

DISPERSAL OF CRESTED TERNS *Sterna bergii* FROM COLONIES IN SOUTH AUSTRALIA

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Received: 30 June 2001

The general dispersal of Crested Terns *Sterna bergii*, banded as chicks at breeding colonies in South Australia between 1955 and 1995 is described.

There was a considerable movement of breeding birds between nearby colonies, and even movement between more distant colonies. Most recoveries (78%) were immature one-year and two-year birds, and both immature and mature birds dispersed similarly. There were two patterns of dispersal. Recoveries from birds which were banded at colonies in the Spencer Gulf and the Gulf St. Vincent, were mostly local within these gulfs of South Australia. Those from the other colonies were eastwards along the Victorian coast and then northwards along the eastern coast of south-eastern Australia to southern Queensland. Such long-distance movements, over 2 000 kilometres, were accomplished within three to four months of banding.

The numbers recovered in various zones along the coast indicated that they were not solely a consequence of searching effort by people, but the result of a variety of ecological factors affecting mortality along a 3 500 kilometre coastline.

INTRODUCTION

One of the early projects of the Australian Bird Banding Scheme was the study of the movements of the Silver Gull *Larus novaehollandiae* and the Crested Tern *Sterna bergii* from breeding sites in south-east and south-west Australia (Carrick *et al.* 1957). In south-eastern Australia banding of Crested Terns continued intermittently in New South Wales, Victoria and Tasmania, but in South Australia it expanded and continued until 2000. Some 35 000 to 48 000 pairs of Crested Terns breed annually in south-eastern Australia (Ross *et al.* 1996), of which 13 000 to 23 000 pairs breed annually in South Australia (Copley 1996). Clearly, South Australia is a major southern breeding area of this species. In this paper are reported the overall dispersal patterns of Crested Terns from all the major colonies in South Australia.

METHODS

Birds were banded with aluminium and then stainless steel bands supplied by the Australian Bird and Bat Banding Scheme. Chicks were banded late in the nest or as runners which were corralled by a low fence. Adults were captured on the nest using a handnet, mostly on nests with a newly-hatched chick.

The 18 colonies at which birds were banded in South Australia (Fig. 1), included all the major colonies from Penguin Island at Beachport, Rivoli Bay, to Brothers Island in Coffin Bay, Eyre Peninsula. These islands vary from fat-topped rocky stacks to rocky islands with sand beaches, to sand spits.

All distances given were calculated along the coast, as distances across south-eastern Australia such as those derived from great-circle calculations, are inappropriate for a strictly coastal bird. In South Australia all distances eastwards were calculated to Penguin Island using selected localities as reference points (Fig. 2). For example, the distance from Brothers Island to Penguin Island was the summation of the rumblin distances to Cape Catastrophe to Cape Spencer to Cape Jervis to Penguin Island. Intermediate distances were calculated to one of the

reference points. From Penguin Island eastwards the reference points were Cape Nelson, Cape Otway, Wilson's Promontory, Cape Howe, Jervis Bay, Sugarloaf Point and Cape Byron.

To appraise dispersal the coastline was divided into six zones within which there were regions that reflected the distribution of people and coastal attributes (Figs 2 and 3). Thus, there are regions that reflect the increased densities of people around capital cities, e.g. Cape Otway to Wilson's Promontory around Melbourne, Victoria (Fig. 3, Cc) and Jervis Bay to Sugarloaf Point around Wollongong, Sydney and Newcastle in New South Wales (Fig. 3, Db).

Ageing by calendar year proved unsatisfactory because the dates of annual banding visits to colonies varied. Birds could be allocated to different age groups (e.g. three-year old or four-year old) simply as a consequence of being banded a week apart. The breeding season of Crested Terns in South Australia is synchronized and falls in the period December to February. Therefore, all chicks banded at a breeding site were aged from the end of the breeding season which was taken as 1 March. Thus, they were aged as one-year, two-year, three-year etc., being within the first, second, third etc. annual non-breeding and breeding cycle since banding. Occasionally, it was desirable to age a bird in its first year from the date of banding and such ages are given in months.

The period of banding reported in this paper is 1955–95. The banding effort at each colony was variable, being dependent upon the assistance available, but at Penguin, Stonywell and Troubridge Islands a sustained effort over several years was achieved (Appendix 1).

There were three types of recoveries. Birds were found dead, dying or injured; recaptured alive; or the band number was read by telescope. In this study on dispersal, only data from dead, dying and injured birds, and birds recaptured accidentally, e.g. on fishing lines, have been used. Only data from such recoveries more than two weeks after banding and more than 10 kilometres from the banding sites have been accepted in order to avoid a bias from chick mortality at the breeding site. Such recoveries were from birds banded as adults were so few that they have not been included. Thus, the results on dispersal refer solely to birds banded as chicks, and are, therefore, from birds of known age.

For appraisal of the general pattern of dispersal from breeding colonies, the birds were divided into immature birds, one- or two-year, and mature birds which were three-year and older. The annual data for each colony were lumped together to obtain a general pattern of dispersal.

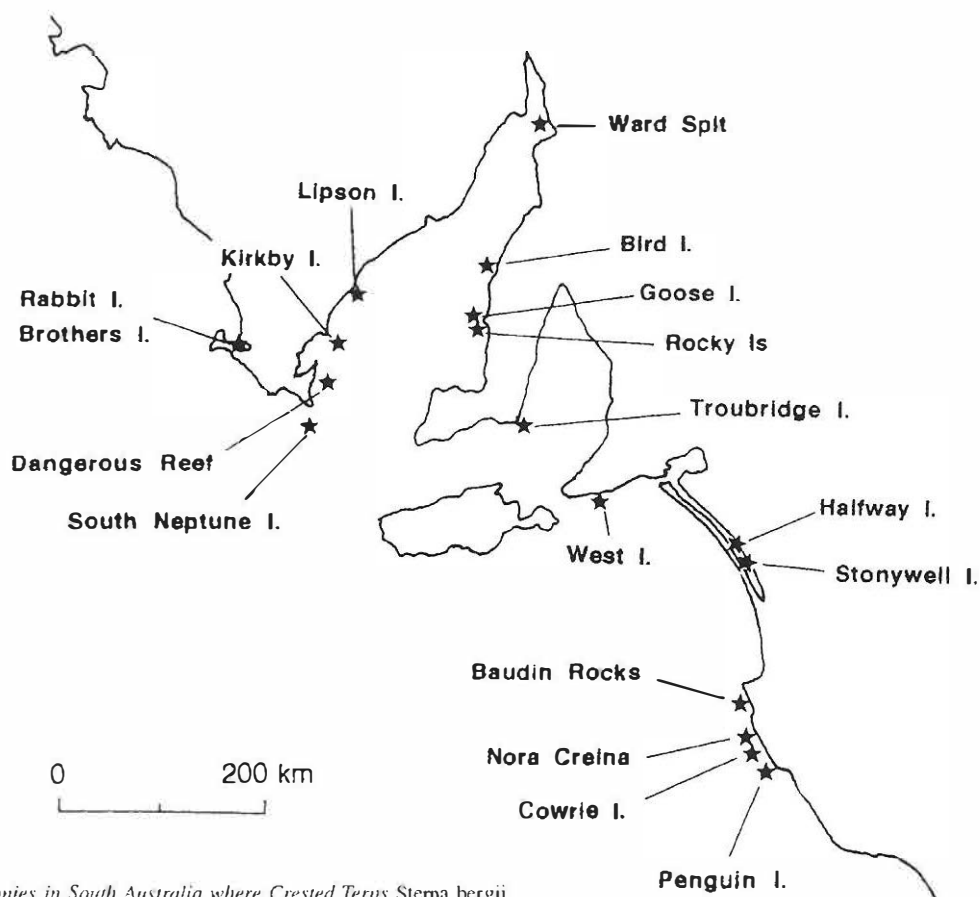


Figure 1. Breeding colonies in South Australia where Crested Terns *Sterna bergii* were banded.

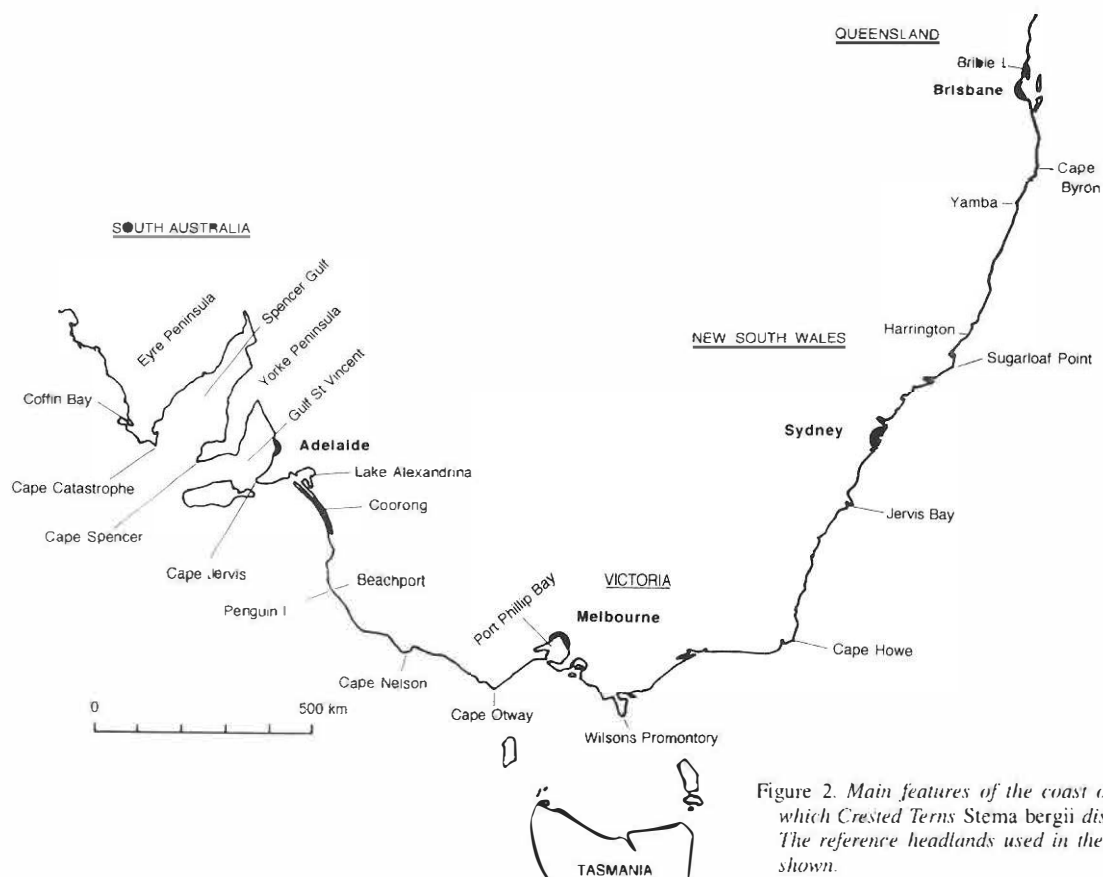


Figure 2. Main features of the coast of south-east Australia along which Crested Terns *Sterna bergii* dispersed from South Australia. The reference headlands used in the calculation of distances are shown.

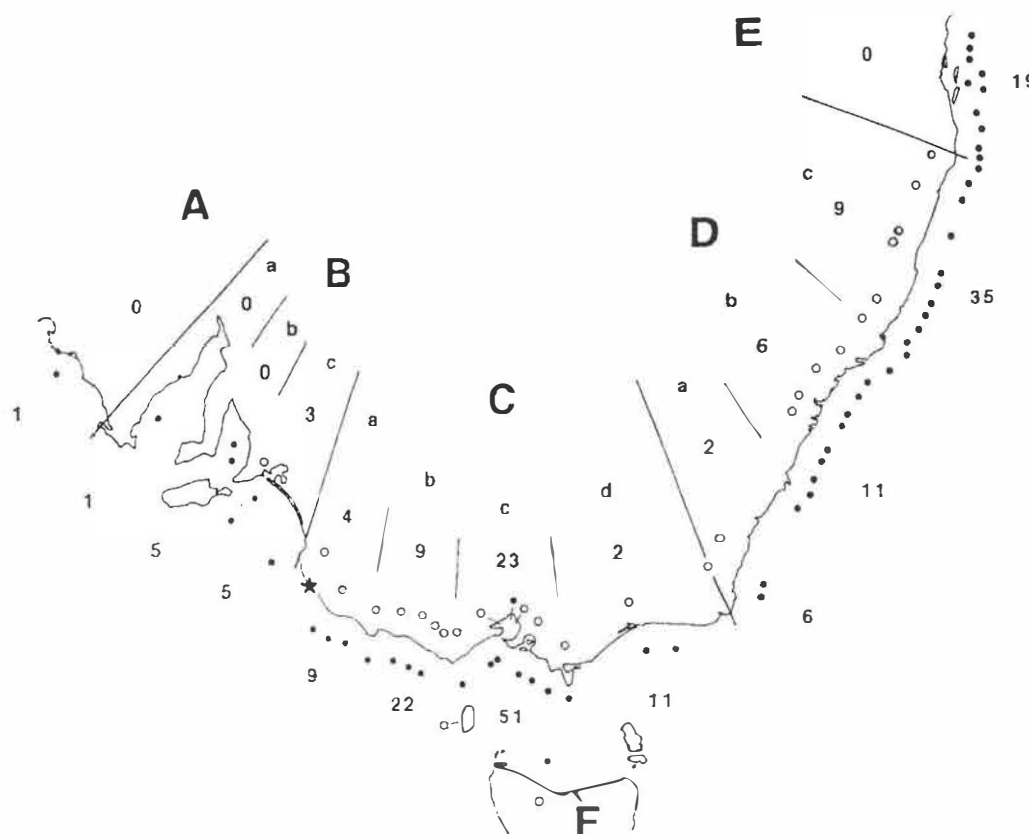


Figure 3. Locations of recoveries of immature, one-year and two-year (solid circle), and mature, three-year and older (open circle) Crested Terns *Sterna bergii* banded as chicks at Penguin Island, South Australia (asterisk). The zones and regions into which the coast was divided are shown. The total number of recoveries for immature and mature terns in each region is given offshore and inland respectively. Unless indicated, symbols of recoveries are approximately perpendicular to their location on the coast.

Birds were deliberately recaptured at breeding sites, and these data from birds banded as chicks or adults are used to appraise movements between colonies. Birds have also been deliberately recaptured at selected sites in Victoria using cannon nets (Minton 1996). These data have not been included, nor have those from band sightings but they will be in a future paper on longevity and mortality.

RESULTS

Banding and recoveries

Of the 103 371 chicks banded at the main colonies, a total of 871 were recovered of which 681 (78%) were recovered in their first and second year. The recovery rate of all birds banded as chicks was only 0.8 per cent, and only 22 per cent of these chicks were recovered after 2 years. As birds survived up to 23-years-old, there were annually few recoveries of birds older than two years from each colony in the various coastal regions.

Dispersal from breeding colony

1. Penguin Island (37°30'S, 140°01'E)

Banding commenced in 1955, continued in most years until 1976, and then commenced again in 1984 and 1986 (Appendix 1). A total 19 249 chicks and 277 adults have been banded, and 299 and 15 have been recovered respectively. The data from 237 chicks are analysed.

Immature birds (one- and two-year) dispersed mainly eastwards around the Victorian coast and then northwards

along the eastern coast to Queensland (Fig. 3, Table 1). The pattern was established in their first year and some moved rapidly to the extremes e.g. 2 020 kilometres to Ballina on the north coast New South Wales in 2 months 29 days. The overall distribution of mature birds (3–20 y) was similar but not as northerly.

2. Cowrie Island (37°29'S, 139°59'E), 3. Nora Creina (37°19'S, 139°45'E), and 4. Baudin Rocks (37°05'S, 139°43'E)

A total of 2 171 chicks were banded of which 35 were recovered and analysed.

Young birds moved eastwards around Victoria and northwards to Queensland (Table 1).

5. Stonywell Island (35°58'S, 138°29'E)

Crested Terns were banded in all but three years between 1964 and 1984 (Appendix 1). In 1985 birds deserted the island for Halfway Island. The data from 272 of the chicks recovered have been analysed.

Chicks dispersed mainly eastwards around Victorian coast and northwards along the New South Wales coast to Queensland (Fig. 4, Table 1). The pattern was established in the first year with some moving great distances rapidly e.g. 2 390 kilometres to Bribie Island, Queensland in four months, 2 200 kilometres to Ballina, New South Wales in three months. The overall distribution of older birds (3–20 y) was basically similar but not as northerly.

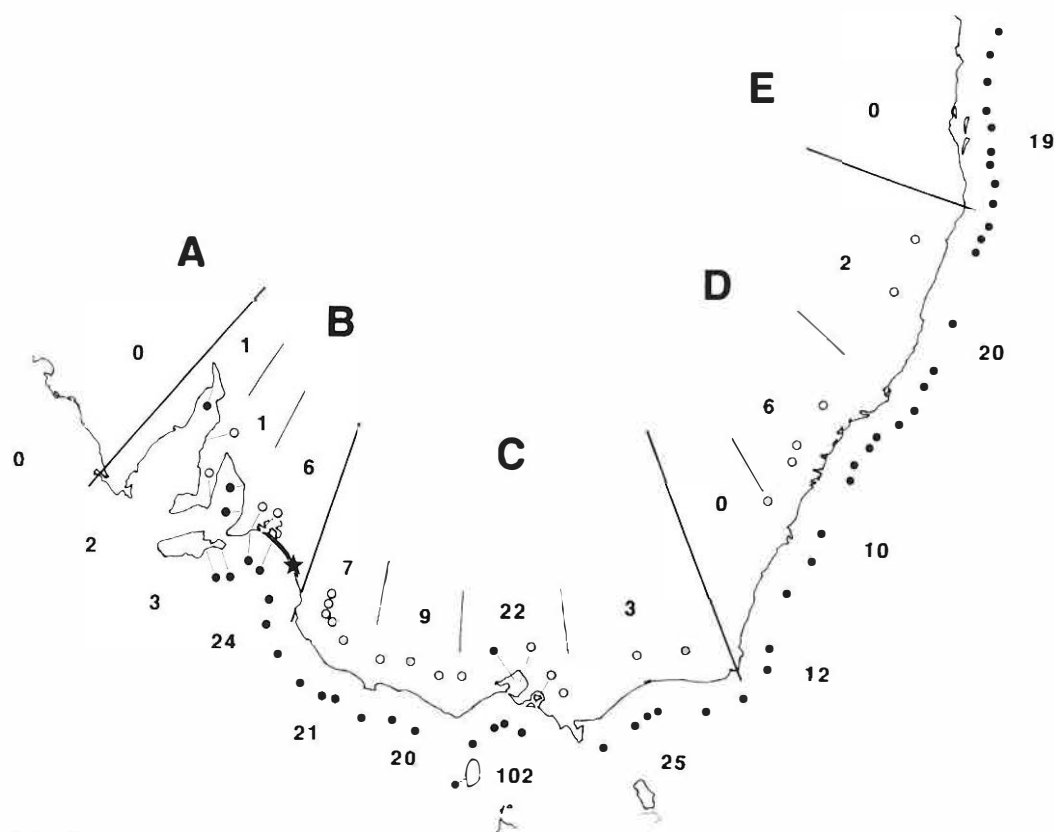


Figure 4. Locations of recoveries of immature, one-year and two-year (solid circle), and mature, three-year and older (open circle) Crested Terns *Sterna bergii* banded as chicks at Stonywell and Halfway Islands, South Australia (asterisk). The zones and regions into which the coast was divided are shown. The total number of recoveries for immature and mature terns in each region is given offshore and inland respectively. Unless indicated, symbols of recoveries are approximately perpendicular to their location on the coast.

TABLE 1

The total number of recoveries of banded Crested Terns *Sterna bergii* from each colony or groups of colonies in South Australia, showing the percentage recovered in each major zone around the coast of south-east Australia. The total numbers of immature (1-y and 2-y) and mature (3-y and older) are also given. The zones are: A — west of Coffin Bay, SA; B — Coffin Bay to Cape Nelson, Vic.; C — Cape Nelson to Cape Howe; D — Cape Howe to Cape Byron, NSW; E — Cape Byron north to southern Queensland; F — Tasmania.

Breeding Places	Age	Number	Percentage recoveries in each zone					
			A	B	C	D	E	F
1. Penguin I.	All	237	1	6	55	29	8	1
	1y, 2y	177	1	6	53	29	10	1
	3y, older	60	0	5	63	28	0	4
2. Cowrie I.	All	35	0	11	57	26	6	0
3. Nora Creina	1y, 2y	22	0	13	55	23	9	0
4. Baudin Rock	3y, older	13	0	8	61	31	0	0
5. Stonywell I.	All	316	0	11	66	16	6	1
6. Halfway I.	1y, 2y	259	0	11	65	16	7	1
	3y, older	57	0	14	72	14	0	0
7. West I.	All	31	0	32	52	3	13	0
	1y, 2y	19	0	26	53	5	16	0
	3y, older	12	0	42	50	0	8	0
8. Troubridge I.	All	112	3	89	4	2	2	0
	1y, 2y	88	3	88	5	2	2	0
	3y, older	24	0	96	4	0	0	0
9. Rocky Is	All	68	1	85	12	2	0	0
10. Goose I.	1y, 2y	53	0	83	15	2	0	0
11. Bird I.	3y, older	15	7	93	0	0	0	0
12. Ward Spit								
13. Lipson I.	All	36	0	83	11	6	0	0
	1y, 2y	35	0	83	11	6	0	0
	3y, older	1	0	100	0	0	0	0
17. Brothers I.	All	29	4	55	17	20	0	4
18. Rabbit I.	1y, 2y	23	5	53	15	22	0	5
	3y, older	6	0	66	17	17	0	0

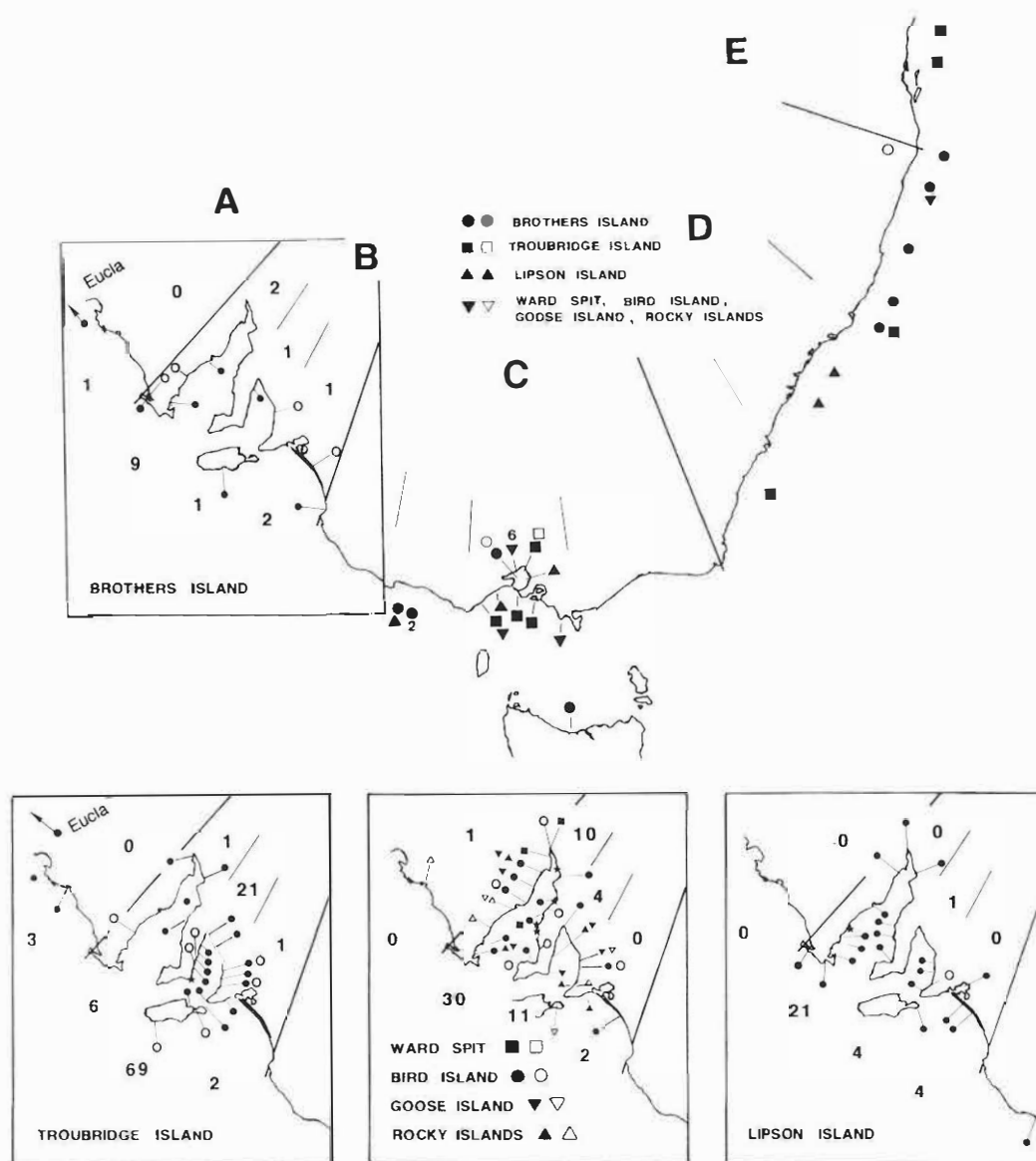


Figure 5. Locations of recoveries of immature, one-year and two-year (solid circle), and mature, three-year and older (open circle) Crested Terns *Sterna bergii* banded as chicks in South Australia. The locations of recoveries from each colony or group of colonies are shown individually for within South Australia, but eastward movements are all shown on the distribution map for Brothers Island. The zones and regions into which the coast was divided are shown. The total number of recoveries for immature and mature terns in each region in South Australia is given seawards and inland respectively. Unless indicated, symbols of recoveries are approximately perpendicular to their location on the coast.

6. Halfway Island (36°03'S, 139°34'E)

Banding commenced when most of the colony on Stonywell Island moved to the island. The dispersal data of 44 chicks have been included with that from Stonywell Island (Fig. 4, Table 1).

7. West Island (35°37'S, 138°36'E)

Of 4 015 chicks banded, 38 were recovered and analysed. In their first year, immature birds moved mainly eastwards along the Victorian coast and northwards along the eastern coast to Queensland (Table 1). Some dispersed westwards. Mature birds were recovered in region Bc, eastwards along the southern coast of Victoria, and one at Moreton Island, Queensland.

8. Troubridge Island (35°05'S, 137°57'E)

Banding commenced in 1966, continued in six of ten years until 1975, recommenced in 1985, and then continued annually until 1994. Of 274 chicks recovered, the data from 112 have been analysed.

Most immature birds were recovered in the Gulf St. Vincent. Some moved westwards and one was recovered at Eucla on the border of South Australia and Western Australia. Others moved along the Victorian coast and north along the New South Wales coast to Queensland (Fig. 5, Table 1). Mature birds were recovered mainly in the Gulf St. Vincent and one in Port Phillip Bay, Victoria.

TABLE 2

The total number of banded Crested Terns *Sterna bergii* captured breeding at the various colonies showing the movement between colonies.

Banding Site	Total number of recoveries	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	17	18
1. Penguin I.	60	48	1		3	2		3					1	1		1		
2. Cowrie I.	1	1																
3. Nora Creina	5	5																
4. Baudin Rocks	1					1												
5. Stonywell I.	367		1			209	140	16					1					
6. Halfway I.	2						2											
7. West I.	15					4		11										
8. Troubridge I.	116								114				1	1				
9. Rocky Is	13								1				11	1				
10. Goose I.	4												4					
11. Bird I.	51								5				46					
12. Ward Spit	9												9					
13. Lipson I.	65							1					2	60	1		1	
14. Kirkby I.	10													10				
15. Dangerous Reef	10													7	1			
17. Brothers I.	35					1								1			33	
18. Rabbit I.	2																2	

9. Rocky Islands (34°29'S, 137°25'E)

Fifteen of 24 chick recoveries were analysed. Immature and mature birds were recovered around Spencer Gulf. Immature birds also dispersed eastwards to Port Phillip Bay, Victoria (Fig. 5, Table 1).

10. Goose Island (34°27'S, 137°22'E)

Eight of 22 chick recoveries have been analysed. Most were recovered in the Spencer Gulf and Gulf St. Vincent, and one along the Victorian coast (Fig. 5, Table 1).

11. Bird Island (33°59'S, 137°32'E)

Banding commenced in 1960 and, except for three years, continued to 1974 after which local disturbances caused the bird to leave the island for Ward Spit. The data from 43 of 96 chicks recovered have been analysed.

All but two immature birds were recovered in the Spencer Gulf and Gulf St. Vincent. One was recovered on the Victorian coast and another at Yamba on the northern New South Wales coast (Fig. 5, Table 1). The distribution of mature birds was Spencer Gulf and Gulf St. Vincent.

12. Ward Spit (33°02'S, 137°54'E)

Banding commenced when birds which had previously bred at Bird Island, moved to the Spit. The data of nine of the 19 chicks recovered have been analysed.

Six of these immature birds were recovered in the Spencer Gulf and three in Port Phillip Bay, Victoria (Fig. 5, Table 1).

13. Lipson Island (34°16'S, 136°16'E)

Banding commenced in 1958 and except for 1970, continued annually until 1974. Birds were banded again in 1984 and 1986. The data from 36 of the 102 banded chicks, which were recovered, have been analysed.

Immature birds were recovered mainly around the Spencer Gulf and Gulf St. Vincent. A few moved eastwards along the South Australian and Victorian coasts and northwards along the eastern coast to mid-northern New South Wales (Fig. 5, Table 1).

14. Kirkby Island (34°35'S, 136°13'E), Sir Joseph Banks Group

Three were recovered within three months, two nearby at Port Lincoln and a third at Corio Bay, Port Phillip Bay, Victoria after 2 months 13 days.

15. Dangerous Reef (34°49'S, 136°12'E), Sir Joseph Banks Group

One immature bird was recovered in the Spencer Gulf and one on the Victorian coast. Two mature birds were recovered, one in the Spencer Gulf and the other in Gulf St. Vincent.

17. Little Neptune Island (35°20'S, 136°07'E)

None of the 630 chicks banded were recovered.

18. The Brothers Islands (34°16'S, 135°23'E) and 19. Rabbit Island (34°37'S, 135°26'E)

Of 5 774 chicks banded, 62 were recovered and the data of 29 have been analysed.

One immature bird was recovered at Eucla, 721 kilometres westwards on the border of South Australia and Western Australia. Dispersal was mainly eastwards around the Victorian coast and northwards along the eastern coast to Queensland (Fig. 5, Table 1). Two were recovered on the northern coast of Tasmania. Again movements were rapid; one chick was recovered 2 months 23 days later at Harrington on the mid-north coast of New South Wales, a distance of 2 190 kilometres. The recoveries of mature birds were also eastward and to the north along the eastern coast.

Movements between breeding colonies

A total of 766 Crested Terns, banded as chicks or adults, were recaptured at breeding colonies. Table 2 shows where they were recaptured. Birds from Penguin Island scattered the most. There appeared to be groupings of breeding colonies within which there were considerable movement between the individual colonies — Halfway, Stonywell and

West Islands; Rocky, Goose and Bird Islands; and Lipson Island and nearby islands. Birds deserted breeding sites, for example, Stonywell Island to Halfway Island, and from Goose, Rocky and Bird Islands to Ward Spit.

At Penguin and Stonywell Islands an effort was made to recapture banded breeding birds. Of 398 chicks recaptured as breeding birds, six were one-year birds, three were two-year, five were three-year and thirteen were four-year with increasing numbers in subsequent years.

DISCUSSION

There were two dispersal patterns from these South Australian colonies. Birds from Penguin Island (Fig. 3) and Stonywell Island (Fig. 4) dispersed eastwards around the southeastern Australian coast to north of Brisbane in Queensland. This was accomplished rapidly as shown by the recovery of three-month-old birds at Ballina, New South Wales, a distance of over 2 000 kilometres. Dispersals from nearby smaller colonies at Cowrie Island, Nora Creina, Baudin Rocks and West Island were similar, as were those from Brothers Island in Coffin Bay (Fig. 5). In contrast, birds from colonies in the gulfs dispersed locally. Those from Troubridge Island were recovered mostly in the Gulf St. Vincent (Fig. 5) and those from Rocky Islands, Goose Island, Bird Island, Ward Spit, and Lipson Island, in the Spencer Gulf (Fig. 5). A few birds from these Gulf colonies dispersed eastwards.

The eastward movements from Penguin and Stonywell Islands and other nearby colonies are clearly a genuine dispersal in this direction because many other birds were recovered westwards in the gulfs. Also, it would appear that few move to Tasmania. The few recoveries to the west of Coffin Bay, however, are probably a consequence of the fewer people along this coastline.

The dispersal of breeding birds between colonies suggests that there are affinities between colonies. Clearly, there is considerable movement between Rocky Islands, Goose Island, Bird Island and Ward Spit, between Lipson Island, Kirky Island, and Dangerous Reef, and between Stonywell Island, Halfway Island and West Island. The movements of breeding birds from Penguin Island indicated that there is also a broader movement between colonies. Such movements between colonies were recognized early in the studies in New South Wales (Carrick *et al.* 1957) and have also been reported from Western Australia (Dunlop and Storr 1981).

Within the overall dispersal there are clearly others that reflect local considerations. Many more birds were recovered along the south Victorian coast than along the eastern coast (Table 1). The abundance of people who regularly visit this coast increases the possibility of finding birds with bands and could explain the greater number of recoveries from the coastline between Cape Otway and Wilson's Promontory, and in Port Phillip Bay. However, there were no more recoveries between Jervis Bay and Sugarloaf Point, the region that includes the main centres of population of New South Wales, than elsewhere along the eastern coast. The differences in the number of recoveries in the various regions also reflect changing ecological factors that affect survival of Crested Terns

along this 3 500 kilometre coastline of south-eastern Australia.

ACKNOWLEDGMENTS

Many people have participated in this study since Jack Hood first banded Crested Terns at Penguin Island in 1955 where the following banders subsequently assisted: P. A. Allen, H. K. Brown, L. L. Burgess, R. J. P. Gower, I. McCallum, D. B. Mack, J. McKean, M. V. Melvin, C. K. Pawsey, R. L. Pink, K. Simpson, and Max Waterman. At Brothers, Rabbit and Lipson Islands, banding was commenced by W. C. Johnstone, assisted by T. T. Schubert. At Bird Island it was initiated by W. E. Mathewson. Joan and David Paton, who have kindly allowed their data to be incorporated into the overall study, did the banding at West Island.

Since 1962, the senior author (M.W.) has co-ordinated the study, and objectives have been achieved with the help of the following assistants for whose efforts we are greatly indebted: Craig Aitchinson, Gay Aitchinson, Keith Aitchinson, Doug Barnes, Paul Bradbrook, Steve Brown, Maurice Collins, Nigel Collins, Steve Collins, Dr John Cross, Clayton Cross, David Condon, Wayne Dodd, Leigh Foreman, Dr Oliver Fuller, Sven Holm, Tom Irish, John Jenkins, Jill Jonathan, Jim Jonathan, Peter McCrow, Peter Malins, Max Melvin, Tom Martin, Roy Masson, Keith Masson, Denis McCarthy, Mick Olsen, Daryl Wanke. We are also indebted to the Director and Officers of the South Australian National Parks and Wildlife Service for their assistance, and the use of their boat to get to islands in the Coorong.

The support of the Bird and Bat Banding Scheme is greatly appreciated, and in particular we wish to thank David Purchase for his enthusiastic and constructive interest.

REFERENCES

- Carrick, R., Wheeler, W. R. and Murray, M. D. (1957). Seasonal dispersal and mortality in the Silver Gull, *Larus novae-hollandiae* Stephens, and Crested Tern, *Sterna bergii* Lichtenstein, in Australia. *C.S.I.R. Wildl. Res.* 2: 116–144.
- Copley, P. B. (1996). The status of seabirds in South Australia. In 'The status of Australia's seabirds: Proceedings of the National Seabird Workshop, Canberra, 1–2 November 1993'. (Eds G. Ross, K. Weaver and J. Greig) Pp. 139–180. (Biodiversity Group, Environment Australia: Canberra.)
- Dunlop, J. N. and Storr, G. M. (1981). Seabird islands: Carnac Island, Western Australia. *Corella* 5: 71–74.
- Ross, G., Weaver, K. and Greig, J. (1996). 'The status of Australia's seabirds: Proceedings of the National Seabird Workshop, Canberra, 1–2 November 1993' (Biodiversity Group, Environment Australia: Canberra.)
- Minton, C. (1996). Tern Banding. *J. Vic. Wader Study Group* 20: 24–29.

APPENDIX 1

The total number of Crested Terns *Sterna bergii* banded at each colony in South Australia between 1955 and 1995.

Breeding Place	Season	Total	Number of birds banded	
			Pullus	Adult
1. Penguin I.	1955/56	28	12	16
	1956/57	132	125	7
	1957/58	420	416	4
	1958/59	700	700	0
	1960/61	20	16	4
	1961/62	1 216	1 209	7
	1962/63	1 242	1 158	84
	1963/64	1 661	1 570	91
	1964/65	1 819	1 816	3
	1965/66	370	370	0
	1966/67	1 932	1 881	51
	1967/68	1 500	1 500	0
	1968/69	330	330	0
	1969/70	1 748	1 748	0
	1971/72	1 300	1 300	0
	1973/74	740	740	0
	1974/75	1 284	1 284	0
	1975/76	884	874	10
	1984/85	2 010	2 010	0
	1986/87	190	190	0
TOTAL		19 526	19 249	277
2. Cowrie I.	1970/71	210	210	0
3. Nora Creina	1959/60	420	420	0
4. Baudin Rocks	1968/69	600	600	0
	1969/70	941	941	0
TOTAL		1 541	1 541	0
5. Stoneywell I.	1964/65	2 140	2 045	95
	1965/66	1 610	1 608	2
	1966/67	2 030	1 850	180
	1967/68	2 199	2 000	199
	1968/69	1 318	1 275	43
	1969/70	1 257	1 237	20
	1970/71	1 200	1 200	0
	1971/72	2 191	2 191	0
	1973/74	1 346	1 100	246
	1974/75	2 610	2 610	0
	1975/76	1 950	1 950	0
	1976/77	1 760	1 760	0
	1978/79	1 600	1 600	0
	1979/80	1 200	1 199	1
	1981/82	899	899	0
	1982/83	1 000	1 000	0
	1983/84	2 756	2 676	80
TOTAL		29 066	28 200	866
6. Halfway I.	1985/86	3 865	3 865	0
	1988/89	430	429	1
TOTAL		4 295	4 294	1
7. West I.	1970/71	493	466	27
	1971/72	698	698	0
	1972/73	1 500	1 200	300
	1973/74	499	499	0
	1974/75	700	700	0
	1975/76	400	400	0
	1983/84	52	52	0
TOTAL		4 342	4 015	327
8. Troubridge I.	1966/67	780	780	0
	1968/69	1 109	1 109	0
	1969/70	329	329	0
	1970/71	200	200	0
	1973/74	500	500	0
	1975/76	900	900	0
	1985/86	1 598	1 598	0
	1986/87	800	800	0
	1987/88	940	840	100
	1988/89	990	990	0
	1989/90	990	990	0

Appendix 1 — *continued*

Appendix 1 — continued

Breeding Place	Season	Total	Number of birds banded	
			Puflus	Adult
Troubridge I. — continued				
	1990/91	990	990	0
	1991/92	1 740	1 740	0
	1992/93	2 300	2 300	0
	1993/94	2 000	2 000	0
	1994/95	1 700	1 700	0
TOTAL		17 866	17 766	100
9. Rocky Is				
	1966/67	1 130	1 010	120
	1968/69	660	660	0
	1975/76	700	700	0
TOTAL		2 490	2 370	120
10. Goose I.				
	1966/67	1	1	
	1969/70	550	550	0
	1970/71	500	500	0
	1971/72	300	300	0
	1972/73	414	414	0
	1974/75	320	320	0
TOTAL		2 085	2 085	0
11. Bird I.				
	1960/61	100	100	0
	1961/62	100	100	0
	1962/63	109	109	0
	1963/64	171	171	0
	1965/66	16	16	0
	1967/68	500	500	0
	1968/69	500	500	0
	1969/70	109	109	0
	1970/71	700	700	0
	1971/72	800	800	0
	1972/73	800	800	0
	1974/75	1 400	1 400	0
TOTAL		5 305	5 305	0
12. Ward Spit				
	1979/80	543	390	153
	1980/81	689	510	179
	1982/83	113	113	0
TOTAL		1 345	1 013	332
13. Lipson I.				
	1958/59	550	550	0
	1960/61	482	482	0
	1962/63	553	553	0
	1963/64	698	698	0
	1964/65	950	950	0
	1965/66	1 290	1 290	0
	1966/67	220	220	0
	1968/69	1 143	1 107	36
	1971/72	600	600	0
	1972/73	497	497	0
	1973/74	919	713	206
	1974/75	176	176	0
	1984/85	670	670	0
	1986/87	790	790	0
TOTAL		9 538	9 296	242
14. Kirkby I.				
	1959/60	18	18	0
	1966/67	450	380	70
	1970/71	6	6	0
TOTAL		474	404	70
15. Dangerous Reef				
	1959/60	500	500	0
16. South Neptune I.				
	1966/67	630	630	0
17. Brothers I.				
	1957/58	950	950	0
	1960/61	220	220	0
	1961/62	127	126	1
	1964/65	1 302	1 300	2
	1965/66	220	220	0
	1968/69	875	875	0
	1969/70	500	500	0
	1970/71	400	400	0
	1971/72	494	493	1
	1972/73	650	650	0
	1984/85	40	40	0
TOTAL		5 778	5 774	4
18. Rabbit I.				
	1958/59	299	299	0
TOTAL		105 710	103 371	2 339