

STAGING OF ROSEATE TERNS *STERNA DOUGALLII* IN THE POST-BREEDING PERIOD AROUND CAPE COD, MASSACHUSETTS, USA  
*RUSTPLAATSEN VAN DOUGALLS STERNS NA DE BROEDTIJD ROND CAPE COD, MASSACHUSETTS, USA*

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*We conducted several studies of Roseate Terns *Sterna dougallii* around Cape Cod, Massachusetts, USA, during the post-breeding period (July-September) in 1990-1998. We also reviewed reports and estimates of numbers in regional publications. We identified 20 discrete sites where Roseate Terns and Common Terns *S. hirundo* staged (rested in flocks during daylight hours) between 24 July and 22 September. All sites were on open beaches or sand flats, usually near the end of barrier islands or barrier beaches. Only one site was found where Roseate Terns were present in thousands, but three other such sites have been documented during the last 20 years. All of these major staging sites are on outer beaches of Cape Cod adjacent to cold Atlantic Ocean waters. Roseate Terns appear to disperse throughout the breeding area in July and August, re-aggregating on outer Cape Cod in late August and September prior to southward migration in mid-September. Roseate Terns ringed at eight colony-sites throughout the breeding area in north-eastern North America were identified at staging sites around Cape Cod. We found only two sites on Cape Cod where Roseate Terns roosted at night in 1998; one of these has been a major roost site for many years. The concentration of a large fraction of this endangered regional population into a small area during September makes it vulnerable to human disturbance (especially at night) and to North Atlantic hurricanes.*

Trull P., S. Hecker, M.J. Watson & I.C.T. Nisbet. 1999. Staging of Roseate Terns *Sterna dougallii* in the post-breeding period around Cape Cod, Massachusetts, USA. *Atlantic Seabirds* 1(4): 145-158.

## INTRODUCTION

The days and weeks immediately following the breeding season are an important period in the life-history of many seabirds, because young birds are then learning to forage for themselves and are beginning the transition to

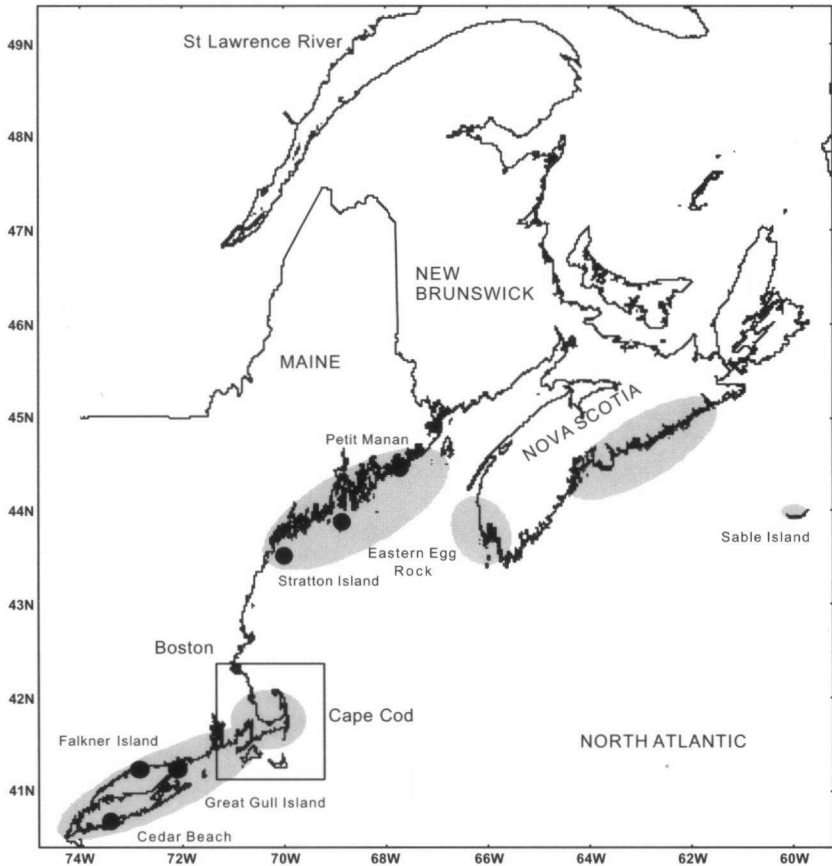


Figure 1. Breeding range of the Roseate Tern in the northwest Atlantic (northeastern USA and southeastern Canada). Major colony sites are marked with dots. The box shows the area where the surveys reported in this paper were carried out (Figs. 2, 3).

Figuur 1. Broedgebied van de Dougalls Stern in het noordwest Atlantische gebied (NO USA, ZO Canada). Belangrijke kolonies zijn met stippen aangegeven. Het quadrant geeft het gebied aan waar de in dit artikel genoemde tellingen werden uitgevoerd (Figs. 2, 3).

independence (Burger 1980). These phenomena are difficult to study, however, because many seabirds leave the breeding sites soon after the young fledge. Pelagic species then disperse widely at sea (Nelson 1978; Brooke 1990), whereas inshore species disperse along the shore (Langham 1971; Spear 1988).

This paper reports a series of field studies of Roseate Terns *Sterna dougallii* during the post-breeding period around Cape Cod, Massachusetts, USA (Figs. 1-3). Our studies were designed to identify important sites used by Roseate Terns from this regional population during the post-breeding period, to gather preliminary information about temporal patterns of use of these sites, including nocturnal roosting, and to identify potential threats to the birds using these sites.

The northwest Atlantic population of Roseate Terns is regarded as endangered because of its concentration into a small number of breeding sites (U.S. Fish and Wildlife Service (USFWS) 1998). This regional population has increased slowly during the past 20 years and now includes about 3700 pairs breeding on islands in warm waters southwest and west of Cape Cod, plus about 300 pairs on islands in cold waters of the Gulf of Maine and southeastern Canada (U.S. Fish and Wildlife Service 1998; Nisbet & Spendelow 1999; Fig. 1). Following the breeding season in May-July, birds from both segments of this population disperse widely along the coast, ranging throughout the breeding area (Nisbet 1984; Shealer & Kress 1994). Juveniles accompany and are dependent on their parents for at least 8 weeks after fledging (Burger 1980; Teets 1998). Pre-breeding birds, mostly two or three years old, also accompany the breeding birds during the post-breeding period (Nisbet & Spendelow 1999). Many of the birds move to staging sites around Cape Cod prior to southward migration in mid-September (Gochfeld *et al.* 1998). This southward migration is believed to be directly across the western North Atlantic Ocean to the West Indies and/or South America (Nisbet 1984).

## METHODS

We studied staging of Roseate Terns around Cape Cod in July-September 1990, 1994, 1996, 1997 and 1998. For this paper, we define a 'staging site' as a site where mixed species of terns, mostly Roseate Terns and Common Terns *S. hirundo*, rest during daylight hours in the period between breeding and southward migration, either feeding in adjacent waters or flying to and from more distant feeding grounds. Some staging sites may be used for 'roosting', a term we use only for sites where terns spend the night.

We initially reviewed published data from regional books (Griscom & Snyder 1954; Bailey 1955; Hill 1965; Veit & Petersen 1993) and journals (*Bird Observer of Eastern Massachusetts* and *Bird Observer*, 1980-1997), in order to

Table 1. Largest reported numbers of Roseate Terns at staging areas around Cape Cod, Massachusetts (see Fig. 3 for site #).

Tabel 1. Maximale aantallen Dougalls Sterns op rustplaatsen rond Cape Cod, Massachusetts (zie Fig. 3 voor plaats #).

site		largest number reported		
#	location	1994 survey	1998 survey	1980-1997 birders' publ.
1	North Beach, Scituate	0	0	200, 29 Jul-1 Aug 1982 200, 29 Aug 1984
2	Long Beach, Plymouth	0	0	240, 5 Aug 1988
3	Sandy Neck, Barnstable	0	750, 19 Sep	100, 26 Jul 1988
4	Chapin Beach, Dennis	0	n.d.	100, 12 Sep 1993
5	Jeremy's Point, Wellfleet	17, 22 Aug	(air only) <sup>a</sup>	n.d.
6	Pamett Point, Truro	n.d.	n.d.	40, 12 Sep 1991
7	Hatch's Harbor, Provincetown	n.d.	1, 18-25 Aug	4000, 21-31 Aug 1980 48, 1 Aug 1990
8	Nauset Inlet, Orleans <sup>b</sup>	27, 15 Aug	40, 1 Sep	2000, 1 Sep 1981 1200, 19 Aug 1982
9	South Beach, Chatham	1980, 26 Aug	3850, 1 Sep	4500, 8 Aug 1997 3200, 31 Jul 1997
10	North Monomoy, Chatham <sup>c</sup>	600, 26 Aug	500, 18 Aug	15 000, 4 Sep 1984 10 000, 19 Sep 1984 7000, 9 Sep 1988 6000, 7 Sep 1987 1500, 4 Sep 1980
11	South Monomoy, Chatham	n.d.	n.d.	
12	Harbor Jetties, Nantucket	250, 4 Sep	n.d.	2000, 9 Sep 1989 <sup>d</sup> 1200, 3 Sep 1989 <sup>d</sup> 1000, 23-25 Aug 1991 <sup>d</sup>
13	Smith's Point, Nantucket	300, 5 Sep	10, 25 Aug	
14	Eel Point, Nantucket	250, 4 Sep	31, 18 Aug	
15	Tuckernuck Island	n.d.	500, 25 Aug	600, 30 Aug 1997
16	Muskeget Island <sup>d</sup>	n.d.	n.d.	n.d.
17	Katama, Martha's Vineyard	0	n.d.	400, 17 Aug 1993
18	PoPONessar, Mashpee	1, 12 Aug	n.d.	n.d.
19	South Cape Beach, Mashpee	25, 28 July	n.d.	n.d.
20	Black Beach, Falmouth	25, 28 July	n.d.	n.d.

<sup>a</sup> flocks of terns were seen from the air at Jeremy's Point (1000 on 8 Sep 1998, 700 on 18 Sep 1998) and Muskeget (600 on 1 Sep 1990), but numbers of Roseates could not be determined

<sup>b</sup> data pooled for three locations around the inlet. In 1998, 1000 terns were seen on 6 Sep, 50 on 15 Sep, 900 on 16 Sep, 1750 on 23 Sep, but numbers of Roseates could not be determined

<sup>c</sup> includes North Monomoy Island, "middle Monomoy", and the north end of South Monomoy Island

<sup>d</sup> published high counts for Nantucket Island did not distinguish among sites

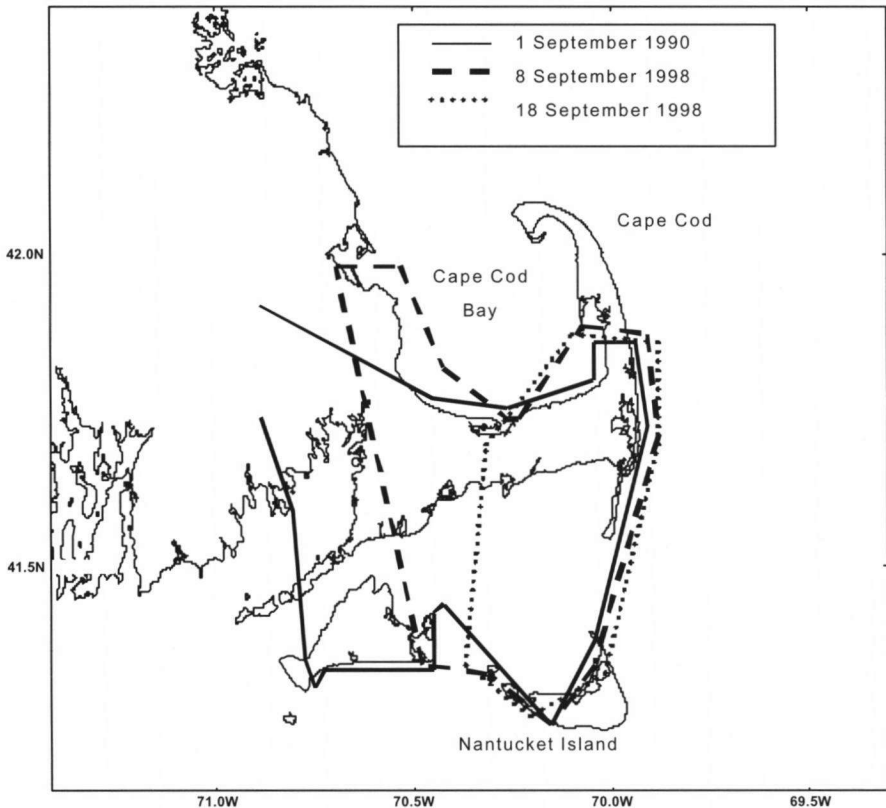
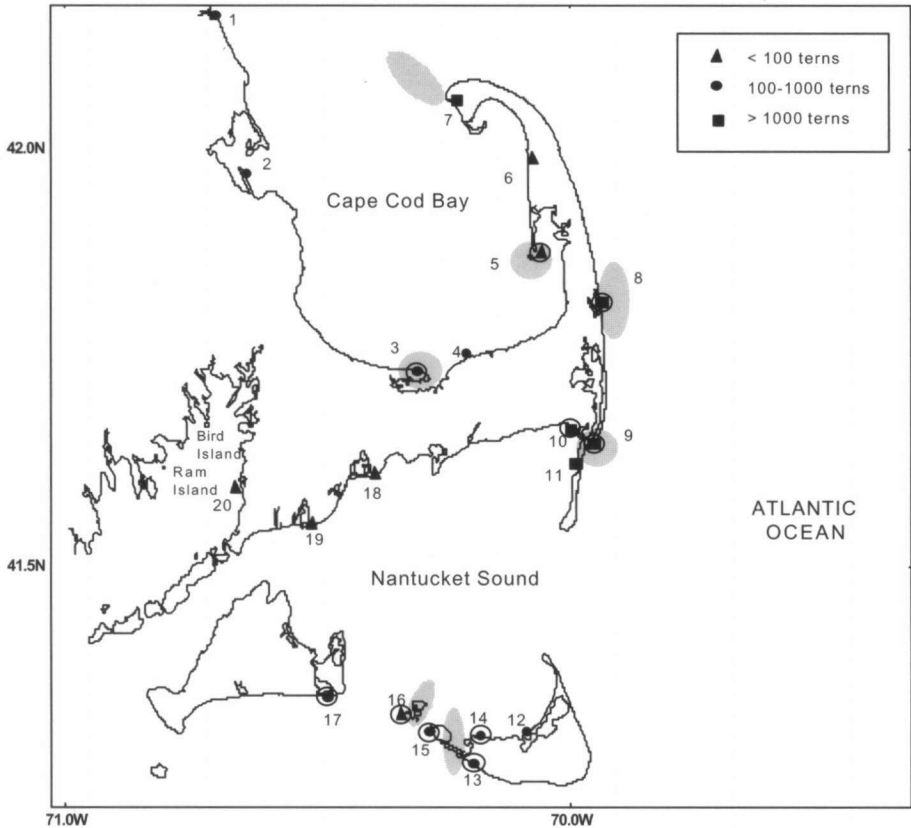


Figure 2. Routes of aerial surveys flown on 1 September 1990, 8 and 18 September 1998.  
Figuur 2. Routes van vliegtuigtellingen op 1 september 1990, 8 en 18 september 1998.

identify sites where staging Roseate Terns had been reported. We conducted aerial surveys on 1 September 1990, 8 and 18 September 1998 (Fig. 2). On each survey we flew around the shoreline during daylight hours (10.00-15.00 h) at heights of 100-160 m and speeds of 130-160 km h<sup>-1</sup>. Using the published data and the results of the three aerial surveys, we identified 20 staging sites around Cape Cod (Table 1, Fig. 3). We selected 15 sites for ground surveys in 1994 and nine in 1998 (Tables 1, 2).

In 1994, we and several co-operators made 52 visits to 15 sites on 31 dates between 24 July and 21 September. All visits were during daylight hours and lasted from 2 to 5 hrs. On each visit, the numbers of Common and Roseate Terns in resting flocks were counted or estimated. On most visits, a 20-60x



**Figure 3.** Staging and roosting areas of Roseate Terns around Cape Cod, Massachusetts, USA. Staging sites are numbered to correspond to the site numbers in Table 1. Symbols indicate the largest numbers of Roseate Terns reported during 1980-1998: square, >1000 birds; circle, 100-1000 birds; triangle, <100 birds. Sites identified during the aerial surveys are enclosed with a ring. Shaded areas indicate where Roseate Terns were seen feeding during the aerial surveys and/or have been reported feeding in other surveys.

**Figuur 3.** Voorverzamelplaatsen en rustplaatsen van Dougalls Sterns rond Cape Cod, Massachusetts, USA. De nummering is ook gebruikt in Tabel 1. Symbolen geven de grootste aantallen Dougalls Sterns aan die werden gemeld tussen 1980 en 1998: vierkant >1000, cirkel 100-1000, driehoek <100 vogels. Gearceerde gebieden geven de foerageergebieden van Dougalls Sterns weer, zoals waargenomen tijdens de waarnemingen vanuit de lucht of zoals gebleken is uit andere waarnemingen.

Table 2. Counts of Roseate Terns at nine<sup>a</sup> sites, August-September 1998.Tabel 2. Telling van Dougalls Sterns op negen<sup>a</sup> locaties, augustus-september 1998.

location	date					
	18 Aug	25 Aug	1 Sep	8 Sep	15 Sep	23 Sep
Sandy Neck	107	200	330	124	688	n.d. <sup>b</sup>
Hatch's Harbor	1	1	0	n.d.	n.d.	n.d.
South Beach	0	n.d.	3850	3530	100	0
North Monomoy	645	0	45	0	0	0
Eel/Smith's Point	31	10	8	8	0	0
Tuckernuck Island	300	500	300	300	25	25
Katama	107	210	31	8	0	0

<sup>a</sup> no Roseate Terns were seen at North Beach or Long Beach<sup>b</sup> n.d., no visit

zoom telescope was used to identify individual Roseate Terns which had been marked with colour-ring combinations at breeding colonies in 1988-1991, or with field-readable metal rings at breeding colonies in 1992-1994 (Spendelow *et al.* 1995).

In 1996, we studied Roseate Terns at Eel Point, Nantucket, from 26 July to 8 September. Field work was conducted on most days between 06.00 and 20.00 h, including observations at dawn or dusk on many days. The main studies conducted were recording parental behaviour and foraging success (Teets 1998; Watson & Hatch 1999), and reading field-readable rings with a 20-60x zoom telescope. In 1997, we counted Roseate Terns at Eel Point and/or Smith's Point, Nantucket, at dawn and dusk on most days from 9 to 24 August.

In 1998, we and several co-operators visited each of nine selected sites on the same day once each week between 18 August and 22 September. All visits were in late afternoon or evening (16.00-20.00 h); the average duration of visits was 1.9 hr. We counted the total numbers of terns present at different times during each visit. Where total numbers were small (<200), we counted the numbers of Roseate and Common Terns within resting flocks. Where total numbers were large (>200), the proportions of each species were estimated by counting samples of 100-300 birds within resting flocks. We recorded directions of flight of both arriving and departing birds. Whenever possible, observers remained at the sites until after dark to determine whether terns were roosting.

## RESULTS

During our three aerial surveys, we observed resting flocks of terns at 10 sites (Fig. 3); estimated numbers ranged from 200 to 1500 birds. In six cases, terns were seen at these sites on each survey; at Sandy Neck, Eel Point and Muskeget,

terns were seen on two of three flights; at Katama, terns were seen on one of three flights. Roseate Terns could not be distinguished from Common Terns from the air while resting, but at five sites we could distinguish Roseate Terns (by their paler upperparts, more rapid wingbeats, and style of flight) while foraging over nearby tidal inlets or gaps between islands (Fig. 3).

Pooling data from published and unpublished sources and from our 1994-98 surveys, resting flocks of Roseate and Common Terns have been reported in July-September from 20 sites around Cape Cod, including all but one of the sites where terns were seen from the air (Fig. 3). At all these sites, flocks of terns were seen resting on beaches or sand flats at or near the ends of barrier beaches or peninsulas, usually near to tidal inlets or tide-rips. The aerial surveys indicated that these staging sites were discrete, separated from each other by many kilometres of beach without resting terns (Fig. 2).

Table 1 summarises high counts of resting Roseate Terns reported from 20 sites during the period 1980-1998. Although the last column in Table 1 lists estimates of numbers as reported in the original publications, we regard all these estimates as very uncertain, for reasons stated in the Discussion. Two sites (Jeremy's Point and Muskeget Island) have been viewed primarily or exclusively from the air and there is little or no information on the relative numbers of Roseate and Common Terns at these sites. Resting flocks of thousands of Roseate Terns have been reported frequently at two sites (South Beach and North Monomoy) and occasionally at two others (Hatch's Harbor and Nauset Inlet). Resting flocks of 100-1500 Roseate Terns have been reported at nine sites, and smaller numbers at four others. At most sites, Common Terns outnumbered Roseate Terns in ratios between 2:1 and 8:1.

In 1998, Roseate Terns were seen in thousands at only one site (South Beach), in hundreds at four others, and in smaller numbers at three (Table 2). They were found roosting at only two sites, South Beach and Sandy Neck. At South Beach, between 3000 and 4000 Roseate Terns were estimated on 1 and 8 September. On each occasion, most of these birds arrived in small flocks from the north and northwest between 18.00 and 20.00 h, continuing to arrive after dark when they could no longer be counted. At Sandy Neck, a flock of 2000-3000 terns was flushed from the beach after dark (20.30 h) on 19 September; earlier in the evening, flocks including about 3000 birds were estimated to contain about 25% Roseates. At other sites, Roseate Terns were seen only during the early part of the evening visits, and at three sites (Nauset Inlet, Smith's Point and Eel Point) they departed in late evening, flying either towards Monomoy or Sandy Neck.

In earlier years, Roseate Terns have been recorded roosting only at Monomoy (1984-1990) and South Beach (1997) (I.C.T. Nisbet and B. Nikula, unpublished data). However, we have no nocturnal observations from Jeremy's



Point, Tuckernuck or Muskeget Islands, so we cannot exclude the possibility that Roseate Terns may roost at those locations also.

At most sites around Cape Cod, the largest numbers of Roseate Terns have been reported in the period 26 August-19 September, i.e. in the 20-25 days before departure (Tables 1, 2). In particular, large numbers were found staging and roosting at North Monomoy in September during the 1980s (Table 1). At five sites where Roseate Terns breed, numbers have been seen staging in late July and early August while breeding birds were still feeding young in the colonies, dispersing when the breeding birds left after the chicks fledged (Monomoy and Nauset in 1998, Table 2; Long Beach in 1988, Table 1; Bird and Ram Islands in other years, I. C. T. Nisbet, unpublished data).

In 1994, 139 colour-ringed Roseate Terns were identified at staging areas around Cape Cod (Table 3). The sites of ringing included all the four colonies where large numbers of birds had been marked during the period 1988-1994. Numbers of birds identified around Cape Cod were roughly in proportion to the numbers ringed at each site. However, quantitative comparisons are not possible because birds from different sites had carried rings for varying periods, and rates of ring loss probably varied among sites (Spendelow *et al.* 1994).

Fifteen birds carrying field-readable rings were identified at South Beach in September 1994, and 171 birds carrying field-readable rings were identified at Eel Point in August 1996 (Table 4). These birds had been ringed at eight breeding sites, including all the sites where substantial numbers had been ringed in 1992-1996. The relative numbers of juveniles identified at Eel Point in 1996 were in proportion to the numbers of chicks ringed at six sites or groups of nearby sites in that year (Table 4). This suggests that birds from all parts of the regional breeding range (including sites to the west and north of Cape Cod) had aggregated at Eel Point in 1996.

All sites where staging Roseate Terns have been observed are on sand flats or beaches, usually at or near the end of barrier islands or barrier beaches (Fig. 3). Most staging sites are at locations far from human access, but staging Roseate Terns were seen to be disturbed by human pedestrians at 11/20 sites, by beach vehicles at 6/20, by aircraft at 2/20, by boats at 3/20, and by dogs at 6/20. Terns were killed by gulls *Larus* spp. at two sites, and resting terns were put to flight by gulls at four others; at five sites, resting flocks of gulls appeared to exclude terns from resting places which had been used on other days. Two of the three sites where Roseate Terns have been observed roosting (North Monomoy and South Beach) are the most remote and least disturbed sites in the area. The third roosting site (Sandy Neck) was heavily disturbed in prior years by fishermen, beach vehicles, and other human activity, but was closed to vehicles during May-September 1998.

*Table 3. Sightings of individual colour-ringed Roseate Terns at staging areas on Cape Cod, August-September 1994.*

*Tabel 3. Waarnemingen van individueel gekleurringde Dougalls Sterns op rustplaatsen op Cape Cod, augustus-september 1994.*

colony of ringing	ringed as adult 1988-94	ringed as chick 1988-90
Cedar Beach, NY	2	2
Falkner Island, CT	14	21
Great Gull Island, NY	34	24
Bird Island, MA	22	20
total	72	67

*Table 4. Sightings of Roseate Terns with field-readable rings at staging areas on Cape Cod, September 1994 and August-September 1996.*

*Tabel 4. Ringaflezingen bij Dougalls Sterns op rustplaatsen van Cape Cod, september 1994 en augustus-september 1996.*

colony of ringing in 1994 or 1996	South Beach, 16 Sep 1994			Eel Point, Aug-Sep 1996		
	adults	juv	1994	adults	juv	1996
Falkner Island, CT	1	0	186	6	5	75
Great Gull Island, NY	3	4	1024	16	41	739
Other sites (4), NY	0	0	153	4	0	29
Bird Island, MA	5	2	1061	32	42	828
Ram Island, MA	0	0	132	1	22	532
Four sites, ME	0	0	60	0	2	97
total	9	6	2616	59	112	2300

## DISCUSSION

The data collected and reviewed by us show that Roseate Terns (and Common Terns) stage at about 20 discrete sites around Cape Cod. Most of these sites are at the end of barrier beaches or barrier islands, either on beaches or open sand flats, and usually adjacent to tidal inlets or tide-rips. Several of these sites have been recorded as staging areas over periods of many years. It is not clear whether these sites are selected because they minimise risks of predation and human disturbance, or because they are close to good feeding areas, or both.

During our surveys, Roseate Terns were seen in thousands at only one site: South Beach. This site is adjacent to and separated only by a tidal inlet from North Monomoy, where flocks of thousands had been seen staging and roosting during the 1980s (Table 1). During the early 1980s, flocks of thousands

had been reported also at Nauset Inlet and Hatch's Harbor (Table 1). Still earlier, Nauset Inlet had been a major staging site, with a report of 10 000 Roseate Terns there on 28 Aug. 1961 (Veit & Petersen 1993). All these sites are on the outer beaches of Cape Cod adjacent to cold Atlantic Ocean waters. Most of the records of large numbers at these sites have been in the period from 26 August to 19 September, i.e., in the last few weeks before southward migration (Tables 1, 2). At other staging sites along the Atlantic coast, reported numbers have been smaller and the largest numbers have been seen in July and August (Griscom & Snyder 1954; Bull 1985; Teets 1998; Shealer & Kress 1994). Thus, it seems likely that birds from the regional population disperse to many sites during July and August, but re-aggregate on the outer parts of Cape Cod in late August and September.

An important finding of our 1998 survey was that Roseate Terns around Cape Cod were found roosting at only two sites, South Beach and Sandy Neck; birds from at least three other staging sites departed towards one or other of these roost sites. In prior years, large numbers of Roseate Terns had been seen roosting at Monomoy, only 1-2 km from South Beach; these two sites probably constitute a single major staging and roosting area, including several km<sup>2</sup> of sand flats that are exposed at all but the highest tides. The configurations of these sites have changed markedly in recent decades and the terns appear to select the most remote and least disturbed locations for roosting. At both sites, terns roosted on sandbars and sand flats which were no more than 1 m above high water mark, and were probably flooded at the highest spring tides. The roost site at Sandy Neck was unexpected, because only small numbers of Roseate Terns had been seen there in prior years (Table 1); this area also has extensive sand flats but was subject to heavy human disturbance prior to 1998.

At the primary roosting area at Monomoy/South Beach, high counts of Roseate Terns have varied among years from a reported low of about 2000 in 1994 to a reported high of about 15 000 in 1984 (Table 1). We regard these reports of high numbers as extremely uncertain, for two reasons. First, roosting terns are present in numbers only in the late evening and continue to arrive after dark, so that it is impossible to see or count them accurately. Second, Roseate Terns are much more vocal than Common Terns at these roosts, so that it is easy to over-estimate the proportion of Roseate Terns in mixed flocks. Nevertheless, the numbers of Roseate Terns reported at these sites are at least comparable with the total numbers in the regional population, which were in the range 10 000-14 000 birds during the post-breeding periods between 1980 and 1998 (3000-4000 breeding pairs, with 2 adults, about 1.1 juveniles, and about 0.4 pre-breeders pair<sup>-1</sup>). It seems likely that, at least at times, the roosting aggregation at Monomoy/South Beach in September has included at least half and perhaps all of the regional population. The only other areas where staging Roseate Terns

have been reported in hundreds are certain inlets on the south shore of eastern Long Island, NY, 180-300 km WSW of Monomoy (Fig. 1); in that area, the highest counts have been reported in late August (Bull 1985; Schiff & Wollin 1988), although there is one old record of a flock of 300 on 15 September 1966 (Cooper *et al.* 1970). Further investigations are needed to determine whether large numbers of Roseate Terns remain on Long Island into September, or whether they move to join the main aggregation on Cape Cod. It will also be necessary to investigate other remote sites, such as Tuckernuck and Muskeget Islands, Jeremy's Point and Nomans Land, as possible roost sites.

Our findings have several implications for the conservation of this endangered regional population. First, the birds use and appear to depend on a limited number of staging areas around Cape Cod, an area where human recreational activity is intense in July-September. Although most staging sites were at locations far from points of human access, staging flocks of terns were disturbed by human activities at 16/20 sites. The coincidence between roosting at Sandy Neck in 1998 and the restriction of human access there in that year suggests that human disturbance may be an important limiting factor on use of roosting areas. It is possible that other sites such as Long Beach and Nauset Inlet would be used for staging or roosting by more birds if human disturbance there were similarly restricted.

Second, the fact that most or all of the birds staging and feeding around Cape Cod appear to roost in a small number of sites (possibly only one or two) means that they are potentially extremely vulnerable to nocturnal human activity at these sites. Monomoy is well protected as a National Wildlife Refuge, and South Beach is protected by its remote location and the difficulty of human access under present circumstances. However, prior to topographical changes that took place in the 1980s, South Beach was open to beach vehicles and the south tip where the terns now roost was occupied nightly by a fishing camp. Re-opening of South Beach to vehicles might prevent the terns from roosting there.

Finally, the concentration of a large fraction of the population at one site, where the birds roost on sand flats no more than 1 m above high water mark, makes it extremely vulnerable to North Atlantic hurricanes, whose frequency peaks in the second week in September when the birds are most concentrated. There is circumstantial evidence that hurricane 'Bob' in August 1991 eliminated a large fraction of the regional population of Roseate Terns (about 17% of adults and 80-90% of juveniles: Nisbet & Spendelow 1999). 'Bob' was not a major hurricane and passed 80-100 km WNW of outer Cape Cod. If a category 4 or 5 hurricane were to pass directly over outer Cape Cod in early September in the future, it might have even more serious consequences for Roseate Terns (and for Common Terns and other species).

## ACKNOWLEDGEMENTS

We thank E. Andrews, D. Clapp, K. Dahlen, T. Daybolt, L. Gill, J. Hatch, S. Koch, S. Landry, V. Laux, B. Long, B. Nikula, S. Perkins, S. Plaut, E. Ray, J. Smith, J. Sones, K. Spectre, P. Trimble, R. Veit and H. Wennemer for assistance in the field; we especially thank Brian Peacock who did much of the field work in 1994. We also thank Chris Floyd and Chandler Lofland for flying us on our aerial surveys, Steve Tucker and Blair Nikula for loan of vehicles, Jeffrey Spendelow for ringing information on the colour-marked birds, and Michael Gochfeld, Jeremy Hatch, Jeffrey Spendelow and two anonymous reviewers for helpful comments on earlier versions of the manuscript. The 1994 and 1998 field surveys were supported by grants from the U.S. Fish and Wildlife Service to the Massachusetts Audubon Society and from the Massachusetts Environmental Trust to the Center for Coastal Studies, respectively. Watson's field work in 1996-97 was supported by the Blake Fund of the Nuttall Ornithological Club.

## SAMENVATTING

*De dagen en weken onmiddellijk volgend op het broedseizoen vormen een periode waarin veel jonge zeevogels leren op eigen benen te staan, dan wel zelfstandig, dan wel onder begeleiding van één of beide ouders. Omdat de vogels de broedplaatsen verlaten en zich bij voorkeur in afgelegen (rustige) gebieden ophouden, is deze belangrijke fase in het leven van vogels dikwijls moeilijk te bestuderen. In dit artikel worden de roestplaatsen en foerageergebieden van de Dougalls Stern na de broedtijd aan de Noord-Amerikaanse oostkust (Cape Cod, Massachusetts) beschreven. Het onderzoek was opgezet in een poging om zowel de ligging van deze gebieden, als het gebruik en de eventuele bedreigingen voor de sterns in kaart te brengen. De Noord-Amerikaanse populatie van de Dougalls Stern wordt beschouwd als een 'bedreigde' populatie, omdat de sterns sterk geconcentreerd op slechts enkele kolonies voorkomen. Gedurende de afgelopen 20 jaren is het bestand langzaam gegroeid, tot 3700 paren op eilandjes ten zuidwesten en ten westen van Cape Cod en 300 paren op eilandjes in Gulf of Maine (Fig. 1). Juveniele Dougalls Sterns worden na de broedtijd ongeveer 8 weken door beide ouders begeleid en zijn daarna zelfstandig. Behalve juvenielen en broedvogels, mengen zich ook onvolwassen niet-broedvogels (pre-breeders, de meeste 2-3 jaren oud) onder de sterns die zich na de broedtijd op verschillende roestplaatsen ophouden. Het gebied wordt medio september verlaten en de sterns trekken dan vermoedelijk via de kortste weg (dat wil zeggen over open zee) naar overwinteringsgebieden in Zuid-Amerika of in het Caribische gebied.*

*De rust- en roestplaatsen werden bestudeerd in juli-september 1990, 1994, en 1996-98. De gehanteerde definitie voor rustplaatsen was: 'een plaats waar groepen sterns overdag rustend konden worden aangetroffen in de periode tussen de broedtijd en de najaarswegtrek'. Roestplaatsen zijn gebieden waar sterns in deze periode de nacht doorbrachten. De gegevens werden verzameld door vogeltijdschriften door te nemen en door speciaal georganiseerde tellingen vanuit de lucht (Fig. 2) en op het land. In totaal werden bij combinatie van literatuurstudie en tellingen vanuit de lucht 20 rust- en roestgebieden gevonden rond Cape Cod (Tabel 1, Fig. 3) en 15 van deze plekken werden vervolgens bezocht in 1994 en 1998 (Tabel 1-2). Tijdens de tellingen vanuit de lucht werd 10 locaties gevonden met 200-1500 sterns elk (Dougalls Sterns konden hierbij doorgaans niet van de aanwezige Visdieven worden onderscheiden). In Tabel 1 is een overzicht gegeven van de grootste aantallen sterns die op elk van de 20 gevonden locaties zijn waargenomen gedurende 1980-98. De voornaamste gebieden grensden aan het koude Atlantische water ten oosten van Cape Cod. De sterns bleken zich onmiddellijk te verspreiden in de periode direct volgend op de broedtijd (juli-augustus), waarna eind augustus/begin september steeds grotere concentraties werden gevormd, als voorverzamelplaatsen ter voorbereiding van de najaarstrek. Slechts twee (van de belangrijkste) plaatsen werden ook 's nachts door de sterns gebruikt en de geweldige concentratie van deze zeldzame vogel op een zo klein aantal roestplaatsen maakt de soort in bijzonder kwetsbaar voor bijvoorbeeld verstoring of voor de jaarlijkse orkanen in dit kustgebied.*

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