Atlantic Seabirds

Vol. 1, no. 4 (1999)

Quarterly journal of The Seabird Group and the Dutch Seabird Group

Atlantic Seabirds *Edited by C.J. Camphuysen & J.B. Reid*

ATLANTIC SEABIRDS is the quarterly journal of the SEABIRD GROUP and the DUTCH SEABIRD GROUP (Nederlandse Zeevogelgroep, NZG), and is the continuance of their respective journals, *SEABIRD* (following no. 20, 1998) and *SULA* (following vol. 12 no. 4, 1998). *ATLANTIC SEABIRDS* will publish papers and short communications on any aspect of seabird biology and these will be peer-reviewed. The geographical focus of the journal is the Atlantic Ocean and adjacent seas at all latitudes, but contributions are also welcome from other parts of the world provided they are of general interest. *ATLANTIC SEABIRDS* is indexed in the Aquatic Sciences and Fisheries abstracts, Ecology Abstracts and Animal Behaviour Abstracts of Cambridge Scientific databases and journals.

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Published by **THE SEABIRD GROUP**, c/o The Lodge, Sandy, Bedfordshire SG19 2DL, U.K., charity number: 260907. Membership secr.: Sheila Russel, Clober Farm, Milngavie, Glasgow G62 7HW, Scotland U.K., E-mail: Sheila-Russell@Cloberfarm.in2home.co.uk

and the **DUTCH SEABIRD GROUP** (Nederlandse Zeevogelgroep), section of the Netherlands Ornithologists' Union (NOU), c/o De Houtmanstraat 46, 1792 BC Oudeschild, Texel, The Netherlands.

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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

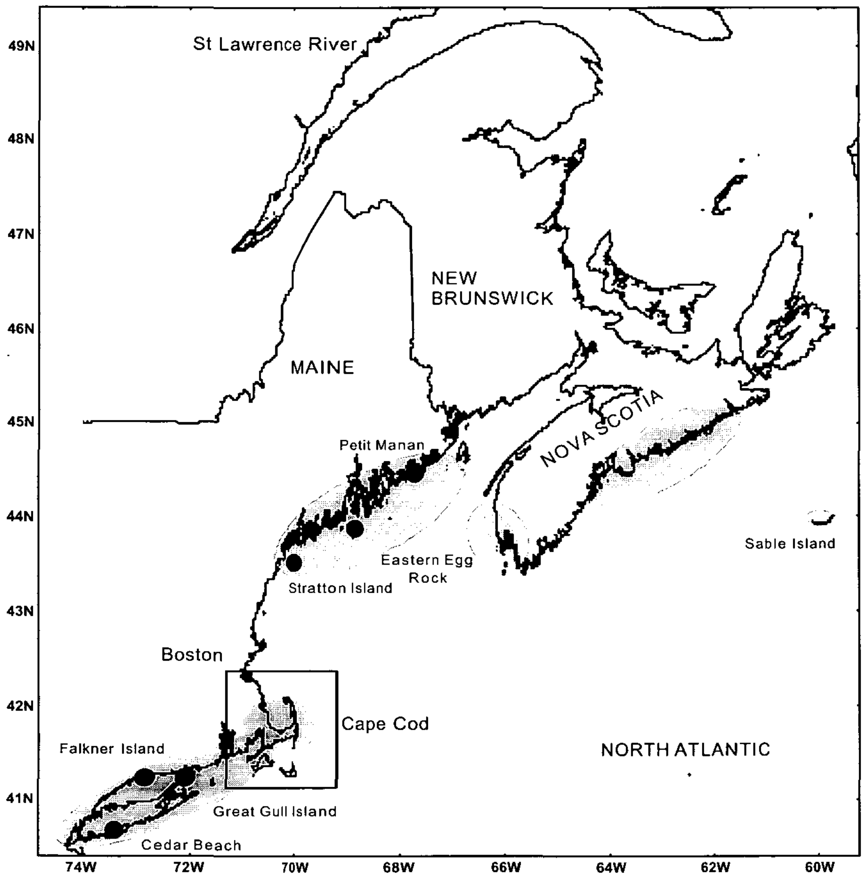

Figure 1. Breeding range of the Roseate Tern in the northwest Atlantic (northeastern USA and southeastern Canada). Major colony sites are marked with dots. The box shows the area where the surveys reported in this paper were carried out (Figs. 2, 3).

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-1Aug 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)[a]	n.d.
6	Pamet 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[b]	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[c]	600, 26 Aug	500, 18 Aug	15 000, 4 Sep 1984 10 000, 19 Sep 1984 7000, 9 Sep 1988 6000, 7 Sep 1987
11	South Monomoy, Chatham	n.d.	n.d.	1500, 4 Sep 1980
12	Harbor Jetties, Nantucket	250, 4 Sep	n.d.	2000, 9 Sep 1989[d]
13	Smith's Poimt, Nantucket	300, 5 Sep	10, 25 Aug	1200, 3 Sep 1989[d]
14	Eel Point, Nantucket	250, 4 Sep	31, 18 Aug	1000, 23-25 Aug 1991[d]
15	Tuckernuck Island	n.d.	500, 25 Aug	600, 30 Aug 1997
16	Muskeget Island[a]	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.

[a] 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

[b] data pooled for three locations arount 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

[c] includes North Monomoy Island, "middle Monomoy", and the north end of South Monomoy Island

[d] published high counts for Nantucket Island did not distinguish among sites

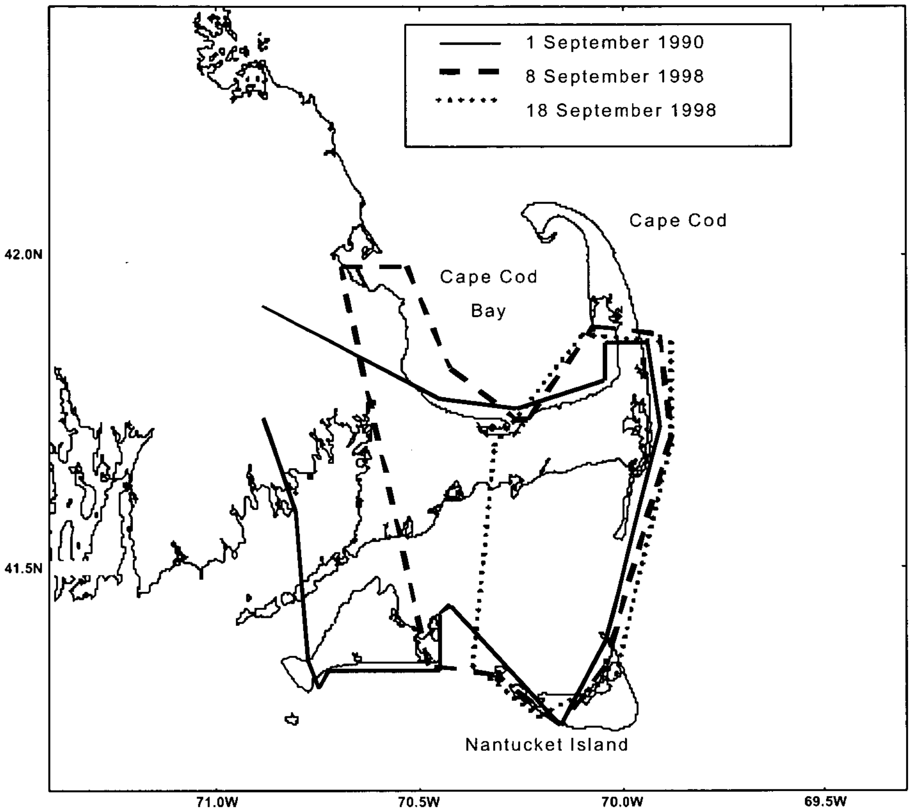

Figure 2. Routes of aerial surveys flown on 1 September 1990, 8 and 18 September 1998.
Figuur 2. Routes van vliegtuigtellingen op 1 september 1990, 8 en 18 september 1998.

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^{-1}. 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

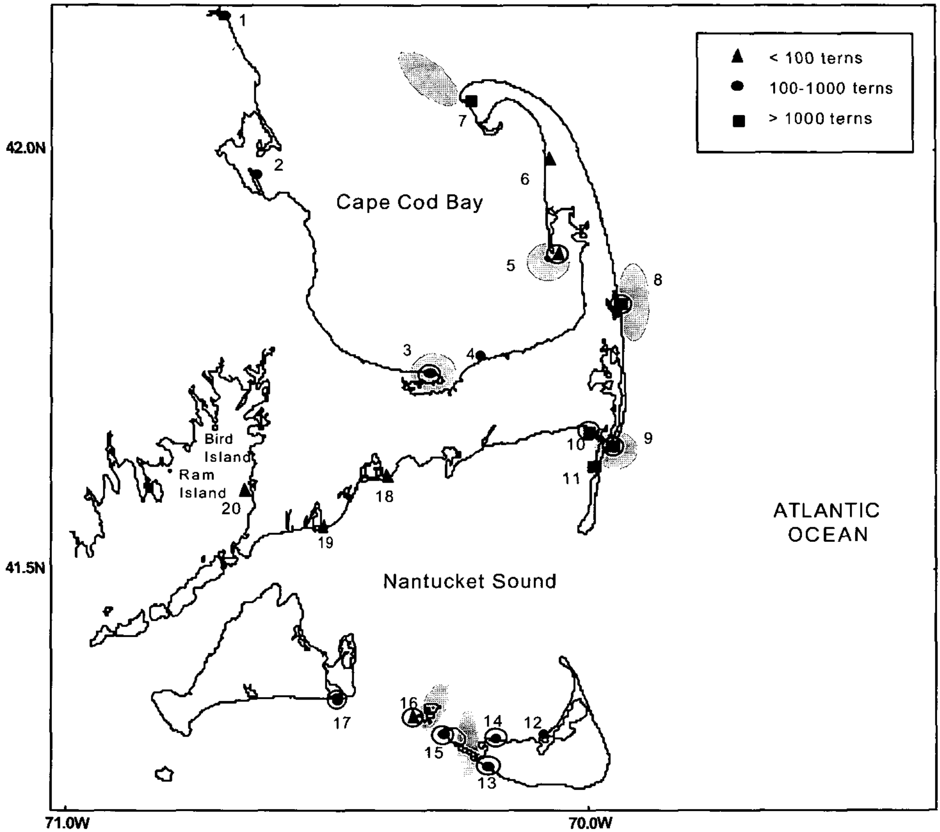

Figure 3. Staging and roosting areas of Roseate Terns around Cape Cod, Massachusetts, USA. Staging sites are numbered to correspond to the site numbers in Table 1. Symbols indicate the largest numbers of Roseate Terns reported during 1980-1998: square, >1000 birds; circle, 100-1000 birds; triangle, <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[a] sites, August-September 1998.
Tabel 2. Tellingen van Dougalls Sterns op negen[a] locaties, augustus-september 1998.

	date					
location	18 Aug	25 Aug	1 Sep	8 Sep	15 Sep	23 Sep
Sandy Neck	107	200	330	124	688	n.d.[b]
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

[a] no Roseate Terns were seen at North Beach or Long Beach
[b] 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 Sep1994			Eel Point, Aug-Sep 1996		
			chicks ringed			chicks ringed
	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^2 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 $pair^{-1}$). 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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THE POPULATION STATUS OF SOOTY TERNS *STERNA FUSCATA* ON ASCENSION ISLAND

DE STATUS VAN BONTE STERNS OP ASCENSION

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Feral cats were introduced to Ascension Island in the 1800s and extirpated all seabirds with the exception of Sooty Terns to inaccessible islets, stacks and cliffs. Sooty Terns continue to breed in reduced numbers on the south-west plains of the island and are still subject to cat predation, so monitoring of their population trends is important. Measuring the impact of cat predation upon seabird populations depends on having reliable baseline data; censuses of Sooty Terns on Ascension were conducted in 1990, 1996, 1997 and 1998 and involved sampling clutch densities in sub-colonies and then extrapolating to the total colony area. The population varied significantly over the study period, with 176 000 pairs in 1990, 202 000 pairs in 1996, 151 000 pairs in 1997 and 207 000 pairs in 1998. The 22% reduction in 1997 compared with 1996 and 1998 is thought to be due to a large proportion of mature birds deferring breeding because of reduced food availability induced by oceanographic perturbations. Such variability in breeding population size in relation to stochastic events means that censuses need to be undertaken frequently to ensure trends can be detected with confidence.

Ratcliffe N., J. Hughes & F.A. Roberts 1999. The population status of Sooty Terns *Sterna fuscata* on Ascension Island. Atlantic Seabirds 1(4): 159-168.

INTRODUCTION

Historic records, subfossil evidence and distribution of guano deposits indicate that large colonies of seabirds once nested on the coastal plains of Ascension Island (Stonehouse 1962; Ashmole 1963a; Olson 1977; Blair 1989). Black Rats *Rattus rattus* reached the island in 1701 (Stonehouse 1962) but it is thought that these had little effect on the seabirds, with the possible exception of Madeiran Storm-petrel *Oceanodroma castro* (Ashmole *et al.* 1994). Domestic cats *Felis catus* were introduced to the island in 1815 in the hope that they would control rats (Ashmole *et al.* 1994), but they preyed on seabirds and their population multiplied rapidly (Stonehouse 1962). By the middle of the nineteenth century, seabirds were almost entirely extirpated to the adjacent Boatswainbird Islet, inaccessible cliffs on the main island and 14 small stacks around the coast (Ashmole *et al.* 1994).

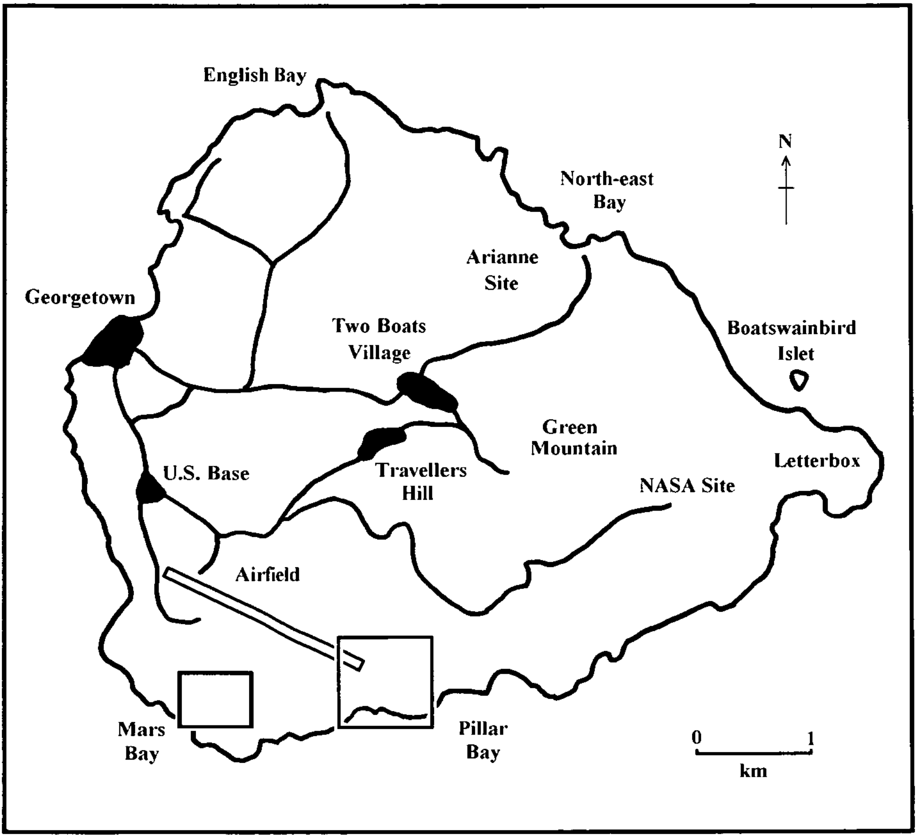

Figure 1. Map of Ascension Island, showing major geographical features, settlements and roads. The boxes in the south-west of the map indicate the areas in which Sooty Tern sub-colonies occur.
Figuur 1. Kaart van Ascension met plaatsnamen. De met vierkanten aangegeven gebieden in het zuidwesten zijn het deel van Ascension waar de in dit stuk besproken sub-kolonies zich bevinden.

Of the 11 breeding seabird species present on Ascension, only Sooty Terns *Sterna fuscata* continue to breed on the coastal plain (Ashmole *et al.* 1994), although it is believed that their numbers are greatly reduced (Ashmole 1963b). Sooty Terns survived on the mainland probably because their sub-annual breeding season is highly synchronised and they are completely absent from the island for 2-3 months of the year (Ashmole 1963b). Following the extirpation of alternative seabird prey, feral cats would have suffered a severe food shortage during this period and their population would consequently have declined to its current size of around 600-800 individuals (Bell & Ashmole 1995). Cat predation upon Sooty Terns still occurs and estimates suggest that approximately 1% of the population is killed every breeding season (Ashmole 1963b; Walmsley 1991, 1992, 1994). Rat predation on eggs or chicks is negligible, with most of the rat population being in vegetated areas well away from the breeding colonies (pers. obs.).

The eradication of feral cats would probably result in an increase in the Sooty Tern population by increasing adult survival rates and productivity, and also in the recolonisation of the mainland by other seabird species (Ashmole *et al.* 1994). A feasibility study for eradication of cats has been conducted by Bell & Ashmole (1995) who concluded that it would be possible to remove cats from the island altogether over a period of 3 years.

In order to investigate the effects of cat eradication on the Sooty Tern population it is important to have accurate baseline census data against which future trends can be judged. Even if eradication is not implemented, it is important to monitor population trends and predation rates so that appropriate action may be taken should Sooty Tern numbers decline. Such action could include intensive cat control around colonies prior to the breeding season. This paper describes the status and population trends of Sooty Terns on Ascension Island between 1990 and 1998 and considers whether the censuses provide adequate baselines for assessing future trends in response to cat eradication.

METHODS

The Sooty Tern population on Ascension was surveyed four times during the 1990s: in March 1990, October 1996, August and September 1997, and June and July 1998. The total population is very large (100 000s), so these censuses estimated mean clutch densities in sample quadrats and extrapolated these to the estimated area of the colony.

Sooty Terns breed relatively synchronously every 9.6 months, but there is still considerable spread in the timing of laying within a breeding season. There are often two or more asynchronous peak periods of nesting in a breeding season, resulting in breeders in some sub-colonies having chicks while others are still laying (pers obs). Timing of the surveys is crucial if the total number of nesting birds is to be estimated accurately. If the census is too early many birds will not have laid, resulting in underestimates of colony area and population size, and if it is too late then the chicks will have hatched, making quantitative estimation of clutch densities impossible.

Laying Sooty Terns nest at the highest density that the habitat will support, so that any expansion in numbers nesting at a sub-colony is always due to an increase in the area occupied rather than increased density due to pairs nesting among established breeders. Established areas of sub-colonies may therefore be surveyed without the risk of more birds nesting among them and thereby increasing clutch density.

Newly forming sub-colonies were distinguished from those where laying was complete by large numbers of adults circling overhead, calling and courting, but with few eggs present. In established sub-colonies, all adults had eggs and incubated quietly if left undisturbed. Sub-colonies were surveyed only when laying had been completed and before chicks hatched. An exception to this was in 1998, when surveying began in one large sub-colony after hatching.

Locating sub-colonies The breeding distribution of Sooty Terns on Ascension Island (7°57'S, 1°22'W) is entirely restricted to the coastal plain between Mars Bay and Pillar Bay (Fig. 1). During each expedition, a large proportion of the Ascension coastal plain was visited, but no Sooty Terns were ever found breeding outside the Mars Bay-Pillar Bay area. The only other colony in Ascension is a small one on Boatswain Bird Islet (Ashmole 1963b). Censuses of the coastal plain between Mars and Pillar Bays, therefore, may be regarded as population estimates for Ascension as a whole. During each census, the breeding area was searched systematically for Sooty Tern sub-colonies. A complete search is required as nesting habitat (typically mixed ash and basalt rubble) is extensive and the distribution, size and shape of sub-colonies changes during each breeding season. Sub-colonies are defined as spatially separate areas occupied by breeding birds.

Mapping subcolonies The sub-colonies were surveyed when all signs of birds establishing new nests had ceased. During the 1990, 1996 and 1998 surveys, cairns of rock (*c.* 0.6 m high) were built around each sub-colony perimeter every 20-30 m or at each change in direction of the sub-colony edge. A circular compass traverse was then conducted around the entire sub-colony perimeter (Hughes 1991). This involved measuring the distances between each cairn and the bearing of each cairn to its two neighbours using a prismatic compass. The distances and angles between each cairn were then plotted on 1 mm square graph paper at a scale of 1:1000. The total area of the sub-colony was deduced by counting the number of 1mm squares in each sub-colony plot and multiplying the total by 1 000 000.

In 1997 the sub-colonies were mapped using a different method. A central reference line (CRL, a string marked at 5 m intervals) was run through the middle of a sub-colony. At each 5 m interval and on each side, the distance from the CRL to the sub-colony edge was measured at 90° to the nearest 5 m. From this, a grid-map of the sub-colony was constructed on graph paper, each square of the grid representing a 5x5 m square on the ground. The number of squares in the grid was then counted and the area of the colony (in m^2) determined by multiplying the total by 25.

Estimating clutch densities In the 1990, 1996 and 1998 surveys, transects were placed at random through each sub-colony. At every 20 paces along the transect, a peg with a 1.784 m long string attached to it was used to describe a circle of area $10 m^2$. The number of clutches within each circle was counted by two observers and the mean count adopted if the two counts differed. In the 1998 survey, eggs at one sub-colony had hatched before the survey began, so collection of nest density data was not possible. However, visual comparisons of incubating and brooding bird densities at two other sub-colonies in the same year suggested that nest density was similar to this sub-colony. Therefore, the mean density (2.12 clutches/m^2) of these was used in estimating the size of the sub-colony where eggs had already hatched.

In the 1997 survey, the density of clutches in each sub-colony was estimated using square 5x5 m quadrats. A rectangular grid was constructed for each sub-colony and the X-Y co-ordinates of every quadrat were written on pegs. In order to avoid any bias in estimating clutch density, sample quadrats for estimating clutch density were randomly selected by drawing pegs from a hat. Quadrat boundaries were marked out with string and all eggs within each quadrat were counted and marked with a spot of red permanent ink to avoid double counting. A second search of the entire quadrat was then made to ensure that no eggs were missed. In cases where the quadrat string straddled clutches, only those that had more than half of their volume in the quadrat were included in the count.

Analysis Clutch densities were calculated by dividing the number of clutches counted in each quadrat by its area in m^2. Clutch densities differed among sub-colonies and so simply multiplying the overall mean density by the total colony area would not produce precise population estimates. Calculating the population size within each sub-colony would also reduce the precision of the estimate due to sub-division of the sample size.

Variation in clutch densities among sub-colonies was tested using Analysis of Variance with Bonferroni Pairwise Comparisons (Winer *et al.* 1991). Sub-colonies were grouped together for further analysis if their clutch densities did not differ significantly. The frequency distribution of clutch densities in some sub-colonies was non-normal with a strong skew towards lower values. As this invalidates arithmetic calculation of means and confidence limits, a bootstrapping procedure was used to re-sample the data with replacement (Westfall & Young 1993). This procedure involves randomly drawing values from the observed data until the number of cases resampled is equal to the number actually sampled; some samples are drawn more than once and others not at all. The mean value of this re-sample was then calculated and the procedure repeated 999 times to produce a frequency distribution of possible mean values based on the raw data. The mean of this re-sampled clutch density data along with the 2.5 and 97.5 percentiles were then calculated and extrapolated by the total colony area to give a population estimate with confidence intervals.

The number of breeding pairs in each sub-colony group in each year was calculated by multiplying the nesting density by the total area occupied by that density. The estimated sizes of all sub-colony groups were then summed to give the overall population estimate. The upper and lower confidence limits of each bootstrapped mean were treated in the same manner to produce measures of precision for each population estimate.

RESULTS

Nesting density varied significantly among sub-colonies in all years (ANOVA 1990: $F_{4,229} = 23.20$, $P < 0.001$; 1996: $F_{3,461} = 57.46$, $P < 0.001$; 1997: $F_{7,536} = 11.94$, $P < 0.001$; 1998: $F_{2,304} = 88.83$, $P < 0.001$). Sub-colonies with mean densities that did not differ significantly (as determined by Bonferroni tests) were pooled for further analysis in order to reduce the variance and improve precision of the population estimates. The mean bootstrapped nesting densities and 95% confidence limits for each of these groupings are shown in Table 1, along with the number of sub-colonies exhibiting that density and their total area.

The breeding population sizes of Sooty Terns on Ascension Island between 1990 and 1998 are shown in Table 2. Examination of the mean population estimates and their confidence intervals shows that the size of the breeding population has varied significantly during this period. The population sizes in 1996 and 1998 were similar and exceeded 200 000 pairs, but population size in 1997 was significantly lower, at 151 000 pairs, than all other years with. The population size in 1990, 176 000 pairs, was intermediate and differed significantly from all other years.

DISCUSSION

Sooty Terns have a minimum global population of 25 million pairs, making it one of the most common seabirds in the world (Gochfeld & Burger 1996). The major part of the population occurs in the tropical Pacific where some colonies exceed 1000 000 pairs (Gochfeld & Burger 1996). Compared with these

Table 1 Variation in Sooty Tern nesting density (clutches per m²) on Ascension Island among sub-colonies and years (with upper and lower 95% confidence limits, CI). The density values within each year are pooled for those sub-colonies that did not differ at the 0.05 significance level. The number of sub-colonies exhibiting each mean density and their total area are also presented.

Tabel 1. Variaties in dichtheden broedende Bonte Sterns op Ascension Island in verschillende subkolonies en in verschillende jaren.

Year	Density	Sample size	Lower 95% CI	Upper 95% CI	N°. Sub-colonies	Area (ha)
1990	0.51	78	0.34	0.67	1	5.46
1990	1.85	156	1.70	2.01	13	8.04
1996	1.93	118	1.72	2.14	2	3.21
1996	0.92	127	0.80	1.04	1	1.40
1996	2.52	219	2.41	2.62	1	5.06
1997	1.09	109	1.01	1.16	4	1.39
1997	1.74	434	1.69	1.79	4	7.73
1998	0.77	100	0.67	2.03	1	0.88
1998	2.12	307	0.87	2.23	3	9.45

Table 2: Population status of Sooty Terns at Ascension Island between 1990 and 1998 (values rounded to the nearest 1000 pairs).

Tabel 2. Populatieschattingen van Bonte Sterns op Ascension Island tussen 1990 en 1998 (afgerond op duizendtallen).

Year	Population size	Lower 95% CI	Upper 95% CI
1990	176 000	155 000	198 000
1996	202 000	188 000	216 000
1997	151 000	143 000	158 000
1998	207 000	197 000	219 000

colonies, the one on Ascension is relatively small, representing approximately 0.8% of the world population. However, it is certainly among the largest colonies in the Atlantic Ocean (Williams 1984) and as such, is an important component of the region's biodiversity. If cats were eradicated the number of Sooty Terns would probably increase dramatically, and the importance of the island for this species would increase further. This single conservation measure would probably also lead to the recolonisation of the main island by other seabird species, including the endemic Ascension Frigatebird *Fregata aquila* (Bell & Ashmole 1995).

The Sooty Tern population on Ascension probably declined from 1815 onwards following the introduction of feral cats, although the population status prior to this date is unknown. Ashmole (1963b) estimated that 500 000 pairs bred on Ascension in 1954 although this is speculative and does not allow formal comparison with the estimates presented here. The population increased from 176 000 in 1990 to 202 000 in 1996. It then declined sharply to 151 000 pairs in 1997 before recovering to 207 000 pairs in 1998. It appears that the Sooty Tern population on Ascension is on average stable and therefore in equilibrium with current rates of cat predation, although significant fluctuations do occur around the average population size.

The 22% reduction in population size in 1997 compared with 1996 and 1998 could not have resulted from a catastrophic mortality event since the recovery during the following year was far too rapid. Such a large difference is also unlikely to be an artefact of the minor methodological differences employed in the 1997 survey. The most likely explanation was that the 1997 season coincided with an El Niño event (National Oceanic and Atmospheric Association, unpublished data) that may have influenced oceanographic conditions in the equatorial Atlantic, causing a reduction in pelagic food availability. A large proportion of the sexually mature population may have deferred breeding in response to this reduced prey availability, as has been documented for Brown Booby *Sula leucogaster* on Ascension (Simmons 1967, 1970), Brandt's Cormorant *Phalacrocorax penicillatus* (Boekelheide & Ainley 1989) and Elegant Tern *Sterna elegans* (Schaffner 1986) in California, and several species of seabird in South Africa (Crawford & Dyer 1995).

A second expedition to Ascension several weeks after the August/September 1997 survey discovered that breeding success of Sooty Terns was very low, with only small numbers of fledged young and very large numbers of abandoned eggs (Simmons & Prytherch 1998). This supports the hypothesis that food availability was poor during 1997 and forced adults to abandon their eggs, as documented for Arctic terns *Sterna paradisaea* on Shetland during a period of poor sandeel *Ammodytes marinus* abundance (Monaghan *et al.* 1992). Mass desertions of eggs by Sooty Terns at Ascension was also documented during the October 1991 breeding season (Hughes 1992). Annual variability in the proportion of mature birds present, in response to stochastic fluctuations in food availability, makes accurate census and monitoring of population trends difficult. Single surveys risk coinciding with a period of low food availability, as seemed to happen in 1997, and so surveys in several successive breeding seasons are required to establish a suitable baseline, and surveys in ten or more seasons are required to obtain an accurate measure of population trends. We recommend, therefore, that monitoring of the Sooty Tern population on Ascension occurs on an annual or biennial basis.

ACKNOWLEDGEMENTS

We would like to thank Roger Huxley for permitting census work on Ascension Island and for logistic support. Hilary Nash and Roger Dickey led the expeditions during 1990 and 1996 & 1998 respectively. They and other members of the Army Ornithological Society, and John Walmsley provided invaluable assistance in mapping the colonies and collecting clutch density data during the 1990, 1996 and 1998 censuses, and Philip Ashmole kindly provided clutch density data from 1990. The Heritage Society kindly made contributions to our subsistence expenses during the 1997 survey. We are indebted to the RAF station commander Adrian Hayward and the SERCo staff on the base for allowing us to use the runway to access Sooty Tern sub-colonies.

SAMENVATTING

Zoals op zoveel afgelegen eilanden bleef ook voor de zeevogels van Ascension Island (Centrale Atlantische Oceaan, juist onder de evenaar) de komst van de mens niet onopgemerkt. In de 19e eeuw werden katten op het eiland geïntroduceerd en daardoor werden de zeevogels van het eiland uitgeroeid, of op zijn minst naar enkele afgelegen rotspunten en kliffen teruggedrongen. Alleen de Bonte Stern Sterna fuscata *wist zich (tot op de dag van vandaag) op het hoofdeiland te handhaven, ondanks de aanhoudende predatie door katten. Een populatie die zo sterk onder druk staat moet nauwkeurig gevolgd worden en in dit artikel worden de resultaten van tellingen in de jaren 1990, 1996, 1997 en 1998 gepresenteerd. De tellingen bestonden uit precieze tellingen van de aantallen legsels in vaste gedeeltes van de kolonies, gevolgd door extrapolatie van de dichtheden voor de totale met vergelijkbare dichtheden bezette oppervlakte. Het bleek dat de aantallen broedvogels enorm van jaar tot jaar verschilden: 176 000 in 1990, 202 000 in 1996, 151 000 in 1997 en 207 000 paar in 1998. Het kleine aantal broedvogels in 1997 werd vermoedelijk veroorzaakt doordat veel volwassen vogels dat jaar wegens slechte voedselomstandigheden van broeden hebben afgezien. Het voedselaanbod staat onder invloed van oceanografische fluctuaties. Indien de populatie zodanig kan variëren, is het aan de hand van een klein aantal tellingen onmogelijk om lange termijn op het spoor te komen. Een dergelijke populatie moet dan ook regelmatig geteld worden.*

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BREEDING SUCCESS OF COMMON GULLS *LARUS CANUS* IN WEST SCOTLAND I. OBSERVATIONS AT A SINGLE COLONY

BROEDSUCCES VAN STORMMEEUWEN IN WEST-SCHOTLAND I. WAARNEMINGEN OP EEN ENKELE KOLONIE

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A colony of c. *100 pairs of Common Gulls* Larus canus *breeding on a 12 ha island 250 m off the coast of west Scotland was studied in the years 1988-95. Laying and hatching dates varied significantly between years. Length of incubation varied little, the annual mean always lying between 24.2 and 25.3 days. In 1988-90, mean clutch size was 2.4, 2.8 and 2.5; productivity (young fledged/pair laying) was 0.48, 0.74 and 0.27; and 34%, 47% and 23% of pairs fledged young. Of these successful pairs, the percentages fledging one, two and three young were 61%, 34% and 5% in 1988; 50%, 42% and 8% in 1989; and 83%, 17% and 0% in 1990. In 1988, the 18% of the colony that laid before 11 May fledged 1.09 young/pair; the 48% that laid in the next week fledged 0.48 young/pair; the 20% that laid in the subsequent week fledged 0.28 young/pair; and the 14% that laid thereafter fledged no young. In 1988-90, no or almost no young fledged from clutches completed after 20 May. In 1988, nests within 1 m of dense vegetation (usually* Juncus*) hatched and fledged more successfully than those further from dense vegetation. Breeding success was reduced by Peregrines* Falco peregrinus, *Herring Gulls* Larus argentatus *and American Mink* Mustela vison. *In 1988, Peregrines took 20% of large unfledged young, and nests within 55 m of a Herring Gull nest hatched and fledged less successfully than those further from Herring Gull nests. Earlier breeders tended to nest further from Herring Gull nests, and closer to vegetation, than did later breeders. Predation by American Mink, unrecorded on this island in 1980-89, was first recorded late in the 1990 breeding season. In 1991 and 1992, mink were established on the island and for the first time on record no Common Gulls fledged there. The study site was abandoned by Common Gulls in 1993-97 (although some bred elsewhere on the island).*

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INTRODUCTION

Perhaps because of its unexceptional habits and prosaic English name, the Common Gull *Larus canus* rarely excites the enthusiasm of ornithologists. Lowe (1915) wrote: 'The Common Gull is not a particularly interesting example of the genus. It does nothing to relieve the apparently humdrum monotony of an ordinary gull's life.' Whatever the reason, there have been few determinations of the

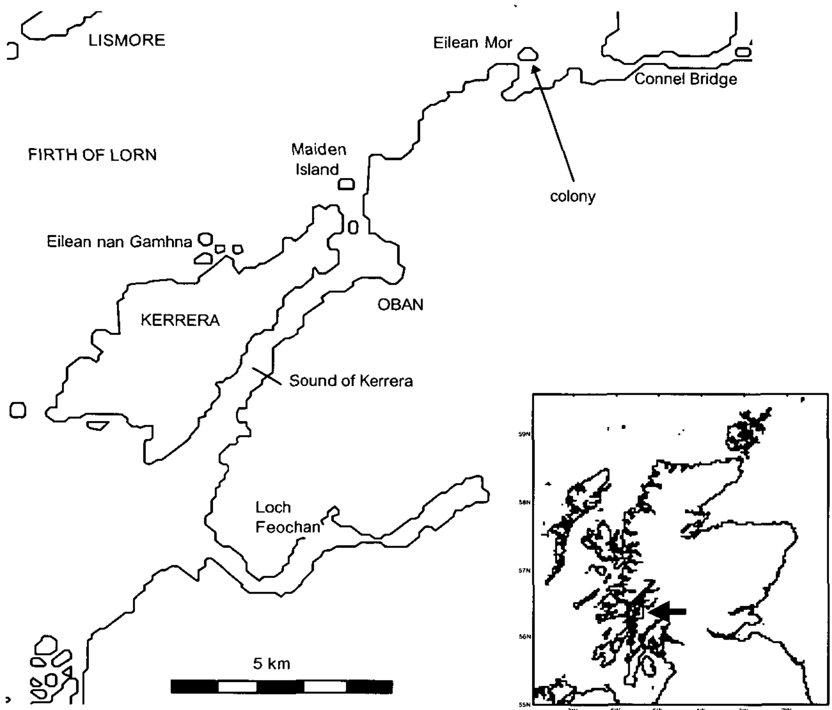


Figure 1. Map showing location of Eilean Mor and of the Common Gull colony. Detailed map of the colony is given in Fig. 4.
Figuur 1. Kaart met de ligging van Eilean Mor ten noorden van Oban aan de Schotse westkust en de ligging van de stormmeeuwenkolonie. Een gedetailleerde kaart van de kolonie is in Fig. 4 gegeven.

breeding success of this species, either in continental Europe or in the British Isles (see Discussion). This study in west Scotland records the breeding success of Common Gulls at one colony over several years and identifies some adverse factors. A second paper (Craik 2000) records Common Gull productivity in less detail at a number of colonies over several years.

METHODS

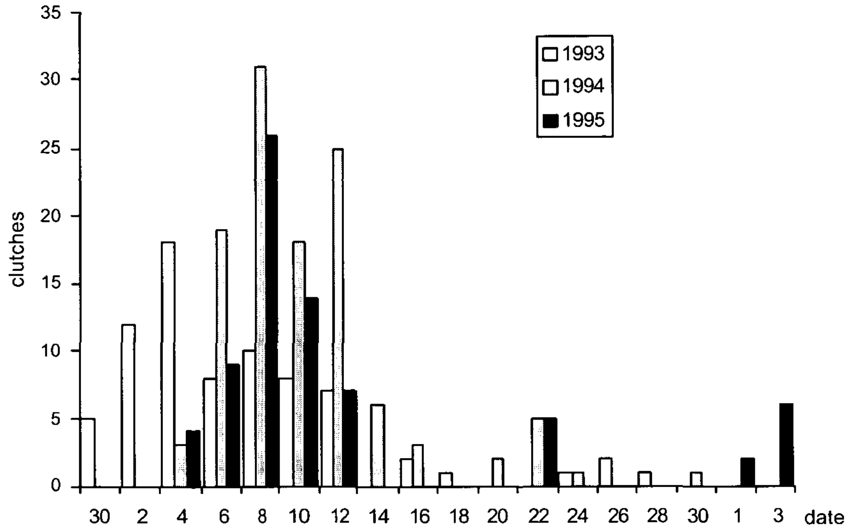
The study was made on Eilean Mor near Oban, Scotland (Fig. 1), an island of *c.* 12 ha lying *c.* 250 m from the nearest mainland. Common Gulls breeding on the island were divided naturally into four or five (depending on year) colonies, separated by 20-300 m of shore, tidal channel or moorland. During the study, each colony held *c*. 20-100 pairs. Most of the work was undertaken at the largest of these colonies ('the colony'). Breeding success (numbers nesting, hatching and fledging) was recorded in the five years 1988-92. Hatching dates of all clutches that hatched in the colony were recorded only in 1988-90 (since few hatched and none fledged in 1991-92). For reasons given below, laying dates were recorded only in 1993-95. Chi-square tests were applied to breeding data, using Yates' correction where appropriate (Fowler & Cohen 1986).

Visits were made at intervals of 2-3 days from early in incubation to shortly before the first young fledged (*c*. 10 May - 24 June). All nests with one or more eggs were numbered and the clutch size at each visit was recorded.

All chicks in the study area were ringed soon after hatching when they were still assignable to nests; after about three days they scatter increasingly widely. On subsequent visits, vegetation was searched and the ring numbers of all chicks found were recorded. This continued until chicks were *c*. 20-25 days old, when they became so mobile that they left the colony area on the approach of investigators and recording the presence of individual chicks became impossible. Chicks that were found dead were aged by their ring number. Those that survived 11 or more days and were not subsequently found dead were assumed to have fledged.

Productivity of the colony was defined as number of chicks fledged/number of clutches (Walsh *et al.* 1995b). The remains of adults and larger chicks killed by predators were collected. The predator was usually identifiable as a raptor ('V'-marks in sternum, windblown spread of many plucked contour feathers, remiges and rectrices not usually plucked, head and legs often detached) or as American Mink *Mustela vison* ('mink'; paired tooth marks 10 mm apart on eggs, eggshell, back of head or neck, prey often intact and cached in vegetation, little or no plucking; see Craik (1995) for further details).

Visits in 1988-92 did not begin until the second week in May each year and so missed exact laying dates of some early clutches. Laying dates were obtained over the whole laying period (late April to early June) in 1993-95 by visiting other Common Gull colonies on the island every 2-3 days. In 1988-94, the timing of visits allowed many exact determinations to be made of the dates of clutch completion and also of hatching if this was seen (but which was assumed to be one day later if egg-chipping was in progress). For these clutches, the incubation period was defined as the difference between these two dates. For other clutches, an accuracy of ±1 day in each date resulted in an unacceptable ±2 days in the difference, so these were not used in estimating the duration of the incubation period.



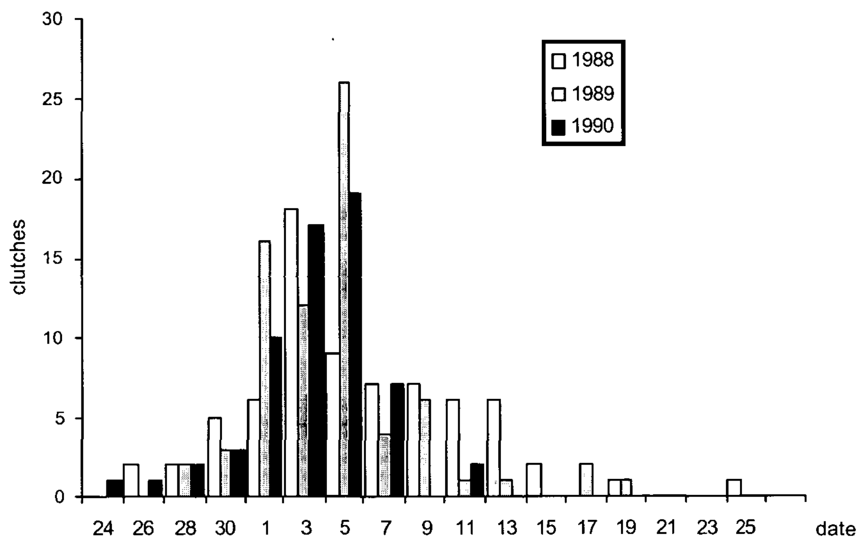


Figure 2. Dates of first egg of all clutches laid 30 April-3 June 1993-95 (top).
Figuur 2. Datum eerste ei van Stormmeeuwen 30 april- 3 juni 1993-95 (boven).

Figure 3. Hatching dates of all clutches that hatched at the colony, 24 May-26 June 1988-90.
Figuur 3. Uitkomstdata van alle succescolle legsels, 24 mei-26 juni 1988-90.

RESULTS

There was highly significant variation between years in dates of laying (Fig. 2; with date classes as shown but with 30 April-4 May combined and 14 May-4 June combined in order to avoid low expected frequencies, $\chi^2_{12} = 84.7$, $P < 0.001$). Fig. 2 shows that this was largely due to earlier laying in 1993, the reasons for which are unknown.

There was significant variation between years in dates of hatching (Fig. 3; with date classes as shown but with 24-31 May - the few earliest -combined and 9-26 June - the few latest - combined in order to avoid low expected frequencies, $\chi^2_{10} = 33.4$, $P < 0.001$). Fig. 3 shows that this was partly due to an earlier median date of hatching in 1988, again for unknown reasons. The incubation period in five different years, estimated from the minority of clutches throughout the study for which dates of clutch completion and dates of hatching were both accurately known, is shown in Table 1. As would be expected, the mean incubation period was very similar from year to year, always falling within the interval 24.2 to 25.3 days.

Mean clutch size was 2.4, 2.8 and 2.5 in 1988-90 (Table 2). This is based on the maximum clutch recorded at each nest, so that effects of egg predation are minimised. The extent to which egg removal by predators, including humans, may have contributed to this variation is difficult to assess. Hatching success and productivity are also given in Table 2. In the years 1988-90, 59%, 72% and 62% of clutches hatched one or more eggs, and 51%, 65% and 53% of eggs hatched.

Estimates of productivity in the three years were 0.48, 0.74 and 0.27 young fledged/pair. The proportions of pairs that fledged one or more young were 41/122 (34%), 48/103 (47%) and 23/100 (23%). Thus, in all three years a majority of pairs failed to fledge any young. Very few pairs fledged three young. The percentages of successful pairs that fledged one, two and three young were: 61%, 34% and 5% in 1988; 50%, 42% and 8% in 1989, and 83%, 17% and 0% in 1990.

In 1988, both hatching and fledging success were greatest for clutches completed by 10 May but both declined sharply thereafter (Table 3). No chicks hatched from clutches completed after 31 May, and no young fledged from clutches completed after 24 May. Very similar results were obtained in 1989 and 1990 (Table 4). Overall, no or almost no young fledged from clutches completed after about 20 May.

Fig. 4 shows the location of all the Common Gull clutches at the colony in 1988; it also indicates which of these were successful (fledging one or more young). One pair of Herring Gulls nested within the Common Gull colony, and another at its edge. There were no other Herring Gull territories within 500 m. In this area Herring Gulls return to their territories in February, whereas Common

Table 1. Mean incubation period of Common Gulls (date of clutch completion to date of hatching in those clutches for which both known).
Tabel 1. Gemiddelde broedperiode van Stormmeeuwen (datum van volledig legsel tot de datum van uitkomst indien beide data bekend).

Year	1988	1989	1990	1993	1994
Mean (days)	24.8	24.4	25.3	24.2	24.7
SD	1.55	0.84	1.32	1.32	0.52
No. of clutches	28	31	29	10	6

Table 2. Productivity at Eilean Mor Common Gull colony. nd= not measured
Tabel 2. Broedsucces op de stormmeeuwkolonie van Eilean Mor. nd= geen gegevens.

	1988	1989	1990	1991
No. of clutches (A)	122	103	100	64
Clutches hatching one or more eggs	72	74	62	nd
No. of eggs laid (B)	294	292	248	nd
No. of eggs hatched	151	189	131	nd
Clutch size (B/A)	2.4	2.8	2.5	nd
Chicks alive when last seen:				
up to 10 days old	33	102	80	0
11-20 days old (C)	34	46	9	0
21-30 days old (D)	25	30	18	0
Young fledged (C+D)	59	76	27	0
Productivity (C+D)/A	0.48	0.74	0.27	0.00
Fledged 1 or more young	41	48	23	0
Fledged 3 young	2	4	0	0
Fledged 2 young	14	20	4	0
Fledged 1 young	25	24	19	0
Fledged 0 young	81	55	77	64

Gulls do so in early April (personal observation). However, the time of return of these two Herring Gull pairs was not noted.

Table 5 shows the relation between hatching and fledging success of Common Gulls and distance from a Herring Gull nest. As the two Herring Gull nests were 110 m apart, Common Gull nests were categorised as near (< 55m) or not near (> 55 m) a Herring Gull nest. There was a significant association between failure to hatch any young and proximity of a Herring Gull nest ($\chi^2_1 = 7.6$, $P < 0.01$). There was also a highly significant association between failure to fledge any young and proximity to a Herring Gull nest ($\chi^2_1 = 11.9$, $P < 0.001$). The 61 nests within 55 m of a Herring Gull nest fledged 17 young (50 x 0, 5 x 1, 6 x 2), and the

Table 3. Breeding success of Common Gulls in relation to time of laying.
Tabel 3. Broedsucces van Stormmeeuwen in relatie tot de legdatum.

(a) Hatching success *Uitkomstsucces*

Date of last egg of clutch	No. of pairs	No. pairs hatching young	No. of young hatched	No. hatched young per pair laying
4-10 May	22	19	46	2.09
11-17 May	58	38	75	1.29
18-24 May	25	14	28	1.12
25-31 May	7	1	2	0.29
1-7 June	5	0	0	0.00
8-15 June	5	0	0	0.00
Totals	122	72	151	

(b) Fledging success *Uitvliegsucces*

Date of last egg of clutch	No. of pairs	No. pairs fledging young	No. of young fledged	No. fledged per pair laying
4-10 May	22	16	24	1.09
11-17 May	58	19	28	0.48
18-24 May	25	6	7	0.28
25-31 May	7	0	0	0.00
1-7 June	5	0	0	0.00
8-15 June	5	0	0	0.00
Totals	122	41	59	

61 nests beyond 55 m fledged 42 young (31 x 0, 20 x 1, 8 x 2, 2 x 3). Thus, productivity was in the ratio 17:42.

Common Gull nests were classified as 'sheltered' (within 1 m of dense vegetation of suitable height in which chicks could hide, usually a patch of *Juncus*) or 'exposed' (1 m distant, or more, from such vegetation). Intermediate cases were designated 'partly sheltered' (in a rock crevice; or within 1 m of vegetation in which a chick could not hide undetected). The breeding outcome of nests in these three categories is given in Table 6. There was a significant association between hatching success and proximity of cover (χ^2_2 = 7.54, $P < 0.05$). There was also a signification association between fledging success and proximity of cover (χ^2_2 = 6.43, $P < 0.05$).

The above findings suggest that earlier breeders might have selected breeding sites that were (a) further from Herring Gulls and (b) closer to vegetation. This was investigated further:

Figure 4. Map of part of the shoreline of the island Eilean Mor showing location of all Common Gull nests with one or more eggs at the colony in 1988. Solid circles, open squares and solid squares are respectively nests from which no (n = 81), one (n = 25), two (n = 14) and three (n = 2) young fledged. The continuous line indicates the approximate border between vegetation (mainly sheep-grazed grass and Juncus *patches) and supra-tidal rocks. The broken line is the approximate limit of high spring tides. Hatched rows are small cliffs (1-4 m high). The two stars show the positions of Herring Gull nests.*

Figuur 4. Kaart van een gedeelte van de kust van Eilean Mor met de precieze ligging van stormmeeuwennesten met tenminste één ei in 1988. Kleine stippen, cirkels, open vierkantjes en gesloten vierkantjes staan voor nesten met geen (n= 81), één (25), twee (14) en drie (2) uitgevlogen jongen. De gesloten lijn geeft de grens aan tussen begroeid terrein en kaal rotsgebied langs de kust. De stippellijn geeft het bereik van springtij weer. Lage kliffen (1-4m hoog) zijn door arcering weergegeven. De twee sterren geven de ligging van zilvermeeuwennesten weer.

(a) the nests in each week class in Table 3 were classified as > 55 m and < 55 m from a Herring Gull nest, giving the results in Table 7. These show that early breeders tended to nest further from Herring Gull nests than late breeders (χ^2_3 = 8.4, P < 0.05); and
(b) the nests in each week class in Table 3 were grouped into the three vegetation classes of Table 6, giving the results in Table 8. These show that early breeders tended to nest closer to vegetation than late breeders (χ^2_6 = 19, P < 0.01).

As shown in Table 2, a high proportion of chicks were not seen again soon after hatching, and were presumably killed in a manner that left no remains, such as being eaten whole or carried off intact. Predation by large gulls (both Herring and Great Black-backed Gulls *L. marinus* nested on the island), and possibly by adult Common Gulls, could not be quantified but was likely to have been important. Its occurrence was confirmed by the finding of four ringed leg bones of Common Gull chicks from the colony in gull pellets at nearby Herring Gull nests and territories.
Prey remains indicated that raptors killed adult Common Gulls in all three years, and large chicks particularly in 1988 (Table 9). Peregrines *Falco peregrinus* were seen killing both adults and chicks at the colony, and the prey remains suggested that this was always the species involved. In 1988, the number of large young (15) killed at the colony in this way showed that raptor predation lowered fledging

numbers by at least 20% [15/(59+15)], assuming the victims would otherwise have fledged. There was no evidence on the island of the presence of rats *Rattus* spp.

A high tide is known to have removed two Common Gull clutches; three or four other nest sites were inundated by high tides after hatching, the fate of the chicks being unknown.

As disturbance by the investigators every few days might have contributed to the low productivity in 1988-90 (Table 2), visits were made less frequently in 1991 (on 13, 16, 22, 28 May and 3, 14 and 26 June). However, productivity of the whole island declined to zero in 1991, not only of the 206 pairs of Common Gulls but also of Herring Gulls, Arctic Terns *Sterna paradisaea* and Eiders *Somateria mollissima*. Eilean Mor was visited for ringing several times every year during 1980-90. Predation by mink was not observed there until the end of the 1990 breeding season, when at least three large Common Gull chicks were killed by this alien predator. The year 1991 was the first in which mink are known to have been present in the colony from near the start of egg laying, and the first year in which mink bred on the island. In 1991, 52 pairs of Common Gulls bred in the colony; 27 small to medium-sized chicks were counted there on 14 June but all had perished by 26 June.

In 1992, 32 Common Gull nests were found at this colony on 11 May; all but five were empty. All were empty on 14 May. Cached eggs and punctured eggshells indicated predation by mink. A male mink was trapped near the centre of the colony on 14 May and a breeding female 500 m away on the island three days later. No further laying occurred.

The study colony site was unoccupied from 1993 to 1997, but smaller colonies of Common Gulls persisted elsewhere on the island. As this colony dwindled in size and was eventually deserted from 1991-93, a new colony of Common Gulls was founded 700 m away on the shore of the adjacent mainland. These were almost certainly the same birds (although there is no ringing or similar evidence). In 1992, this new site held *c.* 70-100 pairs and *c.* 40-50 large young fledged. About 50 pairs bred there in 1993 but all eggs and young were removed (the predator was not identified with certainty). Very few bred there in 1994 and this mainland site was unoccupied in 1995-97.

DISCUSSION

A notable finding of this work was the pronounced advantage of early breeding (Table 3). In 1988, the 18% of the colony that laid before 11 May exhibited twice the productivity of those laying in the next week and almost four times that of those laying in the following week; thereafter productivity fell to zero. This phenomenon has been described in other gull species (e.g. Hunt & Hunt 1976). Two important environmental influences on breeding success were distance from vegetation and

Table 4. Productivity (number of fledged young per number of pairs) of early (clutches begun before 20 May) and late (clutches begun after 20 May) nesting Common Gulls.
Tabel 4. Jongenproductie (uitgevlogen jongen/aantal paren) van vroege legsels (aanvang <20 mei) en late legsels (>20 mei) bij Stormmeeuwen.

Year	Before 20 May	After 20 May
1988	57/99	2/23
1989	76/90	0/13
1990	26/73	1/27

Table 5. Effect of distance from Herring Gull nest on outcome of Common Gull nests. Numbers of Common Gull nests are shown.
Tabel 5. Effect van de afstand tot nestelende Zilvermeeuwen op het broedsucces van Stormmeeuwen (aantal nesten).

	Nearest Herring Gull nest	
	withing 55m	beyond 55m
At least one hatched	28	44
None hatched	33	17
At least one fledged	11	30
None fledged	50	31

Table 6. Effect of distance from vegetation on outcome of Common Gull nests. Numbers of nests are shown. See text for definitions of 'sheltered', 'partly sheltered' and 'exposed' nests.
Tabel 6. Afstand tot de begroeide kustgedeelten en het uitkomen van stormmeeuweieren (aantal nesten). Zie tekst voor de kwalificaties 'sheltered' (beschut), 'partly sheltered' (gedeeltelijk beschut) en 'exposed' (geëxposeerd).

Hatching	Sheltered	Partly sheltered	Exposed
At least one hatched	26	18	28
None hatched	8	22	20
Total	34	40	48
Fledging	Sheltered	Partly sheltered	Exposed
At least one fledged	17	9	15
None fledged	17	31	33
Total	34	40	48

Table 7. Relation between Common Gull time of laying and distance from Herring Gull nests. Numbers of clutches are shown.
Tabel 7. Verband tussen legdatum van Stormmeeuwen (aantal legsels) en de afstand tot nestelende Zilvermeeuwen.

Date clutch completed	Nearest Herring Gull nest within 55 m	beyond 55 m
4-10 May	6	16
11-17 May	32	26
18-24 May	11	14
25 May onwards	12	5

Table 8. Relation between time of laying and distance from vegetation. Numbers of clutches are shown. See text for definitions of 'sheltered', 'partly sheltered' and 'exposed' nests.
Tabel 8. Verband tussen de legdatum en de afstand tot begroeide kustgedeelten (aantal legsels). Zie tekst voor de kwalificaties 'sheltered' (beschut), 'partly sheltered' (gedeeltelijk beschut) en 'exposed' (geëxposeerd).

Date clutch completed	Sheltered	Partly sheltered	Exposed
4-10 May	8	10	4
11-17 May	11	16	31
18-24 May	13	6	6
25 May onwards	2	8	7

Table 9. Numbers of Common Gull chicks and adults found dead (nd = not counted).
Tabel 9. Aantal doodgevonden Stormmeeuwen (kuikens en volwassen vogels; nd = geen tellingen).

	1988	1989	1990	1991
Small chicks (0-10 days)	24	11	19	nd
Large chicks intact	20	0	0	nd
Large chicks killed by peregrine	15	0	2	nd
Large chicks killed by mink	0	0	3	nd
Adults killed by peregrine	4	4	6	7
Adults killed by mink	0	0	3	1

distance from Herring Gull nests. These findings were partly explained by showing that early breeders tended to nest closer to vegetation and further from Herring Gull nests. These were probably older, more experienced birds.

In order to discover the fates of individual chicks and obtain results such as those in Tables 1-9, it is necessary to make visits every few days. The effects of such disturbance on breeding success are not easy to assess. However, the low productivity observed in three successive years (0.48, 0.74 and 0.27 young/pair: Table 2) are within the range of the only two values, 0.2 and 1.8, reported for this species in Cramp & Simmons (1983), and within the similar range of 0.0-2.0 reported in national summaries for Britain and Ireland for 1993-96 (Walsh *et al.* 1995a; Thompson *et al.* 1996, 1997). Moreover, similarly low results were obtained at other colonies in the study area that were disturbed for recording only twice each season, once to count clutches and once to count large young. In particular, low non-zero productivity was recorded at other Common Gull colonies regularly attacked by Peregrines and those on the edge of Herring Gull colonies (Craik 2000).

Egg and chick remains showed that Peregrine, Herring Gull and mink were predators at this colony. In contrast to predation by gulls and raptors, predation by mink was followed by whole-colony breeding failure at this colony both in 1991 and in 1992, and the colony site was abandoned in subsequent years. These events and other whole-colony breeding failures of this species caused by mink in west Scotland (Craik 1995, 1997) are consistent with the view that Common Gulls have evolved the ability to coexist with native predators but are unadapted to this introduced predator and unable to breed successfully in its presence. Others have reported on factors affecting breeding success of Common Gulls in Scandinavia. Bergman (1986) recorded that American Mink and larger gulls reduced breeding success by over 80%, leading to decrease in population size. Kilpi (1995) identified American Mink and Herring Gulls as the main causes of breeding failure and recorded an associated population decline of one third.

ACKNOWLEDGEMENTS

I am grateful to R., A., and N. Lightfoot for regular annual help at Common Gull colonies, and to R.W. Furness, M.P. Harris, K.R. Thompson, M. Tasker and an anonymous referee for valuable comments on earlier drafts.

SAMENVATTING

Het broedsucces werd onderzocht in een kolonie Stormmeeuwen in de buurt van Oban (West Schotland) tussen 1988 en 1995. De kolonie was gevestigd op Eilena Mor, een 12 ha groot eilandje op ongeveer 250 uit de kust van het vasteland (Fig. 1). De eileg- en uitkomstdata verschilden aanzienlijk van jaar tot jaar, maar de broedduur was steeds ongeveer hetzelfde met een gemiddelde van 24.2 tot 25.3 dagen. In 1988-90 was de gemiddelde legselgrootte 2.4, 2.5 en 2.8, de jongenproductie (jongen/leggende paren) bedroeg 0.48, 0.74 en 0.27 (34%, 47% en 23% van de paren hadden uitvliegende jongen). Van deze succesvolle paren kreeg in 1988 61% één enkel jong groot. Twee jongen werden grootgebracht door 34% van de succesvolle broedvogels, 5% kreeg drie jongen.. Voor 1989 en 1990 bedroegen deze percentages respectievelijk 50% (1), 42% (2), 8% (3) en 83% (1), 17% (2) en 0% (3). In 1988 had 18% van alle broedparen voor 11 mei eieren gelegd en het uitvliegsucces van deze 'vroege' legsels bedroeg 1.09 jongen per paar; de 48% die een week later met de leg waren begonnen kreeg 0.48 jongen per paar groot, 20% die nog een week later met de eileg was begonnen kreeg 0.28 jongen per paar groot en de 14% die nog later met de eileg begon kreeg in het geheel geen jongen groot.

Tussen 1988 en 1990 vlogen er vrijwel geen jongen uit van legsels die na 20 mei gecompleteerd waren. In 1988 kon worden vastgesteld dat de meest succesvolle legsels zich in rijkelijk begroeide kustgebieden bevonden, terwijl broedpogingen op kaal terrein dikwijls geen resultaat opleverenden. Belangrijke predatoren in het gebied waren Slechtvalken Falco peregrinus *(20% van de grote jongen in 1988), Zilvermeeuwen* Larus argentatus *en de Amerikaanse Nerts* Mustela vison. *Nesten op minder dan 55m van nestelende Zilvermeeuwen waren aanmerkelijk minder vaak succesvol dan nesten van Stormmeeuwen op grotere afstand. Vroege broedvogels nestelden steevast op grote afstand van Zilvermeeuwen, dicht bij ruige vegetatie, terwijl latere vestigingen (noodgedwongen) vaak in de buurt van deze grotere meeuwensoort op kaal terrein plaatsvonden. Predatie door Amerikaanse Nertsen vond op het eiland voor het eerst plaats in 1990. In de twee daaropvolgende jaren vestigde dit roofdier zich definitief op Eilean Mor en kwamen er prompt geen jonge Stormmeeuwen meer groot. De broedplaats in het studiegebied werd integraal verlaten in 1993-97, ofschoon er elders op het eiland nog wel Stormmeeuwen tot broeden kwamen.*

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Short notes

HIGH NUMBERS OF LESSER BLACK-BACKED GULLS *LARUS FUSCUS** FORAGING AT TRAWLERS AND IN NATURAL FEEDING FLOCKS IN THE SOUTHEASTERN NORTH SEA

GROTE AANTALLEN KLEINE MANTELMEEUWEN LARUS FUSCUS *ACHTER TRAWLERS EN IN NATUURLIJKE GROEPEN IN DE ZUIDOOSTELIJKE NOORDZEE*

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Up to an unprecedented 3800 Lesser Black-backed Gulls were seen foraging behind Dutch beam trawlers 35-80 km north off the Wadden Sea islands, 30 June-4 July 1997. Gulls leaving the trawlers had visibly filled gullets (pharynx) and were obviously carrying food to the colony. The observations confirm the significance of discards in the diet of Lesser Black-backed Gulls during chick-rearing. However, during other cruises in June and July 1997 in the German Bight, large flocks of 'naturally feeding' gulls were encountered. The largest flock comprised 1100 Lesser Black-backed Gulls, 560 Herring Gulls and 1000 Kittiwakes. These flocks were found in waters of 10-20 m depth and 6-30 km off the nearest colonies, in an area without fishing fleets. Earlier studies in colonies have indicated the significance of natural prey (non-discards), but reported sightings at sea of large flocks of 'naturally feeding' gulls are still quite rare.

Flore B.-O. 1999. High numbers of Lesser Black-backed Gulls *Larus fuscus* foraging at trawlers and in natural feeding flocks in the Southeastern North Sea. Atlantic Seabirds 1(4): 182-186.

The breeding numbers of Lesser Black-backed Gulls *Larus fuscus* in colonies of the Wadden Sea have increased markedly during the last two decades (e.g. Fleet *et al.* 1994; Spaans 1998). Camphuysen (1993, 1995) has shown the significance of discards from beam trawlers in the diet of chick-rearing Lesser Black-backed Gulls, but indicated that the offshore distribution of this species suggested that natural prey was probably of equal importance. During ship-based seabird surveys in the southeastern North Sea in June and July 1997, large numbers of Lesser Black-backed Gulls were observed foraging at Dutch beam

Table 1. Numbers of ship-followers behind discarding Dutch beam trawlers in the south-eastern North Sea in July 1997. The distance to the nearest colony of Lesser Black-backed Gulls (km) is indicated.

Tabel 1. Aantallen scheepsvolgers bij enkele Nederlandse boomkorvissers in de Duitse Bocht, juli 1997. De afstand tot de dichtstbijzijnde kolonie Kleine Mantelmeeuwen (km) is aangegeven.

Date	2 July	2 July	3 July	3 July
Latitude	54°17'N	54°19'N	54°24'N	54°03'N
Longitude	7°28'E	7°28'E	6°58'E	7°18'E
Colony distance	59	62	77	36
Fulmarus glacialis	5	6	15	1
Morus bassanus	1	1	0	0
Catharacta skua	1	0	0	0
Larus fuscus	850	1200	3800	2200
Larus argentatus	30	30	50	200
Larus marinus	20	40	30	20
Rissa tridactyla	0	0	3	0

Table 2. Examples of larger (natural) multi-species feeding associations in the southeastern North Sea, summer 1997. The distance to the nearest colony of Lesser Black-backed Gulls (km) is indicated.

Tabel 2. Voorbeelden van de grotere 'natuurlijke' groepen foeragerende meeuwen in de Duitse Bocht, juli 1997. De afstand tot de dichtstbijzijnde kolonie Kleine Mantelmeeuwen (km) is aangegeven.

Date	4 June	17 June	17 June	19 June	30 June	16 July	28 July
Latitude	54°24'N	53°49'N	53°47'N	53°51'N	53°50'N	54°11'N	54°31'N
Longitude	8°10'E	7°20'E	7°17'E	8°06'E	7°48'E	8°14'E	8°10'E
Col. distance	27	11	7	12	6	15	17
L. fuscus	770	750	1040	280	600	400	1100
L. argentatus	300	250	560	130	250	70	0?
R. tridactyla	355	0	0	0	0	1000	0

trawlers 35-80 km off the coast, as well as in large 'natural' feeding flocks in shallower waters more closer to the breeding sites on the Wadden Sea islands.

Systematic observations were conducted on board RV *Atair*, 30 June - 4 July 1997. While steaming, all birds were counted from the top deck within a 300 m wide transect set to one side of the vessel, following methods suggested by Tasker *et al.* (1984), but these surveys included counts of ship-followers at nearby trawlers. In addition, observations of feeding flocks were gathered during various cruises on ferries and research vessels in the German Bight in June (14 days) and July (6 days) 1997. At an anchor-position (53°49'N, 7°50'E), 3 km northwest off Wangerooge (Wadden Sea islands), passage counts of gulls coming from northeasterly directions were carried out on 2 July.

The distribution of Lesser Black-backed Gulls at sea during the *Atair* cruise was very patchy. The highest density (449 birds km^{-2}) was found nearly 80 km north off the coast, near a fleet of Dutch beam trawlers. Densities of over 5 birds km^{-2} were otherwise rarely found away from trawlers.

Anchoring off Wangerooge on 2 July, early in the morning, 839 Lesser Black-backed Gulls were seen heading for the breeding colonies on Spiekeroog (420 ind. h^{-1}; 294 flocks, range 1-16 gulls). Late afternoon passage was only slightly less substantial (306 ind. h^{-1}), and both in the morning and in the afternoon, gulls headed directly to the colonies on Spiekeroog, arriving from directions between 30 and 50°. In total, 99% of observed gulls were adults and the majority clearly had a filled gullet, presumably full of food for the chicks.

Up to 3800 Lesser Black-backed Gulls were seen in association with a single (Dutch) beam trawler, 80 km north off Juist (Table 1) and at least 90 % of these gulls were adults. The beamtrawlers operated in small fleets rather than solitary and the gulls were seen to move from ship to ship on occasions. At intervals, hundreds of gulls were seen to leave the vessels, flying southwards in small groups, apparently towards the colonies on Langeoog and Spiekeroog (59 km away). From the largest feeding frenzy (Table 1), 892 Lesser Black-backed Gulls were seen flying south in 16 groups, presumably to colonies on the Wadden Sea islands, approximately 77 km away, later followed by another group of 110 individuals. Each of the larger groups was later seen to split up into many smaller flocks. Most of these gulls clearly carried food in the gullet, indicating intended food deliveries for the chicks.

Large numbers of Lesser Black-backed Gulls, Herring Gulls *Larus argentatus* and Black-legged Kittiwakes *Rissa tridactyla* were seen in multi-species feeding associations (MSFAs) targeting 'natural' prey (probably surface shoaling fish; the larger groups listed in Table 2). These flocks were found in waters of 10-20m depth, 6-27 km away from the nearest colonies of Lesser Black-backed Gulls on the Wadden Sea islands. Some loose flocks covered an area of about 3 km^2. In all, 14 such MSFAs were recorded, of which the smaller examples contained 125-400 birds (mean ± SD, 258 ± 93 ind.). Other species recorded in these flocks were Northern Gannets *Morus bassanus* (up to 25), Great Cormorants *Phalacrocorax carbo* (3), Audouin's Gull *Larus audouinii* (1), Black-headed Gulls *L. ridibundus* (30), Common Gull *L. canus* (40), Sandwich Terns *Sterna sandvicensis* (130) and 'commic' terns *S. hirundo / paradisaea* (150). All flocks were recorded far away from any trawlers.

Some Lesser Black-backed Gulls breeding on the Wadden Sea islands forage in the intertidal (*cf.* Walter 1997), but most feed well offshore (Noordhuis & Spaans 1992) where they normally outnumber the more coastal

Herring Gulls (Camphuysen 1995, Garthe *et al.* 1995). The observation of 3800 Lesser Black-backed Gulls at a single trawler is the highest number so far recorded in the southeastern North Sea, but flocks of over 1000 ship-followers are not uncommon. The observations suggest that a high proportion of the Lesser Black-backed Gulls foraging behind trawlers 35-80 km north off the Wadden Sea islands originated from breeding colonies at the East Frisian islands.

The sightings of large numbers of Lesser Black-backed Gulls in natural feeding flocks (MSFAs), however, are the long-wanted evidence for the (frequent) occurrence of such feeding associations and they underpin the significance of other food than discards. These gulls were probably targeting (small) surface shoaling fish, such as clupeids or sandeels. Diet studies in The Netherlands have indicated that the breeding success of these gulls is better in years that the availability of 'natural' prey is high than in years when discards are the main resource in the chick-rearing phase (Spaans *et al.* 1994).

The observations were financially supported by the "Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit" (F+E-Vorhaben des Bundesamtes für Naturschutz: Vogelschutz im Offshore-Bereich des Deutschen Wattenmeeres). The "Bundesamt für Seeschiffahrt und Hydrographie" gave access to the VWFS *Atair*. I am grateful to C.J. Camphuysen, S. Garthe and O. Hüppop for commenting on earlier drafts. I am very grateful to Captain D. Pijarowski and the crew of the RV *Atair*.

Tijdens vogeltellingen in de Duitse Bocht van 30 juni tot 4 juli 1997 aan boord van het onderzoeksschip Atair werden veel Kleine Mantelmeeuwen foeragerend achter Nederlandse boomkorvissers waargenomen. In één geval ging het om een groep van maar liefst 3800 exemplaren. Waargenomen werd hoe grote groepen meeuwen na het foerageren met gevulde krop wegvlogen in de richting van de kolonies op enkele Duitse Waddeneilanden. De waarnemingen ondersteunen de al eerder gesignaleerde indruk dat visafval van grote betekenis is voor deze soort in de kuikenfase. Tijdens andere surveys in juni en juli 1997 werden echter ook grote groepen meeuwen waargenomen die zelfstandig op vis foerageerden. Dieetstudies in kolonies hadden al aangegeven dat 'natuurlijke prooien' (bijvoorbeeld haringachtigen) van fundamenteel belang zijn en dat de broedresultaten vaak tegenvielen jaren waarin dergelijk voedsel schaars was. Toch werden dergelijke groepen tot dusverre zelden gemeld door waarnemers op zee.

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FLYING FISH AS FOOD OF CORY'S SHEARWATER *CALONECTRIS BOREALIS**

KUHLS PIJLSTORMVOGELS JAGEN OP VLIEGENDE VISSEN

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Cory's Shearwaters Calonectris borealis *associated with a research vessel near the Canary Islands (off West Africa) were seen to chase and capture flying fish flushed by the vessel. Although the handbooks failed to list flying fish as prey for this species, a literature search revealed that Cory's Shearwaters have been noted on several occasions to prey on these fish after they become airborne.*

Leopold M.F. 1999. Flying fish as food of Cory's Shearwater *Calonectris borealis*. Atlantic Seabirds 1(4): 186-188.

Cory's Shearwaters *Calonectris borealis* were seen pursuing flying fish on four occasions, and capturing such fish on one, off the Canary Islands (West Africa) on 31 May 1988. In all four cases the flying fish leaped into the air just ahead of the ship's bow. Cory's Shearwaters and flying fish were both common in the area. All flying fish chased up by the ship during this cruise were bluish and rather large (estimated 25-30 cm total length) with grey fins ('wings'), possibly belonging to the genus *Cheilopogon* (Whitehead *et al.* 1986).

A first sighting were four shearwaters flying close to the bow that gave chase to a flying fish the moment it became airborne (27°17'N, 15°30'W, 13:00 GMT). The birds flew in from both sides of the ship and chased the fish over some 100m. Then the fish hit the water but one of the birds dived after it and came up with it in its bill, after which the other three landed and started quarrelling over the prey. Some 35 minutes later a single Cory's Shearwater chased a fish over 50m. One meter before re-immersing, the fish made a sharp, 90° turn and the prey was missed. Two more chases, both involving a single fish and a single bird, were seen at 15:50 and 17:00 GMT. Both birds missed the fish after a chase of some 40m. During the last chase, the fish hit the water three times with the lower half of its tail, gaining speed by making strong, lateral movements (off Port of Las Palmas, Gran Canaria; 27°56'N, 15°19'W).

In all four cases, the birds seemed to expect fish to be flushed by the ship and it appeared that they were deliberately flying near the bow, rather than just following the ship. The pursuits were deliberate and reminiscent of chases given by a skua. On the outward journey from Gran Canaria on 7 May, such chases were not seen, and neither was this behaviour seen further south. Seabirds (and flying fish) were also counted *en route* to and from Mauritania between 22° and 24°N, and during three weeks at sea off the Banc d'Arguin, Mauritania between 17° and 20°N (see Leopold 1993). While Cory's Shearwaters were seen in all three areas, and *Cheilopogon* also occurs throughout this range (Whitehead *et al.* 1986), both species were clearly most abundant near the Canary Islands and no chases were observed away from the islands.

Neither Bauer & Glutz von Blotzheim (1966) nor Cramp & Simmons (1977) have listed flying fish as prey for Cory's Shearwater (but see Thibault *et al.* 1997). However, chasing and capturing flying fish by Cory's Shearwaters has been observed in a large area, extending from the Azores to the Mediterranean. Moore (1995) described how a Cory's Shearwater pursued and caught a small flying fish, disturbed by a ship approaching the Azores. The chasing bird was described as *'wobbling clumsily just behind and above the fish'*, over a distance of 150 m. Fish and bird then struck the water and the fish was captured. Only because Cramp & Simmons (1977) did not mention flying fish as prey of Cory's Shearwater, Moore concluded that the observed behaviour was merely opportunistic. Still, Beven (1946) described how 'North Atlantic' (Cory's) Shearwaters caught fish that were jumping out of the water near the Azores, and that they took some of these while actually in the air. *'The fish were assumed to be flying fish.'* Cory's Shearwaters were also noted to: *'pursue flying fish when they took the air sufficiently near them'* by Mayo (1948), probably near the Cape Verde Islands. In more recent years, flying fish have been described as being captured by Cory's Shearwaters in several publications (in general terms, Warham 1990; in the Strait of Gibraltar, Finlayson 1992; and in the Mediterranean, Sarà 1993) and Den Hartog & Clarke (1996) found remains of flying fish in two out of 18 stomachs of Cory's Shearwaters collected near the Canary Islands. Aerial pursuit may thus be a rather normal foraging behaviour in Cory's Shearwaters. *Calonectris*, compared to the *Puffinus* shearwaters has long wings and a weakly developed sternum (Brown *et al.* 1978) and this makes *Calonectris* ill-suited for deep-diving, restricting it to foraging near the surface, including the air.

Kuhls Pijlstormvogels Calonectris borealis *die rond de boeg van een schip in de buurt van de Canarische Eilanden rondhingen, zetten een aantal keren de achtervolging in van vliegende vissen die door de naderende scheepsboeg werden opgestoten. De vissen werden over tientallen, soms ruim 100 m achtervolgd en in één geval ook gegrepen. De vogels leken goed te beseffen dat een varend schip vliegende vissen kan opstoten en zetten de achtervolging snel en doelbewust in, wat suggereert dat deze pijlstormvogels dit gedrag vaker vertonen. De beide handboeken bleken dit gedrag niet te beschrijven, een meer gericht literatuur onderzoek leverde echter nog diverse andere beschrijvingen op van dergelijke situaties. Het gedrag komt voor in een groot gebied, van de Azoren tot in de Middellandse Zee. De vogels lijken bij hun jacht baat te hebben bij schepen die de vissen opstoten, op een voor hen voorspelbare plaats, namelijk bij de boeg.*

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News and notices

SAVING SEABIRDS FROM LONGLINES: A CAMPAIGN OF BIRDLIFE INTERNATIONAL

In every ocean of the world, longline fishing vessels set and haul their lines, bringing aboard halibut, tuna, swordfish and toothfish - and seabirds. Longlining has been commonly regarded as an 'environmentally friendly' fishing technique. Yet, it now has the attention of international NGOs such as Greenpeace International, the World Conservation Union (IUCN) and the World Wide Fund for Nature (WWF). Reports in the early 1990s emanating from Australia of tens of thousands of albatrosses being killed in the Southern Ocean by tuna longliners first led to this attention. A resolution *Incidental Mortality of Seabirds in Longline Fisheries* adopted by IUCN at its First World Conservation Congress in Montréal, Canada in October 1996 led BirdLife International to inaugurate its Seabird Conservation Programme in 1997, with a global review of seabird mortality caused by longline fisheries as its first major project.

Seabirds are being killed in large numbers in the North Atlantic, north-eastern Pacific, South Atlantic and Southern Oceans. Only in the warm seas of the tropics, where seabirds are generally few in number, are reports of mortality few or lacking. In the Pacific Ocean the species of greatest conservation concern is the Short-tailed Albatross *Phoebastria albatrus*, an IUCN Endangered species because of its very small population, breeding on only one Japanese island. U.S. regulations allow for fishery closure if four birds are hooked within two years by the groundfish and Pacific Halibut fisheries in the Gulf of Alaska and the Bering Sea. Numbers of Laysan *P. immutabilis* and Black-footed Albatrosses *P. nigripes* are killed in these fisheries, as well as by the pelagic swordfish and tuna longline fisheries operating out of Hawaii. In the North Atlantic, the species most affected is the Northern Fulmar *Fulmarus glacialis*. However, because of its large and expanding population, it does not seem to be at risk.

In the Southern Hemisphere, apart from the albatrosses, large numbers of petrels are killed, especially the White-chinned Petrel *Procellaria aequinoctialis*. Its large and widespread population means that is not currently Endangered but nevertheless the kill rates are of serious concern. A closely-related and only very recently described species, the Spectacled Petrel *P. conspicillata* of the South Atlantic, has a population of only about a thousand breeding pairs that breeds on only one island (Inaccessible, next to Tristan da Cunha), and the hundreds that have been killed by longliners off Brazil suggest this Endangered species may be in grave danger. Inaccessible Island is a nature reserve, which protects the petrel ashore at its breeding sites, but it requires international protection while it is at sea as well.

In both hemispheres seabird mortality has encouraged research into mitigation methods. Early work was conducted in Australia, pioneered by Nigel Brothers of the Tasmanian Parks & Wildlife Service. New Zealand, Norway, South Africa and the United Kingdom are all experimenting with underwater-setting devices that are designed to keep baited hooks out of the sight of scavenging seabirds. Since every hooked bird is one less fish potentially caught (and much bait are taken by seabirds without themselves becoming hooked) fishers should be quick to see the economic advantages of reducing bird bycatch. Mitigation measures (such as weighting lines to make them sink more quickly, setting lines only at night when few seabird species forage, and deploying bird-scaring steamer lines above the longline) should thus be readily adopted by longline fishers keen to retain their clean image.

In 1997 the Committee on Fisheries (COFI) of the Food and Agriculture Organization of the United Nations (FAO), with the United States and Japan taking the lead, agreed to hold a *Consultation on Reduction of Incidental Catch of Seabirds in Longline Fisheries*. A Seabird Technical Working Group drafted a Plan of Action in Tokyo, Japan in March 1998 for adoption by COFI. Three members of the working group, Nigel Brothers of Australia, John Cooper from South Africa and Svein Løkkeborg of Norway, have written a monograph, due to be published in its final form in late 1999 by the FAO, that describes in detail longline fishing and fisheries, seabird bycatch on a global scale and recommended mitigation measures. The February 1999 meeting of COFI unanimously adopted an *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Seabirds* (IPOA-Seabirds). Endorsement by the FAO Council in June 1999 means it is now official policy, so longlining nations are now expected to proceed with their own National Plans of Action and report back to the FAO on progress in reducing seabird mortality in 2001 when COFI meets again.

Another important development is the intention to negotiate a "Regional Agreement" for southern albatrosses under the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Such an Agreement, in which Australia is taking a lead through the seven-member Valdivia Group of Temperate Southern Hemisphere Countries on the Environment, would require signatory nations to improve the conservation status of their breeding albatrosses, and so further control of longliner-caused mortality would be expected.

Although the above activities should go a long way to reducing seabird mortality from longline fisheries, there remains one area of serious concern: pirate fishing. In the Southern Ocean especially, many illegal, unregulated and unreported longliners, often sailing under flags of convenience, have greatly overfished the Patagonian toothfish *Dissostichus eleginoides* stocks, killing huge numbers of seabirds in the process. Recent estimates by the Convention for the Conservation of Marine and Antarctic Living Resources (CCAMLR) have been of up to 100 000 birds killed a year by the pirate fishery. This is a level which computer modelling has shown is clearly not sustainable, leading to the very real possibilities of extinction of some of the larger albatrosses within decades if nothing is done to halt the slaughter. Only concerted international efforts, with trade restrictions, catch certification, penalties imposed at home and unloading ports, as well as spy satellites tracking and naval patrols arresting miscreant vessels, will result in the fishery being managed sustainably and in far fewer birds being killed.

With the collaboration of inter-governmental bodies such as the FAO and the Bonn Convention, governments, environmental NGOs such as Birdlife International and its national partners, and the fishing industry, it is hoped that come no more than a decade into the next millennium longlining will once more be able to regarded as an environmentally friendly fishing technique, and the world's seabirds will be able to fly their oceans without risk of being hooked. To achieve this aim, Birdlife International intends commencing a global campaign involving its partnership in the year 2000. It is intended that the campaign will concentrate on persuading governments of longlining nations to adopt National Plans of Action, as recommended by the FAO.

BirdLife International's Seabird Conservation Programme is based in the Avian Demography Unit, Department of Statistical Sciences, University of Cape Town, Rondebosch 7701, South Africa. It receives funding from the Royal Society for the Protection of Birds via BirdLife South Africa, with which it closely works. A free issue of the illustrated magazine *World Birdwatch* describing the Programme may be obtained by contacting the Co-ordinator. Further information can be found on the Programme's web site at www.uct.ac.za/depts/stats/adu/seabirds.

John Cooper, Co-ordinator BirdLife International Seabird Conservation Programme, jcooper@botzoo.uct.ac.za

SEABIRD NOMENCLATURE

Camphuysen & Reid (1999) barely touch the surface of the problems posed by recent proposals to modify seabird taxonomy and nomenclature. Not only are there numerous differences between Dutch and British usage, but also similar ones between that of all the other comparable committees, countries and publications of the world. It should be remembered that this does not affect the birds, which remain the same whatever is said about them, but is merely an expression of opinion by the parties concerned, who seldom appear to know much about seabirds and problems in dealing with them, and whose views often cancel each other out. The nature of these problems may be illustrated by considering further the three groups of petrels that were discussed.

Not only is there a difference of opinion between Voous (1973), who recognises three races of Soft-plumaged Petrel *Pterodroma mollis*, and the current Dutch systematic committee (CSNA; Sangster *et al.* 1999), who treat two of them as species Fea's Petrel *P. feae* and Zino's Petrel *P. madeira*. The Irish, who claim to follow Voous (1973), also call the last two Fea's and the Madeiran Soft-plumaged Petrels (Milne & O'Sullivan 1998); it is not clear what they would now call *P. mollis*- could it be "Soft-plumaged Soft-plumaged Petrel"? The Americans also call them the Cape Verde and Madeiran Petrels (Sibley & Monroe 1990), the last name conflicting with its widespread past use (still followed by Birding World) for the Madeiran Storm-petrel *Oceanodroma castro*. None of them has consulted the first recent author to treat them as species, who preferred their local names (Bourne 1983).

Secondly, it should also be realised that the original English name for *Calonectris diomedea* in the 19th century was Cinereous Shearwater, comparable to the French Puffin Cendré. A past BOU committee then decided to call its races the North Atlantic and Mediterranean Great Shearwaters at the risk of confusion with the unrelated (Tristan) Great Shearwater *Puffinus gravis*. This was condensed by Alexander (1928) into a general name Mediterranean Shearwater for the species in the first and long most-widely-used field guide. Another BOU committee then renamed it Cory's Shearwater in homage to an American who belatedly described the North Atlantic form in order to provide a specific name. A Bulgarian paper in a South African journal still refers to the "Mediterranean Shearwater *Calonectris diomedea*" (Nankinov 1996).

Thirdly, in the 19th century the Manx Shearwater *Puffinus puffinus* and Levantine Shearwater *P. yelkouan* were treated as distinct species and the Balearic Shearwater *P. p. mauretanicus* was added after they were all relegated to subspecies of *P. puffinus* by past BOU committees. When we separated the rather distinct Mediterranean forms again (Bourne *et al.* 1988) it was difficult to decide on a general name, since the obvious Mediterranean Shearwater had formerly been used for *C. diomedea*, so since it seemed inadvisable to adopt a name previously used for a race we coined a new general name Yelkouan Shearwater. The BOU then adopted Mediterranean Shearwater anyway, while after splitting the Mediterranean forms further the Dutch have now applied our general name Yelkouan to what used to be known in English as the Levantine Shearwater. When will Dutchmen stop messing about with English names- we do not interfere with Dutch ones?

The Royal Naval Bird-watching Society decided that since no consistency could be found in other usage it had better prepare a list of seabird names of its own, giving (unlike most other lists) reasons for the debatable ones adopted (Bourne & Casement 1993), although unlike others it does not try to impose it on anyone. In the latest version we suggest that if it is wished to include "Mediterranean" in the names of its shearwaters they be called the Greater and Lesser Mediterranean Shearwaters. Since the name Yellow-legged Gull has traditionally been used for *Larus cachinnans*, it also seems equally arguable it should be kept for that form, and *L. michahellis* and *L. melanocephalus* could then also called the Greater and Lesser Mediterranean Gulls as well.

Personally I have long felt that more attention should be paid to minor forms of geographical variation (Bourne 1993), but it seems doubtful if it is practical to elevate most into species and suppress the rest in the way now fashionable in The Netherlands. This has already caused Porter *et al.* (1997) to overlook the passage of most of the numerous population of intermediate"Scopoli's Shearwater" *Calonectris (diomedea) diomedea* past Cape Verde twice a year (Mougin *et al.* 1988) in their enthusiasm to identify the much rarer Cape Verde Shearwater *C. (d.) edwardsii* there instead. Doubtless soon in addition to referring to "*Pterodroma* sp" instead of petrels we shall also have to refer not only to "*Calonectris* or *Puffinus* sp." instead of shearwaters but also "*Larus* sp." instead of species of gulls as well. Is this progress?

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Obituary

Luis Monteiro (1962-99)

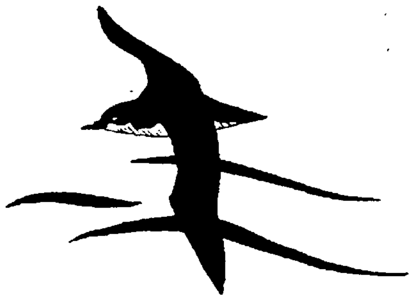
Shortly before Christmas, a routine scheduled inter-island flight in the Azores crashed, killing 35 people. Among the passengers was Dr Luis Rocha Monteiro, who despite his young age had already become one of Portugal's leading scientists. Luis developed research interests in mercury in marine fish, working at the University of the Azores. During the 1980s he was introduced to seabird studies by Adrian del Nevo and soon became the local link person for RSPB and others visiting the Azores to census and study roseate terns, petrels and shearwaters. Luis had a particular facility for making friends with influential people and soon developed an impressive infrastructure around the Azores archipelago to assist visiting ornithologists. I particularly remember once being met by Luis in the chauffeur-driven mayoral limousine and taken across the island via a particularly good cake shop to a waiting coastguard vessel in the harbour to be ferried to census petrels on an uninhabited islet; logistic arrangements he had set up with his broad smiles.

It is a lasting tribute to Luis that he played the lead role in determining accurately the status of seabirds in the Azores. In so doing he found the first breeding tropicbirds in Europe, breeding sooty terns, several Fea's petrels (though breeding is yet to be confirmed), several new colonies of Madeiran storm petrels, little shearwaters, and Manx shearwaters. Perhaps the most intriguing discovery has been that spring and autumn breeding populations of Madeiran storm petrels in the Azores almost certainly represent sibling species, differing in morphometrics, vocalisations and DNA, but time-sharing the same nest sites at some colonies. This ongoing research is yet to be fully published, but has reached the stage where exciting genetic results are emerging.

From 1992-96 Luis joined the Ornithology Group at Glasgow University, obtaining his Ph.D. on mercury dynamics in Azores seabirds. A paper from his work on mercury in marine food chains was awarded a prize for the outstanding paper in Marine Science by a young Portuguese scientist in 1998. In the last few years Luis was outstandingly successful in obtaining large grants to support research into the ecology of seabirds in the Azores and the structure and functioning of marine food chains, and his prolific publication record helped to put his department high in the research rankings of Portuguese biology departments. His tragic death is a terrible loss to his friends and family, especially Ana and their young daughter Eva. It will inevitably also impact on the development of seabird studies in Portugal, but it is good to see that his dedicated group of research assistants and colleagues are determined to continue the studies he has established.

Bob Furness

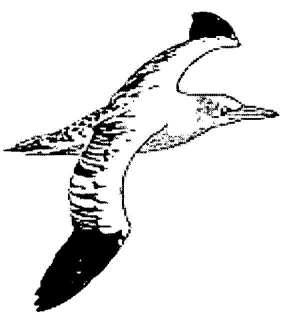
the **Seabird Group**



was founded in 1966 to circulate news of work in progress on seabirds and to promote research. It is run by an elected Executive Committee and maintains close links with the three major British national ornithological bodies the British Ornithologists' Union, the British Trust for Ornithology, and the Royal Society for the Protection of Birds.

Membership (10 per annum, 9 if paid by banker's order, 5 for students) is open to all with an interest in seabirds. For details please contact the Membership Secretary (Sheila Russell, Clober Farm, Milngavie, Glasgow G62 7HW, Scotland U.K., E-mail: Sheila-Russell@Cloberfarm.in2home.co.uk) – payment by banker's order halps the Group. Four issues of *Atlantic Seabirds* and three Newsletters are circulated to members each year.

Current Executive Committee Chair S. Wanless, Secretary J. Uttley, Treasurer J.C. Davies, Membership Secretary S. Russell, *AS* Editor J.B. Reid, Newsletter editor M.L. Tasker, also A. Douse, J.D. Okill, E.K. Dunn and S. Sutcliffe.



Nederlandse Zeevogelgroep (NZG)

(Dutch Seabird Group), sectie van de Nederlandse Ornithologische Unie, opgericht 1 januari 1991, als voortzetting van de Club van Zeetrekwaarnemers (1972-1990) en het Nederlands Stookolieslachtoffer-Onderzoek (1977-1990). De Nederlandse Zeevogelgroep stelt zich tot doel: het stimuleren van zeevogelonderzoek in en vanuit Nederland en het uitwisselen van informatie met de uitgave van het tijdschrift, aanvankelijk *Sula*, vanaf 1999 *Atlantic Seabirds*.

Voor zover samenvallend met onderzoek aan zeevogels worden activiteiten aan zeezoogdieren mede in de doelstelling betrokken. Door een viertal werkgroepen wordt onderzoek gestimuleerd naar broedende zeevogels, de verspreiding van vogels en zoogdieren op open zee (offshore), strandingen, zeetrek en de gevolgen van olievervuiling. De contributie van de NZG bedraagt *f*25 per jaar.

Dagelijks bestuur Voorzitter en Nieuwsbrief redacteur M.F. Leopold, Secretaris J.A. van Franeker, Penningmeester Y. Hermes, *AS* Eindredacteur C.J. Camphuysen, en verder A.J. van Dijk, E.W.M. Stienen en C.J.N. Winter.

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Atlantic Seabirds

vol 1 no. 4 (1999)

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ISSN 1338-2511

Front cover: Roseate Tern (F.A. Atwood)