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

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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).

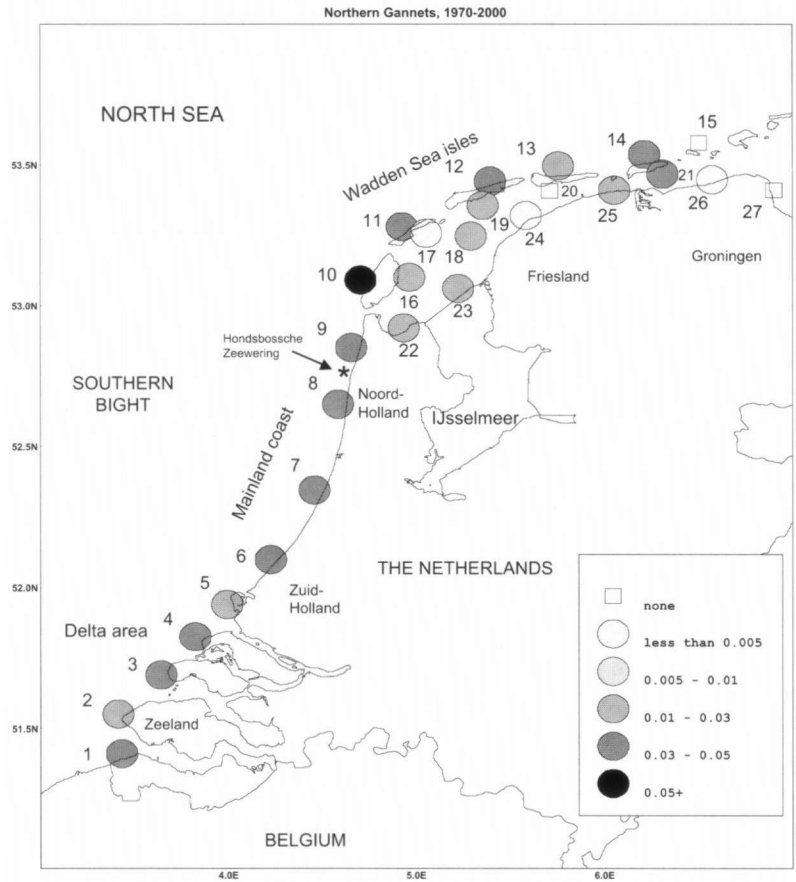

Figure 1. Study area, 27 subregions along the North Sea coast and in the Wadden Sea area (see Table 1 for site names), as well as the location of the constant effort site Hondsbossche Zeewering (near-daily counts 1988-2000) and average densities of Northern Gannets based on beached bird surveys 1970-2000.*

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 ± 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 co-ordinators 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* 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 olieslachtoffertellingen (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).

				winter		summer	
# subregion		stretches	km	counts	km	counts	km
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 olieslachtoffertellingen 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 ± SD 0.033 ± 0.012 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 km^{-1} $year^{-1}$.

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.

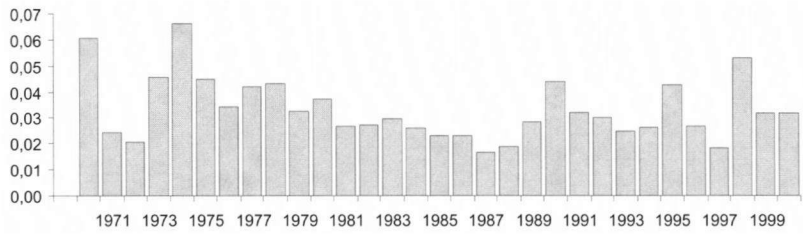

Figure 2. Annual fluctuations in densities of beached Northern Gannets, all subregions combined.

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

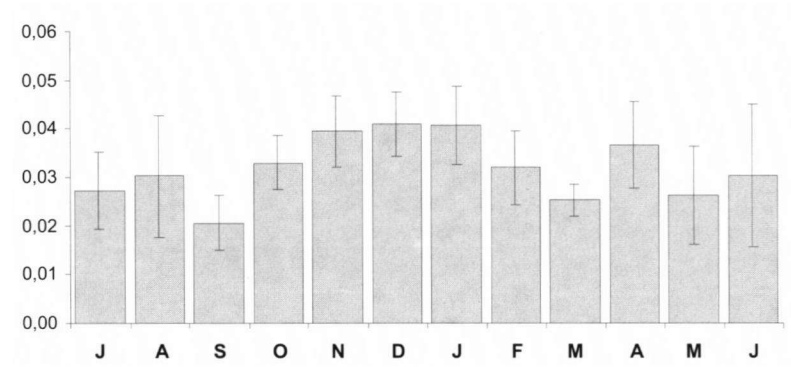

Figure 3. Seasonal pattern in densities (monthly average, n km^{-1} ± SE) of beached Northern Gannets, all subregions combined.

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 (± 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).

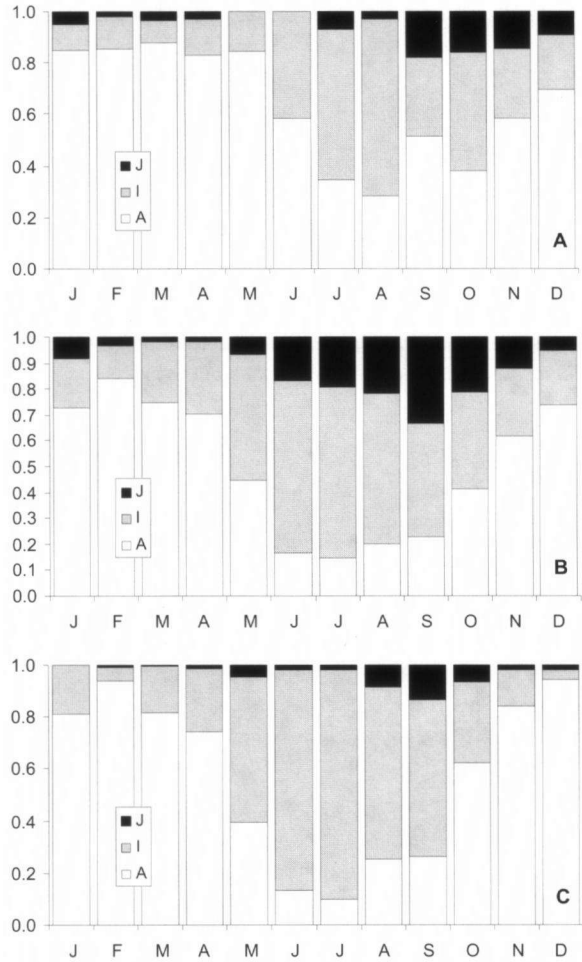

Figure 4. Monthly age composition of Northern Gannets (A) found dead (n = 1220), (B) observed during coastal seawatching 1972-1993 (n = 152 030), and (C) seen during ship-based surveys, 1987-1999, 51-56°N, 2-8°E (n = 9624). J= juvenile, I= immature, A= adult.

Figuur 4. Maandelijkse leeftijdsverdeling van Jan-van-genten (A) dood gevonden op de kust (n= 122), tijdens zeetrektellingen 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.

		Winter			Summer		
	Subregions	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	

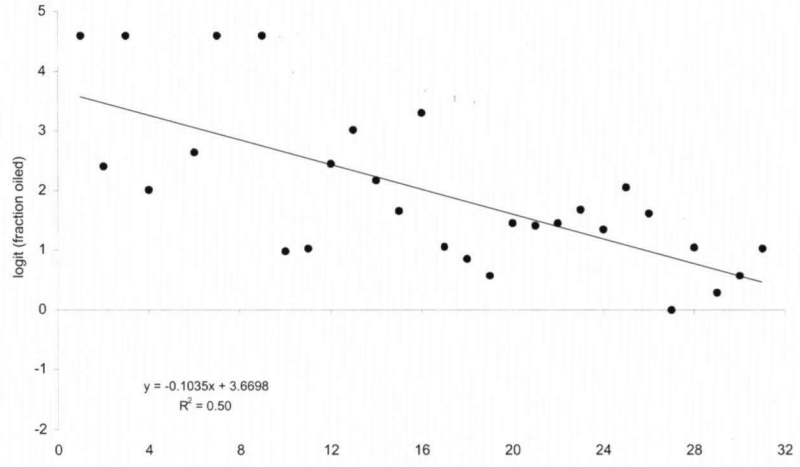

Figure 5. Trend in oil rate (logit-transformed) for Northern Gannets since 1969/70 (season 1), based on annual samples of at least 10 relatively fresh, complete corpses found in winter (Nov-Apr).
Figuur 5. Verloop in de fractie met olie besmeurde Jan-van-genten sinds 1969/70 (seizoen 1), gebaseerd op 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	9	2	2	1	36
	61.1%	26.2%	5.6%	5.6%	2.8%	
1990-2000	9	9	2	23	2	45
	20.0%	20.0%	4.4%	51.1%	4.4%	
1970-2000	33	18	4	25	3	83
	39.8%	21.7%	4.8%	30.1%	3.6%	

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% al 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.

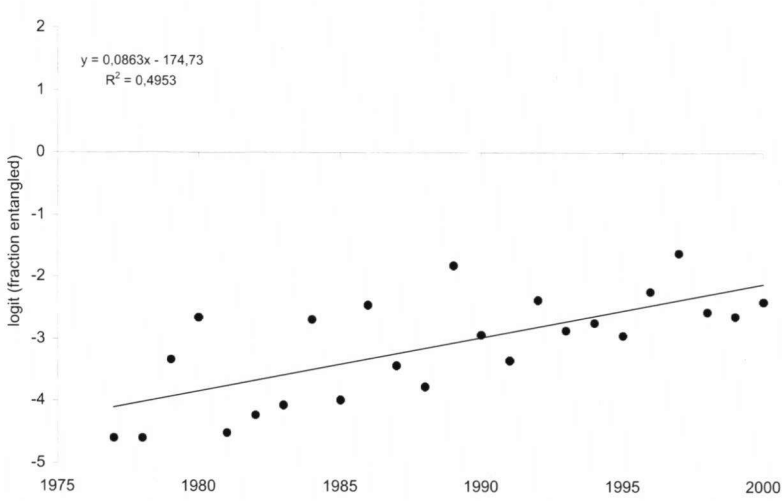

Figure 6. Trend in (logit-transformed) fraction entangled Northern Gannets since 1977, based on annual samples of all corpses found dead.
Figuur 6. Verloop in de fractie verstrikte Jan-van-genten sinds 1977, gebaseerd op jaarlijkse steekproeven van alle gevonden kadavers.

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 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 = 10 571), 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 = -0.134Ln (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 (Montevecchi 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 zeetrektellingen 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 geraakt. 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 verstrikkingsslachtoffers zijn significant. In de jaren tachtig vielen de meeste verstrikkings-slachtoffers 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 20e 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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