

SEABIRD OBSERVATIONS FROM THE SOUTH AND CENTRAL ATLANTIC OCEAN, ANTARCTICA TO 30°N, MARCH-APRIL 1998 AND 2000

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Kampp K. 2001. Seabird observations from the South and Central Atlantic Ocean, Antarctica to 30°N, March-April 1998 and 2000. *Atlantic Seabirds* 3(1): 1-14. *Birds were counted in the early austral autumn (mid-March to late April) during two cruises from Ushuaia, Argentina, north to 30°N via the Antarctic Peninsula, passing South Georgia, Tristan da Cunha, the Cape Verdes and other islands. Records are summarised as mean number of each species seen per hour within 2° or 4° latitudinal zones. Pelagic birds occurred abundantly north to Tristan da Cunha, whereas they were scarce or very scarce during the remaining part of the two trips.*

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INTRODUCTION

The distribution at sea of most pelagic seabirds is still incompletely known. Vessels rarely operate far offshore with the specific aim of studying birds, so most records have been obtained from opportunistic observations onboard ships visiting or passing certain areas for other purposes. Less frequented ocean lanes thus have received the least attention. In addition to the spatial dimension, seabird distributions change over the year, meaning that many 'opportunistic' records must be combined before a full picture – for an area or a species – can be pieced together.

The present report from two almost identical transects, bisecting the Atlantic Ocean from Antarctica to the latitude of Tenerife in the early austral autumn, is intended as one such piece to the puzzle, providing raw material for more specific and/or comprehensive studies in the future. The observations are presented in a semiquantitative way, with some emphasis on latitudinal distribution patterns which seems natural, given the general south-north direction of the voyages. Records are also presented from the southward crossings of the Drake Passage.

Maps summarising the existing knowledge of the pelagic distribution of species mentioned in this paper may be found in Harrison (1983, 1987), Marchant & Higgins (1990) and del Hoyo *et al.* (1992, 1996), among others. Such maps integrate knowledge from throughout the year, however, and may be rather misleading for a particular season. Tickell & Woods (1972) and Bourne

Figure 1. The track of Professor Molchanov 18 March – 2 May 1998 (GPS positions). Thin lines indicate deviations from the 1998-track during the trip in 2000. Localities mentioned in the text are 1) Ushuaia, 2) Antarctic Peninsula, 3) South Orkney, 4) South Georgia, 5) Gough Island, 6) Tristan da Cunha, 7) St. Helena, 8) Ascension, 9) Cape Verde, 10) Tenerife, and 11) Azores.

Figuur 1. Route van Professor Molchanov, 18 maart - 2 mei 1998. Dunne lijntjes geven de afwijkingen van deze route in 2000 aan. In de tekst genoemde plaatsen zijn 1) Ushuaia, 2) Antarctisch Schiereiland, 3) Zuid Orkney eilande, 4) Zuid-Georgië, 5) Gough, 6) Tristan da Cunha, 7) St. Helena, 8) Ascension, 9) Kaap Verdische Eilanden, 10) Tenerife, and 11) Azoren.

Wandering Albatross *Diomedea exulans* *Reuzenalbatros* (photo C.J. Camphuysen)

& Curtis (1985) gave combined summaries from several voyages covering much of the South Atlantic Ocean, including parts of the area treated in the present report and at least in part from approximately the same season. The Drake Passage was part of the study area of Brown *et al.* (1975).

ITINERARY AND METHODS

The observations were made from *Professor Molchanov*, a refurbished Russian research vessel (2140 t displacement, 72 m in length) during two tourist cruises (Fig. 1) in 1998 and 2000, respectively, from Ushuaia on Tierra del Fuego via the tip of the Antarctic Peninsula to South Georgia, Tristan da Cunha, St. Helena, Ascension, Cape Verde Islands and, in 1998, Tenerife where I disembarked, while *Professor Molchanov* continued towards the Netherlands. In 2000, when I stayed aboard for the entire cruise, the route from Cape Verde

Table 1. Pelagic seabird occurrence (birds per hour) in 2° latitudinal zones of the Drake Passage, 19-20 March 1998 and 2000.

Tabel 1. Voorkomen van zeevogels (aantal per uur) in 2° breedtezones in de Drake Passage, 19-20 maart 1998 en 2000.

2° latitudinal zones	56-58	58-60	60-62	Total
Obs. period (hrs)	15.0	1.9	14.4	birds
<i>Diomedea exulans</i>	0.47	0.52	0.14	10
<i>D. epomophora</i>	0.33			5
<i>D. melanophris</i>	2.80	1.57	1.53	67
<i>D. chrysostoma</i>	1.47	1.04	1.46	45
<i>Phoebastria palpebrata</i>	0.13			2
<i>Macronectes giganteus</i>	1.40	4.70	2.57	67
<i>M. halli</i>			0.07	1
<i>Fulmarus glacialisoides</i>	0.07		2.77	41
<i>Daption capense</i>	0.20	0.52	6.80	102
<i>Pterodroma lessonii</i>	0.07			1
<i>P. brevirostris</i>	0.47		0.21	10
<i>P. mollis</i>	1.53		2.15	54
<i>Halobaena caerulea</i>			0.14	2
<i>Pachyptila</i> sp.	2.00		3.95	87
<i>Procellaria aequinoctialis</i>	0.27		0.21	7
<i>Puffinus griseus</i>	0.47		0.07	8
<i>Oceanites oceanicus</i>	1.27	1.57	1.25	40
<i>Fregatta tropica</i>	0.40	1.04	5.55	88
<i>Pelecanoides</i> sp.	0.20		0.07	4
<i>Catharacta</i> sp.	0.07		0.07	2

went by the Azores, but observations are only reported for the first part north to 30°N. The route of the two voyages deviated slightly also in the southern part, going from Antarctica to South Georgia via Elephant Island in 1998, but via South Orkney in 2000, and in 1998 a detour past Gough was made between South Georgia and Tristan da Cunha. Dates for the various legs of both trips appear from Tables 1-5.

Using 10× binoculars, observations were made almost continuously during the day from the top deck (roof of the bridge) so that eye level was about 13 m above the sea. No attempt was made to employ a specific transect width, and most attention was paid to the near surroundings (mostly <200 m from the ship). Absolute bird densities thus cannot be calculated, and neither is it possible to compare numbers between species having different size and flight style; the comparison of abundance between areas for any particular species should not be compromised, however.

Table 2. Pelagic seabird occurrence (birds per hour) in 2° latitudinal zones between the Antarctic Peninsula and South Georgia, 22-24 March 1998 and 2000.

Tabel 2. Voorkomen van zeevogels (aantal per uur) in 2° breedtezones tussen het Antarctisch Schiereiland en Zuid-Georgië, 22-24 maart 1998 en 2000.

2° latitudinal zones Obs. period (hrs)	64-62 7.6	62-60 9.2	60-58 11.1	58-56 12.9	Total birds
<i>Diomedea exulans</i>		0.33	0.18	0.23	8
<i>D. melanophris</i>	3.16	2.73	1.08	2.86	98
<i>D. chrysostoma</i>	0.26	0.44	0.63	0.54	20
<i>Phoebastria palpebrata</i>	0.40		0.18	0.62	13
<i>Macronectes giganteus</i>	4.09	4.15	0.63	3.48	121
<i>M. halli</i>				0.08	1
<i>Fulmarus glacialisoides</i>	37.58	4.58	0.18	0.08	330
<i>Thalassoica antarctica</i>	0.13				1
<i>Daption capense</i>	14.11	2.73	0.90	1.39	160
<i>Pagodroma nivea</i>		0.11			1
<i>Pterodroma brevirostris</i>	0.26	1.53	2.98	0.54	56
<i>P. mollis</i>			0.09	0.08	2
<i>Halobaena caerulea</i>	0.79	5.67	1.35	16.57	287
<i>Pachyptila</i> sp.	13.32	1.09	7.22	3.72	239
<i>Procellaria aequinoctialis</i>	4.09	0.87	2.08	3.72	110
<i>Oceanites oceanicus</i>	2.90	5.35		0.77	81
<i>Fregatta tropica</i>	1.45	6.65	1.08	1.01	97
<i>Pelecanoides</i> sp.		0.11		4.49	59
<i>Catharacta</i> sp.				0.08	1
<i>Larus dominicanus</i>		0.22			2
<i>Sterna vittata</i>		0.33			3

The mean speed of the ship varied between 4.5-12.1 knots (over 4 hours) and most often was 8-10 knots. The visibility was good to excellent in 1998 except for short periods with fog or showers during a few days, while in 2000 visibility was rather poor on most days between Antarctica and 48°S. The Drake Passage was calm in both years, with weak southerly winds. The calm weather continued in 1998 until north of South Georgia, where somewhat fresher winds blew from between north and east, and fairly strong northerly winds prevailed during most days between South Georgia and Tristan da Cunha in 2000. North of Tristan we entered the trade winds and experienced moderate to rather strong, easterly winds for the rest of both trips (as far as covered in this report) which hampered observations to some extent, particularly north of Cape Verde.

SEABIRD OBSERVATIONS

General. Seabirds observed offshore (generally with no land in sight) are summarized in Tables 1-5 as numbers seen per hour within 2° or 4° latitudinal zones. The varying amount of time indicated for each zone is chiefly due to differences in night time and time spent inshore and ashore at islands in the zones. The order and names of species are those of del Hoyo *et al.* (1992, 1996).

For most species the given numbers represent accurate counts of individual birds seen in the zones, but for certain species the numbers are approximate. First, shipfollowing species (albatrosses, fulmarine petrels like Giant *Macronectes* spp. and Cape Petrels *Daption capense*, prions *Pachyptila* spp., *Procellaria* petrels) cannot always be counted accurately; numbers shown are assumed minima and may in a few cases underestimate actual numbers rather considerably. In case of the Wandering Albatross *Diomedea exulans*, however, which may follow ships for hours, temporarily falling far behind and later catching up again, it is usually easy to keep track of individual birds due to the greatly varying plumage in this species. Second, a few species occasionally occurred in great numbers, and in such situations counts were rather rough and, possibly, low. The most notable example is the Great Shearwater *Puffinus gravis* in the Gough – Tristan da Cunha area (40-36°S, Table 3).

Seabirds were generally abundant in the Drake Passage and between Antarctica and Tristan da Cunha, at 37°S. North of Tristan seabird densities decreased dramatically and remained low or very low for the rest of the trip on both voyages. Concordant with the reduced seabird abundance the diversity of species decreased as well, although at a higher taxonomic level the composition of the seabird community became more varied with the appearance of several pelecaniform and charadriiform species and a corresponding diminished dominance of the procellariiforms.

The proximity of land (breeding grounds) appears to have influenced the abundance of some of the species shown in Tables 1-5, particularly around Ascension (8°S; Table 4) and Cape Verde (15-17°N; Table 5).

Inter-year differences. As a broad generalisation birds were more abundant in 1998 than in 2000 in the rich waters south of Tristan da Cunha (Tables 2-3). This appeared to be a real difference, although the less favourable observation conditions experienced in 2000 probably explain part of it. For some species this meant a somewhat more extended apparent distribution in 1998 compared to 2000; in 2000, for example, there was a gap from 52-48°S where not a single *Fregatta* storm-petrel was seen, so the broad overlap of the two species in Table 3 is due solely to observations from 1998. For a few species, especially the

Table 3. Pelagic seabird occurrence (birds per hour) in 2° latitudinal zones between South Georgia and Tristan da Cunha, 28 March - 6 April 1998 and 28 March - 3 April 2000.

Tabel 3. Voorkomen van zeevogels (aantal per uur) in 2° breedtezones van Zuid-Georgië tot Tristan da Cunha, 28 maart-6 april 1998, 28 maart - 3 april 2000.

2° latitudinal zones Obs. period (hrs)	54-52	52-50	50-48	48-46	46-44	44-42	42-40	40-38	38-36	Total birds
<i>Diomedea exulans</i>	0.25	0.12	0.14	0.65	0.69	1.21	1.17	1.95	1.55	85
<i>D. epomophora</i>						0.09				1
<i>D. melanophris</i>	1.52	0.12	0.14	0.92	0.79	1.02	0.21	0.11	0.07	60
<i>D. cauta</i>						0.47	0.21	1.08		17
<i>D. chlororhynchos</i>				0.46	0.59	0.37	1.06	2.92	7.76	162
<i>D. chrysostoma</i>	1.39	0.99	1.29	1.02	0.10					60
<i>Phoebastria fusca</i>	1.01	0.12	0.29	1.02	1.38	0.93	4.46	1.30	2.26	142
<i>P. palpebrata</i>	0.06		0.14	0.28		0.09				7
<i>Macronectes giganteus</i>	0.76						2.02	0.86	1.13	55
<i>M. halli</i>	0.32	0.12			0.10					7
<i>Fulmarus glacialisoides</i>	0.51									8
<i>Daption capense</i>	0.76	0.12	0.07							14
<i>Pterodroma macroptera</i>				0.37			0.53	0.11	3.81	64
<i>P. incerta</i>			0.43	0.92	1.97	11.26	5.63	3.89	0.92	259
<i>P. brevirostris</i>	6.25	1.24	0.36	0.37						118
<i>P. mollis</i>	6.00	4.21	4.89	5.91	6.69	7.53	7.01	5.62	6.28	617
<i>Halobaena caenulea</i>	0.57									9
<i>Pachyptila</i> sp.	1.45	3.22	1.01	1.29	3.05	7.53	7.12	14.70	0.28	396
<i>Procellaria cinerea</i>	0.63	0.99	0.79	1.75	0.59	1.02	1.06	0.11		76
<i>P. aequinoctialis</i>	1.77			0.28	0.69	0.93	1.91	2.05	1.20	102
<i>P. (a.) conspicillata</i>			0.29	0.18	0.79	0.93	0.85	2.16	4.80	120
<i>Puffinus gravis</i>	5.75	3.22	2.87	7.29	7.48	7.26	3.82	39.14	8.33	906
<i>P. griseus</i>	0.06			0.09		1.02	0.11	0.76	0.07	22
<i>P. assimilis</i>		0.12		2.86	3.64	1.67	1.38	0.11	0.42	107
<i>Oceanites oceanicus</i>	0.95	0.37	0.07	1.29	0.69	0.19	0.21		0.56	52
<i>Pelagodroma marina</i>							0.11			1
<i>Fregetta tropica</i>	9.60	2.72	0.65							183
<i>F. grallaria</i>	0.32	1.48	4.89	0.65	3.15	1.30	3.82	0.65	2.96	222
<i>Pelecanoides</i> sp.	1.52	1.98	0.07		0.10	0.09				43
<i>Catharacta</i> sp.	0.06	0.12	0.07		0.10	0.74	0.74	0.86	0.64	36
<i>Stercorarius</i> sp.					0.10	0.09			0.07	3

Kerguelen Petrel *Pterodroma brevirostris* (see below), the distributions in the two years may have been genuinely different.

North of Tristan da Cunha, especially between Tristan and St. Helena (16°S), birds occurred very sparsely in both years but nevertheless were not quite so uncommon in 2000 as in 1998. All the Great-winged Petrels *Pterodroma macroptera* between 36-32°S (Table 4) were seen in 2000, some of them following the ship throughout the day of 4 April. Also following the ship during this and the next two days were several Spectacled Petrels (a taxon

Table 4. Pelagic seabird occurrence (birds per hour) in 4° latitudinal zones between Tristan da Cunha and Ascension, 7-15 April 1998 and 4-13 April 2000.

Tabel 4. Voorkomen van zeevogels (aantal per uur) in 4° breedtezones tussen Tristan da Cunha en Ascension, 7-15 april 1998, 4-13 april 2000.

2° latitudinal zones Obs. period (hrs)	36-32	32-28	28-24	24-20	20-16	16-12	12-08	Total birds
<i>Diomedea chlororhynchos</i>			0.07					1
<i>Pterodroma macroptera</i>	1.61							20
<i>P. incerta</i>	0.32							4
<i>Bulweria bulwerii</i>						0.06	0.04	2
<i>Procellaria aequinoctialis</i>	0.32		0.07					5
<i>P. (a.) conspicillata</i>	0.89	3.23	0.71					66
<i>Calonectris diomedea</i>	0.08		0.21	0.07		0.06		6
<i>Puffinus gravis</i>	0.24	0.29	0.07					8
<i>P. griseus</i>	0.08	0.14						3
<i>Fregetta grallaria</i>	0.08							1
<i>Oceanodroma castro</i>		0.22	0.07		0.08	0.06	0.04	7
<i>Phaethon aethereus</i>				0.14	0.08			3
<i>P. lepturus</i>							0.04	1
<i>Sula dactylatra</i>					0.08		0.25	8
<i>S. leucogaster</i>							0.04	1
<i>Fregata aquila</i>							0.98	27
<i>Stercorarius</i> sp.	0.08		0.07				0.15	6
<i>Sterna paradisaea</i>	0.08		0.14	0.07	1.85	0.31	1.96	87
<i>S. fuscata</i>							6.53	180
<i>Anous stolidus</i>							0.51	14
<i>Gygis alba</i>							0.62	17

usually treated as a subspecies of the White-chinned Petrel *Procellaria aequinoctialis*, but according to Ryan (1998) best considered a full species *P. conspicillata*). Flocks of Spectacled Petrels were also seen sitting on the water at several occasions during this part of the trip.

All Sooty Terns *Sterna fuscata* seen offshore (Tables 4-5) were recorded in 1998. In Ascension this species follows a 9.6-month breeding cycle (del Hoyo *et al.* 1996); it was absent from its breeding grounds in 1998 but present in 2000, where the few nests approached closely contained eggs, and numerous adults and immatures occurred around the island (and one adult was seen just off St. Helena).

Table 5. Pelagic seabird occurrence (birds per hour) in 4° latitudinal zones between Ascension and Tenerife (1998) or the corresponding latitude farther west (2000), 19 April – 1 May 1998 and 16-26 April 2000.

Tabel 5. Voorkomen van zeevogels (aantal per uur) in 4° breedtezones tussen Ascension en Tenerife (1998) of tot dezelfde breedtegraad verder westwaarts (2000), 19 april-1 mei 1998, 16-26 april 2000.

2° latitudinal zones Obs. period (hrs)	06-02	02-02	02-06	06-10	10-14	14-18	18-22	22-26	26-30	Total birds
<i>Pterodroma feae</i>						0.10	0.42			9
<i>Bulweria bulwerii</i>	0.19	0.30	0.66	0.58	0.55	1.49	0.69	1.49	1.46	128
<i>Calonectris diomedea</i>	0.10	1.51	0.82	0.40	0.13	14.98	0.32	0.38	2.63	258
<i>Puffinus assimilis</i>						3.27	0.05			34
<i>Pelagodroma marina</i>								0.05		1
<i>Hydrobates pelagicus</i>			0.11							2
<i>Oceanodroma castro</i>	1.82	2.94	13.21	4.27	1.06	0.30	0.74	3.98	0.06	520
<i>Phaethon aethereus</i>						1.98				20
<i>Sula dactylatra</i>	0.29									3
<i>S. leucogaster</i>						1.19				12
<i>Larus fuscus</i>								0.05		1
<i>Xema sabini</i>						0.60		0.19	0.06	11
<i>Rissa tridactyla</i>							0.05			1
<i>Sterna paradisaea</i>		0.45	1.26	3.01	2.66	2.68	0.11		0.06	189
<i>S. fuscata</i>	0.19	2.94								41
<i>Catharacta</i> sp.				0.04						1
<i>Stercorarius</i> sp.		0.15		0.27	0.08			0.14		13

NOTES ON PARTICULAR SPECIES

Penguins are rarely seen at sea unless conditions are unusually favourable, and even then they are difficult to identify. An exception is penguins resting on offshore icebergs and floes, but data on these may tell more about the distribution of floating ice than of penguins. During the present two cruises, penguins were seen in great numbers near breeding stations but infrequently offshore, those farthest from land being small flocks of King *Aptenodytes patagonicus* and Macaroni Penguins *Eudyptes chrysolophus* up to 520 km northeast of South Georgia.

Kerguelen Petrel *Pterodroma brevirostris*. All except one of 118 birds seen north of South Georgia (Table 3) were recorded in 1998, whereas not a single bird was seen in the Drake Passage that year (10 in 2000, Table 1). This species, and the **Soft-plumaged Petrel** *P. mollis*, both breed on Gough and the

Tristan group but apparently nowhere else in the South Atlantic (Richardson 1984, Prince & Croxall 1996), and their autumn occurrence far south and west of these islands represents a post-breeding dispersal of these populations and, probably, populations in the southern Indian Ocean. Not a single bird of either species was recorded during five crossings of the Drake Passage in December (1992-1995; own unpubl. data).

Cape Verde Petrel *Pterodroma feae*. This close relative of the Soft-plumaged Petrel breeds in the Cape Verdes and on Bugio I. off Madeira but appears to be rare, with a combined population estimated at less than 1200 pairs (Zino & Bischoff 1994, Hazevoet 1995). Breeding in the Azores has been suggested, but recent comprehensive surveys have failed to locate the species (Monteiro *et al.* 1999). All but one of the 9 birds in Table 5 (2 in 1998, 6 in 2000) occurred north of Cape Verde, the northernmost at 20°37'N.

Prions *Pachyptila* spp. All of the rather few prions definitely identified to species (including some found aboard) were Antarctic Prions *P. desolata* or Broad-billed Prions *P. vittata*, the former only identified south of 45°S and the latter north hereof. For the status of various prion species in South Georgia, see Prince & Croxall (1996).

Westland Petrel *Procellaria westlandica*. Not seen in 1998 or 2000, but birds having distinct black tips to the beak were seen in the eastern part of the Beagle Channel on 19 and 30 December 1992, and a single black-tipped bird in heavy wing moult was seen at sea farther south, at 55°25'S 65°55'W, on 18 December 1993 (own unpubl. data). The latter bird followed the ship accompanied by a normally looking White-chinned Petrel. These observations appeared very confusing because they were made before I became aware of the paper by Whitney & Stejskal (1992) reporting on the occurrence of Westland Petrel in the area, and pointing out that adults of this species, contrary to White-chinned Petrels, were likely to show wing moult in November-February.

Sooty Shearwater *Puffinus griseus*. Only two Sooty Shearwaters were seen outside the Beagle Channel in 1998, in the Gough – Tristan da Cunha area. All other records (Tables 1, 3, 4) are from 2000.

Swinhoe's Storm-petrel *Oceanodroma monorhis* ? Two all-dark storm-petrels were recorded in 1998, on 14 April (13°48'S 8°08'W) and 21 April (3°51'N 19°01'W). The latter was seen close by together with a Madeiran Storm-petrel *O. castro* and appeared to be of the same size or very slightly smaller. Dark-rumped storm-petrels indistinguishable from Swinhoe's Storm-petrel began to turn up in Europe and at Salvages (Madeira) in the 1980s, and the existence of an undiscovered population of Swinhoe's Storm-petrel breeding at some unknown location in the North Atlantic has been suggested (Bretagnolle *et al.* 1991). Dark-rumped storm-petrels have also been recorded from Ascension (Bourne & Simmons 1998).

Subantarctic Skua Catharacta antarctica Subantarctische Grote Jager (photo C.J. Camphuysen)

Diving-petrels *Pelecanoides* spp. The two diving-petrels most likely to encounter along the present transects are Common *P. urinatrix* and South Georgia Diving-petrel *P. georgicus*, which are almost impossible to distinguish at sea. One bird found aboard near South Georgia was a Common Diving-petrel, as was probably most of those seen at sea. A total of five birds with very distinct pale tips to the scapulars, hence likely to be South Georgia Diving-petrels, were recorded north of South Georgia at 49°40'–52°40'S, and one south of the island at 56°40'S.

Skuas. No *Catharacta* skuas seen at sea were identified to species, but most likely all seen in the southern hemisphere (Tables 1-3) were Brown Skua *C. antarctica*, south of 46°S *C. a. antarctica* and north hereof *C. a. hamiltoni*, whereas a single bird seen knocking a Cory's Shearwater *Calonectris diomedea* down on the water at 8°38'N (Table 5) probably was a Great Skua *C. skua*. Of the 9 *Stercorarius* skuas seen south of Equator (Tables 3-4), 7 were tentatively

or definitely identified as Long-tailed Skuas *S. longicaudus* and 2 as Arctic Skuas *S. parasiticus*, while the number recorded north of Equator of these two species was 4 and 6, respectively (Table 5). In addition, three Pomarine Skuas *P. pomarinus* were seen at 7°19'N, 22°54'N and 23°21'N, respectively (Table 5). Off St. Helena skuas were quite numerous in 2000, and at sunset on 11 and 12 April about 25 settled on the water off the anchorage at Jamestown. The few seen close by were Arctic Skuas.

Arctic Tern *Sterna paradisaea*. North-migrating birds were recorded on most days north of Tristan da Cunha (Tables 4-5), as singles or small flocks of up to 8 birds, on two occasions more than 30. The total number recorded was 369, 211 in 1998 and 158 in 2000. Not all of them could be identified with certainty, so the possibility that other species (particularly the Common Tern *S. hirundo*) were also involved cannot be excluded.

Land birds recorded at sea have not been considered in this report, but an exception should probably be made in case of the Cattle Egret *Bubulcus ibis*: one bird followed the ship for 20 min on 24 March 1998 south of South Georgia, at 56°07'S 39°01'W, and in the same area (58°02'S 40°13'W) one was seen on 24 March 2000. Similar observations have been made previously (Bourne & Curtis 1985), and this remarkable species is now a regular visitor to South Georgia (Prince & Croxall 1996).

DISCUSSION

The present report is based on two transects only, which implies some obvious limitations in the generalisations that should be made from the data. It may also have its merits, however: observations were made at a specific season, so the picture emerging should represent a snapshot of the 'normal' situation in the covered area during the early austral autumn.

This supposition raises the question whether things were in fact 'normal' during the two cruises – for example, the voyage in March-April 1998 took place during the waning phase of the strong 1997/98 El Niño event. However, El Niño effects are not known to be marked in the South Atlantic, and with few exceptions differences in seabird distributions between 1998 and 2000 were small and apparently explainable as short-term variations caused by local weather patterns, combined with the difficult observation conditions prevailing during part of the trip in 2000. Neither do the presented data suggest any marked anomalies when compared with known distributions as given in the general works quoted in the Introduction.

A more detailed comparison can be made with a few transects (South Georgia – Tristan da Cunha – St. Helena) in Tickell & Woods (1972), although their data were collected 4-6 weeks later in the season, and most of the apparent

discrepancies probably reflect this small but significant seasonal difference. This explanation certainly applies to the absence of Great Shearwater south of Tristan da Cunha in May, and presumably also to the less extreme paucity of birds (albatrosses, Soft-plumaged Petrel) between Tristan and St. Helena in late May (Tickell & Woods *l.c.*) as compared with early-mid April (this report). A seasonal explanation of the striking absence from the report by Tickell & Woods of Kerguelen Petrel and Little Shearwater appears less obvious, however. The latter species was characterized as regular between 38-50°S by Bourne & Curtis (1985), in complete agreement with the present report. The Kerguelen Petrel was found to be common south of 40°S by Bourne & Curtis (*l.c.*), and its sparse occurrence west of South Georgia during the cruise by Jehl *et al.* (1979) may merely reflect that the species becomes less common towards the west in the South Atlantic. However, a rather variable autumn distribution in the South Atlantic is suggested by the fact that the difference in occurrence between 1998 and 2000 was more marked in the Kerguelen Petrel than in any other species.

Perhaps the most anomalous occurrence reported here, at least compared with information in general works, is the presence of Soft-plumaged Petrel in the Drake Passage. However, the species has previously been characterized as abundant there in the austral autumn (Prince & Croxall 1996), and actual records from the Drake Passage south to 60°32'S are given in Brown *et al.* (1975) and Bourne & Curtis (1985).

In conclusion, the latitudinal distributions of seabirds in the South Atlantic Ocean reported in this paper are probably normal for the early autumn. They contain no great surprises but generally confirm previous knowledge and assumptions. The semiquantitative presentation and the degree of detail may hopefully be of use in future work in the area.

ACKNOWLEDGEMENTS

Chris Collins and Tony Marr are thanked for good company and helpful advice during the voyage in 1998.

ZEEVOGELWAARNEMINGEN IN DE ZUIDELIJKE EN CENTRALE ATLANTISCHE OCEAAN, VAN ANTARCTICA TOT 30°NB, MAART-APRIL 1998 EN 2000

Tijdens twee vaartochten met de Professor Molchanov in 1998 en 2000 vanuit Ushuaia, Argentinië, via het Antarctische schiereiland, langs Zuid-Georgië, Tristan da Cunha, de Kaap-Verdische Eilanden en enkele andere eilanden werden vogels geteld gedurende het begin van de zuidelijke zomer (halfmaart tot eind april). De waarnemingen zijn in tabellen samengevat als gemiddelden per waarnemingsuur in stroken van 2 tot 4 breedtegraden. In beide jaren waren zeevogels over het algemeen talrijk in de Drake Passage en tussen Antarctica en Tristan da Cunha. Ten noorden van Tristan da Cunha namen de dichtheden sterk af en waren zeevogels (zeer) schaars. Ook de diversiteit nam naar het noorden toe af. De aantallen van sommige soorten werden positief beïnvloed

door de nabijheid van hun broedgebieden. In de rijke wateren ten zuiden van Tristan da Cunha waren zeevogels in 1998 talrijker dan in 2000. Tussen Tristan da Cunha en St. Helena waren vogels schaars, maar juist in 2000 talrijker. Zo werden in 2000 Langvleugelstormvogels *Pterodroma macroptera* waargenomen tussen 36-32°ZB. Ook werden dat jaar verscheidene Brilstormvogels *Procellaria conspicillata* tussen beide eilanden waargenomen. Het verschil in waarnemingen van de Bonte Stem *Sterna fuscata* wordt verklaard door de 9.6-maandelijkse broedcyclus; in 1998 toen er niet gebroed werd (ook) ver op zee, in 2000 toen er gebroed werd uitsluitend in de nabijheid van land. Over het algemeen bevestigt de beschreven verspreiding van zeevogels de bestaande kennis en aannames.

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NORTHERN GANNETS *MORUS BASSANUS* FOUND DEAD IN THE NETHERLANDS, 1970-2000

KEES (C.J.) CAMPHUYSEN^{1,2,3}

Camphuysen C.J. 2001. Northern Gannets *Morus bassanus* found dead in The Netherlands, 1970-2000. *Atlantic Seabirds* 3(1): 15-30. *Northern Gannets are passage migrants in Dutch coastal waters. Ship-based seabird surveys revealed that Northern Gannets occur year-round in the Southern North Sea, a finding that has been supported by beached bird surveys. Most of the beached Northern Gannets in The Netherlands were either oiled, or entangled in fishing gear. Typical patterns of oiling (birds seem to hit the oil mainly during take-off) and types of ropes and fishing gear responsible for most Northern Gannet deaths are described. Oil rates in beached Northern Gannets declined significantly over time, but are still very high (79% in adults and immatures, 47% in juveniles). On the contrary, the frequency of entangled Northern Gannets increased significantly recent years (1977-89 5%, 1990s 7.5%). In the 1980s, most were entangled in fishnets or in various types of ropes and nylon fibres from trawlers. In the 1990s most entangled Northern Gannets were killed in nylon fish line, normally used by sports anglers. Approximately 450 Northern Gannets are estimated to wash ashore annually. Relatively few juvenile Northern Gannets have been found and the shift in age distribution through the year reflects the age composition of Northern Gannets in the Southern Bight. The Atlantic breeding population has increased during most of the 20th century and in accordance with that, numbers of Northern Gannets recorded during seawatching have increased over the past 30 years. These trends are not reflected in Northern Gannet strandings, the frequency of which seems to have declined markedly after the late 1940s and have been stable over the last 30 years.*

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INTRODUCTION

Northern Gannets *Morus bassanus* are passage migrants in Dutch coastal waters (Camphuysen 2001). In coastal waters, numbers gradually increase after March and Northern Gannets reach peak abundance in autumn (Sep-Nov; Camphuysen & Van Dijk 1983; Platteeuw *et al.* 1994; Camphuysen 2001). From ship-based seabird surveys it was demonstrated that Northern Gannets occur year-round in the Southern Bight, but in variable numbers, with peaks in February/March and in August-November (Camphuysen & Leopold 1994; Stone *et al.* 1995).

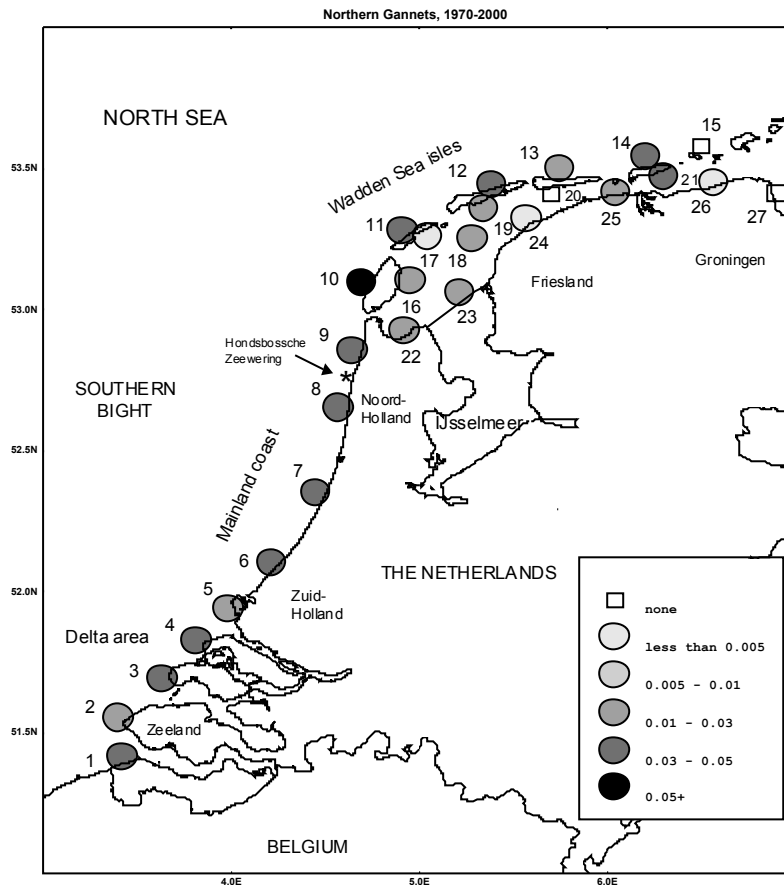


Figure 1. Study area, 27 subregions along the North Sea coast and in the Wadden Sea area (see Table 1 for site names), as well as the location of the constant effort site Hondsbossche Zeewering (* near-daily counts 1988-2000) and average densities of Northern Gannets based on beached bird surveys 1970-2000.

Figuur 1. Studiegebied, 27 deelgebieden langs de Noordzeekust en in het Waddengebied (zie Tabel 1), met daarbij de ligging van de Hondsbossche Zeewering (*) waar tussen 1988 en 2000 vrijwel dagelijks werd geteld en gemiddelde dichtheden Jan-van-genten op basis van stookolieslachtoffer-tellingen 1970-2000.

Most of the world population of Northern Gannets nests in Europe (Tasker 1994) and it may be assumed that substantial numbers migrate through the Southern Bight towards wintering areas in the Bay of Biscay and along the

African west coast (Cramp & Simmons 1977). It is therefore of interest to monitor the well being of these Northern Gannets and to identify the scale and any trends in mortality patterns and causes of death, for example by means of beached bird surveys (BBS). This paper reviews the results of 30 years of systematic beached bird surveys in The Netherlands.

METHODS

This analysis includes BBS results collected between 1970 and 2000 on all Dutch North Sea coasts and in the Wadden Sea (Fig. 1). BBS are conducted on foot, walking the tide-line with one or more people, recording and describing every corpse. Standard notes include details on the presence of oil on the feathers, or other obvious causes of death such as entanglements or injury, and the state of the corpse (fresh, old, very old, complete or disintegrated; *cf.* Camphuysen & Heubeck 2001). To avoid double counts during subsequent surveys, corpses were marked by clipping the primaries of the wings.

Twenty-seven subregions were used, 15 along the North Sea, 12 within the Wadden Sea. Within those subregions, data were collected on a smaller scale (108 standard, numbered, stretches of variable length, mean \pm SD length 6.5 ± 3.7 km, max 18 km length). Total coast length was 706 km, of which 381 km (54%) was along the North Sea shore. BBS were organised so that as many coastal stretches as possible were visited at least monthly. Regional coordinators were responsible for the precise planning of surveys, which were mainly organised between November and April and with lower frequency in the rest of the year. Results were usually presented as 'densities' (n found per km surveyed; $n \text{ km}^{-1}$). The data comes from 6533 surveys, of which 5126 were conducted in winter (Nov-Apr), 1407 in summer (May-Oct; Table 1), and of which 4732 were performed along the North Sea coast and 1801 in the Wadden Sea (Table 2). The latter area was not adequately surveyed between 1974 and 1979.

Part of the Noord-Holland mainland coast, an 8 km long stretch of dike and sandy beach between Camperduin and St Maartenszee, has been surveyed on a near-daily basis since 1988. This 'constant-effort-site' was used to estimate the daily stranding rate of corpses km^{-1} and from that the total number of Northern Gannets washing ashore per year.

Northern Gannets were aged by using plumage characteristics and grouped in six (plumage 1-5, and adults) or three categories (first year birds, immatures and adults). Plumage types 1-5 were taken from Fig. 2 in Nelson (1978). Of the nine immature stages depicted there, type 1 was represented by the first, type 2 by the second, fourth and fifth, type 3 by the third, sixth and

Table 1. Subregions used for the analysis of beached bird surveys (1-27, see Fig. 1), their location along the North Sea coast (S) or in the Wadden Sea area (W), the number of standard stretches ($n = 108$), total coast length in km (total 706 km), and number of surveys (counts) and coverage (km) in winter (Nov-Apr) and summer (May-Oct) surveys since 1969.

Table 1. Deelgebieden gebruikt voor de analyse van olielachtoffertellingen (1-27, zie Fig. 1), hun ligging langs de Noordzeekust (S) of in het Waddengebied (W), het aantal standaard-trajecten (stretches; $n = 108$), de kustlengte per deelgebied in km (totaal 706 km), en het aantal sinds 1969 uitgevoerde tellingen (counts) en de daarbij afgelegde afstand (km) in winter (nov-apr) en zomer (mei-okt).

# subregion		stretches	winter		summer		
			km	counts	km	counts	
1 Zeeuws Vlaanderen	S	1	14	25	192	1	4
2 Walcheren	S	6	37	393	2168	53	322
3 Schouwen	S	4	24	420	3225	18	112
4 Goeree	S	3	16	118	988	7	36
5 Voorne-Maasvlakte	S	4	25	176	1151	24	178
6 Zuid-Holland	S	5	36	313	2523	48	312
7 Noord-Holland Z	S	4	26	421	3241	37	300
8 Noord-Holland M	S	6	29	481	2842	69	328
9 Noord-Holland N	S	5	31	602	4623	250	1741
10 Texel strand	S	6	32	482	2402	104	365
11 Vlieland strand	S	5	29	120	862	80	401
12 Terschelling strand	S	4	27	86	1064	33	284
13 Ameland strand	S	4	27	154	1438	76	373
14 Schiermonnikoog strand	S	3	19	102	618	32	153
15 Rottum	S	2	9	3	11	4	29
16 Texel wad	W	5	25	140	626	32	189
17 Vlieland wad	W	5	12	60	219	18	70
18 Griend	W	1	6	15	61	16	86
19 Terschelling wad	W	5	34	18	88	2	14
20 Ameland wad	W	4	22	22	98	8	39
21 Schiermonnikoog wad	W	4	20	50	377	14	69
22 Balgzand	W	4	23	35	452	11	64
23 Afsluitdijk	W	3	31	200	1851	104	1218
24 Friese kust W	W	4	38	402	3673	303	2699
25 Friese kust O	W	4	34	198	1327	47	254
26 Groninge kust W	W	3	42	82	864	13	98
27 Groningse kust O	W	4	38	8	67	3	14
		108	706	5126	37 050	1407	9747

Table 2. Annual observer effort (number of counts and total km surveyed) in beached bird surveys along the North Sea coast or in the Wadden Sea area, 1970-2000.

Table 2. Jaarlijkse waarnemingsinspanning (aantal tellingen en totaal afgelegde afstand in km) tijdens olielachtoffertellingen langs het Noordzeestrand en in het Waddengebied, 1970-2000.

	North Sea coast		Wadden Sea coast	
	counts	km surveyed	Counts	km surveyed
1970	29	492	13	148
1971	23	508	4	152
1972	17	277	2	114
1973	21	337	11	164
1974	31	181		
1975	48	312		
1976	31	263		
1977	35	335		
1978	79	593	1	7
1979	141	886	2	5
1980	178	1185	6	52
1981	372	2489	92	915
1982	256	1645	124	938
1983	385	3014	107	978
1984	285	2046	106	937
1985	304	1849	76	538
1986	154	1074	74	477
1987	150	1120	99	762
1988	227	1737	69	593
1989	198	1279	63	473
1990	232	1484	47	307
1991	218	1406	52	432
1992	152	1053	48	497
1993	124	842	65	659
1994	103	625	69	615
1995	120	702	83	697
1996	113	693	56	472
1997	107	642	67	653
1998	158	843	103	730
1999	225	1234	156	1084
2000	216	1139	206	1118
Totals	4732	32 284	1801	14 514
sample		31		25*

*1978 and 1979 not recognised as adequate samples

seventh, type 4 by the eighth and type 5 by the ninth. Ageing was standardised only in 1977 and all detailed data on the age of Northern Gannets were derived from surveys since 1977. The age composition was compared with that found during seawatching in The Netherlands (1972-93; Camphuysen & Van Dijk 1983; Platteeuw *et al.* 1994; and NZG/CvZ unpubl. data) and with data collected during ship-based seabird surveys at sea in Dutch waters (51-56°N, 2-8°E; Camphuysen & Leopold 1994; ESAS database, unpubl. data).

The most comprehensive data were collected in winter (Nov-Apr). Trends in annual winter oil rates (fraction of birds oil contaminated of all birds found) were estimated after logit-transformation by fitting a linear trend on annual oil rates by least-squares estimation (methods follow Camphuysen 1995, 1997). The significance of r was assessed after converting it to a t value (Fowler & Cohen 1986). Annual oil rates were calculated only if at least 10 complete, relatively fresh corpses were found of which the oiling was recorded (29 out of 31 winter seasons since 1969). Trends in the frequency of entanglements were treated similarly.

RESULTS

Review of strandings, 1970-2000 Between January 1970 and December 2000, 1413 dead Northern Gannets were found. Of all Northern Gannets, 50.4% were found as 'fresh' or 'rather fresh' corpses, 38.0% were recorded as being 'old' and 8.0% were 'very old'. These Northern Gannets were all intact and suitable for examination of oiling. In addition, 3.6% were described as incomplete corpses (often just pairs of wings). Annual fluctuations in densities are minor (mean \pm SD $0.033 \pm 0.012 \text{ km}^{-1}$, range 0.016-0.066 km^{-1} , $n = 31$; Fig. 2) and there have not been any mass strandings of Northern Gannets in The Netherlands in this study period. At constant effort site Hondsbossche Zeewering, 93 Northern Gannets were found between 1988 and 2000, a daily rate of 0.003 km^{-1} , or approximately one $\text{km}^{-1} \text{ year}^{-1}$.

Seasonal pattern and age composition Northern Gannets wash ashore year-round, but with a slightly higher density between November and January (Fig. 3). Between January and May, over 80% of the Northern Gannets found dead were in adult plumage (86.3% adult, $n = 606$ aged individuals). Immatures increased proportionally in June, peaked in July and August and gradually declined again during autumn. Juveniles (i.e. black-headed, first year individuals) were most commonly found between September and November (17.5%, $n = 189$) and were near absent in late spring and early summer (Apr-Jun 2.1%, $n = 97$; Fig. 4). Of 158 immatures aged in further detail, 44.3% were plumage type 2, 33.5% were type 3, 19.0% were type 4, and 3.2% were type 5.

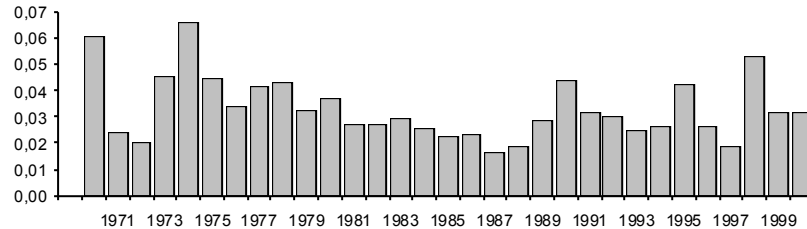


Figure 2. Annual fluctuations in densities of beached Northern Gannets, all subregions combined.

Figuur 2. Jaarlijkse fluctuaties in dichtheden gestrande Jan-van-genten op de Nederlandse kust, alle deelgebieden gecombineerd.

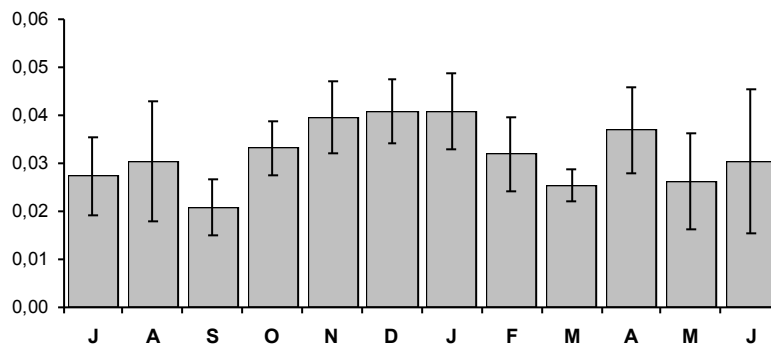


Figure 3. Seasonal pattern in densities (monthly average, n km⁻¹ ± SE) of beached Northern Gannets, all subregions combined.

Figuur 3. Seizoenspatroon in dichtheden (maandgemiddelde, n km⁻¹ ± SE) gestrande Jan-van-genten op de Nederlandse kust, alle deelgebieden gecombineerd.

Spatial pattern Along the North Sea coast, in 31 years with adequate survey results (Table 2), the mean annual density (\pm SD) of Northern Gannets amounted to 0.042 ± 0.014 (min 0.023, max 0.087) km⁻¹. Average densities were highest in the north-west of the country (westernmost Wadden Sea islands and northern half of the mainland coast), but overall the differences are rather small and this species may be considered evenly distributed over most of the Dutch North Sea coastline (Fig. 1; Table 3). In the Wadden Sea area, in 25 years with sufficient data (Table 2), the mean annual density was 3.86x lower with 0.011 ± 0.014 (min 0.0, max 0.061) km⁻¹ (Table 3).

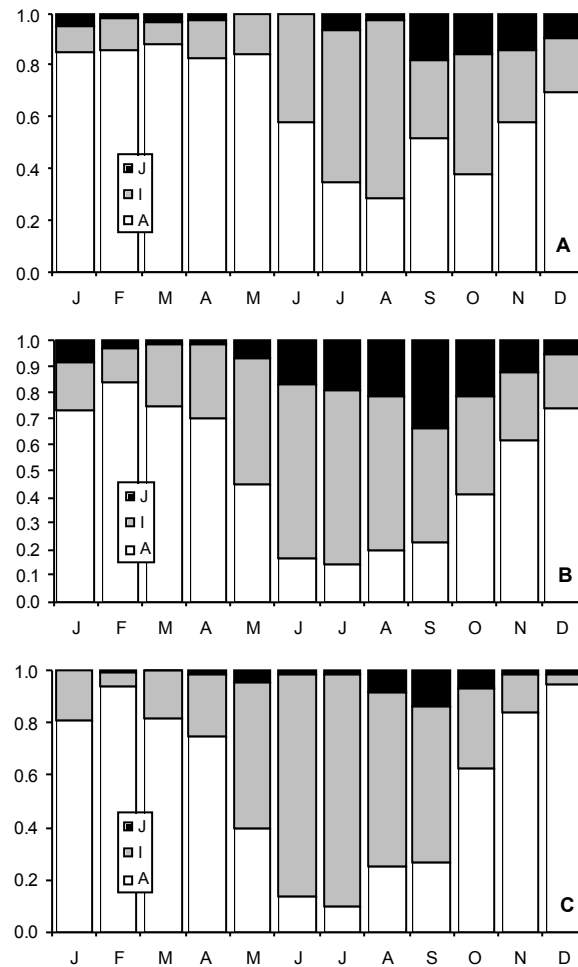


Figure 4. Monthly age composition of Northern Gannets (A) found dead ($n = 1220$), (B) observed during coastal seawatching 1972-1993 ($n = 152\ 030$), and (C) seen during ship-based surveys, 1987-1999, 51-56°N, 2-8°E ($n = 9624$). J= juvenile, I= immature, A= adult.

Figuur 4. Maandelijks leeftijdsverdeling van Jan-van-genten (A) dood gevonden op de kust ($n = 122$), tijdens zeetrektingen 1972-1993 ($n = 152\ 030$) en tijdens tellingen vanaf schepen op zee, 1987-1999, 51-56°N, 2-8°O ($n = 9624$). J= juveniel, I= onvolwassen, A= adult.

Tabel 3. Regional densities of Northern Gannets in winter and summer, 1970-2000.

Tabel 3. Regionale verschillen in dichtheden Jan-van-genten in zomer en winter, 1970-2000.

	Subregions	Winter			Summer		
		km	Gannets	n km ⁻¹	km	Gannets	n/km ⁻¹
S Delta area	1-3	5584	199	0.04	438	7	0.02
N Delta area	4-5	2140	58	0.03	213	7	0.03
S mainland coast	6-7	5764	183	0.03	612	25	0.04
N mainland coast	8-9	7465	326	0.04	2069	91	0.04
W Wadden Sea isles	10-12	4329	238	0.05	1049	62	0.06
E Wadden Sea isles	13-15	2066	65	0.03	555	18	0.03
W Wadden Sea area	16-19, 22-25	8297	81	0.01	4592	34	0.01
E Wadden Sea area	20-21, 26-27	1405	16	0.01	219	2	0.01
Totals		37 050	1166		9747	246	

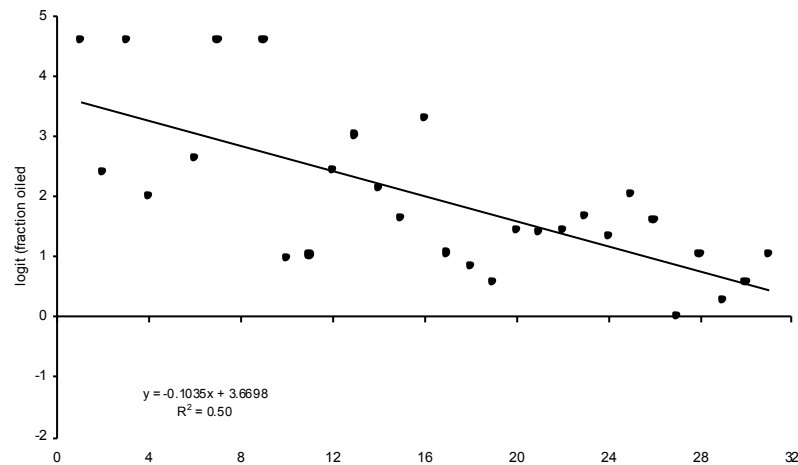


Figure 5. Trend in oil rate (logit-transformed) for Northern Gannets since 1969/70 (season 1), based on annual samples of at least 10 relatively fresh, complete corpses found in winter (Nov-Apr).

Figuur 5. Verloop in de fractie met olie besmeurde Jan-van-genten sinds 1969/70 (seizoen 1), gebaseerd op jaarlijkse steekproeven van tenminste 10 relatief verse, complete kadavers in de wintermaanden (nov-apr).

Table 4. The incidence of entanglements reported in beached Northern Gannets in The Netherlands between 1977 and 1989, since 1990 and over the entire period 1970-2000.

Tabel 4. Het voorkomen van verstrikkingen bij aangespoelde Jan-van-genten in Nederland van 1977-1989, sinds 1990 en over de gehele onderzoeksperiode 1970-2000.

	Fish net	Rope	Nylon fibres	Nylon line	Miscell.	Total
1977-1989	22 61.1%	9 26.2%	2 5.6%	2 5.6%	1 2.8%	36
1990-2000	9 20.0%	9 20.0%	2 4.4%	23 51.1%	2 4.4%	45
1970-2000	33 39.8%	18 21.7%	4 4.8%	25 30.1%	3 3.6%	83

Oiling A characteristic pattern of oiling found most frequently in Northern Gannets, is that both wing-tips, the tail and the belly between the feet are heavily oiled, whereas the rest of the bird is more or less clean. This pattern is interpreted as representing the effect of a take-off (running and hitting the water with the wings in an attempt to fly) when facing an 'approaching' oil-slick. Northern Gannets take wing into the wind and oil driven by wind towards swimming birds therefore poses a great risk even in case of an attempted escape.

For adults (1970-2000, 79.5% oiled, $n = 694$) and immatures (79.4%, $n = 126$), oil rates are similar. In juveniles, however, overall oil rates are significantly lower (46.5%, $n = 43$; $G_{adj} = 21.0$, $df = 2$, $P < 0.001$). Oil rates in Northern Gannets found dead in The Netherlands have declined gradually, but highly significantly, since the early 1970s ($t = 5.17$, $df = 27$, $P < 0.001$; Fig. 5). In recent years, just over half of all Northern Gannets found were somehow oiled or contaminated with other lipophilic substances, whereas nearly all birds found in the early 1970s were oil-fouled.

Other substances causing the death of Northern Gannets included dodecylphenol (March 1990, one individual), Apron-plus (toxic pesticide; January 1994, 1), and polyisobutylene (December 1998, 4). Some Northern Gannets were captured and treated in rehabilitation centres in November 1987 (not included in BBS database) and these were covered in a sticky substance that was found to contain 90% linseed oil (Engelen 1987a).

Entanglements in fishing gear A total of 83 Northern Gannets were found that were entangled (5.8%, $n = 1431$). Prior to 1977, it is not certain that all entangled Northern Gannets were reported as such and these data were therefore omitted from the trend analysis. The fraction of entangled Northern Gannets has

increased significantly since 1977 ($t = 3.85$, $df = 22$, $P < 0.01$; Fig. 6). Between 1977 and 1989, 5.2% of all Northern Gannets were entangled ($n = 692$) and most were entangled in fishing nets (61.1%, $n = 36$) or in various heavy ropes or nylon fibres from beamtrawler nets (31.8%; Table 4). In the 1990s, the incidence of entanglements increased to 7.5% of all Northern Gannets found dead ($n = 600$), but half of these were killed in nylon sports anglers fish line (often with hook and/or sinker still attached; 51.1%, $n = 45$). The proportion of Northern Gannets entangled in fishing nets declined from 3.2% to 1.5% of all birds found dead, whereas that of Northern Gannets in nylon lines increased from only 0.3% to 3.8%. Eight Northern Gannets found dead had a broken wing (4), missing wings (or part of wings, 3) or a broken mandible (1), injuries that were most likely caused when they were pulled out of a net on a fishing trawler.

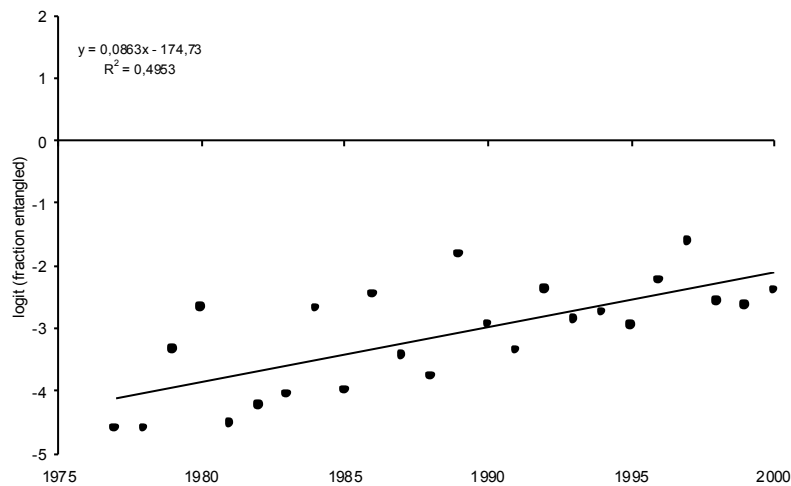


Figure 6. Trend in (logit-transformed) fraction entangled Northern Gannets since 1977, based on annual samples of all corpses found dead.

Figuur 6. Verloop in de fractie verstrikte Jan-van-genten sinds 1977, gebaseerd op jaarlijkse steekproeven van alle gevonden kadavers.

DISCUSSION

In the first report of beached oiled seabirds in the Netherlands, in 1915, of 18 oiled seabirds found dead, six were Northern Gannets (Verwey 1915). A much lower proportion has been found in most anecdotal reports and subsequent

systematic surveys conducted since, but Camphuysen (1989) identified the Northern Gannet as being highly vulnerable to oil pollution, given that 86.5% of 561 individuals found dead between 1969 and 1985 were oil-fouled. In this and in later publications (Camphuysen 1990a, 1994), the incidence of entanglements in fishing gear in Northern Gannets was highlighted as an additional (unnatural) cause of death in Dutch waters.

There is no other species in The Netherlands which shows so little variation in numbers washing ashore, both between years (Fig. 2) and within one calendar year (Fig. 3). No mass strandings of Northern Gannets have been recorded on the BBS, either in particularly harsh, or mild winters, in exceptionally stormy seasons, or in oil pollution incidents. Yet, they were represented in virtually all local oil pollution incidents, but in relatively small numbers (e.g. Swennen & Spaans 1970; Engelen 1987ab; Camphuysen *et al.* 1988; Camphuysen 1989; Leopold & Camphuysen 1992; Camphuysen 1995, 1997; Camphuysen *et al.* 1999). When extrapolating the results of constant effort site Hondsbossche Zeewering over the entire 381 km long North Sea coast, approximately 360 Northern Gannets have washed ashore annually in the 1990s. Considerably lower densities in the Wadden Sea (see below) would suggest that another 80 Northern Gannets may wash ashore on the 325 km long Dutch Wadden Sea shores. These figures are not unrealistic given the annual coverage in beached bird surveys and the *c.* 53.4 ± 19.6 Northern Gannets actually found dead each year since 1988.

Estimates of total numbers of Northern Gannets in the Dutch sector of the North Sea based on densities derived from ship-based surveys ranged from a minimum of 3700 birds December-January, via 18 800 in February-March, 7200 in April-May and 5040 in June-July, to peak numbers in autumn with 16 700 in August-September and 28 700 in October-November (Camphuysen & Leopold 1994). In October-November, 4.0% of the East Atlantic breeding population may be found in Dutch waters (*cf.* Lloyd *et al.* 1991). These estimates are in fact misleading, because the turnover (caused by migratory movements through this sea area) is substantial, albeit very difficult to quantify. Strandings of some 450 Northern Gannets on an annual basis are clearly no reason for immediate worry, even if not all corpses of Northern Gannets dying at sea are likely to wash ashore.

The seasonal pattern of stranding ($n \text{ km}^{-1}$) is not representative of seasonal changes in relative abundance at sea (Camphuysen & Leopold 1994). The age structure of beached birds, however, although with an understandable one month delay, mirrors the offshore situation quite precisely (Fig. 4). So, the relative abundance of each of the age-classes in beached birds seems to be a direct result of differences in the relative abundance of different age groups at sea. A closer look shows that there are subtle differences. Because of the greater

frequency of strandings in winter than in summer, a relatively greater proportion of Northern Gannets found dead were adult (71.8%, $n = 1094$) than could be expected from year-round abundance at sea (51.8%, $n = 9624$). In summer, however, the proportion of adults beached (10.3%, $n = 204$) was lower than expected on the basis of ship-based surveys (28.1%, $n = 4447$). In winter, both the proportion of adults (78.0%) as well as the proportion of juveniles (6.5%, $n = 890$) were significantly higher than in ship-based surveys (adults 72.3%, juveniles 4.5%, $n = 5177$; $G_{adj} = 31.3$, $df = 2$, $P < 0.001$). Differences in the relative abundance of each of the immature stages are difficult to explain, but could be due to different skills of observers in either scheme. During ship-based surveys, of 3255 aged immatures, 54.2% were plumage type 2, 21.7% were type 3, 14.8% were type 4, and 9.3% were type 5. Particularly the latter type may be easily overlooked at sea (mis-identified as adults), but this fraction is distinctly greater than in beached bird surveys, where a single remaining black feather would be noticed immediately.

Only 3.6% of the Northern Gannets were found as incomplete corpses ('wings'). This percentage is considerably lower than for example in other pelagic seabirds such as Northern Fulmars *Fulmarus glacialis* (10.8%, $n = 4557$), Great Black-backed Gulls *Larus marinus* (21.0%, $n = 2300$) or Black-legged Kittiwakes *Rissa tridactyla* (24.6%, $n = 10571$), with a similar distribution in the Southern Bight (Camphuysen & Leopold 1994). However, this percentage is in accordance with a negative relationship between body mass (g) and the fraction of corpses recorded as wings (fraction as wings = $-0.134 \ln(\text{body mass, g}) + 1.1097$; $r^2 = 0.48$; calculated over 81 species; NZG/NSO unpubl. data): large birds tend to be found whole.

The oil-rates in Northern Gannets in The Netherlands are still very high, indicating that these aerial seabirds are perhaps more vulnerable to oil pollution than generally assumed. A recent study of the activity budget of Northern Gannets in the breeding season showed that these birds spend considerable time swimming at sea (Garthe *et al.* 1999). This, combined with their heavy weight and difficulty in taking flight, could pose the greatest risk for these birds to get in contact with oil, even if their escape behaviour would be to fly off near an approaching oil slick. The age dependent differences in oil rates indicate differences in the risk to become oiled for juvenile versus immature and adult (combined) birds. This must be a different risk due to age-specific behavioural differences at sea or age-specific mortality rates and therefore points to pre-mortal oiling only.

In comparison with historical beached bird surveys in The Netherlands, Northern Gannets seem to have declined. Brouwer (1953), reviewing observations from the first half of the 20th century, suggested that 7% of all birds killed by oil along the Dutch coast were Northern Gannets (1970-2000 only

0.7% of all birds found dead, $n = 192\,450$, 1.5% of all intact corpses reported as oiled, $n = 63\,271$; NZG/NSO *unpubl. data*). Mörzer Bruijns (1959) reported on the results of beached bird surveys in The Netherlands between 1948 and 1958 (1018 km surveyed, year-round programme) and found 133 oiled Northern Gannets (4.0% of all birds found). His overall density (0.13 km^{-1}) was four times higher than our present figure and even more than twice the highest density found in any one year since 1970. In a follow-up study, numbers seemed to have declined quite markedly (1958-62 0.031 km^{-1}), in fact to similar levels as reported in the present study, and Northern Gannets formed only 1.5% of all birds reported as oil victims (Tanis & Mörzer Bruijns 1962). Although the evidence has a slender factual basis (relatively few data compared to the present day situation), these publications suggest that Northern Gannets have declined as beached birds both in relative terms and in absolute terms. This trend is completely opposite to the marked population increase over most of the last century (Nelson 1978; Wanless 1987; Lloyd *et al.* 1991; Tasker 1994) and suggests a reduced risk for Northern Gannets to fall victim to oil pollution, or a markedly changed at-sea distribution.

The overall proportion of evidently entangled individuals is higher than in any other species found in beached bird surveys in The Netherlands and is increasing (Camphuysen 1990a, 1994). Previous studies have pointed at these entanglements, that are not only common in the Southern North Sea (Schneider 1991; Hartwig *et al.* 1992), but also known from breeding colonies (Montevicchi 1991; Camphuysen 1990b) and winterquarters (Leopold 1993). Northern Gannets are probably the most vulnerable seabirds to get trapped in trawls, due to their habit to hammer into gear hauled into the boat. Most trapped Northern Gannets will be pulled out of the net by fishermen and be thrown into the sea, without obvious indications of the cause of death visible on the corpse. Yet, the available evidence points at a recent reduction in both the relative and in the absolute importance of deaths in trawl nets, whereas the contrary was observed in entanglements in nylon lines and hooks (sports anglers fishing gear). Future surveys will have to prove whether these trends are consolidated.

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VONDSTEN VAN JAN-VAN-GENTEN MORUS BASSANUS LANGS DE NEDERLANDSE KUST,
1970-2000

Jan-van-genten *Morus bassanus* zijn doortrekkers in Nederlandse kustwateren, waarvan de grootste aantallen tijdens zeevogeltellingen in de herfst (september-oktober) worden gezien. Tellingen vanaf schepen wezen uit dat *Jan-van-genten* gedurende het gehele jaar in de Zuidelijke Bocht voorkomen, een bevinding die bevestigd werd door de resultaten van olieslachtoffertellingen op de Nederlandse kust. Van de in Nederland aangespoelde *Jan-van-genten* was een groot deel of met olie besmeurd, of in vistuig verstrikt gemaakt. Een karakteristiek patroon van oliebesmeuring bij de *Jan-van-gent*, olie aan de vleugelpunten, tussen de poten en aan de staart (de vogels komen kennelijk vaak tijdens het opvliegen met olie in contact en 'rennen' als het ware door de olie) wordt beschreven. De meest voorkomende vormen van vistuig waarin *Jan-van-genten* verstrikt raken zijn allerlei visnetten en nylon vislijnen van sportvissers. De oliebevuilingspercentages bij de *Jan-van-genten* (jaarlijkse fractie met olie besmeurde exemplaren, gemeten op grond van tenminste 10 complete kadavers in het winterhalfjaar) vertonen een gestage afname in de tijd, maar zijn nog steeds relatief hoog (79% bij adulte en onvolwassen exemplaren, 47% bij juvenielen). Daar staat tegenover dat tegenwoordig steeds vaker in vistuig verstrikte *Jan-van-genten* worden gevonden (1977-89 5%, 1990-99 7.5%). Zowel de afname van het percentage olieslachtoffers als de toename van het percentage verstrikkingslachtoffers zijn significant. In de jaren tachtig vielen de meeste verstrikkingslachtoffers in allerlei touwen en visnetten. Sinds 1990 worden de meeste verstrikte *Jan-van-genten* echter in vislijnen van sportvissers aangetroffen, vaak met de haken en het gewicht er nog aan. In totaal spoelen er jaarlijks in Nederland ongeveer 450 *Jan-van-genten* aan. Hieronder zijn betrekkelijk weinig juveniele exemplaren (die een hogere jaarlijkse sterfte hebben dan oudere vogels) en de maandelijkse veranderingen in de leeftijdsopbouw van gestrande vogels zijn een nauwkeurige afspiegeling van de leeftijdsopbouw die bij de *Jan-van-genten* tijdens tellingen vanaf schepen op zee wordt gevonden. De Noord-Atlantische populatie van de *Jan-van-gent* is in de 20^e eeuw enorm toegenomen en de soort vestigde zich in tal van nieuwe kolonies. Zeetrekwaarnemers zien dan ook meer en meer *Jan-van-genten* langs de Nederlandse kust langstrekken. Op het strand wordt deze trend echter niet gevonden. Na een opvallende afname in het aantal aangespoelde *Jan-van-genten* sinds de jaren veertig is het aantal strandingen opmerkelijk stabiel gebleven.

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ATTENDANCE PATTERNS OF COMMON GUILLEMOTS *URIA AALGE* AND KITTIWAKES *RISSA TRIDACTYLA* AT COLONIES DURING CONTINUOUS DAYLIGHT

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Barrett R.T. 2001. Attendance patterns of Common Guillemots *Uria aalge* and Kittiwakes *Rissa tridactyla* at colonies during continuous daylight. *Atlantic Seabirds* 3(1): 31-48. *Attendance patterns of adult Common Guillemots Uria aalge and Kittiwakes Rissa tridactyla at breeding colonies during continuous daylight were studied in arctic Norway. While there were clear diurnal variations in the attendance of Common Guillemots that were similar to those found in colonies further south, those of the Kittiwakes were more diffuse. Seasonal variations were otherwise similar to those of birds breeding further south. Variations in attendance pattern were least during incubation and early chick-rearing for both species, corroborating published recommendations of carrying out census or monitoring counts during these periods.*

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INTRODUCTION

In order to determine when best to census or monitor breeding seabird populations, it is necessary to document short-term diurnal and seasonal changes in attendance patterns of adults in the colony (Nettleship 1976; Evans 1980). This has been done several times at temperate latitudes (e.g. Cullen 1954; Lloyd 1972, 1975; Birkhead 1978; Slater 1980; Richardson *et al.* 1981; Harris *et al.* 1983), but apart from Gaston and Nettleship's (1981, 1982) study of Brünnich's Guillemots *Uria lomvia* and Tschanz's (1983) study of Common Guillemots *U. aalge*, little has been published on the effects of continuous daylight on attendance patterns in the Arctic.

Kittiwake *Rissa tridactyla* and Guillemot monitoring is generally based on counts of apparently occupied nests or individual birds on the breeding shelves within previously determined sample plots. Although nest counts are the basis of most Kittiwake monitoring (Walsh *et al.* 1995), counts of individuals have also been recommended and used as they measure whole populations of breeders and non-breeders (Heubeck *et al.* 1986; Hatch & Hatch 1988). The use of individuals as the counting unit also avoids the problem of the observer's subjective definition of a nest (e.g. Heubeck & Mellor 1994) and results in

Figure 1. Map showing the location of the seabird colonies mentioned in the text in relation to the Arctic Circle.

Figuur 1. Ligging van de in de tekst genoemde zeevogelkolonies ten opzichte van de poolcirkel.

smaller inter-observer differences in counts than when nests are used as units (Wanless *et al.* 1982). Furthermore, short term counts of adults may be useful indicators of attendance changes which, in turn, may be a result of, for example, fluctuating food availability, predation or human disturbance (Wanless & Harris 1992; Cadiou 1999; Sandvik & Barrett 2001).

In 1979, a national seabird monitoring programme was initiated in Norway, focusing on three species considered representative of Norwegian seabird colonies, the Common Guillemot, the Atlantic Puffin *Fratercula arctica* and the Kittiwake (Røv *et al.* 1984). Counting techniques standardised by the

Seabird Group (Evans 1980; and later Walsh *et al.* 1995) were, and still are used, irrespective of the latitude of the colony in question. Consequently, counts of auks and Kittiwakes were timed according to the recommendation of British studies (Evans 1980; Richardson *et al.* 1981) and assumed that attendance patterns at nest sites within the Arctic Circle were similar to those of more southerly colonies. In Norway, >80% of Norway's cliff-breeding seabirds breed north of the Arctic Circle (Barrett & Vader 1984; Anker-Nilssen *et al.* 2000) and three of the four main monitoring sites have continuous daylight throughout the breeding season (Røst 67° 25' N, Hjelmsøya 71° 07' N and Hornøya 70° 22' N).

This paper reports adult attendance patterns of the Common Guillemot and the Kittiwake at colonies within the Arctic Circle and compares them with data published from colonies further south.

METHODS

The main part of this study was carried out on Hornøya (70°22' N, 31°10' E), an island off the northeastern tip of Norway, in 1980 and 1981 (Fig. 1). Supplementary data are drawn from a study of Kittiwakes (Barrett 1978) on Hekkingen (69°36' N, 17°50' E), *c.* 40 km west of Tromsø. Both islands are 'bathed in midnight sun' during most of the breeding season, from 17 May-26 July (Hornøya) and 20 May-23 July (Hekkingen).

Common Guillemot Seasonal patterns of attendance by adult Common Guillemots were studied by daily counts at 12:00 (Norwegian Summer Time, NST = GMT +2 hr) of birds on a clearly defined monitoring plot on Hornøya. The plot contained *c.* 220-240 pairs or up to 400 birds that could be counted easily using binoculars from a ledge *c.* 40 m from and 10 m above the plot. Counts were made between 14 May and 12 August 1980, and between 13 May and 17 August 1981. Using time-lapse photography in 1980 and direct counts in 1981, diurnal attendance patterns were recorded every 2 or 4 hr throughout a 48 hr period (weather permitting) at *c.* 10 day intervals throughout each field season. In order to correct for possible effects of weather on attendance (Corkhill 1970; Birkhead 1978; Slater 1980), the diurnal counts were restricted to a period of fine, calm weather. Whenever a count series was threatened by deteriorating weather, it was postponed (or suspended when the weather suddenly worsened) until conditions improved.

Data on wind speed, precipitation, temperature and sea state (on a scale of 1-9) at Hornøya were based on observations made at 08:00 and 14:00 NST by the Norwegian Meteorological Institute at Vardø, *c.* 1 km from the colony.

Kittiwake Diurnal patterns of adults at nests were determined by counting adults at nests on photographs taken either directly (Hornøya) or using time-lapse photography (Hekkingen). On Hekkingen, photographs were taken from a hide c. 20 m from a group of 57 nests every 45 min over a 24 hr period using a Nikon F2 35 mm camera with automatic aperture control (Nikon DS-1), motor drive (Nikon MD-1) and a battery-driven timer, seven times between 7 May and 29 July 1976. On Hornøya, photographs of c. 160 Kittiwake nests surrounding the Guillemot plot were taken manually in 1981 at the same time and from the same site as the Guillemots were counted. Seasonal changes in numbers were based on the means of the diurnal counts made within the given 24 hr periods.

The numbers of birds on nests with eggs or chicks (or, in the pre-laying period, nests in which eggs were later laid) and the numbers on failed nests in the pre-laying, incubation and chick-rearing periods on Hekkingen were determined from daily records of the contents of all the nests.

RESULTS

Common Guillemot Judging from when the first chicks were seen on the monitoring plot (16 June 1980 and 21 June 1981) and using a mean incubation period of 33 days (Gaston & Jones 1998), the daily counts at Hornøya began each year around the start of egg laying. The first chicks fledged from the plot on 10 July 1980 and 17 July 1981, and counts continued until the last adults left.

Despite considerable daily variation in the midday numbers of birds, attendance patterns through the season were essentially the same in 1980 and 1981 (Fig. 2). There were no trends in the numbers present before the first chicks were seen in either year ($r^2 = 3.2\%$, $P > 0.1$ in 1980; $r^2 = 7.5\%$, $P > 0.1$ in 1981). However, linear regressions indicated a significant increase in numbers from the day of first hatching to the day the first chicks fledged in 1980 ($r^2 = 46.8\%$, $P < 0.001$), although in 1981 the increase in the same period was not significant ($r^2 = 8.9\%$, $P > 0.1$). In both seasons there was a significant overall increase over both periods until fledging started ($r^2 = 52.2\%$, $P < 0.001$ in 1980; $r^2 = 28.9\%$, $P < 0.001$ in 1981). Once chicks started to leave the colony, the numbers of adults on the plot dropped steadily and within 30 days all had departed.

Significant, positive correlations between wind speed at 14:00 NST and numbers present during the incubation and nestling periods were found in 1980 ($r^2 = 11.6\%$, $P < 0.01$). Although there were no significant correlations between attendance and wind speed measured at 08:00 NST, there were significant, positive correlations with sea state at 08:00 and 14:00 NST ($r^2 = 8.2\%$, $P < 0.05$ and $r^2 = 11.6$, $P < 0.01$ respectively). In 1981, the correlation between numbers and wind speed at 14:00 NST was weak but significantly negative ($r^2 = 8.7\%$,

Figure 2. Seasonal variation in the numbers of adult Common Guillemots attending a sample plot at Hornøya, North Norway during the incubation, chick-rearing and fledging periods in 1980 and 1981. Counts were made at midday local time. h = date on which the first chick was seen, f = date on which the first chick was seen on the water below the cliff.

Figuur 2. Variatie in de loop van het seizoen in het aantal volwassen Zeekoeten dat aanwezig was op een steekproefplot op Hornøya, Noord-Noorwegen, tijdens de broedfase, kuikenfase en het uitvliegen in 1980 en 1981. Tellingen werden om 12 uur 's middags lokale tijd uitgevoerd. h = datum dat het eerste kuiken werd gezien, f = datum dat het eerste jong op zee werd gezien.

$P < 0.05$), but there was no correlation between numbers and either wind speed at 08:00 NST or sea state at 08:00 or 14:00 NST. No significant correlations between attendance and other weather variables were found.

There were large fluctuations in the size and coefficients of variation (CV) of the counts of Guillemots made at 2 or 4 hr intervals over 1-2 days on the plot during the pre-laying period (before 15 May both years) and after the chicks begin to leave the cliff (10 July 1980 and 18 July 1981), but smaller fluctuations during the incubation and nestling periods (Figs. 3 and 4). However, there was a clear diurnal pattern of attendance with fewest birds on the plot around midnight and usually most during the evening. Two exceptions to this pattern, during the afternoon of 29 June 1981 and morning of 11 July 1981, coincided with periods of heavy rainfall.

Opposite page. Figure 3. Diurnal variations in numbers of adult Common Guillemots attending a sample plot at Hornøya, North Norway, 1980 and 1981. x-axis indicates Norwegian Summer Time (GMT+2 hr). The main incubation period and early chick-rearing period fall in June. Solid line = first 24 hours, dotted line = second 24 hours.

Figuur 3. Dagelijkse variatie in het aantal volwassen Zeekoeten dat aanwezig was op een steekproefplot op Hornøya, Noord-Noorwegen, 1980 en 1981. X-as geeft Noorse zomertijd weer (GMT + 2 uur). De hoofdbroedfase en de vroege kuikenseizoen vallen in juni. Doorgetrokken lijn = eerste 24 uur, onderbroken lijn = tweede 24 uur.

Figure 4. Seasonal variation in the coefficient of variation of the means of the diurnal counts (Fig. 3) of Common Guillemots attending sample plots at Hornøya, North Norway, 1980 and 1981.

Figuur 4. Variatie in de loop van het seizoen in de variatiecoëfficiënt van de gemiddelden van de dagelijkse tellingen (Fig. 3) van Zeekoeten die steekproefplots op Hornøya, Noord-Noorwegen, bezochten, 1980 en 1981.

Kittiwake Whereas total numbers of Kittiwakes on the study plot on Hornøya declined through the 1981 season ($r^2 = 87.3\%$, $P < 0.01$), there was no evidence of such a trend on Hekkingen ($r^2 = 35.6\%$, $P > 0.1$; Fig. 5). This pattern also prevailed when attendance only after the start of egg laying (on 20 May) was considered ($r^2 = 79.0\%$, $P < 0.01$ $r^2 = 17.6\%$, $P > 0.1$ respectively). In both seasons, however, numbers stabilised and became less variable when most birds were incubating.

Figure 5. Seasonal variation in the mean numbers of diurnal counts \pm SD (Figs. 6 & 7) of adult Kittiwakes attending sample plots at Hekkingen (triangles, 1976, n = 57 nests) and Hornøy (dots, 1981, n = c. 160 nests), North Norway. Shaded bars indicate the main incubation periods.

Figuur 5. Seizoensvariatie in het gemiddelde aantallen van dagelijkse tellingen \pm SD (Figs. 6 & 7) van volwassen Drieteenmeeuwen die aanwezig waren in steekproefplots op Hekkingen (driehoekjes, 1976, n = 57 nesten) en Hornøy (rondjes, 1981, n = c. 160 nesten), Noord-Noorwegen. Grijs balken geven de hoofdbroedperiode aan.

There were considerable variations in the diurnal counts on both Hornøya and Hekkingen, often with tendencies towards minima during 'night' and maxima during the morning or afternoon (Figs. 6 and 7). On Hekkingen, there were several episodes of sudden departure from the colony (e.g. at 09:15 on 8 May, 20:50 on 6 July, 13:05 and 22:50 on 12 July, 02:20, 03:50 and 04:30 on 29 July, all times NST; Fig. 7). These were probably identical to mass flights from the colony observed late in the breeding season when all birds would suddenly adopt the pre-flight posture (Paludan 1955) and then simultaneously fly down from the cliff, circle two or three times, and return. This was sometimes repeated several times over a period of 2-3 mins before the birds finally settled on the colony. During 22.5 hrs observation on 12-14 July, such behaviour was recorded 33 times, once being repeated 11 times within 10 mins. These mass flights generally involved only birds with no chicks, but in periods of high agitation even these would leave their nests. However, they returned to their nests almost immediately and did not fly around as long as the failed or non-breeders.

Figure 6. Diurnal variations in numbers of adult Kittiwakes attending a sample plot at Hornøya, North Norway, 1981. X-axis indicates Norwegian Summer Time (GMT+2 hr). The main incubation period falls between 25 May and 30 June. Solid line = first 24 hours, dotted line = second 24 hours.

Figuur 6. Dagelijkse variatie in het aantal volwassen Drieteenmeeuwen dat aanwezig was op een steekproefplot op Hornøya, Noord-Noorwegen, 1981 en 1981. X-as geeft de Noorse zomertijd weer (GMT + 2 uur). De hoofdbroedperiode liep van 25 mei t/m 30 juni. Ononderbroken lijn = eerste 24 uur, onderbroken lijn = tweede 24 uur.

Opposite page. Figure 7. Diurnal variation in numbers of adult Kittiwakes attending a sample plot at Hekkingen, North Norway, 1976. Numbers in brackets indicate number of nests with eggs or chicks, number of failed nests. In May the numbers denote the number of nests that would later contain eggs. Shaded dates indicate the main incubation period.

Figuur 7. Dagelijkse variatie in aantal volwassen Drieteenmeeuwen dat aanwezig was op een steekproefplot op Hornøya, Noord-Noorwegen, 1976. Getallen tussen haakjes geven het aantal nesten met eieren of jongen en het aantal mislukte nesten weer. De mei-getallen geven het aantal nesten weer, waarin eieren werden gelegd. Gearceerde data geven de hoofdbroedperiode aan.

Figure 8. Seasonal variation in the coefficient of variation of the means of the diurnal counts of adult Kittiwakes attending sample plots at Hekkingen, 1976 (Fig. 7) and at Hornøya 1981 (Fig. 6), North Norway.

Figuur 8. Variatie in de loop van het seizoen in de variatiecoëfficiënt van de gemiddelden van de dagelijkse tellingen van volwassen Drieteenmeeuwen op steekproefplots op Hekkingen 1976 (Fig. 7) en op Hornøya 1981 (Fig. 6), Noord-Noorwegen.

Eggs were laid in 53 of the 57 nests in the plot on Hekkingen. Before the first eggs were laid, the total numbers of birds on the plot and the numbers attending future active nests fluctuated greatly with a minimum during the early morning (8 May) or near midnight (19-20 May; Fig. 7). Only a small proportion (8-16%) of the nests were unoccupied at any one time during the pre-laying

Table 1. Attendance by adult Kittiwakes at 51 nests with eggs or later failed nests expressed as the mean % \pm SD of nests attended by 0, 1 or 2 adults at Hekkingen, North Norway 1976. n = no. of nests.

Tabel 1. Aanwezigheid van volwassen Drieteenmeeuwen op 51 nesten met eieren of later mislukte nesten, uitgedrukt als gemiddelde % \pm SD van nesten met 0, 1 of 2 volwassen vogels op Hekkingen, Noord-Noorwegen 1976. n = aantal nesten.

	No. of adults at nests with eggs/chicks			n
	0	1	2	
May 7-8	16.2 \pm 17.6	62.1 \pm 14.6	21.7 \pm 13.9	51
May 19-20	7.5 \pm 4.9	74.9 \pm 7.8	17.6 \pm 9.5	51
June 8-9	0	98.7 \pm 1.6	1.3 \pm 1.6	34
June 20-21	0	99.7 \pm 0.9	0.3 \pm 0.9	38
July 6-7	3.6 \pm 14.5	95.7 \pm 14.6	0.7 \pm 2.5	23
July 12-13	0	97.6 \pm 4.4	2.4 \pm 4.4	22
July 28-29	6.3 \pm 15.6	90.4 \pm 15.9	3.3 \pm 6.7	18

	No. of adults at failed nests			n
	0	1	2	
June 8-9	11.3 \pm 5.9	77.6 \pm 1.2	11.1 \pm 1.1	17
June 20-21	32.5 \pm 1.4	57.0 \pm 1.3	10.6 \pm 0.9	13
July 6-7	58.1 \pm 26.8	36.3 \pm 22.3	5.6 \pm 7.1	28
July 12-13	36.9 \pm 22.3	50.9 \pm 14.5	12.3 \pm 10.8	29
July 28-29	36.1 \pm 24.2	46.9 \pm 17.0	17.1 \pm 13.3	33

period whereas 18-22% were attended by two adults (Table 1); a single bird attended the remaining nests.

During incubation in June, there was very little variation in the numbers of birds attending nests with eggs, and the fluctuations in total numbers were smaller than earlier in the season (Fig. 8). During this period, more than 98% of nests with eggs were attended by single adults, while 11-32% of the failed nests were unoccupied and 10-11% occupied by two adults (Table 1).

Once chicks had hatched in July, variation in total numbers increased much as a consequence of increased variance in the attendance at failed nests (Fig. 8); attendance at nests with chicks remained stable with over 93% being attended by single or two birds at any one time. As during the incubation period, more than 90% were attended by single birds. In contrast, failed breeders abandoned their nests for up to 58% of the time (Table 1).

DISCUSSION

Common Guillemot Seasonal trends in numbers of Common Guillemots on Hornøya were similar to those reported from more southerly regions and for

Brünnich's Guillemots on Prince Leopold Island in the Canadian Arctic (Gaston & Nettleship 1981). Many studies report relatively stable or a gentle increase in numbers during incubation and chick-rearing, after which numbers fall steadily as chicks and adults leave the colony. In the Canadian Arctic, Brünnich's Guillemot numbers peaked ± 14 days within the median hatching date, a little earlier than for Common Guillemots in this study, which Gaston and Nettleship (1981) attributed to off-duty site-holding Common Guillemots spending longer time on their sites than off-duty Brünnich's Guillemots.

On Hornøya, day-to-day numbers were most stable when birds were incubating and before the first chicks hatched. In this period, the CVs of the mean number of birds on the plot were 7.1% and 6.5% in 1980 and 1981 respectively, slightly lower than the 12% recorded by Harris *et al.* (1986) during the chick-rearing period on a Scottish colony, and the 17.6% and 12.4% during the incubation and chick-rearing periods respectively on a Welsh colony (Lloyd 1975). However, it is similar to the 5.2-9.4% found during the chick-rearing period of Brünnich's Guillemots on Prince Leopold Island (Gaston & Nettleship 1981). The subsequent slow rise in numbers during the chick-rearing period on Hornøya may have been due to the arrival of non-breeding adults and/or an increase in the proportion of time off-duty birds spent at the colony when rearing chicks (Lloyd 1972; Slater 1980).

While weather conditions may influence attendance patterns, especially early in the breeding period (Corkhill 1970; Birkhead 1978; Slater 1980), the poor association between attendance by birds on Hornøya and wind speed later in the season accords with findings from Orkney, Scotland and Newfoundland (Slater 1980; Harris *et al.* 1983; Piatt & McLagan 1987). The weather on Hornøya was, however, relatively calm in the two seasons of the study, with winds averaging 7-8 knots (*c.* 12-14 kph, Beaufort force 3) and never exceeding 18 knots (*c.* 31 kph, Beaufort force 5). Sea state never exceeded 4 (= 2.5 m waves) on a scale of 0-9 (9 = >14 m waves). These were well short of the 'extreme' conditions Gaston and Nettleship (1981) concluded were necessary to influence attendance patterns of Brünnich's Guillemots.

Although diurnal patterns of guillemot attendance at the colony vary from locality to locality many studies, including this one, indicate that fewest birds are present at night or early morning, and most are present during the morning and afternoon (Birkhead 1978; Slater 1980; Gaston & Nettleship 1981; Tschanz (1983); Hatch & Hatch 1989). One exception to this is a small plot of 21 pairs of Common Guillemots in Alaska where numbers tended to peak at midnight (Watanuki *et al.* 1992). The CVs of the means of the diurnal counts on Hornøya were at a minimum in the second half of June (Fig. 4), *i.e.* early in the chick-rearing period. This accords with data presented by Gaston and Nettleship (1981) for Brünnich's Guillemots on Prince Leopold Island.

Verspoor *et al.* (1987) and Uttley *et al.* (1994) have shown that food availability can influence Guillemot attendance patterns, low food availability causing adults to spend less time resting in the colony. That Guillemot attendance patterns on Hornøya were very similar in 1980 and 1981 suggests that there was little change in feeding conditions around the island, agreeing with Furness and Barrett's (1985) observation of a superabundance of food in the early 1980s.

Despite a regime of continuous daylight, Guillemots in arctic colonies maintain a diurnal and seasonal rhythm of attendance that is very similar to that found at more southerly latitudes. Furthermore, the best time to monitor the Common Guillemot population on Hornøya was towards the end of the incubation period and early in the chick-rearing period when numbers were most stable both from day to day and from hour to hour, again in accordance with recommendations made for colonies further south (Walsh *et al.* 1995).

Kittiwake The seasonal pattern of nest attendance by Kittiwakes between egg-laying and late in the chick-rearing period seems to vary from colony to colony, and also from year to year. This study recorded a decline in numbers of adults on a plot on Hornøya, while numbers on Hekkingen remained stable (Fig. 5). In a four year study of a colony in Alaska, Hatch and Hatch (1988) recorded one season with an increase in numbers, two with a decrease and one with no change over this period. In Britain, Coulson and White (1956) reported a large influx of prospecting birds that augmented numbers during incubation and chick-rearing.

The large variation in numbers attending the colony before incubation starts, the stabilisation of numbers during incubation and early chick-rearing, and the subsequent increase again in birds attending as chicks near fledging and after fledging starts are characteristic features of all studies. The variability early in the season may be attributed to birds prospecting for, establishing and defending nests, as well as pair formation. Later in the season, the arrival of non-breeding adults occupying nests and sites coincides with birds at sites leaving their nests unguarded or occupying them in pairs more often than birds at nests with eggs or chicks. This, along with reduced attendance of breeding adults during the late chick-rearing period (Coulson 1959; Hodges 1977; Roberts & Hatch 1993; Cadiou *et al.* 1994; Harris & Wanless 1997), results in additional variability in attendance. This was obvious on Hekkingen where the variation in numbers of adults attending failed nests was much higher, and where many more sites were either left unattended or were occupied by two adults, than during the incubation period (Table 1). Furthermore, as also found by Anderson *et al.* (1974) and Hodges (1977), the variation in numbers of birds on failed or empty nests was much greater than on nests with eggs or chicks, a

fact that Hodges (1977) attributed to a greater degree of activity co-ordination among breeding birds.

Several studies have shown that nest attendance declines as chicks become older and/or as food availability decreases (Barrett & Runde 1980; Wanless & Harris 1989; Roberts & Hatch 1993; but see Regehr & Montevecchi 1997 for evidence of the converse). The fact that very few nests with chicks on Hekkingen were left unattended accords with Barrett and Runde's (1980) suggestion that feeding conditions in the region were good in the early 1970s. At Hekkingen, however, there was evidence of a third factor, disturbance by mink *Mustela vison*, and this probably affected nest attendance both directly and indirectly. Whereas the indirect effect of increasing the numbers of failed nests through predation of chicks was clearly evident (Barrett & Runde 1980), the sudden, short-term departures from the colony of birds attending failed nests and/or nests with young suggests a more direct response. This was observed in the plot several times late in the breeding season. Although not actually seen, the presence of mink near the colony was the likely cause of this behaviour. Similar behaviour has been observed several times in larger colonies in the region and has coincided with the presence of predators such as Peregrine Falcons *Falco peregrinus* and Gyr Falcons *F. rusticolus* (pers. obs.).

While Guillemots showed a clear diurnal pattern in colony attendance, patterns of total numbers of Kittiwakes at Hornøya and Hekkingen were more diffuse, as was also shown during a one-day count of Kittiwakes in Arctic Greenland (80° N; Falk & Møller 1997). Although attendance patterns varied little, there were nevertheless detectable lulls in activity and calling between *c.* 01:00 and 02:00 NST (pers. obs.), as also reported by Anderson *et al.* (1974). This near lack of diurnal attendance patterns in the Arctic during periods of continuous daylight agrees with Cullen's (1954) findings from Jan Mayen (71° N), Anderson *et al.*'s (1974) observations at Spitsbergen (79° N) and personal and Furness and Barrett's (1985) observations of chick-feeding activity through 24 hours with no evidence of a break at 'night'. Later in the season, however, or throughout the season at more southerly colonies, diurnal variation is more marked with low attendance, longer absences from the nest, no chick-feeding and rare calling activity during the hours of darkness (Wooller 1979; Richardson *et al.* 1981; Galbraith 1983; Wanless & Harris 1992; Coulson & Johnson 1993; Roberts & Hatch 1993).

Thus, while the diurnal attendance patterns of Common Guillemots seem to be similar throughout their breeding range, those of Kittiwakes become less marked as daylight hours increase with latitude. Despite this, it seems that numbers of adult Kittiwakes attending arctic colonies vary least from day to day and from hour to hour during the incubation period, again corroborating the

recommendation that Kittiwake populations be monitored during the latter half of the incubation period in colonies further south (Walsh *et al.* 1995).

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PATRONEN IN DE AANWEZIGHEID VAN ZEEKOETEN *URIA AALGE* EN DRIETEENMEEUWEN *RISSA TRIDACTYLA* OP KOLONIES IN GEBIEDEN MET CONTINU DAGLICHT

*In 1980 en 1981 is de aanwezigheid van volwassen Zeekoeten *Uria aalge* en Drieteenmeeuwen *Rissa tridactyla* in Noord-Noorwegen onderzocht in broedkolonies die 's zomers blootstaan aan voortdurend daglicht. Dit om de beste inventarisatietijd voor beide soorten vast te stellen. De aanwezigheid van volwassen Zeekoeten vertoonde voor de eieren waren uitgekomen geen trend. Daarna namen de aantallen toe tot de eerste jongen "uitvlogen". Vervolgens nam het aantal aanwezige vogels gestaag af (Fig. 2). De aanwezigheid verschilde in de loop van de dag sterk. Het patroon was vergelijkbaar met meer zuidelijk gelegen kolonies waar het 's nachts donker wordt. 's Nachts en in de vroege ochtend waren de aantallen het laagst, het hoogst in de loop van de ochtend en 's middags (Fig. 3). Het seizoenspatroon van de Drieteenmeeuw verschilde enigszins tussen de kolonies. De aanwezige aantallen fluctueerden voor de broedfase begon, gevolgd door een stabilisatie tijdens de broedfase en vroege kuikenfase en een toename toen de jongen bijna vliegvlug of uitgevlogen waren (Fig. 5). De seizoensvariëaties verschilden niet wezenlijk van meer zuidelijk gelegen broedplaatsen. De aanwezigheid in de loop van de dag was meer diffuus; 's nachts waren de aantallen over het algemeen het laagst en 's ochtend of in de middag het hoogst (Fig. 6 & 7). Verschillen in aanwezigheid gedurende de dag waren het kleinst tijdens het bebroeden van de eieren en kort na het uitkomen van de jongen. De auteur sluit zich aan bij eerder gepubliceerde suggesties om tellingen van Zeekoeten en Drieteenmeeuwen vooral in deze periode van intensieve broedzorg te concentreren.*

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