

Population numbers of the Caspian tern (*Sterna caspia*) in New Zealand

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Abstract During 1971-75 and 1991-95, surveys of Caspian tern (*Sterna caspia*) colonies throughout New Zealand were carried out. The breeding population in 1971-75 was 1266 pairs, in 16 colonies, predominately in the northern North Is. In 1991-95, there were 1190 breeding pairs found in 17 mainly northern colonies, suggesting the population had been relatively stable over the 20-year period. As census methodology may under-record the breeding of isolated pairs, we included an estimate of the number of isolated pairs to give a total national population of 1300-1400 breeding pairs. This is less than 3% of the global population. Colony size and location showed some change between survey periods; 6 colonies disappeared and 8 new colonies were formed. Addition surveys in 2011-2015 are recommended to compare recent population trends.

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INTRODUCTION

The Caspian tern (*Sterna caspia*) is the largest of the terns (length 47-54 cm, wingspan 130-145 cm, weight 680 g) with an almost cosmopolitan distribution, with breeding occurring in North America, Europe, Africa, Asia and Australasia (Higgins & Davis 1996). The global population is estimated at 50,000 breeding pairs (de Hoyó *et al.* 1996).

In New Zealand, Caspian terns breed in colonies or isolated pairs in coastal areas throughout the country, but especially on the northern harbours of the North Is. Some breeding also occurs about the central lakes of the North Is, and on inland braided rivers of the South Is (Heather & Robertson 1996; Higgins & Davis 1996). Colonies in the South Is are at the southern limit for the species. Due to the scarcity of 18th and early 19th century records, Sibson (1992) suggested the Caspian tern might be a relatively recent colonist. Fossil bones have since been recorded from Northland, but not from extensive dune collections further south. Possibly the species was once confined to northern New Zealand (Worthy & Holdaway 2002).

The breeding biology of Caspian terns is relatively well known in New Zealand, especially from studies of isolated pairs in Canterbury by Pierce (1984) and a Southland colony by Barlow and Dowding (2002). Most Caspian terns nest in loose colonies, with the nest being a shallow sparsely-lined scrape in the ground (Heather & Robertson 1996; Higgins & Davis 1996; Barlow and Dowding 2002). Laying is from late September to late December (Pierce 1984; Heather & Robertson 1996; Barlow and Dowding 2002); with 1-3 eggs (average 2.0 Southland; 2.3 Canterbury) laid generally 2 days apart (Pierce 1984; Barlow & Dowding 2002). The incubation period is 27 days, and hatching success 81% in Southland and 73% in Canterbury (Pierce 1984; Barlow & Dowding 2002). Chicks hatch over several days and when food is in short supply the youngest starve (Pierce 1984; Heather & Robertson 1996). Chicks move from nests after 4 days and are very mobile from 14 days old (Barlow and Dowding 2002). The mean fledging period is 35 days, with annual productivity between 0.6-1.0 chicks fledged pair⁻¹ in Southland (Barlow and Dowding 2002) and 0.6 in Canterbury (Pierce 1984).

During 1972-74 members of the Ornithological Society of New Zealand (OSNZ) carried out a survey

of Caspian tern colonies across the country. This survey was repeated in 1992. Based on the results of these surveys and other published information, primarily Classified Summarised Notes, we describe the distribution and number of breeding pairs of Caspian tern colonies in New Zealand during 1971-75, and 1991-95.

METHODS

Surveys

During 1972-74, and 1992 the scheme convener (BDB) sent OSNZ Regional Representatives survey forms to record counts of breeding Caspian terns. Details recorded included colony (or isolated breeding pair) location, number of adult birds present, number of nests and their contents, and the number of free-roaming chicks. Completed forms were returned to BDB at the end of each breeding season.

Although outside the original survey period, a number of returns were sent in for 1971, 1975 and 1993. We have included these, and other published counts (primarily from Classified Summarised Notes), to estimate the Caspian tern population size during the first five years of each decade; 1971-75 and 1991-95.

Data analysis

The timing of counts varied at each colony throughout the country, and included counts of nests and free-roaming chicks. To estimate the population during each 5-year period we used the highest count for each colony, therefore giving an estimate of maximum national population size.

Many returns included counts of empty nests. Here we use only counts of nests with contents take into account the number of free-roaming chicks when determining the number of breeding pairs at each colony. We exclude counts of empty nests as the concept of brood nests, as described by Barlow & Dowding (2002), was unknown during both survey periods. When chicks 1st become mobile they are found in unlined hollows near to the original nest (Barlow & Dowding 2002). The inevitable counting of these brood nests during the surveys would have over-estimated the number of pairs breeding at the colony.

To calculate the number of pairs from counts of free-roaming chicks we used data from Barlow & Dowding (2002). Using an average clutch size of 2.04, and hatching success of 81%, we calculate a hatching rate of 1.65 chicks pair⁻¹. Given that counts occurred at various stages of the breeding cycle, we determine that the number of chicks alive at any point of time pair⁻¹ as the medium value between the hatch rate and fledging rate. With average annual productivity of 0.88 fledged chicks pair⁻¹,

Table 1 The number of breeding pairs and colonies of Caspian tern within each OSNZ region during 1971-75 and 1991-95. Returns confirming no colonies found were received from East Cape, Taranaki, Manawatu and Wellington.

	1971-75		1991-95	
	Pairs	Colonies	Pairs	Colonies
Far North	258	3	121	2
Northland	49	2	85	3
Auckland	337	2	315	3
South Auckland	164	2	105	2
Waikato	0	0	22	1
Bay of Plenty	73	2	151	1
Volcanic Plateau	7	0	6	0
Wanganui	1	0	2	0
Hawkes Bay	0	0	12	1
Wairarapa	48	1	38	1
Marlborough	53	1	40	1
Nelson	212	2	172	2
Canterbury	9	0	43	1
West Coast	6	0	6	0
Otago	1	0	1	0
Southland	48	1	80	1
Total	1266	16	1199	19

the mid point from hatching is 1.25 chicks pair⁻¹. Therefore at any one time there was 1.25 chicks alive pair⁻¹; dividing the free-roaming chick count by 1.25 gives an estimate of the number of breeding pairs. Adding this figure to the number of occupied nests gives an estimate of the total number of breeding pairs at the colony.

RESULTS

The 1972-74 survey was well supported, with 107 survey returns received. Although most covered the official survey period, returns received ended up covering the 5-year period 1971-75. One additional record was extracted from Edgar (1972). Some regions where no breeding colonies were recorded sent in nil returns, but breeding by isolated pairs may have been missed. Surveys were carried out between Oct and Jan, with 1-6 counts being conducted for each colony year⁻¹. However, every colony was not surveyed in every year, making annual analyses impossible.

The repeat survey carried out during 1992 was not as well supported, with only 38 returns received. Counts were carried out between Oct and Jan, with 1-4 counts colony⁻¹. Some known colonies

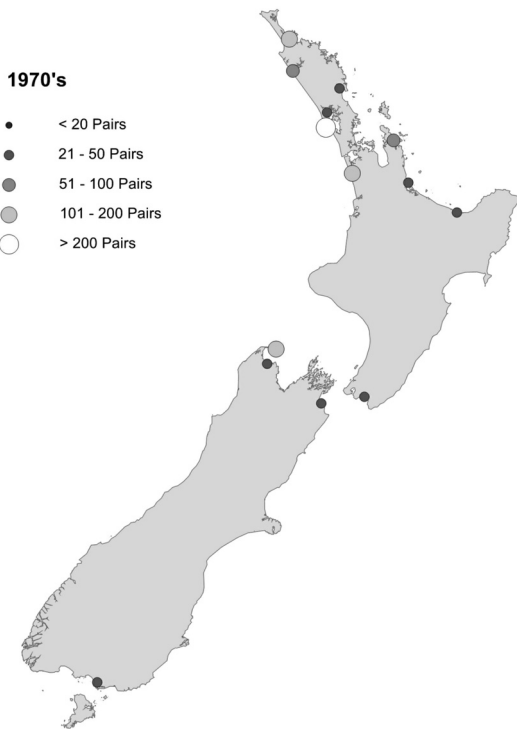


Fig. 1 The location and size of Caspian tern colonies in New Zealand during 1971-75.

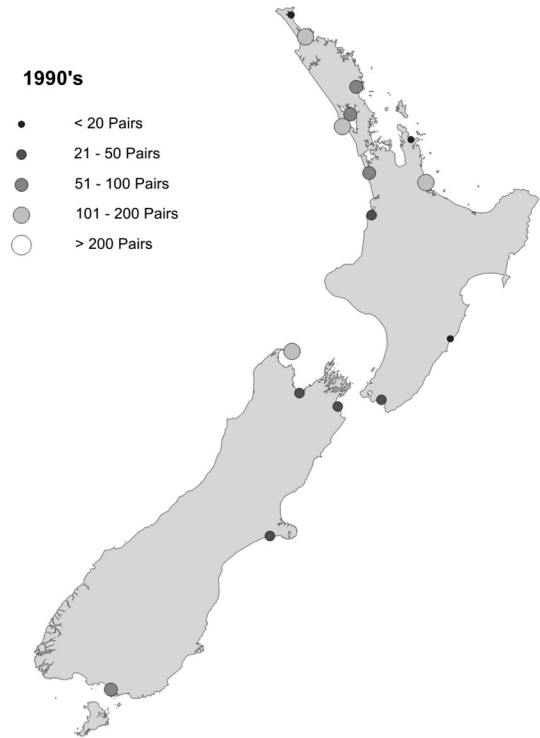


Fig. 2 The location and size of Caspian Tern colonies in New Zealand during 1991-95.

were not covered during this survey period. To supplement survey counts, we have used published observations from Classified Summarised Notes between 1991 and 1995 (Taylor and Parrish 1992; Taylor and Parrish 1994a; Taylor and Parrish 1994b; O'Donnell and West 1994; O'Donnell and West 1995; Parrish and Lock 1995; Parrish and Lock 1996; Parrish and Lock 1997).

During 1971-75, the breeding population of the Caspian tern was estimated to be 1266 pairs (Table 1). Breeding took place in 16 colonies distributed from the Far North to Southland (Fig. 1). Colonies ranged in size from 15-280 pairs (average 81 pairs colony), although isolated pairs were also recorded breeding at inland lakes, braided rivers and coastal sites. The vast majority of breeding birds (74% of pairs; 75% of colonies) occurred in the North Is, with a significant proportion (63% of pairs; 56% of colonies) of these were found within and north of South Auckland (Table 1 and Fig. 1).

In 1991-1995, the population was similar to that recorded in 1971-75, with an estimate of 1199 pairs (Table 1), across 19 colonies throughout the country (Fig. 2). Average colony size declined to 67 pairs (range 10-158). Again most breeding took place in the North Is (71% of pairs; 73% of colonies), but the

significance of the northern North Is waned (down to 52% of pairs, and 53% of colonies). Two new colonies formed in the central North Is, and 2 in the South Is (Table 2; Figs. 1 and 2).

The distribution of Caspian tern colonies changed during the 20-year period (Table 1; Figs. 1 and 2). Numbers of breeding pairs declined markedly in the Far North (53% decline) and South Auckland (35%), but nearly doubled in Northland, Bay of Plenty and Southland. Additional colonies had established in the Hawkes Bay, Waikato, Nelson and Canterbury.

There was considerable change in the location of colonies. Of the 16 colonies recorded in 1971-75, 10 were still occupied by Caspian terns in 1991-95 (Table 2). Two of these colonies involved greatly reduced numbers of pairs, and 1 had significantly increased (with a nearby colony disappearing). Six of the 1971-75 colonies had ceased to exist, and 8 new colonies were formed (Table 2). Generally, vacated colony sites were replaced by new colonies within the region, or by large increases in numbers of pairs at existing colonies. There was a trend towards population declines in the north, with new colony formation further south (Table 2; Figs. 1 and 2).

DISCUSSION

The census method targeted colonies, with breeding of isolated pairs seldom recorded, exceptions being the Volcanic Plateau, West Coast and Canterbury during 1971-75. This has likely caused the population to be under-estimated. Additional isolated breeding pairs are known from Northland, Coromandel Peninsula, East Coast, Marlborough, and Southland (Higgins and Davis 1996, Barlow 1998). Using counts from the three regions with good data of isolated breeding pairs (see Table 1); the average was 6 pairs region⁻¹. Given that such breeding is likely to be widespread, there could easily be an additional 100 pairs. Thus combining an estimate of the number of isolated breeding pairs with those counts from colonies gives a population estimate of 1300-1400 breeding pairs for each survey. The New Zealand population is only 2.6 - 2.8% of the global population (de Hoyo *et al.* 1996).

Using banding data from the Great Lakes (USA) population, Ludwig (1965) recorded survival from fledging to age of first breeding as 0.38, requiring annual productivity of 0.6 chicks pair⁻¹ fledged for the population to be stable (Ludwig 1965). In the rapidly expanding population on the Pacific Coast of North America between 1981 and 1998, Suryan *et al.* (2004) estimated survival to age 3 years of 0.69. The population was increasing at 4.3% per annum, requiring annual productivity of 0.32-0.74 chicks pair⁻¹ to account for this growth (Suryan *et al.* 2004). In comparison, average productivity for the species from 2 studies in New Zealand was 0.75 chicks pair⁻¹ (Pierce 1984; Barlow and Dowding 2002). However, because the New Zealand population was stable, and had a relatively high productivity, this suggests that survival to age of first breeding may be lower than recorded in the US by Ludwig (1965) and Suryan *et al.* (2004).

Caspian terns generally do not breed until 3 years old (de Hoyo *et al.* 1996); therefore there is a pool of non-breeding birds. Using the lowest survival figure of 0.38 to age of 1st breeding (Ludwig 1965), and average productivity of 0.75 chicks pair⁻¹ (Pierce 1984; Barlow and Dowding 2002), suggests there were about 750 immature birds present.

Although our results of 1266 breeding pairs in 1971-75 and 1199 in 1991-95 suggest that the population has remained stable, there has been some redistribution of the population. The number of breeding pairs in the South Is and central North Is has increased, with marked declines in the Far North. Even regions with stable populations have seen colony size and location changes. Similar changes in colony size and location have been recorded in other studies of Caspian terns (Higgins & Davis 1996; Suryan *et al.* 2004), and appear to be a normal aspect of Caspian tern ecology.

Although the Caspian tern population appears

Table 2 Persistence of Caspian tern colonies between 1971-75 and 1991-95 in New Zealand.

Region	Colony		
	Disappeared	Still Present	New
Far North	2	1	1
Northland	2		2
Auckland		2	1
South Auckland		2	
Waikato			1
Bay of Plenty	1	1	
Hawkes Bay			1
Wairapa		1	
Nelson	1	1	1
Marlborough		1	
Canterbury			1
Southland		1	
Total	6	10	8

stable, the decline in significance of northern New Zealand is concerning if indicative of a new trend. The New Zealand human population has increased from 2.9 million in 1971, to 3.4 million by 1991, and was 4.1 million in 2006 (Statistics New Zealand 2007). In 2006, 32% of the population lived within the Auckland region, which had an average annual population growth of 2.4%. Some 52% of the country lives in the 4 northern regions with average annual population growth of 1.6% (Statistics New Zealand 2007). This population increase has come during a time of accelerated coastal property development, greater access to isolated coastal areas via wider 4-wheel drive ownership and increased leisure time. Human disturbance is known to have a detrimental effect on New Zealand dotterel (*Charadrius obscurus aquilonius*) breeding success (Wills *et al.* 2003), and is likely to have similar impacts on other shore nesting birds such as Caspian tern. A repeat survey in 2011-15, a further 20 years since the last survey, would provide valuable information on the present status of Caspian tern in New Zealand, and provide an opportunity to investigate the effects of increased human use of coastal areas on shorebirds.

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LITERATURE CITED

- Barlow, M.L. 1998. Movements of Caspian terns (*Sterna caspia*) from a colony near Invercargill, New Zealand, and some notes on their behaviour. *Notornis* 45:193-220.
- Barlow, M.L.; Dowding, J.E. 2002. Breeding biology of Caspian terns (*Sterna caspia*) at a colony near Invercargill, New Zealand. *Notornis* 49: 76-90.
- Edgar, A.T. 1972. Classified summarised notes 1963-1970. *Notornis* 19 (Supplement): 1-91.
- Heather, B.A.; Robertson, H.A. 1996. *The field guide to the birds of New Zealand*. Auckland, Viking.
- Higgins, P.J.; Davis, S.J.J.F. 1996. *Handbook of Australian, New Zealand and Antarctic birds. Volume 3. Snipe to pigeons*. Melbourne, Oxford University Press.
- De Hoyo, J.; Elliott, A.; Sargatal, J. (ed.) 1996. *Handbook of the birds of the World. Vol 3. Hoatzin to Auks*. Barcelona, Lynx Edicions.
- Ludwig, J.P. 1965. Biology and structure of the Caspian tern population of the Great Lakes from 1896-1964. *Bird Banding* 36: 217-233.
- Pierce, R.J. 1984. Breeding success of isolated pairs of Caspian tern in Canterbury. *Notornis* 31: 185-190.
- O'Donnell, C.F.J.; West, J.A. 1994. Classified summarised notes, South Island, 1 July 1991 to 30 June 1992. *Notornis* 41: 167-188.
- O'Donnell, C.F.J.; West, J.A. 1995. Classified summarised notes, South Island, 1 July 1992 to 30 June 1993. *Notornis* 42: 53-77.
- Parrish, G.R.; Lock, W.J. 1995. Classified summarised notes, North Island, 1 July 1993 to 30 June 1994. *Notornis* 42: 145-173.
- Parrish, G.R.; Lock, W.J. 1996. Classified summarised notes, North Island, 1 July 1994 to 30 June 1995. *Notornis* 43: 117-145.
- Parrish, G.R.; Lock, W.J. 1997. Classified summarised notes, North Island, 1 July 1995 to 30 June 1996. *Notornis* 43: 79-109.
- Statistics New Zealand. 2007. *Demographic trends 2006*. Wellington. Statistics New Zealand Tauranga Aoeteroa.
- Sibson, R.B. 1992. Some thoughts on Caspian terns in New Zealand. *Notornis* 39:87-89.
- Suryan, RM; Craig, DP; Roby, DD; Chelgren, ND; Collis, K; Shuford, WD; Lyons, DE. 2004. Redistribution and growth of the Caspian tern population in the Pacific coast region of North America, 1981-2000. *The Condor* 106: 777-790.
- Taylor, G.A.; Parrish, G.R. 1992. Classified summarised notes, North Island, 1 July 1990 to 30 June 1991. *Notornis* 39: 161-210.
- Taylor, G.A.; Parrish, G.R. 1994a. Classified summarised notes, North Island, 1 July 1991 to 30 June 1992. *Notornis* 41: 1-49.
- Taylor, G.A.; Parrish, G.R. 1994b. Classified summarised notes, North Island, 1 July 1992 to 30 June 1993. *Notornis* 41: 235-274.
- Worthy, T.H.; Holdaway, R.N. 2002. *The lost world of the moa: prehistoric life of New Zealand*. Christchurch, Canterbury University Press.