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## BREEDING SUCCESS OF ISOLATED PAIRS OF CASPIAN TERNS IN CANTERBURY

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### ABSTRACT

In Canterbury, Caspian Terns (*Hydroprogne caspia*) nest mainly as single pairs associated with colonies of Black-backed Gulls (*Larus dominicanus*) on shingle riverbeds. Of 37 nests studied, 28 (75%) hatched and 20 (54%) produced a total of 21 flying young, each pair raising an average of 0.6 young per season. The low productivity is attributed to reduced prey availability.

The Caspian Tern (*Hydroprogne caspia*) is primarily a colonial nester throughout its semicosmopolitan range (e.g. Ludwig 1965, Falla *et al.* 1970, Soikkel 1973), some colonies containing over 100 pairs. At least two colonies occurred in Canterbury until about the 1950s, one at Rakaia River and one at Washdyke Lagoon (Pennycook 1949, Oliver 1955, Sagar 1976). Since the 1950s there have been no reports of colonies of Caspian Terns in Canterbury. Apart from a few pairs nesting together on at least two islands in Lake Ellesmere (G. A. Tunnicliffe, C. F. J. O'Donnell, pers. comm.), the birds breed in solitary pairs scattered throughout the province. From 1970 to 1983 I recorded nest sites and breeding success of some of these pairs.

During the early 1970s in particular, I walked stretches of many riverbeds and lake shores, mainly in Mid and South Canterbury, and found many nesting pairs of Caspian Terns. Because the pairs appeared to have a high site fidelity, I could in later years reach the nesting places quite closely by vehicle. At all accessible nests I noted the substrate, the clutch or brood size, and the approximate number of nests in nearby colonies of gulls or terns. Except at the Cass River, I could not visit the nests often enough to assess accurately the young reared per nest, even by the "exposure method" of Mayfield (1975).

For example, I would have missed the start and loss of some nests. Instead, I used young reared per pair per season as a measure of breeding success. This I consider to be highly precise because there was no confusion with other pairs of Caspian Terns, and I was able to time my visits to critical periods, especially fledging.

Nesting localities were widespread in Canterbury (Fig. 1), but only five (four at Lake Ellesmere and one at Lake Wainono) were near the sea coast, where most nesting had occurred in the early 20th century (Stead 1927). All others were along braided shinglebed rivers, ranging in size from the Cass River (mean daily spring flow less than 10 cumecs) to the Rakaia and Waitaki Rivers (mean daily spring flow over 100 cumecs). Most of these rivers are partly snowfed and have highly variable flows, but two (the Tekapo and Waitaki Rivers) have artificially controlled flows. Breeding is likely to be more regular on the Waitaki River than indicated in Fig. 1, but nesting sites are difficult to visit there. I made no visits to the Waimakariri River where four birds have been seen recently (O'Donnell & Moore 1983).

All nesting pairs were over 8 km apart, but they were markedly associated with colonies of Black-backed Gulls (*Larus dominicanus*) and a few nests were at colonies of Black-billed Gulls (*L. bulleri*) or White-fronted Terns (*Sterna striata*). See Table 1. The distance from Caspian Tern nest to nearest gull nest ranged from 4.5 to 120 m ( $\bar{x} = 16$  m,  $n = 24$ ), apart from one nest c.800 m away. (In Table 1, the headings for gull colonies should read > 100 nests, < 50, 50-100, > 100 nests.)

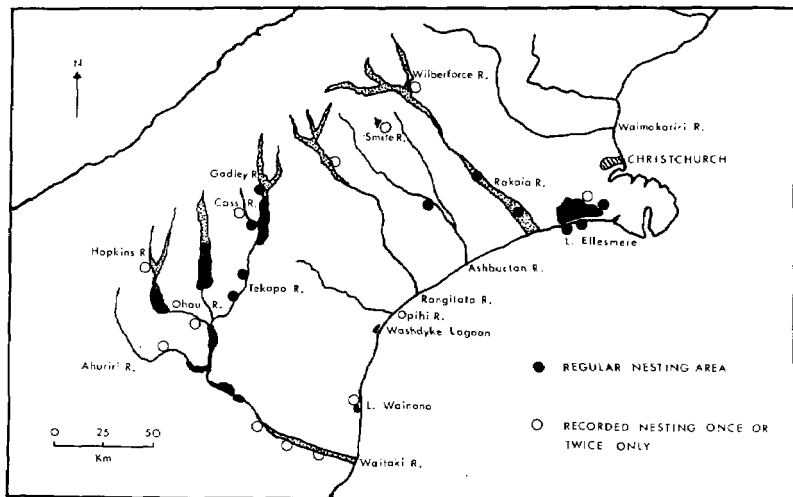


FIGURE 1 — Breeding distribution of Caspian Terns in Canterbury

TABLE 1 — Caspian Tern nest sites

Locality	Other larids present				Substrate and % cover of vegetation			
	None	<i>L. bulleri</i> 100 nests	<i>L. dominicanus</i> 50 50-100	100 nests	Dirt >50% veg	<50%	Shingle >50%	<50%
Godley River			5		1		3	1
Cass River	1		12		4	1	2	6
Tekapo River			2	4	4			2
Ohau River			1					1
Hopkins River		1					1	
Ahuriri River	1				1			
Waitaki River			1					1
Kangitata River			1				1	
Ashburton River			2		1			1
Rakaia River	1 <sup>1</sup>	2	1	1			4	1
Lake Wainono				1		1		
Lake Ellesmere			6		4	2		
Total	1	2	28	6	.15	4	11	13

Note: <sup>1</sup> Also 100 nests of White-fronted Tern present

Most nests were on raised shinglebanks or riverbed terraces, where gulls nested also. Vegetation around the nest ranged from bare dirt or fine shingle to almost complete cover of prostrate plants such as *Raoulia*, *Muehlenbeckia axillaris*, *Coprosma*, and grasses such as *Trifolium*, *Agrostis*, *Myosotis*, *Poa*, and *Festuca*. The closest tall shrubs or trees to nests were willows (*Salix* sp.) c. 30 m away on the Ashburton and Tekapo Rivers. Nests were depressions in the ground with little or no lining, but one nest on the Tekapo River was in a disused Black-backed Gull nest of the previous season and the nest consisted of grasses and a few branches. October appeared to be the main month for nesting. The earliest completed clutch was found on 30 September and the earliest chicks on 3 November, at separate nests on the Tekapo River. Laying, including of repeat clutches, occurred until the end of November. The laying of first clutches approximated (and sometimes preceded) laying times of the Black-backed Gulls. Normal clutch size was 2 ( $\bar{x}$  = 2.3, range 1-3,  $n$  = 17). The only 1-egg clutch found was an infertile egg on the Godley River in November-December 1977.

Table 2 shows the outcome of the 37 Caspian Tern nests that I was able to follow closely. Of these 37 nests, 28 (75%) reached the hatching stage and 20 (54%) produced flying young. The average number of young reared per pair per season was 0.6 ( $n$  = 35 pairs). Only one pair reared a brood of two (at Lake Ellesmere in the 1973-74 season), all other successful pairs rearing one young only. Of the ten clutches that did not hatch, four were flooded, two had infertile clutches, one was deliberately run over by motorcycles, and three had an unknown fate. Seven nests failed during the fledging period, and on four occasions I found dead chicks: one nest with three dead chicks less than 1 week old, one with a dead chick 2-3 weeks old, and two

TABLE 2 — Fate of 37 nests

Locality	No. nests	No. nests hatched	No. nests productive	Total no. of flying young	Infertile egg(s)	Flooded	Nest driven over	Dead chick(s) found	Dead adult found	Unknown, during incubation	Unknown, during chick stage
Godley River	5	3	3	3	1	1					
Cass River	13	9	5	5		2	1	2	1	1	1
Tekapo River	4	3	2	2	1			1			
Awariri River	1	1	1	1							
Ashburton River	2	2	1	1				1			
Rakula River	5	3	2	2		1				1	1
Lake Wainono	1	1	1	1							
Lake Ellesmere	6	5	5	6						1	
Total	37	27	20	21	2	4	1	4	1	3	2

with a dead chick 4 weeks old. One of the 4-week-old chicks was emaciated when it died but the other seemed to be of normal weight.

During the nesting period, off-duty Caspian Terns hunted over rivers, inland and coastal lakes, lagoons, and the sea. Some pairs, e.g. on the Tekapo River, appeared to feed only along rivers. At the Cass and Godley Rivers, almost all hunting was done around the shores of Lake Tekapo, up to 10 km from the nest sites, and only during times of steady river flow did birds hunt over the rivers. At the Cass River Delta, where I had many observations, other Caspian Terns were not tolerated on or near the delta and were "escorted" from the area by the off-duty bird, which would call frequently. Repeated flooding disrupted river feeding in much the same way as it did for some other riverbed species (Pierce 1983). Thus, during repeated flooding in 1983 there was no successful nesting on the Cass, Godley and Tekapo Rivers at least.

After breeding, Caspian Tern pairs and family parties converged on coastal and inland river deltas and at coastal lagoons and lakes. All far-inland birds appeared to move to the east coast for autumn and winter, but single birds occasionally visited the inland lakes in winter. A chick colour-banded on the Tekapo River in 1981 was seen at Lake Wainono in April 1982, but the mouth of the Opihi River attracts many more Caspian Terns (Pierce 1980).

#### DISCUSSION

Caspian Terns nest in colonies of other species not only in New Zealand. In the Northern Hemisphere, single pairs have nested in colonies of Black Skimmers (*Rhynchops nigra*), Herring Gulls (*L. argentatus*) and Ring-billed Gulls (*L. delewarensis*) (Pettingill 1958, Woolfenden & Meyerriecks 1963), although these single pairs seem to constitute a very small percentage of the breeding population (Fergusson-Lees 1971). In the North Island of New Zealand, colonies

of Red-billed Gulls (*L. novaehollandiae*) and Black-billed Gulls have been used also (Falla *et al.* 1970), and at Nelson a few pairs nest among Black-backed Gulls each year (J. Hawkins, pers. comm.). Presumably the terns, which are normally gregarious, are attracted to the gull colonies, which may stimulate them to start breeding and/or reduce the chances of their eggs or young being preyed on.

The raising of 0.6 young per pair per season is much less than the approximately 1.5 young per pair per season at colonies in North America and Scandinavia (Ludwig 1965, Soikkel 1973). The low productivity in Canterbury did not appear to result from predation. Although introduced carnivorous mammals often cause heavy losses to several species of riverbed birds (Pierce, in prep.), I found no evidence that these take the eggs or young of Caspian Terns. Oliver (1955) thought that Black-backed Gulls killed Caspian Tern chicks, but I found no evidence of this: none of the six dead chicks I saw seemed to have been injured. Adult Caspian Terns usually tolerated Black-backed Gulls (both on the ground and in the air) to within several metres of the nest or young before diving at them. Black-backed Gulls may well occasionally kill tern chicks, but they do not seem to be as important a cause of breeding failure as are Red-billed Gulls at some colonies of Caspian Terns (e.g. Soper 1965).

The fact that only one young (and not two or three) was usually reared suggests that food was the limiting factor in Canterbury. Caspian Terns lay their eggs at 2-3 day intervals and begin incubation after the first egg is laid, which results in asynchronous hatching. This is said to be an adaptive mechanism producing potentially more survivors in good years and ensuring the survival of at least one chick in poor years (Lack 1954, Soikkel 1973). Except at one Lake Ellesmere nest, the siblings (presumably the second and third chicks to hatch) at all the nests found died within a few days of hatching. This suggests that the feeding conditions in Canterbury provide only "poor years" for Caspian Tern breeding. Moreover, I found no successful riverbed pairs in 1979 and 1983, when there was repeated flooding, although nests were not necessarily destroyed by flood water.

Soikkel (1973) found that Caspian Tern chicks in Sweden often died of starvation and that fledging success (and possibly clutch size) was related to availability of food. In the Great Lakes area, Ludwig (1965) found that Caspian Terns were declining up to 1957 but that, in 1957, an increasing fish population resulted in an increased fledging success and that, by 1960, the breeding population began increasing. Unfortunately, Ludwig's study did not include data on breeding success during the period of Caspian Tern decline, and so we do not know the level of breeding success needed for a stable population. If a fledging success of 1.5 young per pair per season is enough for an expanding population in North America, and if we bear in mind the high mortality of immatures (Ludwig 1965), then the Canterbury population with its low productivity may be only marginally self-

perpetuating. It is even possible that the population is supplemented by birds from other areas. For example, at the Opihi River mouth, P. M. Sagar (pers. comm.) found several birds which had been metal-banded at an unknown breeding locality outside Canterbury. Nevertheless, several apparently suitable areas (e.g. the delta of Tekapo River, near the Waitaki River mouth and Lake Wainono) are used irregularly or not at all for nesting.

It is not surprising that, earlier this century, colonies of Caspian Terns nested in coastal localities in Canterbury where the birds could fish in a range of habitats, e.g. river, lagoon and open sea, and not necessarily be dependent on any one habitat. These habitats have, however, been severely modified by man and are also subject to much disturbance. Lake Ellesmere may be the only coastal locality where these changes have not prevented successful nesting by pairs or small groups of Caspian Terns. Data from a colony at Mangawhai near Auckland (M. Taylor, pers. comm.) indicate that fledging success is less than 0.9 per pair per season. Clearly there is a need for a concerted study of the breeding biology and population dynamics of Caspian Terns throughout New Zealand, in relation to local habitat quality (especially food supply) and the possible effects of disturbance, disease and predation.

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