm., Davies & Riegen 1993). At sites unaffected by tides (e.g., Lakes Ellesmere and Wairarapa) observers walked over areas of suitable wader habitat, recorded the numbers of waders as they progressed.

Counts were returned to the regional organisers, who collated them before forwarding site totals to the national organiser. There were undoubted differences between observers in ability to count and identify waders and this will have caused bias in determining species totals. However, analysis involving many sites taken together should be much more robust than analyses of count data from individual sites (Hill *et al.* 1993). Likewise, differences in physical complexity and size of estuaries meant that complete standardisation of counts was not possible and no correction factors have been included. Also, observers were asked to concentrate on counting waders rather than search for rarities, and so some rarer species may have been overlooked in counts.

Prater (1981) identified two ways in which incomplete coverage of coastal sites affects counts of waders; firstly, estimates of wader numbers cannot be made accurately when observations are made only on part of a site or not on all sites; secondly, each species has its own habitat requirements and unless all habitats are thoroughly covered, estimates also cannot be accurate. During the OSNZ National Wader Counts, estimates were obtained for most sites on most occasions. However, the intertidal areas in Fiordland (west coast of the South Island, south of Jackson's Bay) and most of those on Stewart Island were not covered. Estuarine areas in Fiordland comprise deep-water fiords which are unsuitable for waders and only six estuaries occur on Stewart Island (McLay 1976). Since the numbers of waders in these areas is likely to be very small, the error is insignificant compared with counting errors at large estuaries. In some surveys, several major sites which supported >10% of the total numbers of a species were not covered. Therefore, in addition to providing national totals, by year and season, we also include population estimates for each species. These were calculated as the sum of the mean counts at all sites visited between 1983 and 1994. Although totals for the Chatham Islands are included in the text, they are omitted from the population estimates because only one summer count was completed during the period 1983-1994.

Some species were not counted accurately because they occur in areas other than coastal sites or are dispersed along coastlines. Species particularly affected were NZ Dotterel, Banded Dotterel, Wrybill (during the breeding season), Pacific

TABLE 1 – Numbers of sites where waders were counted in winter and summer, 1983-1994

Season	Year					
	1983	1984	1985	1986	1987	1988
Winter	-	106	147	167	143	127
Summer	68	110	135	140	113	108
	1989	1990	1991	1992	1993	1994
Winter	123	79	80	100	81	72
Summer	85	69	71	77	61	-

Golden Plover, Spur-winged Plover, Pied Stilt, and Black Stilt. Problems of interpretation in the counts of these are considered in the species accounts.

Scientific names and the status of each species are listed in Appendix 1.

RESULTS & DISCUSSION

Effort

During the 11 years of this study, waders were counted at least once at a total of 263 sites. Fig. 1 shows the distribution of these sites. By season, the number of sites counted ranged from 61 (1993) to 140 (1986) in summer, and 73 (1994) to 167 (1986) in winter (Table 1). Most of the variation in numbers of sites covered was a result of many small estuaries being visited regularly during the first five years of the study, but not thereafter. For example, in the summer 1986 count, 38 sites were covered on the west coast of the South Island, but in the period 1989-1994 no more than six were visited in any season. While relatively small numbers of a few species of wader occurred at west coast, South Island, estuaries this was not true of the large northern harbours and Southland estuaries, which had either no or incomplete counts in some seasons (Table 2). This would have resulted in the under-counting of many species, and so we have calculated the national population estimates for each species.

The locations of sites named in the species accounts or their associated tables are shown in Fig. 2.

Total numbers of waders

Each summer, an average total of about 163 000 waders was reported, comprising about 139 000 migrants and 24 000 native species (Table 3). At this time most native waders are on their breeding grounds, usually away from the coast, and so would not be counted. However, during winter most migrants have returned to their Northern Hemisphere breeding grounds and most native waders have moved to coastal sites, and so the relative numbers of these groups of waders is reversed. Thus, the average total of about 130 000 waders counted during winter comprises about 112 000 native and 18 000 migrants waders (Table 3).

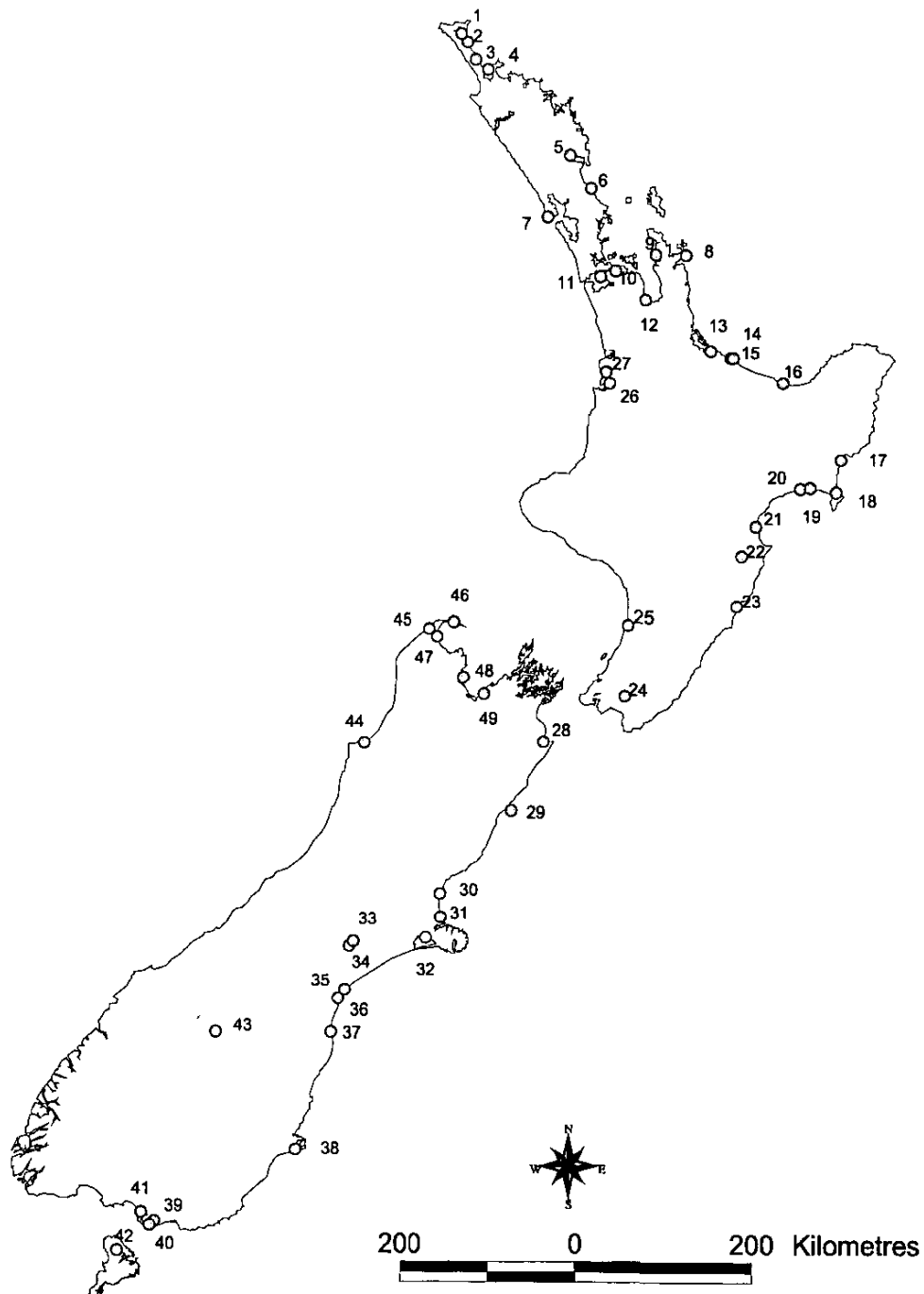


FIGURE 2 – Locations of sites mentioned in the text and tables. 1, Parengarenga Harbour; 2, Great Exhibition Bay; 3, Houhora Harbour; 4, Rangaunu Bay; 5, Whangarei Harbour; 6, Mangawhai Estuary & Spit; 7, Kaipara Harbour; 8, Tahanga; 9, Coromandel Peninsula; 10, Tamaki Estuary; 11, Manukau Harbour; 12, Firth of Thames; 13 Tauranga Harbour; 14, Little Waihi & Pukehima Spit; 15, Kaituna Cut & Maketu Estuary; 16, Ohope Spit & Ohiwa Harbour; 17, Muriwai Lagoon; 18, Oraka/Mangawhai Estuary; 19, Whakai & Korito Lagoons; 20, Wairoa Estuary & Ngamotu Lagoon; 21, Ahuriri Lagoon/Westshore Ponds; 22, Lake Poukawa; 23, Porangahau Estuary; 24, Lake Wairarapa; 25, Manawatu Estuary; 26, Kawhia Harbour; 27, Aotea Harbour; 28, Lake Grassmere; 29, Kaikoura Peninsula; 30, Ashley Estuary; 31, Avon-Heathcote Estuary; 32, Lake Ellesmere; 33, Valetta paddocks; 34, Mayfield; 35, Opihi Rivermouth; 36, Washdyke Lagoon; 37, Lake Ki-Wainono; 38, Otago Harbour; 39, Waituna Lagoon; 40, Awarua Bay; 41, Invercargill Estuary; 42, Freshwater mudflats; 43, MacKenzie Basin; 44, Orowaiti Lagoon; 45, Westhaven Inlet; 46, Farewell Spit; 47, Golden Bay; 48, Motueka Estuary; 49, Waimea Estuary & Nelson Haven.

TABLE 2 – Summary of major estuarine areas for which no wader counts were received in particular surveys.

Year	Season	Estuarine areas
1983	Summer	Lake Wairarapa, Otago Harbour
1986	Winter	Rangaunu Harbour
1986	Summer	Rangaunu Harbour
1987	Winter	Parengarenga, Rangaunu and Houhora Harbours
1988	Summer	Houhora and Rangaunu Harbours
1989	Summer	Kaipara and Whangarei Harbours
1990	Winter	Parengarenga, Rangaunu and Houhora Harbours
1990	Summer	Parengarenga, Rangaunu, Houhora and South Kaipara Harbours
1991	Winter	Parengarenga, Rangaunu and Houhora Harbours; Invercargill Estuary, Awarua Bay, Riverton Estuary, Waituna Lagoon
1991	Summer	Invercargill Estuary, Awarua Bay, Riverton Estuary, Waituna lagoon
1992	Winter	Rangaunu Harbour
1992	Summer	Rangaunu and Houhora Harbours
1993	Summer	Parengarenga, Rangaunu and Houhora Harbours; Westhaven Inlet; Kaikoura Peninsula
1994	Winter	Parengarenga, Rangaunu and Houhora Harbours; Invercargill Estuary, Awarua Bay, Riverton Estuary, Waituna Lagoon

TABLE 3 – Numbers of native and migrant waders counted in New Zealand during winter and summer 1983-1994. (-, not counted.)

Year	Winter			Summer		
	Native	Migrant	Total	Native	Migrant	Total
1983	-	-	-	17 592	124 874	142 467
1984	107 622	15 197	122 809	24 695	141 297	165 992
1985	111 495	10 629	122 124	24 805	137 648	162 453
1986	116 488	16 039	132 527	27 569	130 882	158 451
1987	113 999	10 196	124 195	28 260	151 453	179 713
1988	113 365	21 982	135 347	24 791	171 939	196 730
1989	125 613	25 326	150 939	18 618	131 469	150 086
1990	98 374	21 351	119 725	24 729	128 527	153 256
1991	106 354	17 465	123 819	20 216	156 927	177 188
1992	112 295	21 555	133 850	28 610	151 806	180 416
1993	117 598	21 338	138 936	22 763	102 060	124 823
1994	105 157	15 212	120 369	-	-	-
Mean±SD	111 669±6911	17 845±4664	129 514±9290	23 881±3565	138 989±17911	162 870±19 288
Estimated NZ population	163 213	21 596	184 809	36 976	166 547	203 523

New Zealand breeding species

Pied Oystercatcher

Pied Oystercatchers breed inland in the South Island and on a few riverbeds in Hawke's Bay and the Wairarapa (Heather & Robertson 1996). From late December, they move to the coast and most migrate to northwards (Sagar & Geddes 1999). About twice as many birds wintered in the North Island as in the South Island (Table 4). In winter, the total number counted in most years was over 80 000

TABLE 5 – Sites where >2000 Pied Oystercatchers were counted, on average, during winter 1984-1994.

Site	No. counts	Mean	SD	Range
Manukau Harbour	11	25 707	3501	19 467 - 31 976
Kaipara Harbour	9	13 554	3910	8969 - 21 730
Firth of Thames	11	12 618	3414	6274 - 17 657
Farewell Spit	11	7443	1363	5689 - 10 883
Golden Bay	8	3052	1393	554 - 5480
Avon-Heathcote Estuary	11	3006	646	2126 - 4022
Motueka Estuary	11	2304	518	1562 - 3083

birds with a maximum of 88 234 in 1993 and an estimated national total of 112 675 birds (Table 4). These results confirm the continued increase in numbers of this species since their protection in 1940.

From the mid-1800s the population declined markedly (Potts 1885) and it was not until their protection from hunting in 1940 that wintering populations began to increase, especially in northern harbours (Sibson 1966; Baker 1973). Conversion of tussockland to pasture increased nesting sites for Pied Oystercatchers (Heather & Robertson 1996) and this probably contributed to the spectacular rate of population increase. By 1970-71, the estimated population was 49 000 birds (Baker 1973), and so with an estimated population of about 112 675 birds the population has increased subsequently by about 128%.

Although Pied Oystercatchers were widely distributed throughout the country during winter (Fig. 3), most of these birds (65%) occurred at just three sites, with about 26 000 at Manukau Harbour, 13 500 at Kaipara Harbour, and 12 600 at the Firth of Thames (Table 5). The increase in numbers of birds counted at Manukau Harbour and the Firth of Thames is remarkable; there were fewer than 500 birds at these two sites in 1941 (Sibson 1966), but about 12 000 birds in 1972 (Baker 1973, Veitch 1978). Consequently, the approximately 38 000 birds recorded during this study represents an increase of over 310% since 1972. Numbers of Pied Oystercatchers have not increased uniformly at all wintering sites and indeed there appears to have been a decrease in the numbers using the Avon-Heathcote Estuary, where about 3500 birds occurred during the early 1970s (Baker 1973), but numbers averaged about 3000 birds between 1984 and 1994 (Table 5). Of the 23 251 birds which wintered in the South Island, on average, about half occurred in the Nelson area (Table 5).

During the summer, an estimated 18 000 birds remained on estuarine areas (Table 4). These are mainly subadults, birds aged 1-3 years (Baker 1975; Sagar & Geddes 1999). Most of these birds remain at the main wintering sites, particularly Manukau Harbour (c. 3700), and Firth of Thames (c. 1900), and the Nelson area (c. 3000), with the remainder widely distributed at other estuaries (Fig. 3).

TABLE 4 – Numbers of New Zealand breeding waders counted in New Zealand during winter and summer, 1983-1994. (-, not counted.) NI = North Island; SI = South Island.

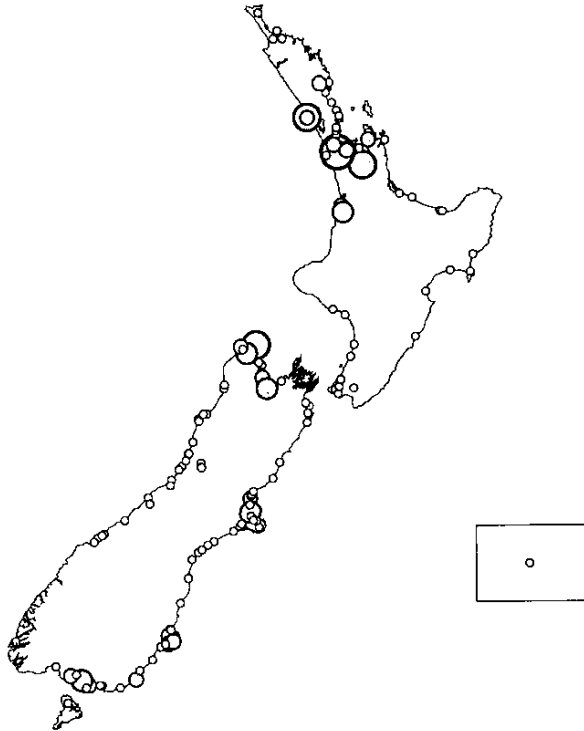
Species Season	Year												Mean±SD	Estimated NZ popn
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994		
Pied Oystercatcher														
Winter														
NI	-	55 268	56 703	58 623	53 365	61 177	65 282	49 177	52 640	53 579	69 194	56 050	57 369±5600	83 017
SI	-	24 961	26 386	21 763	24 283	24 602	22 591	19 836	25 497	27 332	19 040	19 465	23 251±2759	29 658
Total	-	80 229	83 089	80 386	77 648	85 779	87 873	69 013	78 137	80 911	88 234	75 515	80 619±5388	112 675
Summer														
NI	9417	8849	7005	8712	8150	7996	4788	8367	7800	11 998	12 444	-	8684±2030	10 849
SI	5032	7039	6006	6417	9577	7159	6931	5728	3949	6188	5954	-	6362±1351	7402
Total	14 449	15 888	13 071	15 129	17 727	15 155	11 719	14 095	11 749	18 186	18 398	-	14 779±2409	18 251
Pied Stilt														
Winter														
NI	-	14 587	15 605	18 684	18 029	12 390	19 113	13 919	14 720	14 522	14 065	14 552	15 285±2271	23 131
SI	-	2826	2920	2635	2106	2586	2246	2736	2767	2853	2520	3378	2687±321	4775
Total	-	17 413	18525	21 319	20 135	14 976	21 359	16 655	17487	17 375	16 585	17 930	17 971±2156	27 906
Summer														
NI	2501	4794	5004	4770	4362	3498	3395	3534	3400	3836	3952	-	3913±723	5841
SI	1031	1790	2811	3932	3348	3077	2388	3337	2533	2661	2285	-	2654±762	4557
Total	3532	6584	7815	8702	7710	6575	5783	6871	5933	6497	6237	-	6567±1274	10 398
Banded Dotterel														
Winter														
NI	-	3522	3435	4032	5703	3792	6559	3002	2430	3198	4307	4802	4041±1159	5974
SI	-	4047	3414	4487	3356	2845	2683	2703	2824	4700	2189	3491	3340±761	4869
Total	-	7569	6849	8519	9059	6637	9242	5705	5254	7898	6496	8293	7882±1292	10 843
Summer														
NI	57	196	841	294	182	265	150	124	152	107	69	-	222±208	458
SI	490	850	537	973	563	462	841	646	270	853	270	-	614±229	1289
Total	547	1046	1378	1267	745	727	991	770	422	960	339	-	836±315	1747
Wrybill														
Winter														
NI	-	3952	3713	3130	2752	4418	3912	3819	2953	3785	3393	4157	3635±494	3848
SI	-	8	10	9	55	0	2	8	28	40	48	40	23±19	32
Total	-	3960	3723	3139	2807	4418	3914	3827	2981	3825	3441	4197	3657±485	3880
Summer														
NI	70	82	42	270	190	127	48	60	40	215	64	-	110±76	128
SI	103	39	11	66	142	119	6	30	2	10	8	-	49±48	56
Total	173	121	53	336	332	246	54	90	42	225	72	-	159±106	184

TABLE 4 – Continued

Species Season	Year												Mean±SD	Estimated NZ popn
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994		
Variable Oystercatcher														
Winter														
NI	-	666	1108	1411	900	702	1411	705	655	1094	851	768	934±270	2001
SI	-	346	466	368	366	389	438	518	498	609	519	536	459±81	1412
Total	-	1012	1574	1779	1266	1091	1849	1223	1153	1703	1370	1304	1393±275	3413
Summer														
NI	210	450	884	842	848	968	361	375	675	469	815	-	627±249	1651
SI	116	310	217	257	207	284	306	394	307	309	349	-	278±72	410
Total	326	760	1101	1099	105	1252	667	769	982	778	1162	-	905±259	2061
Spur-winged Plover														
Winter														
NI	-	27	544	463	947	394	556	530	1117	1102	928	945	565±322	3459
Summer														
NI	37	169	569	624	314	141	289	846	838	1755	712	-	572±462	3604
New Zealand Dotterel														
Winter														
NI	-	446	515	711	496	553	542	226	201	345	265	275	416±156	944
SI	-	22	54	50	22	2	30	2	20	13	15	1	21±17	26
Total	-	468	569	761	518	555	572	228	221	358	280	276	437±168	970
Summer														
NI	106	289	451	397	339	447	153	163	254	193	321	-	283±115	728
SI	0	9	2	1	0	1	1	0	0	4	2	-	2±3	2
Total	106	298	453	398	339	448	154	163	254	197	323	-	285±115	730
Black-fronted Dotterel														
Winter														
NI	-	68	201	88	260	206	241	141	177	223	145	56	164±67	321
Summer														
NI	0	6	122	62	21	15	14	20	22	10	5	-	27±34	52
Black-hybrid Stilt														
Winter														
NI	-	10	23	32	19	3	19	4	4	11	16	19	15±9	68
Summer														
NI	0	1	3	2	0	0	2	2	3	1	0	-	1±1	1

Summer

- 1 - 100
- 101 - 500
- 501 - 1000
- 1001 - 2000
- 2001 - 4000



Winter

- 1 - 100
- 101 - 500
- 501 - 1000
- 1001 - 10000
- 10001 - 30000

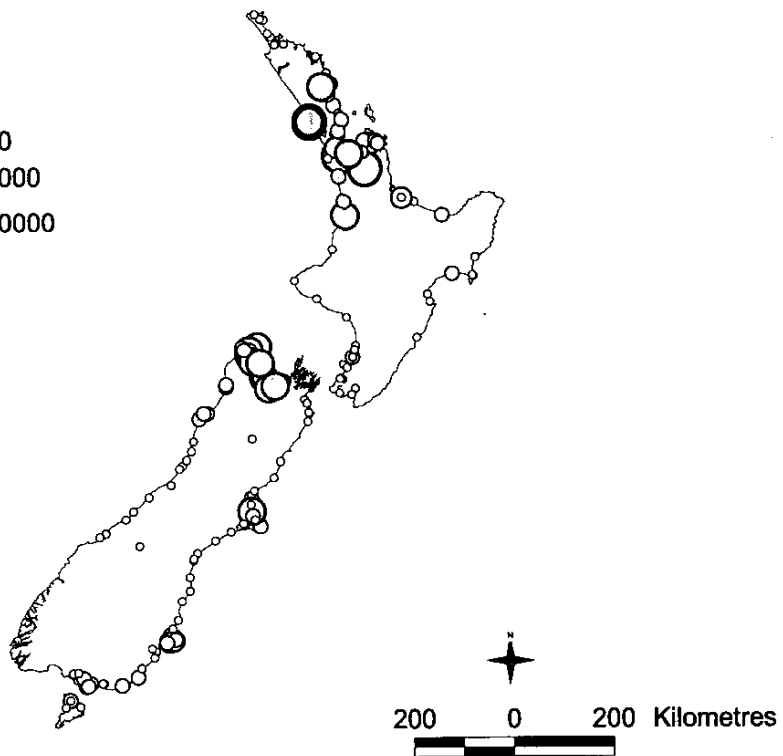


FIGURE 3 – Distribution and numbers of Pied Oystercatchers in New Zealand during summer and winter, 1983-1994. Inset = Chatham Islands.

TABLE 6 – Sites favoured by Pied Stilts during summer and winter, 1983-1984.

Site	No. counts	Mean	SD	Range
Summer				
Firth of Thames	11	3452	1152	1975 - 5234
Manukau Harbour	11	3348	850	2278 - 4826
Kaipara Harbour	9	2651	1008	1534 - 4679
Lake Wairarapa	10	988	228	573 - 1443
Parengarenga Harbour	8	688	438	99 - 1345
Ahuriri/Westshore	11	605	329	5 - 1177
Lake Ellesmere	11	548	219	253 - 923
Tauranga Harbour	11	441	229	141 - 862
Whangarei Harbour	10	418	175	47 - 731
Winter				
Firth of Thames	11	711	315	305 - 923
Manukau Harbour	11	779	306	281 - 1169
Kaipara Harbour	10	632	334	51 - 1187
Lake Wairarapa	10	528	128	335 - 578
Parengarenga Harbour	8	45	63	0 - 163
Ahuriri/Westshore	11	395	107	256 - 520
Lake Ellesmere	11	1110	505	203 - 1817
Tauranga Harbour	11	9	11	0 - 23
Whangarei Harbour	9	184	151	23 - 435

Pied Stilt

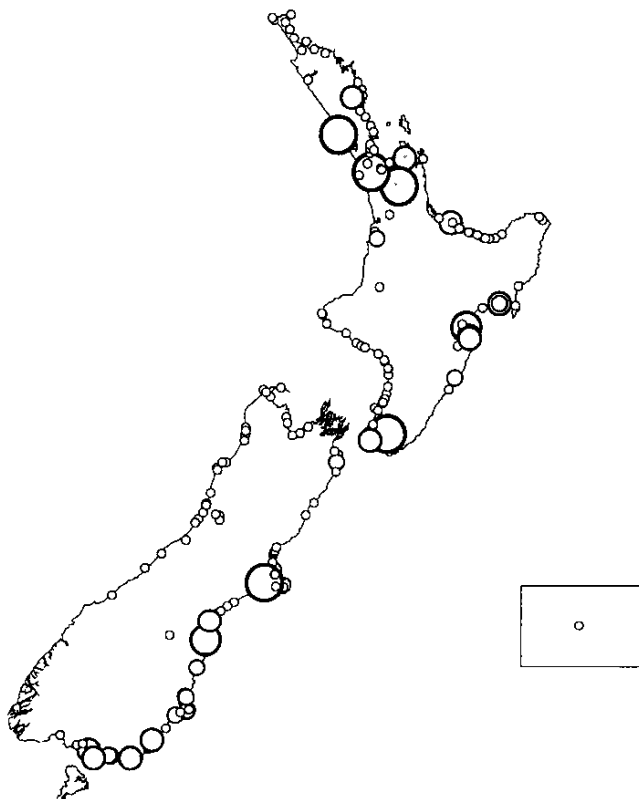
Pied Stilts breed throughout New Zealand, but are absent from Fiordland and rare on Stewart and Chatham Islands (Heather & Robertson 1996). They breed near water in wetlands in coastal and inland areas (Pierce 1984). During December to February birds which breed inland move to coastal areas; those that breed on the coast or in northern areas are sedentary throughout the year (Heather & Robertson 1996).

Winter counts in this study provide the first estimate of the minimum size of the Pied Stilt population in New Zealand and show that it is about 28 000 birds (Table 4). However, this total is likely to be below the actual population size, with many birds remaining uncounted, particularly on small wetlands in the northern half of the North Island. On this basis, Heather & Robertson (1996) estimated that the total population was about 30 000 birds. During winter, about 85% of the birds counted were in the North Island, with less than 3000 birds being counted in the South Island (Table 4). More birds were also counted in the North Island than the South Island during summer, when only about 37% of the winter total were located (Table 4).

Although widespread in both main islands during winter (Fig. 4), highest numbers were consistently counted at the Firth of Thames, Manukau Harbour, and Kaipara Harbour (Table 6). In addition to the large harbours of the North Island, Pied Stilts also favoured coastal lakes such as Wairarapa and Ellesmere, and the Ahuriri

Summer

- 1 - 50
- 51 - 100
- 101 - 300
- 301 - 500
- 501 - 1500



Winter

- 1 - 100
- 101 - 500
- 501 - 1000
- 1001 - 2000
- 2001 - 4000

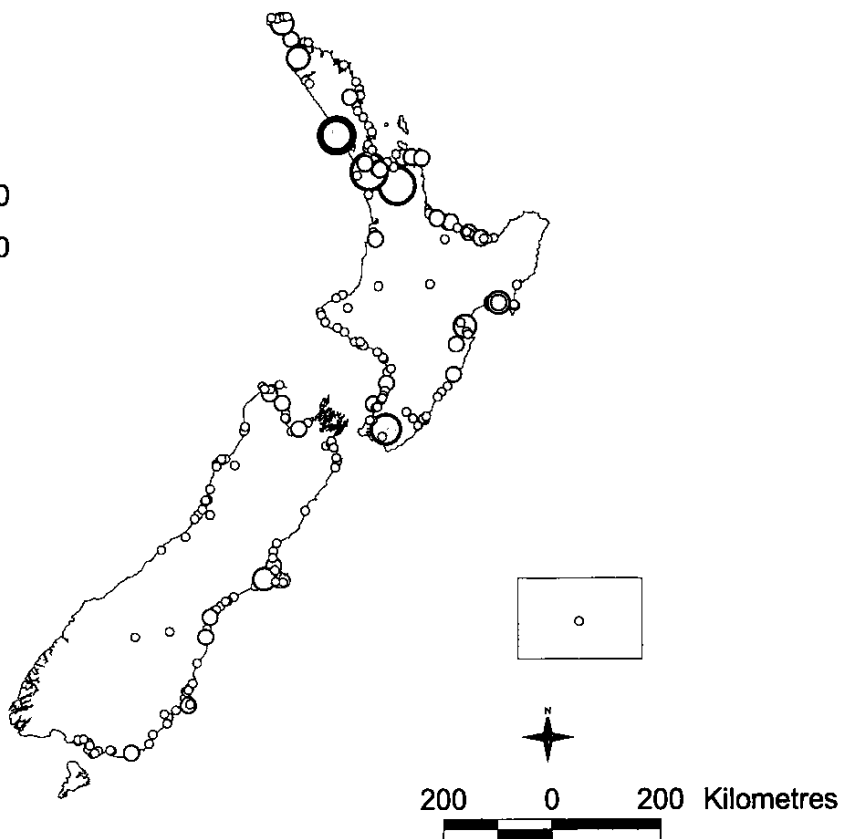


FIGURE 4 – Distribution and numbers of Pied Stilts in New Zealand during summer and winter, 1983-1994. Inset = Chatham Islands.

TABLE 7 – Sites where >250 Banded Dotterels were counted, on average, during winter 1984-1994.

Site	No. Counts	Mean	SD	Range
Farewell Spit	11	1030	311	447 - 1442
Lake Ellesmere	11	887	684	305 - 2502
Parengarenga Harbour	8	881	343	430 - 1380
Manukau Harbour	11	642	220	63 - 939
Kaipara Harbour	9	459	324	85 - 1026
Ohope/Ohiwa Harbour	11	404	134	228 - 676
Kawhia Harbour	11	347	150	16 - 543
Tauranga Harbour	11	334	276	6 - 743
Whangarei Harbour	11	290	176	5 - 689

Estuary/Westshore Lagoon complex (Table 6). During summer, many Pied Stilts were counted at the sites favoured for overwintering, although relatively few stayed at Parengarenga and Tauranga Harbours (Table 6).

Banded Dotterel

The endemic Banded Dotterel breeds primarily on gravel riverbeds of the east coast of both the North and South Islands (Heather & Robertson 1996). From about January, birds breeding inland migrate northwards to coastal areas within New Zealand, or to Tasmania and Australia from Cairns around the south coast to Perth (Blakers *et al.* 1984); birds breeding at coastal sites are mainly sedentary (Heather & Robertson 1996).

Totals ranged from 5254 to 9242 birds during winter, with similar numbers reported in both the North and South Islands (Table 4). The population of Banded Dotterels has been estimated from banding studies at 50 000 birds (Heather & Robertson 1996), with about 30 000 of these migrating to Australia (Watkins 1993; Heather & Robertson 1996). Thus, about 20 000 birds remain in New Zealand, although only an estimated 11 000 of these were located during this study (Table 4). This may be explained by the paucity of winter counts at inland sites during this study. For example, winter counts of Banded Dotterel at the MacKenzie Basin, Valetta, and Mayfield (Fig. 5) showed that several hundred birds overwintered on river deltas and paddocks. Consequently, many more Banded Dotterels may have occurred at other inland sites which were not covered.

Banded Dotterels were widespread throughout coastal sites in both main islands during winter (Fig. 5). However, about 70% of birds counted occurred at just nine sites (Table 7), which are characterised by large areas of intertidal sand flats or extensive, sparsely vegetated, muddy lake margins. These favoured sites were in the northern North Island, and Farewell Spit and Lake Ellesmere in the South Island (Table 7).

More birds were counted at coastal sites in the South Island than the North Island during summer (Table 4), which probably reflects that subadults move towards the breeding grounds in the South Island (Heather & Robertson 1996).

Winter

- 1 - 10
- 11 - 100
- 101 - 500
- 501 - 750
- 751 - 1000

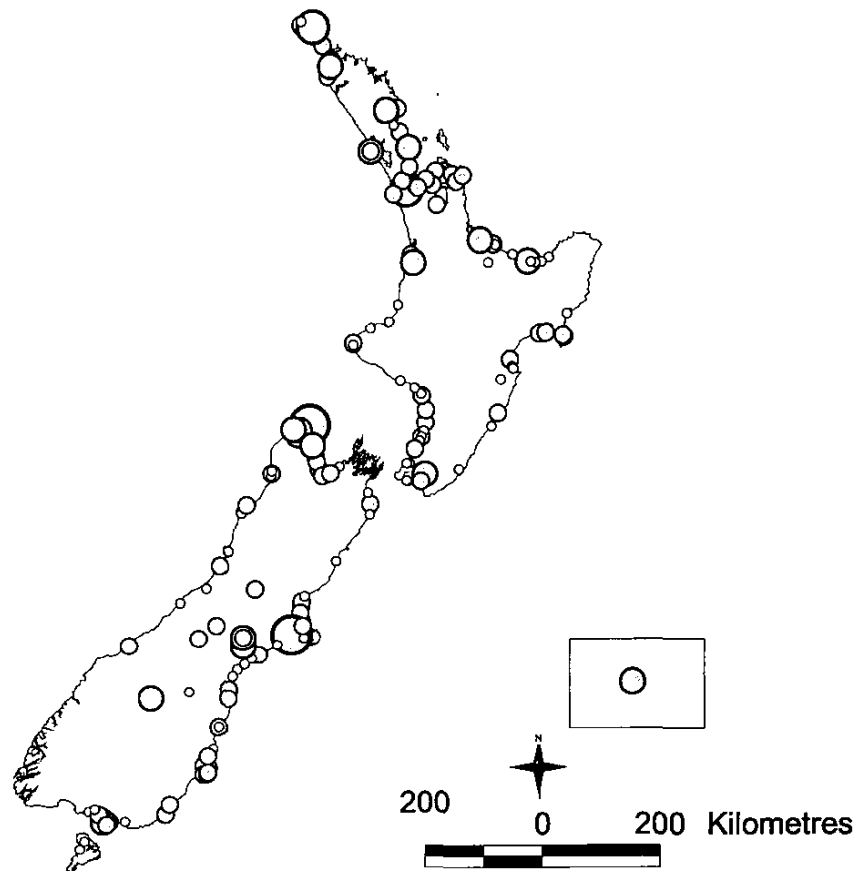


FIGURE 5 – Distribution and numbers of Banded Dotterels in New Zealand during winter, 1984-1994. Inset = Chatham Islands.

Wrybill

Wrybills breed in Canterbury and inland Otago riverbeds, with eggs being laid from late August to January (Heather & Robertson 1996). From late December-early January, adults begin arriving at their wintering grounds in the harbours of Northland, Auckland and South Auckland (Davies 1997). Winter totals of birds ranged from 2981 (1991) to 4418 (1988) (Table 4). However, a total of 5111 birds was recorded during a specific nationwide count of Wrybills during May 1994 compared to 4197 during the National Wader Counts in June/early July that year. This indicates that the national count under-recorded Wrybills by about 20% (Davies 1997), possibly because observers had insufficient time to search for flocks. In a review of population trends of Wrybills, Davies (1997) concluded that although flocks of thousands were recorded in the nineteenth century (Buller 1905), the species had become rare by 1940. The total population rose to 1500-2000 birds by 1950 and to >4000 by 1960 (Sibson 1963). The population was probably then stable for the next 20 years (Hughey 1985), and this total appears to have been sustained until at least 1994 (Davies 1997).

During winter, most Wrybills congregated at the Firth of Thames and Manukau Harbour, which together supported an average of 84.9% (SD = 7.4%) of the total number of Wrybills counted (Table 8). Other sites where (10 birds were counted

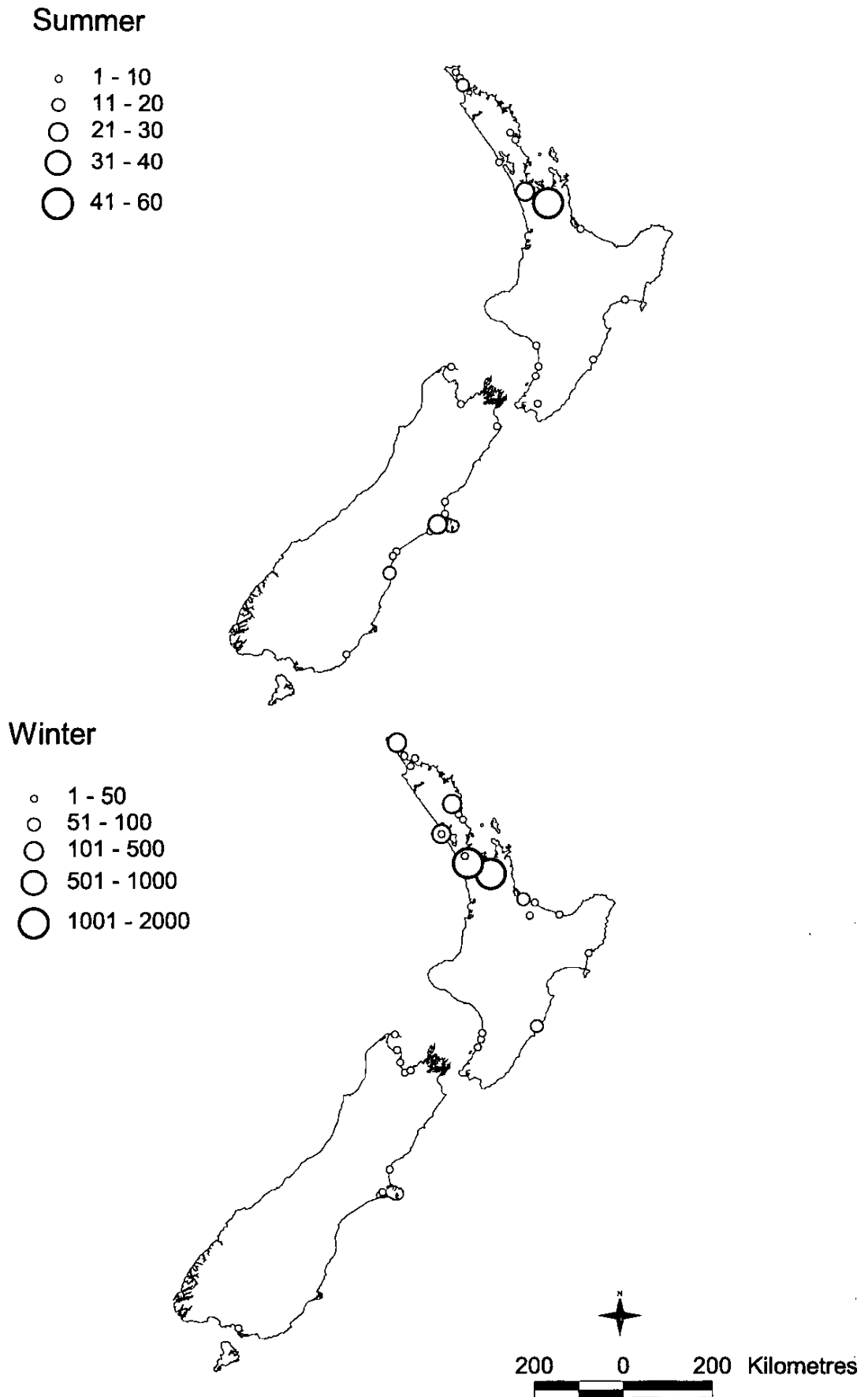


FIGURE 6 – Distribution and numbers of Wrybills in New Zealand during summer and winter, 1983-1994.

TABLE 8 – Sites where ≥ 10 Wrybills were counted, on average, in winter 1984-1994.

Site	No. counts	Mean	SD	Range
Firth of Thames	11	1958	666	650 - 2702
Manukau Harbour	11	1171	177	850 - 1391
Parengarenga Harbour	7	137	54	38 - 220
Whangarei Harbour	11	136	90	6 - 365
Kaipara Harbour	11	115	66	16 - 222
Tauranga Harbour	11	71	18	43 - 101
Porangahau Estuary	9	56	14	40 - 83
Houhora Harbour	6	34	23	4 - 75
Manawatu Estuary	11	14	5	4 - 21
Waitemata Harbour	6	14	9	0 - 28
Waimea Estuary	11	13	17	0 - 45

each winter were Houhora, Parengarenga Harbour, Whangarei Harbour, Kaipara Harbour, Tauranga Harbour, Porangahau Estuary, Manawatu Estuary, and Waimea Estuary (Table 8, Fig. 6).

The birds remaining in the North Island during summer are probably 1st- or 2nd-year non-breeders (Hughey 1985). Major flooding of the breeding rivers is the main cause of breeding season failure (Pierce 1979, Hay 1984, Hughey 1985). Because poor breeding success due to floods results in fewer pre-breeders, there is a highly negative correlation between numbers of Wrybills remaining in the north during summer, and the size and frequency of flood events from the previous breeding season (Hughey 1985). This probably accounts for the nearly three-fold variation in numbers counted at North Island sites in summer during this study (Table 4).

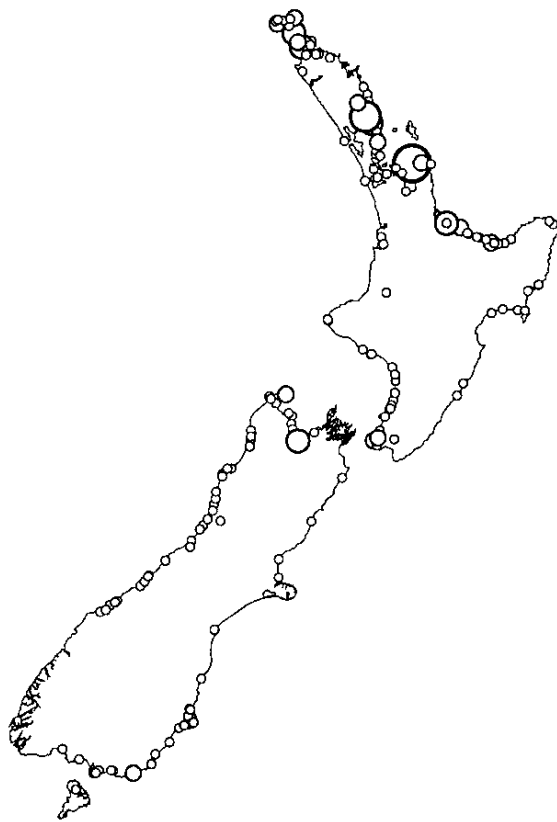
Variable Oystercatcher

The Variable Oystercatcher is an endemic species which breeds on the coast. Most birds occupy their territory throughout the year, but some birds form small winter flocks, often associated with flocks of Pied Oystercatchers (Heather & Robertson 1996). In winter, totals averaged about 1400 birds each year, with about twice as many counted in the North Island as in the South Island (Table 4). Summer totals averaged 905 birds, again with about twice as many recorded in the North Island as in the South Island (Table 4).

The estimated total population from the winter counts is 3413 birds (Table 4). However, winter totals probably greatly underestimate the true population size because most birds do not join flocks and during this study no counts were made in Fiordland or southern Stewart Island. In 1970-71, the population was estimated at 2000 birds following a comprehensive survey of coastal New Zealand (Baker 1973). His survey showed that Variable Oystercatchers occurred at many sites in Fiordland and southern Stewart Island, areas not covered during this study. Despite the underestimation of numbers during this study, the estimated population during winter was still substantially greater than that reported by Baker (1973).

Summer

- 1 - 25
- 26 - 50
- 51 - 100
- 101 - 200
- 201 - 350



Winter

- 1 - 25
- 26 - 50
- 51 - 100
- 101 - 200
- 201 - 350

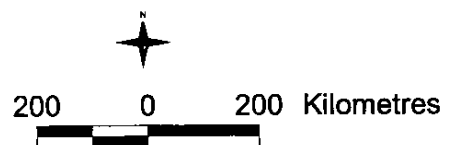
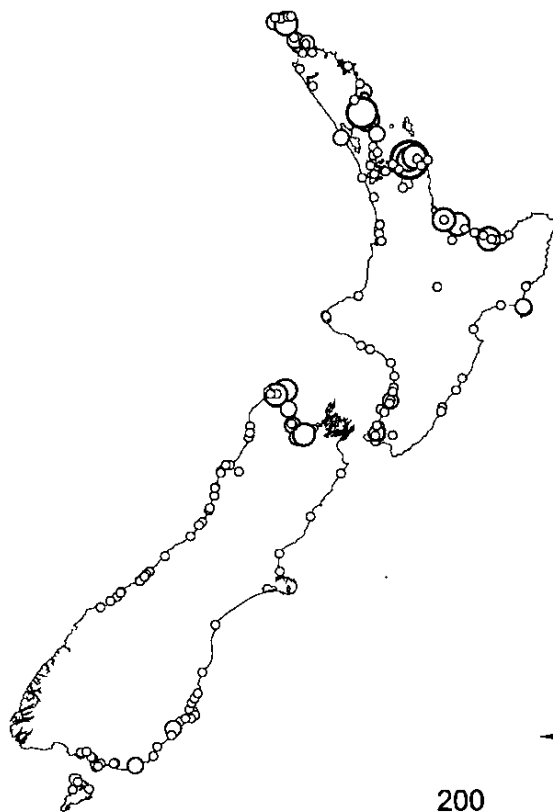


FIGURE 7 – Distribution and numbers of Variable Oystercatchers in New Zealand during summer and winter, 1983-1994.

TABLE 9 – Sites where >50 Variable Oystercatchers were counted, on average, in winter 1984-1994.

Site	No. counts	Mean	SD	Range
Waipu	11	126	32	88-202
Mangawhai Estuary	5	100	23	61-119
Great Exhibition Bay	2	92	43	61-122
Ohope/Ohiwa Harbour	11	82	41	26-136
Waimea Estuary/Nelson Haven	11	80	19	49-115
Tauranga Harbour	11	74	19	50-108
Farewell Spit	11	60	17	43-104
Little Waihi	11	60	30	10-125

Heather & Robertson (1996), using unpublished survey data from the complete coast, including Fiordland and Stewart Island, estimated the population at 4000 birds, a doubling of the numbers since 1970-71.

Favoured areas were in the northern half of the North Island and the Nelson area, with few birds being recorded between the Manawatu Estuary and Auckland on the west coast of the North Island, and between Lake Grassmere and Palmerston, along the eastern coast of the South Island (Fig. 7). In winter, flock sizes rarely averaged over 100 birds (Table 9).

Spur-winged Plover

Spur-winged Plovers breed in a variety of grassland and riverbed habitats (Barlow *et al.* 1972). They are often gregarious when not breeding and flocks of up to several hundred birds may congregate on farmland or wetlands with short vegetation (Heather & Robertson 1996). This behaviour means that the methods used during this study were not appropriate for determining the population size of this species. However, counts are presented for the North Island and the Chatham Islands to provide baseline information about their numbers and rate of range expansion.

North Island totals ranged from 27 (1984) to 1755 (1992) and usually were greater during winter than summer (Table 4). There was a general increase in numbers throughout the study, with winter totals averaging 475 (SD = 295) from 1984 to 1988, and 843 (SD = 236) from 1989 to 1994. Most of these birds were found in Wairarapa and along the east coast of the North Island to Gisborne (Table 10). However, 69 were counted at the Karikari Peninsula, near the northern tip of the North Island during winter 1986. On the Chatham Islands there was also an indication of increased numbers, winter totals from Te Whanga Lagoon were 124 (1988) and 266 (1995), with 155 being counted there in summer 1994.

New Zealand Dotterel

Two subspecies of this endemic have been described (Dowding 1994). The larger Southern New Zealand Dotterel breeds on Stewart Island and regularly disperses to the Invercargill Estuary during winter, while the Northern New Zealand

TABLE 10 – North Island sites where ≥ 30 Spur-winged Plovers were counted, on average, during winter or summer 1983-1994.

Site	No. counts	Mean	SD	Range
Winter				
Lake Wairarapa	9	165	203	36 - 622
Whakaki Lagoon	5	135	93	42 - 360
Lake Poukawa	3	92	11	84 - 100
Porangahau Estuary	11	54	100	0 - 241
Piham-Taranaki	1	48	-	-
Kaituna Cut-Maketu Estuary	11	43	70	0 - 209
Patea River	1	41	-	-
Summer				
Lake Wairarapa	9	442	434	57 - 1495
Lake Poukawa	1	90	-	-
Ahuriri Estuary	11	53	43	11 - 132
Pencarrow-Wellington	1	42	-	-
Waipawa River	1	32	-	-
Lake Onoke	1	30	-	-

Dotterel breeds and winters on the coast of the northern North Island (Heather & Robertson 1996). During this study, summer totals ranged from 106 to 451 birds in the North Island and 0 to 9 birds in the South Island (Table 4). Winter totals ranged from 201 to 711 birds in the North Island, and 1 to 54 birds in the South Island (Table 4). During winter, there were an estimated 944 birds in the North Island and 26 in the South Island (Table 4). In 1994, the northern population was estimated at 1400 birds, and in 1993, the southern at 65 birds (Dowding & Murphy 1993; Dowding 1994). The differences in population counts between the comprehensive surveys completed by Dowding & Murphy (1993) and Dowding (1994), and this study can be explained by the sedentary behaviour of some northern birds; some birds stay in their breeding areas while others move a short distance to a flocking site at an estuary (Dowding & Chamberlin 1991). In addition, some southern birds overwinter at coastal sites in southern Stewart Island (Dowding & Murphy 1993), where no counts were made during the present study. Thus, counts at estuaries during this study would not provide comprehensive coverage of the range of habitats occupied by either subspecies of New Zealand Dotterel.

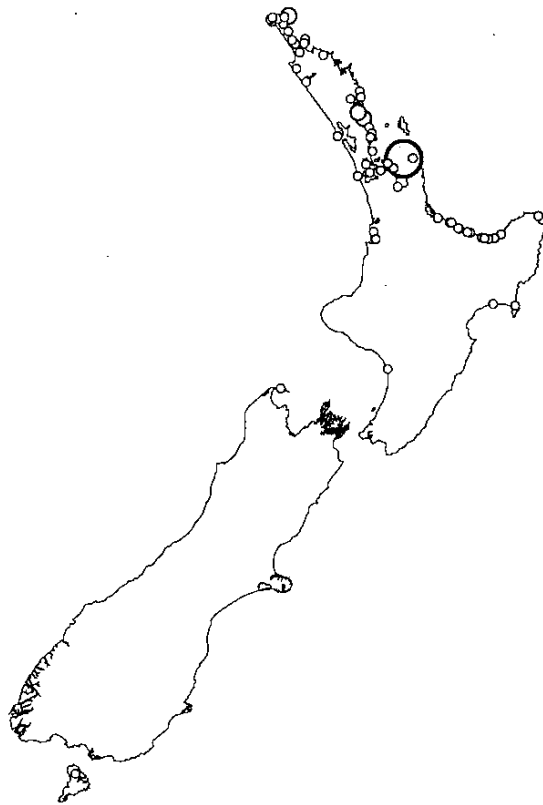
Sites favoured by flocks of Northern New Zealand Dotterels in winter were all in the northern North Island, while Southern New Zealand Dotterels were on Stewart Island, the Invercargill Estuary, and Farewell Spit (Table 11, Fig. 8).

Black-fronted Dotterel

Black-fronted Dotterels breed throughout Australia (Blakers *et al.* 1984), but since colonising New Zealand in the late 1950s (MacKenzie 1962) they have spread to breed on shingle riverbeds of the eastern and southern North Island, and north-eastern and eastern South Island (Heather & Robertson 1996). After the breeding season, most stay on the rivers, but some form flocks at lagoons, lakes, estuaries and sewage ponds (Heather & Robertson 1996).

Summer

- 1 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 101 - 125



Winter

- 1 - 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 60

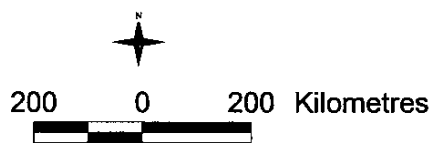
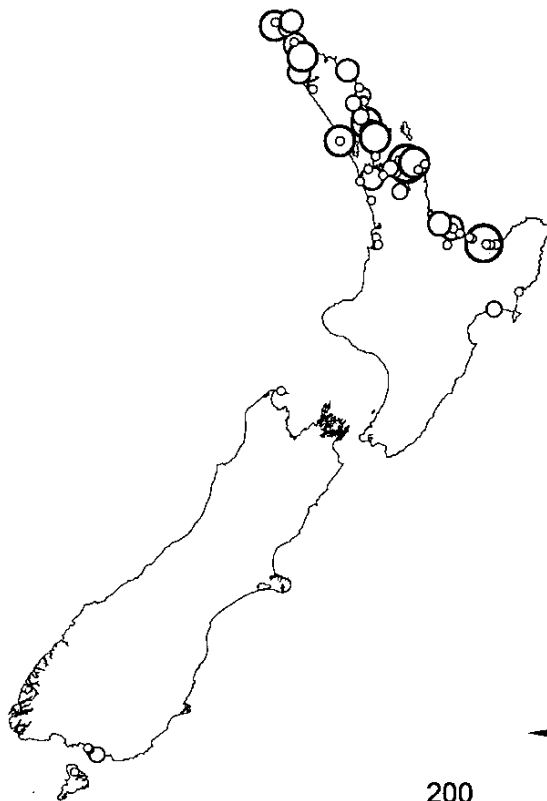


FIGURE 8 – Distribution and numbers of New Zealand Dotterels during summer and winter, 1983-1994.

TABLE 11 – Sites where >25 New Zealand Dotterels were counted, on average, during winter 1984-1994.

Site	No. counts	Mean	SD	Range
Ohope/Ohiwa Harbour	11	51	26	32 - 99
Mangawhai Estuary	11	38	13	23 - 55
Whangapoua Harbour	1	34	-	-
Whangateau Estuary/Omaha Spit	11	32	6	28 - 42
Kaipara Harbour	9	32	6	3 - 64
90-Mile/Twilight	3	34	20	12 - 51
Rangaunu Harbour	5	33	22	13 - 64
Tauranga Harbour	11	29	12	16 - 48

TABLE 12 – Sites where ≥ 5 Black-fronted Dotterels were counted, on average, during winter 1984-1994.

Site	No. counts	Mean	SD	Range
Lake Wairarapa	10	64	52	8 - 175
Ashburton Rivermouth	5	39	59	0 - 115
Kapiti Coast	1	20	-	-
Turanganui Rivermouth	1	17	-	-
Ahuriri Estuary/Westshore Lagoon	11	9	18	0 - 52
Waitangi Estuary	11	8	9	0 - 20
Washdyke Lagoon	8	8	11	0 - 29
Manawatu Estuary	11	7	9	0 - 25
Matata/Tarawera Rivermouth	1	5	-	-

Relatively few birds were counted during this study. Despite an estimated population of 1700 birds in New Zealand (Heather & Robertson 1996), usually fewer than 200 were counted in winter and the summer total only averaged 27 birds (Table 4). Such low counts were probably because most birds stayed on the riverbeds all year. All sites where flocks of non-breeding birds were found in winter (Table 12) were within the known breeding range of the species, with the possible exception of the birds wintering in the Bay of Plenty, which may have come from breeding populations in the Volcanic Plateau.

Black Stilt/hybrid Stilt

Black Stilts are an endemic and now breed only inland in the MacKenzie Basin (Reed 1998). Because of its endangered status, the species has been under intensive management for many years. In 1994, there were 72 adults remaining in the wild (Heather & Robertson 1996), a total similar to that estimated during this study (Table 4), and the breeding locations of these were known. As the Black Stilt population declined, they became widely separated on inland riverbeds and this resulted in some birds interbreeding with Pied Stilts (Pierce 1984). Although Black Stilts are normally sedentary, those mated with Pied Stilts, plus hybrids resulting from these matings, tended to migrate to the coast and northwards at the end of the breeding season. These are the birds which were recorded during this study.

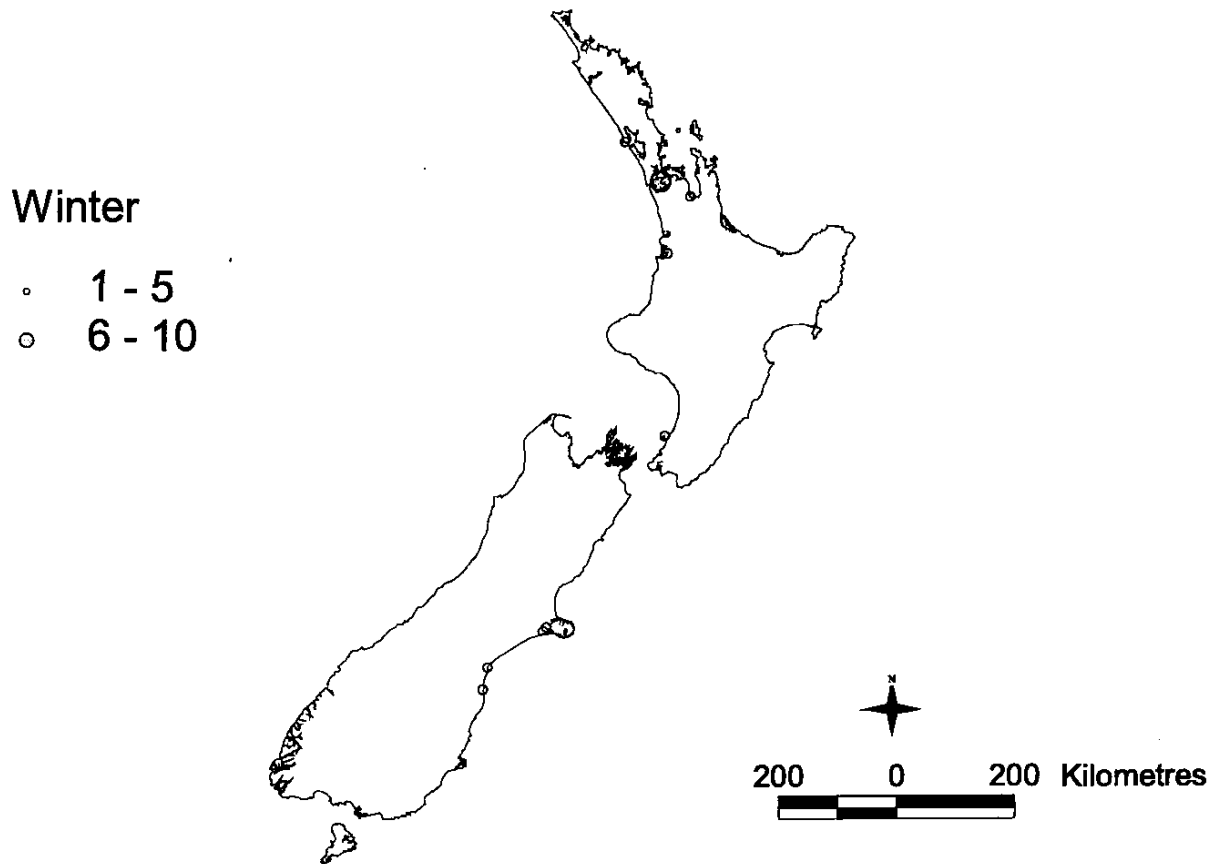


FIGURE 9 – Distribution and numbers of Black/hybrid Stilts in New Zealand during winter, 1984-1994.

In winter, up to 32 Black/hybrid Stilts were counted at coastal sites, with an average of 15 per year (Table 4). Most of these birds were found in the North Island, at Manukau Harbour, Firth of Thames, Kaipara Harbour, and Kawhia Harbour, however, one or two occurred regularly at Lake Ki-Wainono and Washdyke Lagoon (Fig. 9). In summer, a few birds were seen at coastal sites near the MacKenzie Basin breeding area, especially Lake Ki-Wainono, Washdyke Lagoon, and Lake Ellesmere.

Common Northern Hemisphere migrants

1. *Bar-tailed Godwit*

Bar-tailed Godwits migrating to south-eastern Australia and New Zealand are considered to be from populations which breed in eastern Siberia and Alaska (Barter 1989). Although the total number of godwits in the flyway is an estimated 330 000 birds (Watkins 1993), evidence from measurements and movements of birds suggest that these may comprise two populations. Measurements of birds wintering in north-western Australia are significantly different from those of birds wintering in south-eastern Australia (Barter 1989) and no movements have been recorded (by band recoveries or sightings of colour-dyed birds) between north-western and south-eastern Australia (Watkins 1993). However, banded birds from south-east

TABLE 13 Numbers of common migrant waders counted in New Zealand during winter and summer, 1983-1994, (-, not counted.)

Species Season	Year												Mean±SD	Estimated NZ popn
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994		
Bar-tailed Godwit														
Winter	-	10 608	7291	9843	6633	16 323	17 172	15 637	12 229	11 733	14 000	11 723	12 108±3307	14 993
Summer	73 918	85 538	85 323	77 315	87 432	101 771	87 565	80 094	82 768	86 138	66 604	-	83 133±8562	101 698
Lesser Knot														
Winter	-	2397	3503	5418	3480	4832	7145	5348	4707	8248	7023	6305	5310±1696	5806
Summer	48 901	52 162	49 126	47 377	57 869	63 552	42 245	42 418	67 367	59 423	33 054	-	51 227±9713	58 637
Turnstone														
Winter	-	727	292	969	350	488	933	83	293	1436	224	652	586±386	762
Summer	5516	5915	4674	4420	4840	3834	3872	2394	3099	5427	2506	-	4227±1146	5069
Pacific Golden Plover														
Winter	-	0	3	1	6	1	4	2	0	0	1	7	2±2	3
Summer	339	30	568	1120	705	490	348	499	351	251	151	-	466±254	649
Red-necked Stint														
Winter	-	10	51	11	32	56	32	2	37	45	3	11	26±19	28
Summer	213	186	164	195	158	171	95	104	231	161	65	-	158±49	175
Whimbrel														
Winter	-	15	70	14	16	12	9	11	10	43	7	56	24±21	40
Summer	57	105	129	113	106	65	62	33	89	178	42	-	89±41	117
Curlew Sandpiper														
Winter	-	1	6	6	1	11	11	0	3	88	2	5	12±24	13
Summer	77	62	76	102	116	56	29	29	102	136	38	-	75±34	86
Sharp-tailed Sandpiper														
Winter	-	0	0	0	0	0	0	3	1	9	0	2	1±3	1
Summer	76	34	132	93	173	43	53	37	49	48	14	-	68±45	81
Eastern Curlew														
Winter	-	7	22	5	3	14	6	5	1	4	7	7	7±6	9
Summer	26	46	41	40	26	24	28	29	19	22	21	-	29±9	34

TABLE 14 – Sites where > 3000 Bar-tailed Godwits were counted, on average, during summer or winter, 1983-1994.

Site	No. counts	Mean	SD	Range
Summer				
Manukau Harbour	11	15 534	4133	10 693 - 22 571
Farewell Spit	11	13 557	2639	8130 - 17 181
Kaipara Harbour	9	10 381	3204	4995 - 14 507
Firth of Thames	11	6479	2672	2588 - 12 264
Tauranga Harbour	11	5105	835	3850 - 6900
Rangaunu Harbour	6	3975	2153	500 - 7850
Ohope/Ohiwa Harbour	11	3952	549	3200 - 5000
Parengarenga Harbour	9	3717	1441	384 - 5200
Kawhia Harbour	11	3693	879	2400 - 5350
Whangarei Harbour	10	3224	1563	1258 - 7245
Winter				
Manukau Harbour	11	3110	1477	1314 - 5992
Farewell Spit	11	2626	1136	1218 - 4267
Kaipara Harbour	9	1173	602	435 - 2356
Firth of Thames	11	743	339	333 - 1360
Tauranga Harbour	11	732	386	310 - 1501
Rangaunu Harbour	4	154	116	10 - 286
Ohope/Ohiwa Harbour	11	413	198	80 - 700
Parengarenga Harbour	7	333	256	63 - 800
Kawhia Harbour	11	324	232	75 - 867
Whangarei Harbour	11	467	269	18 - 821

ern Australia, Queensland and New Zealand have been observed together on northward migration in Japan (Minton 1993). On this evidence, Barter (1989) suggested that *L.l. menzbieri* visits north-western Australia, while *L.l. baueri* visits south-eastern Australia and New Zealand. Numbers of Bar-tailed Godwits in Australia are estimated at 100 000 in the north-west, 45 000 in the Northern Territory and Queensland, and 15 000 in the south-east (Watkins 1993). The New Zealand population is an estimated 102 000 birds (Table 13). Thus, New Zealand estuaries support a significant proportion of the total population of Bar-tailed Godwits in the East Asian-Australasian flyway. However, if only *L. l. baueri* is considered, then New Zealand supports the majority of the population of this subspecies.

In New Zealand, summer counts ranged from 66 664 (1993) to 101 771 (1988), with 85 000 - 90 000 being recorded in most years (Table 13). Numbers remaining during winter usually ranged from about 10 000 to 17 000 birds (Table 13). Godwits are distributed widely around New Zealand, reaching Stewart Island and the Chatham Islands (Fig. 10). They favoured areas with broad intertidal flats. Usually, over 10 000 were counted each summer at Manukau and Kaipara Harbours and Farewell Spit and these sites also supported >1000 godwits each winter (Table 14).

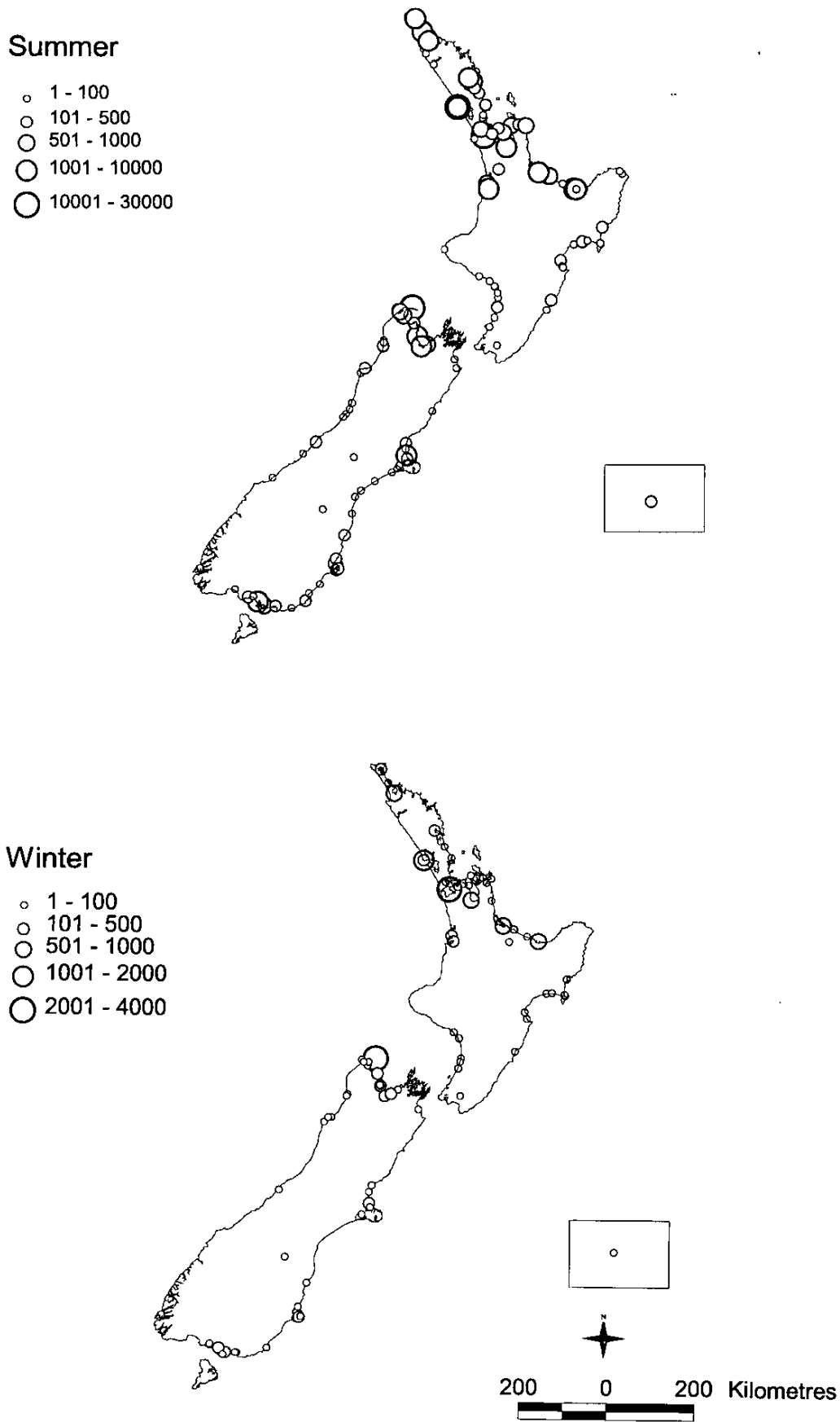


FIGURE 10 – Distribution and numbers of Bar-tailed Godwits in New Zealand during summer and winter, 1983-1994, Inset = Chatham Islands.

TABLE 15 – Sites where >1000 Lesser Knots were counted, on average, during summer or winter, 1983-1994.

Site	No. counts	Mean	SD	Range
Summer				
Manukau Harbour	11	16 083	4472	9950 - 22 433
Farewell Spit	11	15 538	3958	9206 - 24 227
Kaipara Harbour	9	7846	4981	1375 - 16 910
Parengarenga Harbour	10	4897	3868	155 - 13 500
Firth of Thames	11	3848	900	1901 - 5200
Whangarei Harbour	10	2528	1159	856 - 4198
Houhora Harbour	6	1876	676	1100 - 2855
Rangaunu Harbour	6	1839	818	100 - 2500
Winter				
Manukau Harbour	11	3394	1496	45 - 5350
Farewell Spit	11	421	257	220 - 1144
Kaipara Harbour	9	377	264	2 - 676
Parengarenga Harbour	8	569	631	45 - 2000
Firth of Thames	11	506	682	3 - 1835
Whangarei Harbour	11	14	26	0 - 90
Houhora Harbour	6	4	10	0 - 26
Rangaunu Harbour	4	114	166	0 - 400

2. Lesser Knot

Lesser Knots which migrate to Australia and New Zealand are considered to breed on the Chukotski Peninsula, eastern Siberia (Tomokovich 1987, Barter 1992). The East Asian-Australasian flyway population is an estimated 255 000 birds, of which 153 000 migrate to Australia. Summer counts in New Zealand averaged about 51 000 birds, although 67 367 birds were counted in 1991 and the estimated total population during this study was 58 637 birds (Table 13). In addition, 816 were counted in 1988 and 1818 in 1994 on the Chatham Islands (Oates 1996). Winter totals averaged about 10% of the previous summer total (Table 13).

Despite being the second most numerous Arctic migrant in New Zealand during summer, Lesser Knots favoured a few sites, all in the northern harbours or at Farewell Spit (Table 15, Fig. 11). Over 50% of the total each summer was at Manukau Harbour and Farewell Spit; the only sites to average more than 10 000 birds (Table 15). In winter, few sites were occupied by Lesser Knots (Fig. 11) and about 60% of the overwintering population was at Manukau Harbour (Tables 13 & 15). None was seen at the Chatham Islands in June 1995 (Oates 1996).

3. Turnstone

Turnstones breed along the northern coasts and islands of Greenland, Scandanavia, Siberia, Alaska, and the islands of northern Canada (Heather & Robertson 1996). There are an estimated 28 000 Turnstones on the East Asian-Australasian flyway, with about 14 000 of these in Australia (Watkins 1993). However, analysis of measurement data suggests that birds in the north-west and south-east of Australia may be from different areas of the breeding range (Houston & Barter 1990).

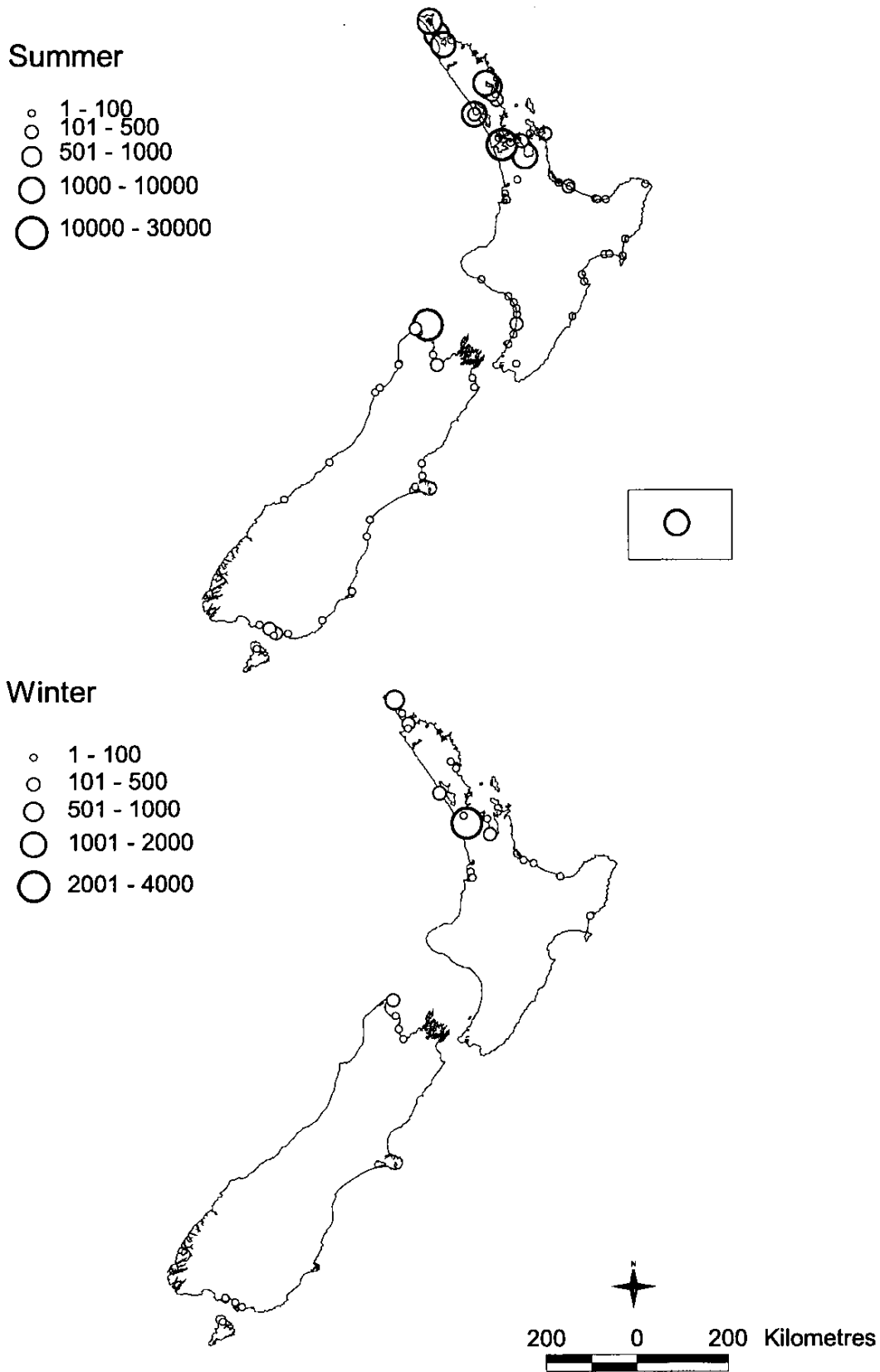


FIGURE 11 – Distribution and numbers of Lesser Knots in New Zealand during summer and winter, 1983-1994. Inset = Chatham Islands.

TABLE 16 – Sites where >50 Turnstones were counted, on average, during summer or winter, 1983-1994.

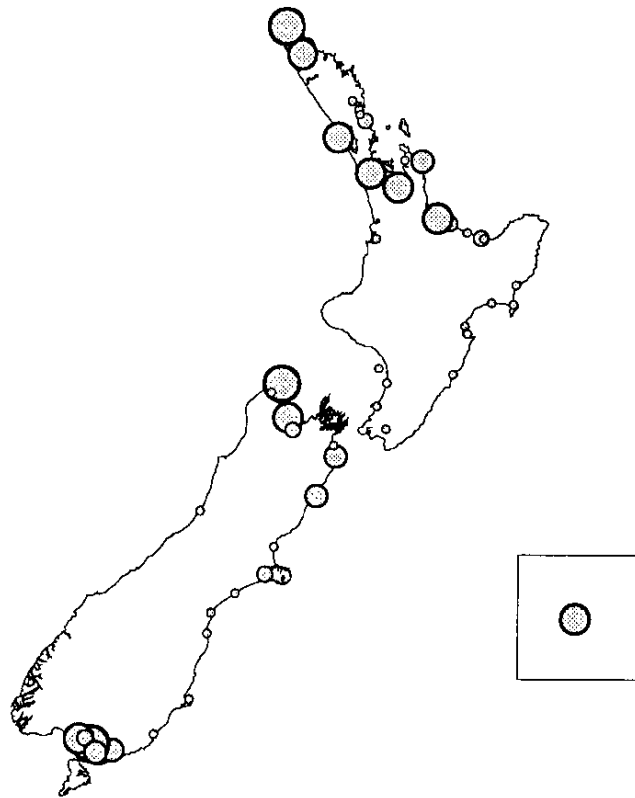
Site	No. counts	Mean	SD	Range
Summer				
Parengarenga Harbour	8	915	465	409 - 1500
Farewell Spit	11	846	351	598 - 1792
Invercargill Estuary	10	574	250	276 - 1150
Manukau Harbour	11	427	205	130 - 803
Kaipara Harbour	9	423	200	35 - 618
Rangaunu Harbour	6	256	165	0 - 372
Motueka Estuary	11	252	130	0 - 434
Tauranga Harbour	11	250	70	170 - 402
Awarua Bay	11	203	165	16 - 333
Firth of Thames	11	106	54	42 - 196
Riverton Estuary	10	104	115	0 - 338
Fortrose	10	75	39	13 - 137
Kaikoura Peninsula	11	71	35	8 - 132
Lake Grassmere	10	58	66	0 - 200
Winter				
Parengarenga Harbour	8	165	188	0 - 600
Farewell Spit	11	176	121	2 - 376
Invercargill Estuary	10	21	21	0 - 75
Manukau Harbour	11	81	57	0 - 201
Kaipara Harbour	9	50	43	1 - 138
Rangaunu Harbour	4	9	8	0 - 21
Motueka Estuary	11	21	36	0 - 119
Tauranga Harbour	11	23	24	0 - 80
Awarua Bay	10	32	36	0 - 132
Firth of Thames	11	14	19	0 - 62
Riverton Estuary	10	<1	1	0 - 3
Fortrose	10	<1	1	0 - 4
Kaikoura Peninsula	11	21	21	0 - 74
Lake Grassmere	11	4	9	0 - 29

In New Zealand, 4000-6000 Turnstones were counted in most summers and the estimated total population was about 5000 birds (Table 13), while a further 210 (1988) and 397 (1994) birds were counted on the Chatham Islands. About 100 birds occur most summers on the Auckland Islands (Heather & Robertson 1996). A highly variable number of birds (83-1436) overwintered during the study period (Table 13). These comprised 3-45% of the previous summer's count; 3.5% (14/397) birds overwintered at the Chatham Islands in June 1995 (Oates 1996).

Turnstones occurred throughout New Zealand, although rarely on the western coast of the South Island (Fig. 12). Favoured sites tended to be in the northern harbours, Nelson-Marlborough region, and southern estuaries (Fig. 12). Parengarenga Harbour and Farewell Spit were the most favoured sites during both summer and winter (Table 16). Although, in summer, several hundred birds could also occur at Manukau Harbour, Kaipara Harbour, Rangaunu Harbour, the Firth of Thames, and Tauranga Harbour in the north; Motueka Estuary, L. Grassmere, and the Kaikoura Peninsula in the northern South Island; and Awarua Bay, Riverton Estuary, Fortrose, and the Invercargill Estuary in southern South Island (Table 16).

Summer

- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 500
- 501 - 1000



Winter

- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 150
- 151 - 200

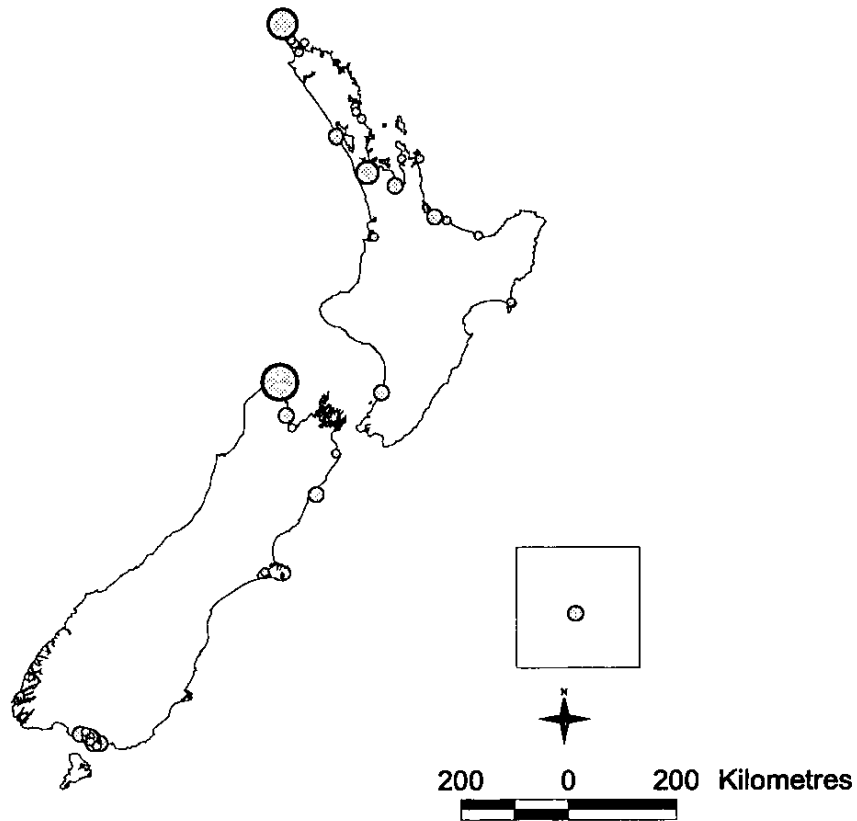


FIGURE 12 – Distribution and numbers of Turnstones in New Zealand during summer and winter, 1983-1994. Inset = Chatham Islands.

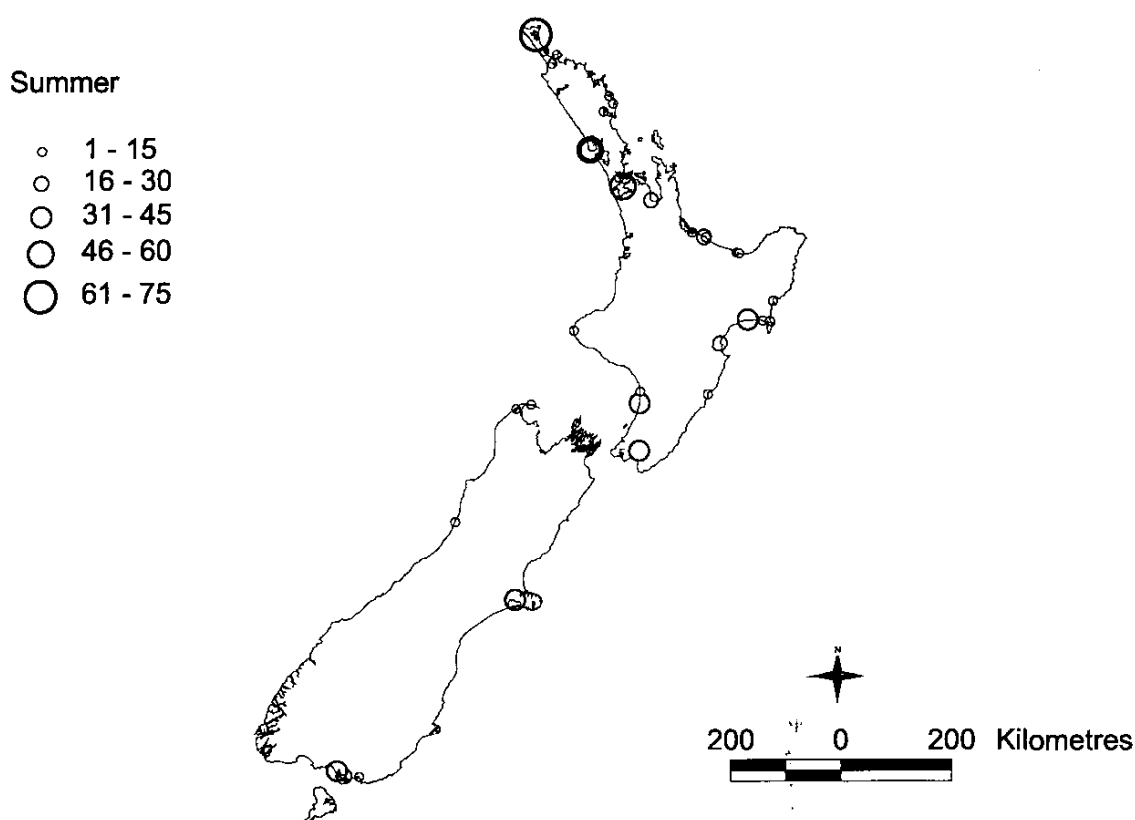


FIGURE 13 – Distribution and numbers of Pacific Golden Plovers in New Zealand during summer, 1983-1993.

4. *Pacific Golden Plover*

Pacific Golden Plovers breed in the arctic and subarctic tundra of Siberia and western Alaska (Heather & Robertson 1996). They migrate south after breeding and have been reported in many countries within the East Asian-Australasian flyway, where the population was estimated at 90 000 birds (Watkins 1993). In New Zealand, the numbers counted during summer ranged from 151 (1993) to 1120 (1987) birds, with an estimated national total of 649 birds (Table 13). Few remain in the winter, the highest total being 7 in 1994 (Table 13). Although they are seldom reported far from the coast, they prefer to feed on grassland, saltmarsh, and the upper levels of tidal flats (Robertson & Dennison 1979; Heather & Robertson 1996) and often do not gather at high tide roosts. This makes them difficult to locate (McKenzie 1967a), and so they may have been under-reported during these counts.

They were widespread in New Zealand, from Parengarenga Harbour in the Far North to the Invercargill Estuary in Southland (Table 17, Fig. 13). Highest numbers were in Parengarenga, Kaipara and Manukau Harbours and Lakes Wairarapa and Ellesmere (Table 17). However, at all sites numbers varied widely between summers (Table 17), which may reflect difficulty in locating the species, low site fidelity, or differences in habitat availability at lake and non-estuarine sites (e.g., they leave Lake Wairarapa in flood conditions, when their habitat is inundated, and they usually do not return that season: H.A. Robertson, pers. comm.).

TABLE 17 – Sites where ≥ 10 Pacific Golden Plovers were counted, on average, in summer 1983-1993.

Site	No. counts	Mean	SD	Range
Parengarenga Harbour	8	75	75	0 - 200
Kaipara Harbour	9	49	28	0 - 90
Manukau Harbour	11	47	23	6 - 80
Lake Wairarapa	10	43	44	0 - 151
Lake Ellesmere	11	39	44	0 - 128
Invercargill Estuary	9	34	34	0 - 87
Manawatu Estuary	11	32	8	21 - 47
Firth of Thames	11	32	46	0 - 150
Kaituna Cut/Maketu Estuary	11	27	17	0 - 48
Ahuriri Estuary	11	23	17	0 - 61
Awarua Bay	10	18	18	0 - 57
Wairoa Estuary	11	17	18	0 - 65
Farewell Spit	11	15	10	2 - 36
Ohope/Ohiwa Harbour	11	10	5	0 - 18

TABLE 18 – Sites where ≥ 5 Red-necked Stints were counted, on average, during summer 1983-1993.

Site	No. counts	Mean	SD	Range
Lake Ellesmere	11	68	28	24 - 125
Awarua Bay	11	27	19	0 - 64
Manukau Harbour	11	16	9	4 - 35
Farewell Spit	11	15	7	0 - 25
Porangahau Estuary	8	7	5	0 - 14
Parengarenga Harbour	8	6	8	0 - 18
Kaipara Harbour	9	5	4	0 - 11
Lake Grassmere	11	5	5	0 - 14
Firth of Thames	11	5	6	0 - 20

5. Red-necked Stint

Red-necked Stints breed in northern Siberia and migrate to Malaysia, the Philippines, and Australasia (Heather & Robertson 1996). They are the most abundant migrant wader in Australasia, with an estimated 353 000 of the 471 000 birds in the flyway migrating to Australia (Watkins 1993), particularly south-eastern Australia (Lane 1987). Usually, 65-195 birds were counted during summer and up to 50 birds during winter (Table 13). Often, they associated with Wrybills and Curlew Sandpipers, and most were reported from sites where these species also occurred (Tables 8, 18 & 20), particularly in the northern harbours, Porangahau Estuary, Farewell Spit, and Lakes Grassmere and Ellesmere. The exception was Awarua Bay, where Wrybills are seldom reported. The largest flocks (64-125 birds) were reported from Lake Ellesmere and Awarua Bay (Table 18). They were reported from few other estuaries (Fig. 14).

Summer

- 1 - 15
- 16 - 30
- 31 - 45
- 46 - 60
- 61 - 75

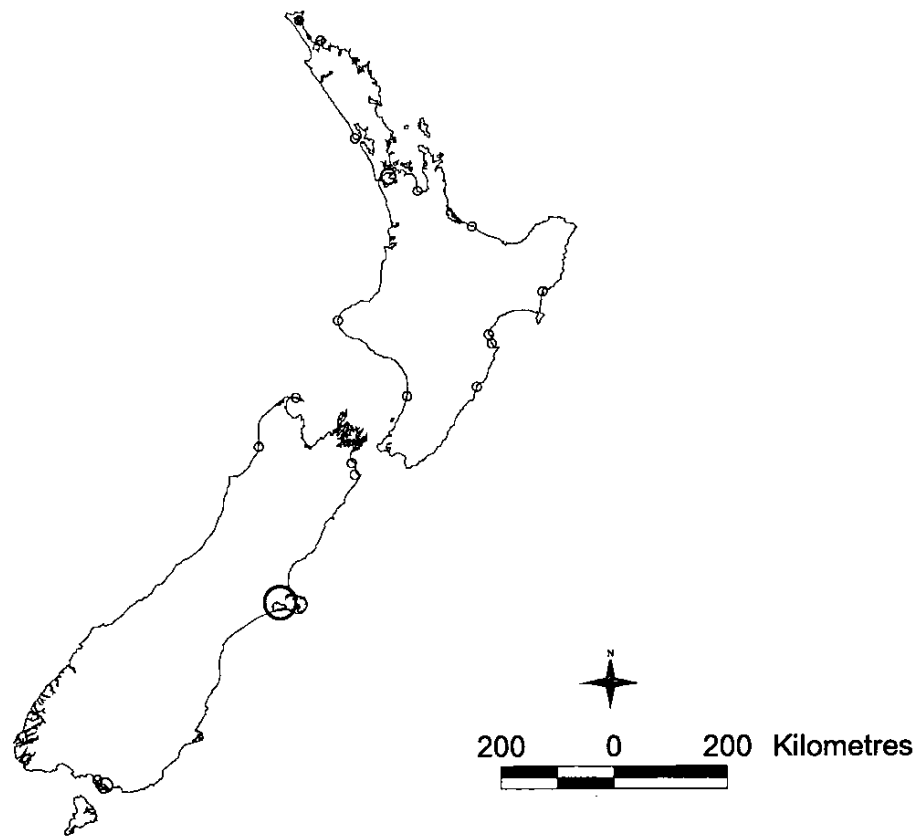


FIGURE 14 – Distribution and numbers of Red-necked Stints in New Zealand during summer, 1983-1993.

Summer

- 1 - 5
- 6 - 10
- 11 - 15

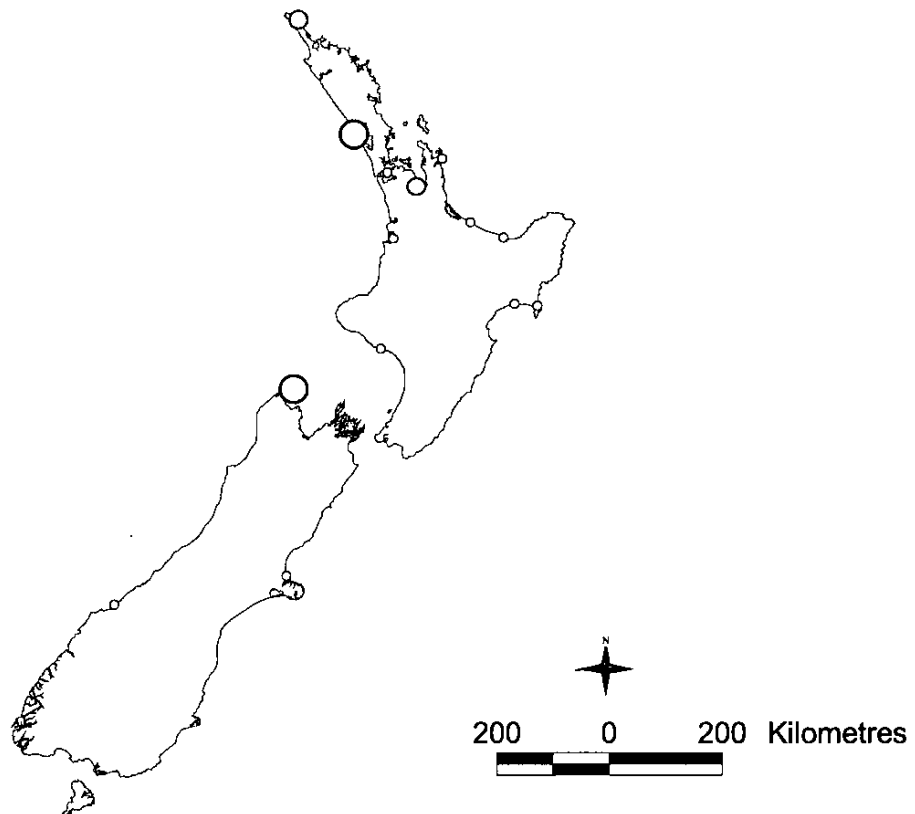


FIGURE 15 – Distribution and numbers of Whimbrels in New Zealand during summer, 1983-1993.

TABLE 19 – Sites where ≥ 3 Whimbrels were counted, on average, in summer 1983-1993.

Site	No. counts	Mean	SD	Range
Parengarenga Harbour	8	26	17	0 - 53
Firth of Thames	11	19	14	0 - 47
Kaipara Harbour	9	16	12	0 - 39
Farewell Spit	11	15	8	1 - 29
Manukau Harbour	11	6	5	0 - 15
Kaituna Cut/Maketu Estuary	11	3	2	0 - 7
Ohope/Ohiwa Harbour	11	3	2	0 - 5

6. *Whimbrel*

Two of the three subspecies of Whimbrel occur regularly in New Zealand (Turbott 1990). The Asiatic Whimbrel, which breeds in eastern Siberia, is the more common form reported from Australasia (Heather & Robertson 1996; Higgins & Davies 1996), with an estimated flyway population of 40 000, of which 10 000 migrate to Australia (Watkins 1993). The American Whimbrel breeds in northern North America and regularly visits New Zealand in small numbers (Heather & Robertson 1996). The majority of Whimbrel sightings submitted during the National Wader Counts did not distinguish between subspecies, and so all reports of Whimbrels are combined for this analysis.

Numbers in summer ranged from 33 (1990) to 178 (1992) and in winter from 7 (1993) to 70 (1985) (Table 13). Most Whimbrels were at the large northern harbours and Farewell Spit (Table 19), but 1-2 birds were reported from many estuaries throughout the country (Fig. 15). Two American Whimbrels were at Te Whanga Lagoon, Chatham Islands, in November 1994 (Oates 1996). The largest flocks reported were 46 and 53 birds in 1986 and 1992 respectively, at Parengarenga Harbour. The wide range and SD of numbers occurring in summer and winter may indicate wide fluctuations in the breeding success of Whimbrels or that the species is at the limit of its migratory range in New Zealand. Given the large numbers which migrate to Australia and the relatively few which reach New Zealand, the latter may be more likely.

7. *Curlew Sandpiper*

Curlew Sandpipers breed in high arctic central Siberia and a few have bred in Alaska (Heather & Robertson 1996). The East Asian-Australasian flyway population was estimated at 250 000 birds, of which 188 000 migrate to Australia (Watkins 1993). In New Zealand, 29-106 (mean 75 birds) were recorded each summer, with 0-88 birds (mean 12 birds) remaining over winter. (Table 13). Small numbers (1-3 birds) were reported from many estuaries in summer (Fig. 16), but largest numbers (11-59 birds) were regularly at Lake Ellesmere, Firth of Thames, Parengarenga Harbour, Awarua Bay, and Farewell Spit (Table 20).

Summer

- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 30
- 31 - 40

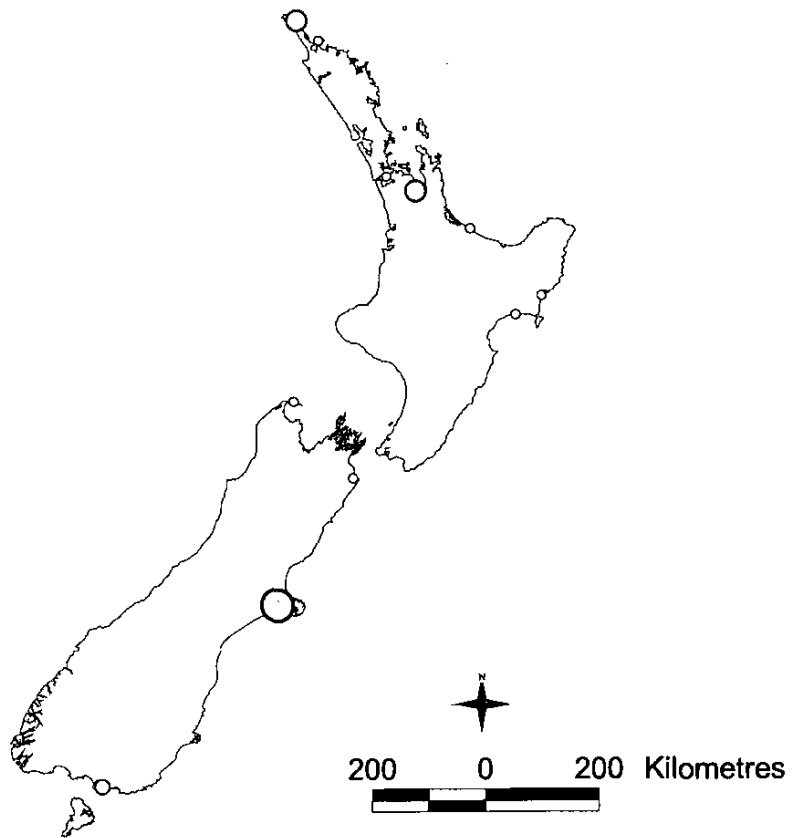


FIGURE 16 – Distribution and numbers of Curlew Sandpipers in New Zealand during summer, 1983-1993.

Summer

- 1 - 5
- 6 - 10
- 11 - 15

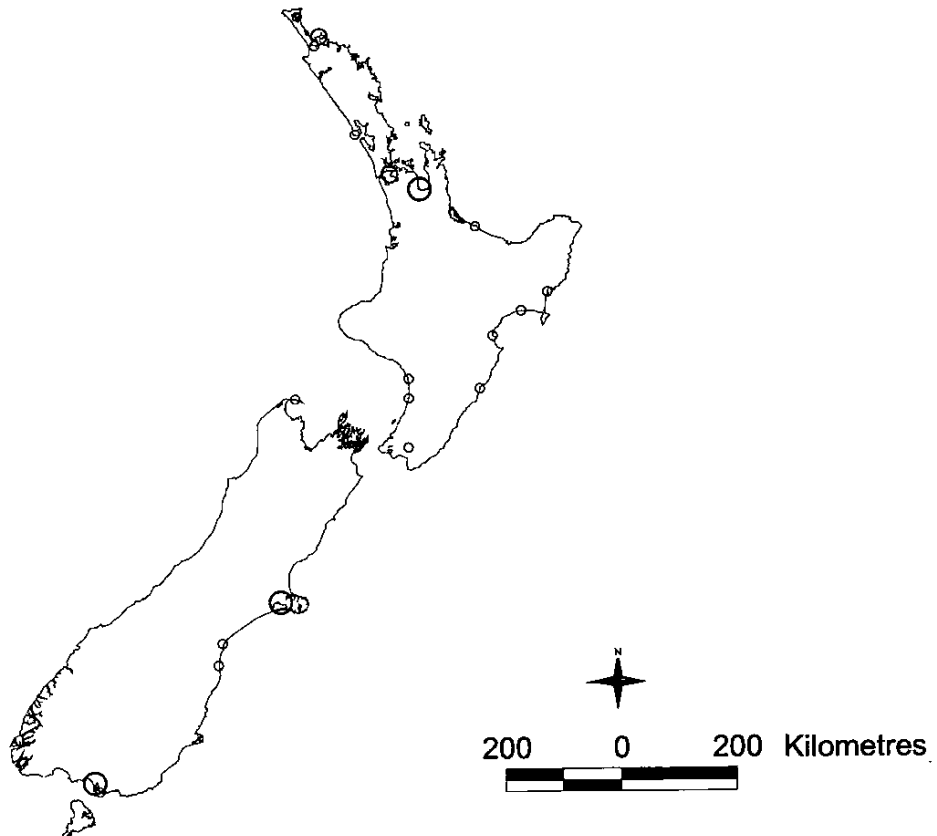


FIGURE 17 – Distribution and numbers of Sharp-tailed Sandpipers in New Zealand during summer, 1983-1993.

TABLE 20 – Sites where ≥ 3 Curlew Sandpipers were counted, on average, during summer 1983-1993.

Site	No. counts	Mean	SD	Range
Lake Ellesmere	11	30	16	5 - 59
Firth of Thames	11	15	10	0 - 36
Parengarenga Harbour	9	14	15	0 - 39
Awarua Bay	11	10	10	0 - 37
Farewell Spit	11	3	3	0 - 11

TABLE 21 – Sites where ≥ 5 Sharp-tailed Sandpipers were counted, on average, during summer 1983-1993.

Site	No. counts	Mean	SD	Range
Firth of Thames	11	13	12	4 - 40
Lake Ellesmere	11	11	14	0 - 48
Invercargill Estuary	11	11	17	0 - 46
Manukau Harbour	11	9	6	2 - 18
Karikari Peninsula	5	7	5	0 - 15
Kaituna Cut/Maketu Estuary	11	5	4	0 - 13

8. Sharp-tailed Sandpiper

Sharp-tailed Sandpipers breed in north-eastern Siberia (Heather & Robertson 1996). Almost all of the East-Asian-Australasian flyway population of 166 000 birds migrate to Australia (Watkins 1993), mostly in the south-east (Blakers *et al.* 1984). A few birds from this population reach New Zealand, where 14 - 173 (mean 68) birds were counted (Table 13). However, numbers in south-eastern Australia do not peak until January and early February (Lane 1987), and so more birds may reach New Zealand after the summer counts were completed. They were reported from estuaries or lakes throughout the country (Fig. 17), with largest numbers (13-48 birds) at northern (Firth of Thames, Manukau Harbour, Karikari Peninsula, Kaituna Cut/Maketu Estuary) and southern (L. Ellesmere, Invercargill Estuary) sites (Table 21). A flock of 20 was at Te Whanga Lagoon, Chatham Islands, in November 1988. Few overwintered (Table 13), despite the moderate numbers regularly reaching New Zealand during the summer.

9. Eastern Curlew

The Eastern Curlew is the largest of the wader species to occur in New Zealand. It breeds in northeastern Asia (Heather & Robertson 1996) and migrates primarily to Australia, where 19 000 occur in summer (Watkins 1993). In New Zealand, numbers reported during summer have declined during the period of this study, 26-47 were counted annually from 1983 to 1986, 26-29 from 1987 to 1990, and 19-22 from 1991 to 1993 (Table 13). Unlike other migrant waders, a high proportion (mean 25.6%, SD 15.0%, range 3.4-53.8%) of birds remained over winter (Table 13).

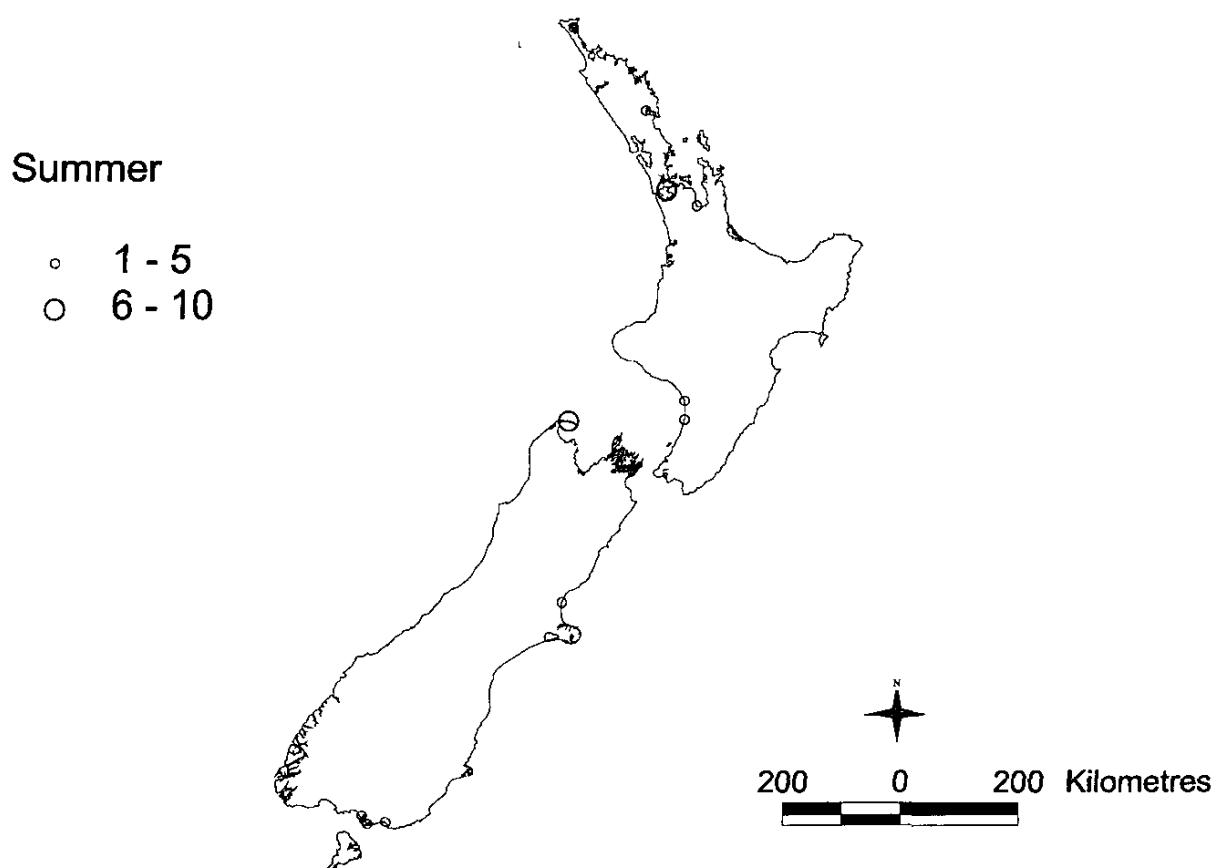


FIGURE 18 – Distribution and numbers of Eastern Curlews in New Zealand during summer, 1983-1993.

The Eastern Curlew is widespread in New Zealand, occurring regularly at sites from Parengarenga Harbour to Waituna Lagoon, on the southern coast of the South Island (Table 22, Fig. 18). Despite this distribution, Eastern Curlews were reported year after year from just a few sites (Table 21). In summer, most birds were reported from just three sites - Manukau Harbour, the Firth of Thames, and Farewell Spit. Up to 11 were reported from Waituna Lagoon from 1983 to 1985, but then the mouth of the lagoon became closed and water levels rose to become too high for feeding of waders during the period 1986-1990.

TABLE 22 – Sites where ≥ 1 Eastern Curlews were counted, on average, in summer 1983-1993.

Site	No. counts	Mean	SD	Range
Manukau Harbour	11	9	4	2 - 19
Farewell Spit	11	8	2	5 - 13
Firth of Thames	11	4	2	1 - 8
Waituna Lagoon	6	4	5	0 - 11
Parengarenga Harbour	8	2	1	0 - 4
Manawatu Estuary	11	1	1	0 - 3
Whangarei Harbour	11	1	3	0 - 10
Ashley Estuary	10	1	1	0 - 2

TABLE 23 - Numbers of rare migrant waders counted in New Zealand during summer and winter 1983-1994. (-, not counted)

Species	Year												Mean±SD	
	Season	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993		1994
Large Sand Dotterel														
Winter	-	2	0	0	0	0	1	0	2	1	0	0		1±1
Summer	2	0	1	5	3	2	0	0	0	0	0	-		1±2
Mongolian Dotterel														
Winter	-	0	1	1	1	2	3	2	0	1	0	0		1±1
Summer	2	1	0	0	2	2	0	2	0	0	0	-		1±1
Grey Plover														
Winter	-	0	0	0	0	0	0	0	1	0	0	0		0
Summer	2	5	8	0	0	1	0	0	3	1	9	-		3±3
Sanderling														
Winter	-	0	0	0	0	0	0	0	1	0	0	0		0
Summer	0	2	8	4	2	2	1	1	1	1	0	-		3±3
Pectoral Sandpiper														
Winter	-	0	0	0	0	1	0	0	0	0	0	0		0
Summer	6	3	5	9	6	5	1	4	2	2	5	-		4±2
Black-tailed Godwit														
Winter	-	0	8	1	0	0	0	0	0	0	0	0		1±2
Summer	0	0	2	0	0	0	1	1	4	2	0	-		1±1
Hudsonian Godwit														
Winter	-	0	0	1	1	1	1	2	0	1	1	0		1±1
Summer	0	2	2	2	1	2	1	2	0	0	0	-		1±1
Tattler species														
Winter	-	1	1	1	3	1	4	2	2	3	0	0		2±1
Summer	8	9	12	13	7	9	12	7	2	11	1	-		8±4
Greenshank														
Winter	-	1	1	1	1	2	2	0	0	0	0	0		1±1
Summer	0	0	4	4	1	3	6	0	0	1	2	-		2±2
Marsh Sandpiper														
Winter	-	0	0	0	1	2	3	0	0	1	1	0		1±1
Summer	1	2	2	2	1	3	1	1	0	0	0	-		1±1
Terek Sandpiper														
Winter	-	0	1	0	2	0	0	0	1	1	0	2		1±1
Summer	1	3	8	9	5	2	4	1	3	2	1	-		4±3

Rare Northern Hemisphere migrants

Each year, some species of waders reach New Zealand in small numbers and associate with the flocks of other waders. While some of these species occur most years they are defined as uncommon or rare migrants; those that stray from their regular migration route and reach New Zealand only occasionally are termed vagrants. The following is a summary of rare migrants reported during this study.

The Siberian Tattler is an annual visitor which has been reported widely from several sites throughout New Zealand, but mainly from northern harbours, Farewell Spit and Kaikoura Peninsula (Heather & Robertson 1996). The Wandering Tattler is possibly also an annual migrant, but is reported less often than Siberian Tattler. Most of the reports made during this study did not distinguish between these two species, and so totals have been combined. The counts show that tattlers occurred annually and that some overwintered in most years (Table 23). Likewise, Terek Sandpipers also visited annually and overwintered occasionally. Pectoral Sandpipers visited annually, but rarely overwintered. Large Sand Dotterel, Mongolian Dotterel, Grey Plover, Sanderling, Hudsonian Godwit, Greenshank, and Marsh Sandpiper all visited during summer in most years. However, while some Large Sand Dotterels, Mongolian Dotterels, Hudsonian Godwits, Greenshanks, and Marsh Sandpipers remained over winter, Grey Plover and Sanderling rarely did so. Asiatic Black-tailed Godwits were rarely reported in either summer or winter.

CONCLUSIONS

This study shows that New Zealand estuaries support a large and varied population of waders, which changes dramatically with season. Of the native species, the Pied Oystercatcher is the most abundant and its population size has increased markedly since 1940. Winter counts of Pied Stilt and Banded Dotterel are the first available for these species, but both significantly underestimate their total populations, primarily because not all birds flock at estuaries and many Banded Dotterels migrate to Australia after breeding. Significant proportions of the East Asian-Australasian flyway populations of Bar-tailed Godwit, Lesser Knot and Turnstone migrate to New Zealand estuaries after breeding, and many pre-breeders remain for their first northern summer following their arrival here. New Zealand is at the extreme limit of the migration routes for many arctic species and only a small proportion of the flyway populations of these species occur here each year. Most waders favoured relatively few estuaries, especially the large harbours of the northern North Island, Farewell Spit, and southern parts of the South Island. Large coastal lakes such as Wairarapa, Grassmere and Ellesmere, plus smaller estuaries such as the Ahuriri/Westshore complex, Porangahau, and Manawatu Estuaries supported as great a variety of species as where the largest numbers of waders congregated. This study provides information about the extent to which waders use particular estuaries. As such it provides just one type of the information required to put in place effective conservation action. Information is now required to determine the ecology and population dynamics of the wader species, what role each site plays in the annual cycles of each species, and what features of each site determine how it is used by the various wader species.

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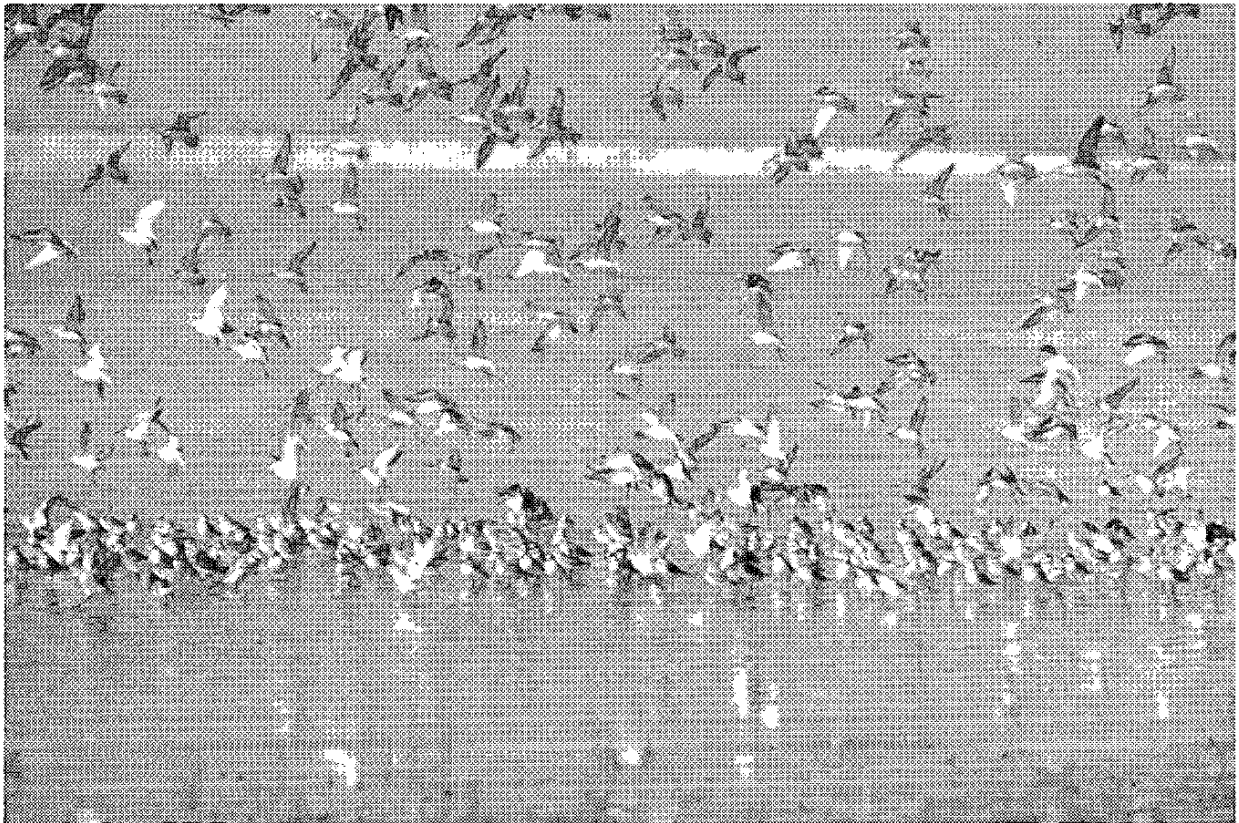
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APPENDIX 1

Common and scientific names (after Turbott 1990) and status (after Heather & Robertson 1996) of species mentioned in the text. Those species listed by Cromarty & Scott (1996) as being of conservation concern have their status marked with a *.

Common name	Scientific name	Status
Pied Oystercatcher	<i>Haematopus ostralegus</i>	Native
Variable Oystercatcher	<i>Haematopus unicolor</i>	Endemic*
Pied Stilt	<i>Himantopus himantopus</i>	Native
Black Stilt	<i>Himantopus novaehollandiae</i>	Endemic*
Northern New Zealand Dotterel	<i>Charadrius obscurus aquilonius</i>	Endemic*
Southern New Zealand Dotterel	<i>Charadrius obscurus obscurus</i>	Endemic*
Banded Dotterel	<i>Charadrius bicinctus</i>	Endemic*
Black-fronted Dotterel	<i>Charadrius melanops</i>	Native
Large Sand Dotterel	<i>Charadrius leschenaultii</i>	Migrant
Mongolian Dotterel	<i>Charadrius mongolus</i>	Migrant
Wrybill	<i>Anarhynchus frontalis</i>	Endemic*
Pacific Golden Plover	<i>Pluvialis fulva</i>	Migrant*
Grey Plover	<i>Pluvialis squatarola</i>	Migrant*
Spur-winged Plover	<i>Vanellus miles</i>	Native
Turnstone	<i>Arenaria interpres</i>	Migrant
Lesser Knot	<i>Calidris canutus</i>	Migrant
Sanderling	<i>Calidris alpina</i>	Migrant
Curlew Sandpiper	<i>Calidris ferruginea</i>	Migrant*
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Migrant*
Pectoral Sandpiper	<i>Calidris melanotos</i>	Migrant
Red-necked Stint	<i>Calidris ruficollis</i>	Migrant*
Eastern Curlew	<i>Numenius madagascariensis</i>	Migrant*
Asiatic Whimbrel	<i>Numenius phaeopus variegatus</i>	Migrant*
American Whimbrel	<i>Numenius phaeopus hudsonicus</i>	Migrant*
Eastern Bar-tailed Godwit	<i>Limosa lapponica</i>	Migrant
Black-tailed Godwit	<i>Limosa limosa</i>	Migrant
Wandering Tattler	<i>Tringa incana</i>	Migrant*
Grey-tailed Tattler	<i>Tringa brevipes</i>	Migrant*
Greenshank	<i>Tringa nebularia</i>	Migrant
Marsh Sandpiper	<i>Tringa flavipes</i>	Migrant
Terek Sandpiper	<i>Tringa terek</i>	Migrant*



Wrybills (*Anarhynchus frontalis*) at Miranda.

(Geoff Moon)