The distribution and diversity of whales and dolphins (Cetacea) in the southern North Sea: 1970-2005

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Abstract: Between 1970 and 2005 sightings data of cetaceans in the southern North Sea were collected as part of the *Marine Mammal Database* of the Dutch Seabird Group. The data include incidental sightings and reports as well as results from systematic surveys and seawatching data. They are therefore difficult to correct for fluctuations in observer effort. The material was evaluated firstly to see which species occur in Dutch waters and, secondly, to see if any spatial and temporal trends in abundance can be observed. In this study the harbour porpoise (*Phocoena phocoena*) is excluded from the analysis, except in the discussion, where the results are put into context with data about strandings and overall abundance. The status of the 17 different species that have been recorded in the southern North Sea between 1970 and 2005 was evaluated based on the frequency of occurrence of sightings (dead and alive) in the last 36 years. Two species were listed as resident (harbour porpoise and white-beaked dolphin (*Lagenorhynchus albirostris*)), because they were abundant in 36 and 34 years respectively. The bottlenose dolphin (*Tursiops truncatus*), recorded in 23 years, was listed as a regular visitor or passage migrant. Ten species were qualified as irregular visitors (represented in 4-18 of the 36 years of study) and four as vagrants (recorded in <4 years). The frequency of sightings of cetaceans has generally increased between 1970 and 2005, but it is unclear how the increased popularity of cetaceans by the general public (i.e. more reports) has contributed to that trend. From effort-corrected data this trend seems genuine, but offshore surveys suggest more variable results.

Keywords: whales, dolphins, Cetacea, *Balaenoptera*, *Megaptera*, *Physeter*, *Hyperoodon*, *Mesoplodon*, *Globicephala*, *Tursiops*, *Lagenorhynchus*, *Delphinus*, *Stenella*, *Grampus*, sightings, The Netherlands, North Sea, status, distribution, diversity.

Introduction

The status of harbour porpoises (*Phocoena phocoena*) in Dutch waters has recently been evaluated (Camphuysen & Leopold 1993, Witte et al. 1998, Camphuysen 2004a), but published information on the occurrence of other species of whales and dolphins is still highly fragmented (Camphuysen 1982, Peet et al. 1992, Gronert 1999, Camphuysen 2004b, Camphuysen 2005). Knowledge about the diversity of whales and dolphins occurring in the southern North Sea is mainly derived from strandings data (van Deinse 1931, and numerous annual strandings reports since). Natural offshore distribution patterns and the seasonality of occurrence in the southern North Sea have thus far not been evaluated. Dedicated cetacean sighting surveys, to assess the distribution, diversity and abundance of cetaceans, have rarely been undertaken. However, in recent years, largely as a side product of systematic ship-based and aerial surveys of seabirds at sea, we have learned more about the whereabouts and abundance or scarcity of whales and

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dolphins in this area (Baptist 1987, Camphuysen & Leopold 1993, Reid et al. 2003). In addition, seawatchers studying seabird migration from daily-manned coastal sites in the Netherlands, have provided valuable material over the past 35 years (Camphuysen 1982, Camphuysen 2004a).

The *Marine Mammal Database* of the Dutch Seabird Group has been established to collect information on cetacean sightings in the North Sea and beyond from all available sources, in order to avoid valuable data being lost. This database now contains tens of thousands of sightings of cetaceans, ranging from the North to the South Atlantic, but many from the southern North Sea. The database holds sightings from dedicated surveys as well as reported incidental sightings, which provide an alternative source of information. Rare species are seldom encountered during systematic censuses, and incidental sightings can provide evidence that these species do occur in certain areas. It is clear that the data need be checked and validated continuously, and rare sightings are never accepted without proper documentation. The *Marine Mammal Database* is now the most extensive source of information on the distribution and diversity of cetaceans in the southern North Sea and it is now timely to explore the data and report the most interesting patterns and trends.

This article is based on data from the southern North Sea, stored in the *Marine Mammal Database.* Sightings of harbour porpoises were excluded, given the recent analysis published by Camphuysen (2004a). Incidental sightings were included (52% of all records, *n*=590 sightings), as well as results from systematic surveys (39%) and regular coastal observations by the Club van Zeetrekwaarnemers (CvZ, seawatching data; 9%). The sightings were collected between 1970 and 2005.

The return of the harbour porpoise has been documented and the numbers are currently still on the increase (Camphuysen & Leopold 1993, Camphuysen 1994, Witte et al. 1998, Camphuysen 2004a). The present paper is intended to provide an indication of the current status of other cetaceans in the southern North Sea. To do so, we will first briefly review the sightings, then compare the sightings with strandings data and, finally, we will review the diversity, distribution and current status of cetaceans in the southern part of the North Sea, based on all the currently available material.

Material and methods

The focus of this analysis is on the southern North Sea, between 51°00'–56°00' N latitude and 02°00'–07°00' E longitude. The mean water depth is approximately 25 m, with deeper gullies mainly in the northwest, just to the south of the Dogger Bank (depth 25 m). The section between the Netherlands and England has a depth of up to 40 m. The coastal waters are very shallow, with extensive estuaries in the Delta area and the Wadden Sea, and a sandy coast along the

Table 1. Source of cetacean sightings in the southern North Sea. Number of sightings, proportion of all sightings (*n*=590) and number of species recorded, 1970-2005 (*Marine Mammal Database*). Not corrected for double counts, i.e. animals or groups that were re-sighted at other locations or that stayed as residents. 'Incidental sightings' include a wide range of reports for which effort correction is impossible. CvZ (Club van Zeetrekwaarnemers) reports are based on coastal seawatching effort (circa 100,000 hours of observation since 1972; Camphuysen 2004 for details), and seawatching effort on offshore platforms (1978-1982, and winter 1984/1985; Camphuysen et al. 1982, Platteeuw et al. 1985). SASBASE/ESAS 4.1 data include 186,243 km steamed on effort by research vessels in the southern North Sea with a distribution as shown in figure 1. RIKZ data include results from aerial surveys between 1984-1999, reproduced with permission (see Baptist 1987 and Witte et al. 1998 for details).

	Incidental	CvZ coast	CvZ platforms	SASBASE ESAS 4.1	Aerial RIKZ	Total
Number of sightings	320	50	5	110	105	590
% of sightings	54.2	8.5	0.8	18.6	17.8	100
Number of species recorded	13	7	3	5	4	14

mainland and the Wadden Sea islands (ICONA 1992).

The *Marine Mammal Database* contains 590 sightings of whales and dolphins in this area between 1970 and 2005, including (1) incidental sightings, (2) Club van Zeetrekwaarnemers (CvZ) seawatching results, from coastal vantage points and some offshore platforms, (3) sightings during ship-based surveys (European Seabirds at Sea database, ESAS 4.1), and (4) partly published sightings during aerial surveys of the Rijksinstituut voor Kust en Zee (RIKZ) (table 1).

Incidental sightings, account for 54.2% of the material used here (*n*=590 sightings) and are occasional reports of sightings reported by to the Dutch Seabird Group database co-ordinator by members of the public, together with reports found published in the literature or on the Internet. Efforts are always made to verify identification and if the descriptions are insufficiently detailed, the animals were logged as 'unidentified' or 'uncertain'. Results from Dutch partners in the 1994 SCANS-survey (Small Cetacean Abundance in the North Sea and adjacent waters; Hammond et al. 2002) were also included in this set.

The coastal seawatchers group (CvZ), a working group of the Dutch Seabird Group (NZG), has collected data on migrating seabirds along the coast on a highly systematic basis since 1972 (Camphuysen & van Dijk 1983). In this 'seawatching' scheme, ornithologists record seabird passages from fixed sites, scattered along the length of the entire Dutch coast. Seabirds are recorded on an hourly basis and the observer effort (hours observed per day) is exactly known. In all, between 1972 and 2005, total observer effort amounts to nearly 100,000 hours of observation. Seawatchers work through the year, during virtually all weather circumstances, with extra effort in spring and autumn. Since its creation in 1972 the birdwatchers have recorded cetaceans and seals as well as seabirds. As outlined earlier (Camphuysen 1982, Camphuysen 2004a), cetacean sightings were exceptional in the 1970s and early 1980s. Today, sightings of cetaceans, other than harbour porpoises, are still unusual, but certainly more frequent than in the past. 8.5% of the sightings reported in this paper originate from coastal seawatchers (*n*=590). This growing number of cetacean sightings and the parallel increase in general interest in cetaceans within the CvZ, when offshore surveys became part of its work, provided the motivation for the establishment of a separate *Marine Mammal Database* by the second author, who still manages that database.

In addition to the coastal work, CvZ has also conducted systematic observations on some offshore platforms. Spring and autumn migration was studied from Meetpost Noordwijk, 10 km off Noordwijk aan Zee (Zuid-Holland) between 1978 and 1984 (1,572 hours of observation; see Camphuysen et al. 1982 for details). Two weeks of observation were conducted in December 1984 and again in January 1985 at gas production platforms K7-FA-1 (53°34'N, 03°18'E) and K8-FA-1 (53°30'N, 03°22'E; Platteeuw et al. 1985). This platform work contributed 0.8% of all sightings (*n*=590).

After initiating the *Marine Mammal Database* other cetacean sightings were included, such as data derived from systematic surveys at sea. Systematic surveys include ship-based seabird surveys under the European Seabirds at Sea programme (ESAS 4.1, international database managed in Aberdeen, UK) in the Dutch sector, most of which are conducted by the Dutch Seabird Group and several research institutes in the Netherlands (mainly by Royal NIOZ and IBN-DLO, the latter now renamed Alterra), with the national database currently managed by Royal NIOZ at Texel (SASBASE). SASBASE/ESAS 4.1 data includes observations collected during 186,243 km of voyages in the southern North Sea with a distribution as shown in figure 1. Effort is biased to near-shore waters, but all sectors of the southern North Sea have been frequently visited. Systematic ship-based surveys provide 18.6% of all sightings reported in this paper (*n*=590).

Results from aerial surveys from the Institute for Coastal and Marine Management (RIKZ) monitoring programme, are also included where they have been published or otherwise made available to the database (1984-1999 data; see Baptist (1987) and Witte et al. (1998) for details). The surveys were conducted along a regular flight path, with an even distribution of near-shore and off-shore flights, and throughout the year (bimonthly), but exclusively within the boundaries of the Dutch sector of the southern North Sea. These systematic aerial surveys 1984-1999 provided 17.8% of all sightings reported in this paper (*n*=590).

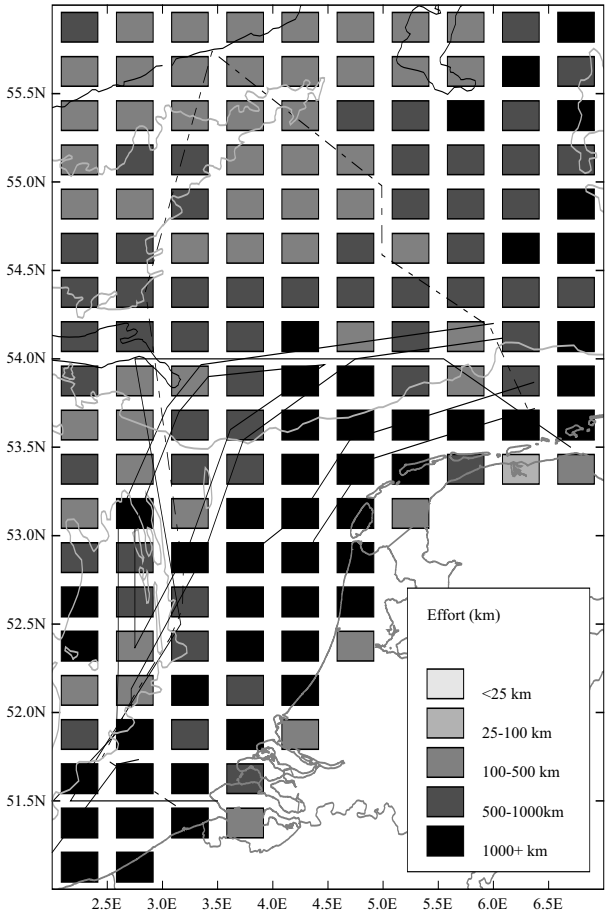


Figure 1. Observer effort (km steamed on effort per 15'N x 30'E rectangle) for ship-based surveys in the southern North Sea, 1985-2005 (ESAS 4.1 and SASBASE 2005 databases).

Validation

The sightings data in the *Marine Mammal Database* have been collected by a variety of observers, from experienced scientists to interested laypeople. Sightings during seabird surveys were collected by professional ornithologists with known experience in identifying cetacean species. Coastal sightings mainly came from CvZ-birdwatchers, many of whom have some experience in recognising cetacean species. The other incidental sightings included in the database came from anglers, birdwatchers, yachtsmen, tourists, oil platform workers, the Royal Dutch Navy and others, people with no or only limited previous experience with cetaceans. In these cases, the database manager tried to obtain photographic evidence or at least a detailed description. If the documentation was considered insufficient, the record was rejected and listed as 'species unknown' or 'identification not certain'.

Analysis

The database contains 'sightings', i.e. observations of a cetacean or a group of cetaceans swimming together in formation. The information on sightings in the database includes date and time, the number of animals seen, a description of the animals, if available, and the location (geographical position, degrees latitude / longitude). Additional information on direction of movement (if seen from the coast), behaviour, the presence of young animals (calves), visibility, wind direction, sea state, and weather is also

included in the database. When available, pictures are added and all other additional information noted (such as live-strandings or bycatches). Where needed, and allowing for statistical analysis, all information is categorised. In this paper, we refer to sightings (see above) or individuals (all animals seen).

The effect of variable observer effort could only be determined for the data collected during systematic surveys. Published aerial surveys provided sightings collected during a regular, bimonthly flight plan over the Dutch sector of the North Sea, but not beyond (Baptist 1987). Most of the ship-based surveys were conducted between 1987 and 1994, and these have been irregular since then, with no standardisation in study area in any period. These relatively 'erratic' data have provided numerous sightings and therefore influenced the annual number of sightings in a way that is further explained in the discussion. The coverage of ship-based surveys is indicated in figure 1 (km steamed on effort per 15'N x 30'E rectangle, from ESAS 4.1). To provide an idea of the geographical distribution of records, sightings were counted in 15'N x 30'E rectangles and mapped. On the maps, the number of records of a species was plotted. "Visited rectangles"

Table 2. Cetacean sightings, numbers of animals observed and animals per sighting in the southern North Sea, 1970-2005 (*Marine Mammal Database*). Not corrected for double counts, i.e. animals or groups that were re-sighted at other locations or that stayed as residents.

Cetacean		Sightings	Animals	Animal(s)/ sighting
Whale or dolphin		4	4	1.0
Whales				
Whale		11	18	1.6
Large whale		3	3	1.0
Large fin whale	*Balaenoptera* spec.	6	8	1.3
Fin whale	*Balaenoptera physalus*	4	4	1.0
Minke whale	*Balaenoptera acutorostrata*	24	39	1.6
Small whale		10	10	1.0
Humpback whale	*Megaptera novaeangliae*	4	5	1.3
Sperm whale	*Physeter macrocephalus*	11	23	2.1
North Atlantic bottlenose whale	*Hyperoodon ampullatus*	4	4	1.0
Sowerby's whale	*Mesoplodon bidens*	1	2	2.0
Small whale, large fin		1	1	1.0
Dolphins				
White whale	*Delphinapterus leucas*	6	6	1.0
Pilot/false killer whale	*Globicephala / Pseudorca*	1	10	10.0
Long-finned pilot whale	*Globicephala melas*	11	227	20.6
Unidentified dolphin		105	684	6.5
Patterned dolphin		2	3	1.5
Bottlenose dolphin	*Tursiops truncatus*	66	400	6.1
Striped dolphin	*Stenella coeruleoalba*	2	2	1.0
Common dolphin	*Delphinus delphis*	41	63	1.5
White-beaked/sided dolphin	*Lagenorhynchus* spec.	20	87	4.4
White-beaked dolphin	*Lagenorhynchus albirostris*	232	1883	8.1
White-sided dolphin	*Lagenorhynchus acutus*	12	190	15.8
Risso's dolphin	*Grampus griseus*	2	3	1.5
Unidentified small cetacean		7	150	21.4
All		590	3829	6.5
Identified genus level		468	2978	6.4
Identified species level		442	2883	6.5



Minke whale (*Balaenoptera acutorostrata*), Wintershall A6 Alpha platform, 55°47'N, 03°59'E, 13 May 2001. The characteristic pointed snout and white flipper bands are clearly visible. *Photograph: M. Jut*.

(rectangles where at least one sighting of a whale, dolphin or harbour porpoise originated from; *Marine Mammal Database* 1970-2005) were indicated with open circles. For the white-beaked dolphin (*Lagenorhynchus albirostris*), a common species, an effort corrected distribution map was also provided, based exclusively on ship-based sightings since 1985 in the southern North Sea.

Finally, seawatching results were backed up by an extensive scheme of systematic counts from coastal sites: varying from 2,000-4,000 hours per annum in the 1970s, 1980s, and early 1990s to 1,500-2,500 hours per annum in more recent years (see Camphuysen 2004a for further details).

Results

Between 1970 and 2005, 3,829 whales and dolphins have been recorded in the southern North Sea (590 sightings), of which 2,883 were identified at the species level (442 sightings), and 2,978 at the genus level (468 sightings; table 2). A total of 14 species were recorded. Of all the animals observed, 117 (3.0%, 79 sightings) were whales (including the beaked whales), 3,708 (96.9%, 507 sightings) were categorised as dolphins (including pilot and white whales) and four were either whales or dolphins (0.1%, 4 sightings). A total of 13 species were reported as incidental sightings, 7 species occurred during coastal seawatching, 5 during ship-based surveys and 4 during aerial surveys (table 1).

The most frequently specifically identified whales, were minke whale (*Balaenoptera acutorostrata*) (24 sightings, 39 individuals, 33.3% of recorded whales) and sperm whale (*Physeter macrocephalus*) (11 sightings, 23 individuals, 19.7% of recorded whales). In the dolphin group, the most abundant species were white-beaked dolphin (232 sightings, 1,883 individuals, 50.7% of recorded dolphins), bottlenose dolphin (*Tursiops truncatus*) (66 sightings, 400 individuals, 11.6% of recorded dolphins), long-finned pilot whale (*Globicephala melas*) (11 sightings, 227 animals, 6.1% of recorded dolphins), and common dolphin (*Delphinus delphis*) (41 sightings, 63 animals, 1.7% of recorded dolphins). Note that this summary was not corrected for double counts, i.e. animals or groups that were re-sightings at other locations or that stayed as residents.

Baleen whales

A total of ten sightings (twelve individuals) were probably of fin whales (*Balaenoptera physalus*), but only four individuals could be identified with certainty. Two of these were seen in August and in September 1998 along the mainland coast off of Zuid-Holland, one was seen 14 miles off Scheveningen in April 2000 and a fourth individual (12.5 m long) drowned in Sloehaven, Vlissingen, in January 2001 (table 3). Of the probable sightings of large whales or large Balaenopterid whales with characteristics suggesting fin whales, which were mostly referred to as large animals producing vertical blows, the majority were seen off the mainland coast in Zuid-Holland (figure 2a). One large *Balaenoptera* observed in May



Fin whale (*Balaenoptera physalus*), IJmuiden, 52°27'N, 04°30'E, 7 September 1998. The shape of the dorsal fin (falcate rather than concave) is characteristic, while other images show the diagnostic white right lower jaw. *Photograph: KNRM / K. Brinkman*.

Table 3. Seasonality of sightings of whales in the southern North Sea.

Species	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Balaenoptera physalus	1			1				1	1			
possible *Balaenoptera physalus*			1		1	1			2			1
Balaenoptera acutorostrata			1	2	6	5	7	1			2	
possible *Balaenoptera acutorostrata*		1		1		1		1	1	4	1	
Megaptera novaeangliae	(3)											1
Physeter macrocephalus		1		1	1	1	1				2	4
Hyperoodon ampullatus							1	1	1		1	
Mesoplodon bidens										1		

1987 in the Dogger Bank area was either a sei whale (*Balaenoptera borealis*) or a fin whale.

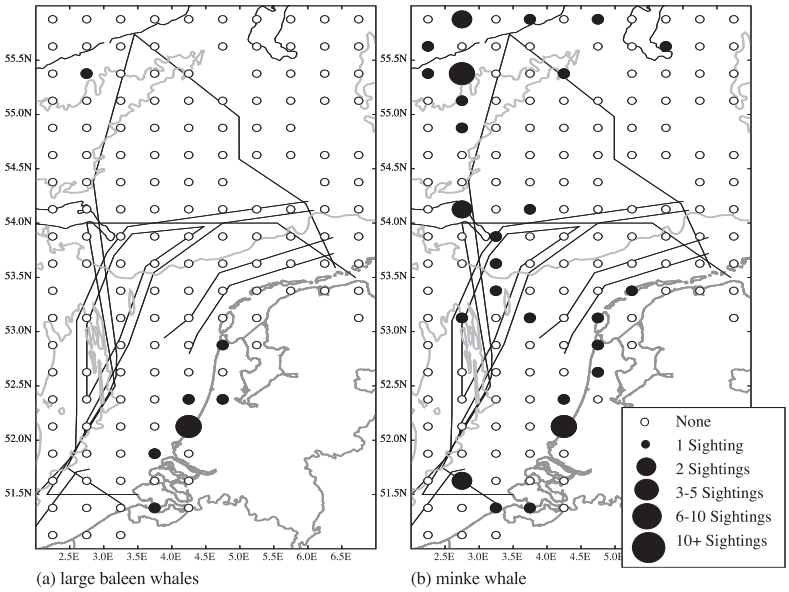
Most positively identified minke whales were seen in summer (83% April-July, *n*=24 sightings, table 3) and in the northern half of the study area, often even to the north of the Dogger Bank (figure 2b). The largest group, nine individuals together, was seen in the Dogger Bank area in May 1987. Three of these sightings were reported from oil platforms. There were three confirmed coastal sightings, all live-strandings (Groot-Valkenisse - November 1994, Terschelling - March 1998, and Noordwijk aan Zee - April 2001). All three were rather young, circa 4.5 m long, individuals. The first, a severely emaciated young male, died on the beach. The animal found on Terschelling was returned to the sea by rescue workers and nothing was heard of it since. The last whale, washed ashore alive near Noordwijk, was killed on the spot. Other sightings near the Dutch coast were 'possible' minke whales for which the descriptions were incomplete or otherwise unsatisfactory. As such, the map (figure 2b) may overestimate the presence of minke whales in Dutch coastal waters: confirmed records of healthy animals near the Dutch coast have been very rare in the past 35 years.

Two humpback whales (*Megaptera novaeangliae*) were seen 18 December 2003, a female and calf swimming off the coast of Katwijk and Scheveningen (mainland coast Zuid-Holland). On 20 December, the calf was found freshly dead and severely mutilated (flukes cut off, damaged flipper), apparently after an encounter with fishing gear. The adult was re-sighted on several occasions in January 2004; often as an 'unidentified whale', sometimes as a humpback whale (table 3). Photographs confirmed it was the same individual as in December 2003. The four sightings listed in table 2 refer to the same adult humpback whale, which was accompanied by a calf in December 2003.

Sperm whales

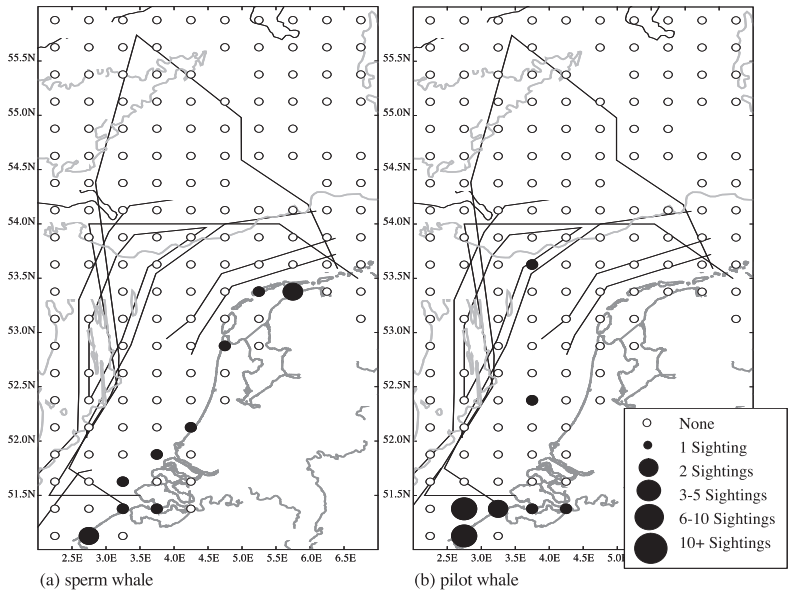
Sperm whales have been reported eleven times (23 animals) between 1989 and 2004 (figure 3a). At least eight of these whales were in some kind of trouble or disoriented. A sperm whale sighted near Koksijde (Belgium) in February 1989 washed ashore the next day. Another one in the same shallow area in December 1991 became stuck at low tide, but later freed itself (Van Gompel 1996: 46). Three animals off Ameland in December 2003 were reported as nearly stranded, but backed off in time. An animal in May 2004 off Zeebrugge (Belgium) was clearly sick, with gulls pecking its back, but it did not wash ashore. Finally, in November 2004, two sperm whales washed ashore alive at De Richel (a sandbank south of Vlieland in the Wadden Sea). The animals were successfully set free following concerted action by the local coastguard and lifeboats.

Sightings of animals that were either fit, or did not wash ashore shortly thereafter, were all close to the Dutch and Belgian coasts or within the Westerschelde (a deep inlet in the Delta area). The largest pods involved six individuals seen on 6 April 1993 off Ameland (Dutch Wadden Islands; Camphuysen & Reijnders 1993, Smeenk & Addink 1993) and five individuals seen on 5 December 2000 off Schouwen (Delta area). Solitary sperm whales were seen off Den Helder (November 1997), off Scheveningen (December 2000), near Vlissingen which was followed when it swam to Zeebrugge



(a) large baleen whales (b) minke whale

Figure 2. Distribution of reported sightings and live-strandings per 15'N x 30'E rectangle in the southern North Sea. Rectangles for which cetacean sightings of any kind are known are indicated as open circles. Black symbols represent the number of positive sightings (a) for large Balaenoptera whales (6 sightings) and fin whales (4 sightings) and (b) for minke whales (24 sightings) and unidentified small whales (10 sightings).



(a) sperm whale (b) pilot whale

Figure 3. Distribution of reported sightings and live-strandings per 15'N x 30'E rectangle in the southern North Sea. Rectangles for which cetacean sightings of any kind are known are indicated as open circles. Black symbols represent the number of positive sightings (a) for sperm whales (11 sightings) and (b) for pilot whales (11 sightings).

(Belgium; June 2002), and off Westkapelle (July 2002) (table 3).

Beaked whales

Northern bottlenose whales (*Hyperoodon ampullatus*) were sighted four times in Dutch waters (table 3). In September 1984 a live-stranding occurred near the harbour dam of Breskens and the animal died the same day (Meininger et al. 2003). On 15 November 1989, a northern bottlenose whale was seen by seawatchers at Bergen aan Zee (Noord-Holland) swimming in a northerly direction. On 25 July 1990 an adult northern bottlenose whale entered the industrial Sloehaven, Vlissingen. The animal seemed to be in a fairly good condition, but got scratched during its stay in the harbour. The whale left in the evening, moving westwards towards the North Sea (Kastelein & Gerrits 1991). A fourth northern bottlenose whale was observed swimming along the Hondsbossche Zeewering (Noord-Holland) on 25 August 1993. The whale, a female, stranded later that same day a few kilometres further to the south and died (Gronert 1993). Dissection revealed a serious infection of liver and spleen (Smeenk 1993).

Two Sowerby's beaked whales (*Mesoplodon bidens*), an adult female and her calf, died after a live-stranding on the coast at Bredene (Belgium), 9 October 1972 (De Smet 1981) (table 3).

Pilot whales

Long-finned pilot whales (*Globicephala melas*) have been recorded at least eleven and possibly thirteen times in the southern North Sea (table 4). The most spectacular sightings were circa 175 individuals off Koksijde (Belgium), 15 April 1980, reported as 'black whales' swimming eastwards (Van Gompel 1991: 33), a pod of ten animals off Knokke in December 1980 (not identified with certainty), and two larger groups in September 1988 (30 animals in Zeebrugge and 10 off Koksijde). In October 1987 three pilot whales were seen off Oostende and a clear picture of two animals swimming off the coast near Wenduine, 4 September 1988, was published by Van Gompel (1991: 32). The other reported sightings concern solitary animals. Apart from one record of a pilot whale off Scheveningen (May 2004), only one sighting is known further to the north (figure 3b): two pilot whales were sighted at Botney Grounds on 9 December 1984 during an aerial survey (Baptist 1987).

It is possible that a pod of 19 'small whales' off Wenduine (Belgium) on 20 June 1975 (Van Gompel 1991: 33) were also pilot whales, but in the absence of any kind of description, this record was not verified.

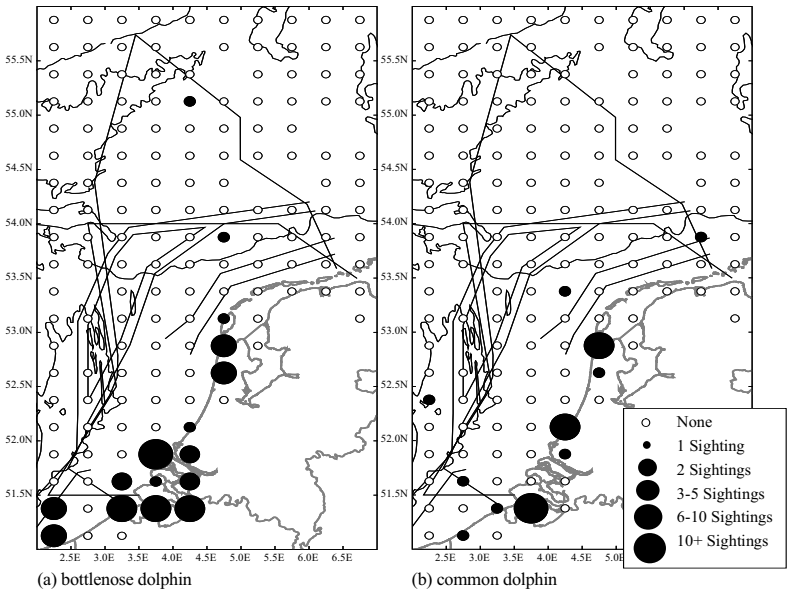
Belugas

Between 1981 and 1989 the beluga (*Delphinapterus leucas*) has been recorded on six occasions (table 4). In January 1981 one was seen in the River Schelde near Zandvlietsluis (Belgium) (Meininger et al. 2003). In November 1983 a solitary animal was seen in the Eems Dollard. In March 1984 three sightings of an adult beluga were recorded within ten days, in a narrow range off the coast of Belgium. These most likely involved the same animal (Vedder 1984). In November 1989 a solitary animal was seen off the coast of Belgium.

Dolphins

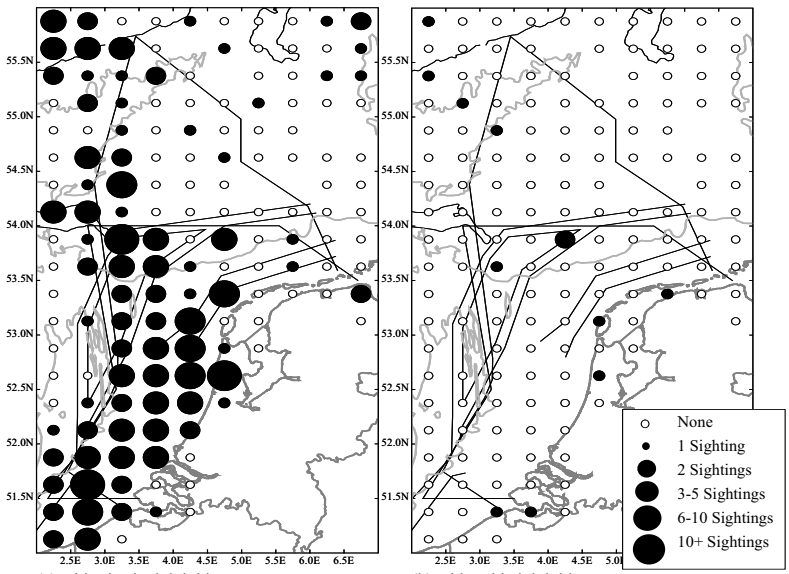
There have been a total of 114 sightings involving 'dolphins' of any kind, but without an adequate description (table 4). Of these, 22 sightings (32 animals) were reported as bottlenose dolphins (*Tursiops truncatus*) during aerial surveys, but in the absence of co-observers and convincing documentation such as photographs, these records are treated as 'unidentified dolphins' in the present analysis. Of the more spectacular sightings of unidentified dolphins are 'hundreds' of (listed as 200) dolphins on 7 June 2004 just south of the Outer Silver Pit, about 100 individuals 8 km north of Terschelling on 19 June 1985, 50 off Walcheren on 30 March 1990, 30 in the Helder Gas field on 16 February 1988, and 25-30 nautical miles off of Scheveningen on 8 February 2005. A sighting of 15 unidentified dolphins off Scheveningen in May 2004 is of interest because a pilot whale was seen to approach and join the dolphins.

Properly documented bottlenose dolphin sightings include some repeat sightings of a resident individual at Brouwersdam (Delta area; twelve reports of the



(a) bottlenose dolphin (b) common dolphin

Figure 4. Distribution of reported sightings and live-strandings per 15'N x 30'E rectangle in the southern North Sea. Rectangles for which cetacean sightings of any kind are known are indicated as open circles. Black symbols represent the number of positive sightings (a) bottlenose dolphins (88 sightings) and (b) common dolphins (41 sightings).



(a) white-beaked dolphin (b) white-sided dolphin

Figure 5. Distribution of reported sightings and live-strandings per 15'N x 30'E rectangle in the southern North Sea. Rectangles for which cetacean sightings of any kind are known are indicated as open circles. Black symbols represent the number of positive sightings (a) white-beaked dolphins (232 sightings) and (b) white-sided dolphins (12 sightings).

Table 4. Seasonality of sightings of dolphins (including pilot and white whales) in the southern North Sea.

Species	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Globicephala/Pseudorca ('blackfish')											1	1
Globicephala melas	1			1	2			1	2	2	1	1
Delphinapterus leucas	1		3								2	
unidentified dolphins	11	12	6	7	4	26	6	15	3	7	7	10
Tursiops truncates	1	2	3	4	2	5	1	3	9	5	5	26
Stenella coeruleoalba											2	
Delphinus delphis	9	9	3	4	1	1	1	1	2	1	4	5
Lagenorhynchus spec.	2	1	4	2	3	2	2		1	1		2
Lagenorhynchus albirostris	11	11	23	33	27	23	15	11	5	17	24	32
Lagenorhynchus acutus	1	2	2	1				2				4

same individual, at least once a month between July 1990 and April 1991), repeated sightings of an animal named *'Dony'*, travelling through the Delta area and visiting harbours in the Netherlands and Belgium (an inquisitive dolphin known from British and French harbours; 28 reports of the same individual between Dunkerque, Antwerp, Dinteloord and Stellendam, between November-December 2002), and repeated sightings of what were probably parts of the same (large) school in August and September 2004 (one report in August, six reports in September). Between April and June 1995, there were repeated sightings (3 reported) of a presumed bottlenose dolphin in the Westerschelde, between Breskens and Baasrode.

As a result of the repeated sightings, both the map (figure 4a) and the seasonal pattern are heavily biased. There are very few documented offshore sightings in the southern North Sea (except the records during aerial surveys, mentioned earlier), and relatively more reports in the Delta area, off the Belgian coast and along the mainland coast of Noord-Holland. The most spectacular sightings in recent years were schools of between 40 and 100 bottlenose dolphins observed, filmed and photographed between Texel and the Noord-Holland mainland, entering the western Wadden Sea as far as the Afsluitdijk near Friesland in August 2004, and briefly visiting the same area in September 2004. The estimates, ranging from 40 to over 100 individuals, should be viewed with some scepticism, but an accurate count at one of the sea-watching sites revealed that indeed at least 54 individuals were involved (Nick van der Ham, Camperduin, September 2004). What may have been smaller parts of the same school were seen in Germany (River Elbe) and Belgium (off Oostdijk) in the same period.

Striped dolphins (*Stenella coeruleoalba*) were reported only twice and both reports involved live-strandings (5 November 1999 near Ter Heijde, 14 November 2004 at Brouwersdam).

There have been 41 reported sightings of common dolphins (*Delphinus delphis*), but these refer to at most 22 individuals (table 4). In January and February 1999 there were 10 reported sightings of two common dolphins in Scheveningen (usually in the vicinity of buoys). Between December 2001 and April 2003 there were 17 reported sightings of a solitary dolphin that took residence in the western part of the Westerschelde, and was predictably seen near a large buoy (MG17) in that area. There were six sightings of a solitary common dolphin in the Marsdiep area, between Texel and Den Helder, in November-December 2004 (often, again, close to small buoys). Thus, the three prominent clusters of sightings of common dolphins (figure 4b) were the result of these resident or semi-resident individuals. One unusual record involved two individuals that had entered the Rotterdam 7th Petrol harbour (12 January 1997). The other records are of properly described individuals, seen at sea or from the coast, including a group of ten, north of Westhinder on 30 March 1990. Solitary individuals feeding off Camperduin (29 September 2001) and seen from Koksijde (17 February 2002) may in fact have referred to the same individual that stayed in Westerschelde for about a year and a half before it was found dead.

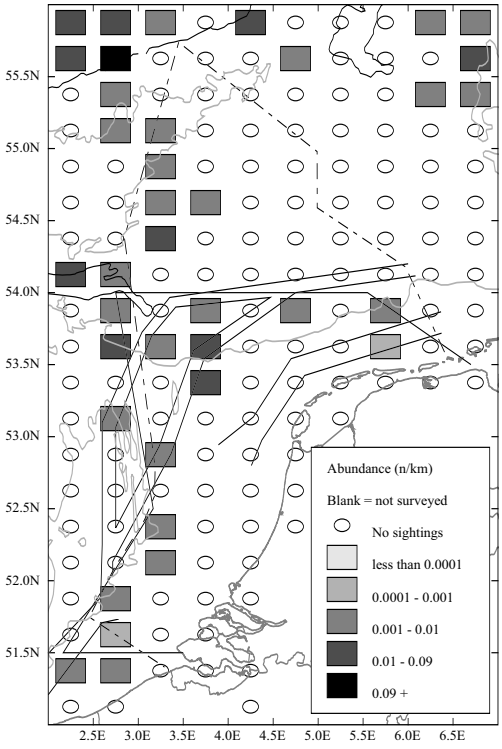


Figure 6. Effort corrected sightings of white-beaked dolphins during ship-based surveys per 15'N x 30'E rectangle in the southern North Sea. Surveyed rectangles are indicated as open circles, shaded squares represent positive sightings (number of dolphins per km surveyed; ESAS 4.1/SASBASE database 1985-2005).

The most frequently encountered species was the white-beaked dolphin (*Lagenorhynchus albirostris*), with 232 sightings (1,883 individuals), i.e. 39.3% of all sightings of cetaceans in the southern North Sea excluding harbour porpoises (table 4). Note that with 1,883 recorded individuals, 65.3% of all specifically identified cetaceans (apart from harbour porpoises) were white-beaked dolphins. Group size was highly variable, ranging from one single individual to circa 250 animals in a single aggregation, with an average (±SE) group size of 8.1 ± 1.2. The size distribution of these groups is as follows: 145 pods (62.5%, *n*=232) consisted of between 1 and 4 animals (total 380 individuals); 70 pods (30.2%) consistsed of between 5 and 24 animals (575 individuals in all), and only 17 groups (7.3%) contained 25 or more animals (928 individuals in all). Large pods were seen during an aerial survey off the mainland coast of Zuid-Holland, 10 December 1992 (250 individuals), from a fishing vessel off Noorderhaaks near Texel, 31 March 1990 (100 individuals), and again during an aerial survey but in the NE of the Dutch sector on 2 June 1987 (80 individuals). Several pods of between 30 and 50 dolphins were seen west of Texel and Den Helder, often by anglers fishing there from stationary small speedboats (9 December 1992, 10 December 1992, 10 January 1999, 26 April 2000, and 19 April 2002). White-beaked dolphins often approached these boats and could be seen, photographed or filmed at very close range. One sight-

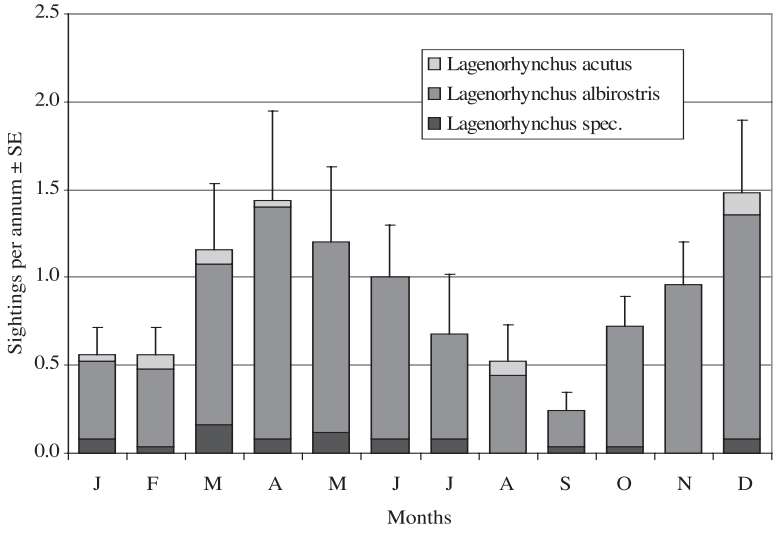


Figure 7. Seasonal pattern in reported sightings of Lagenorhynchus dolphins in the southern North Sea, 1981-2005. Showing the mean monthly number of sightings per annum ± SE.

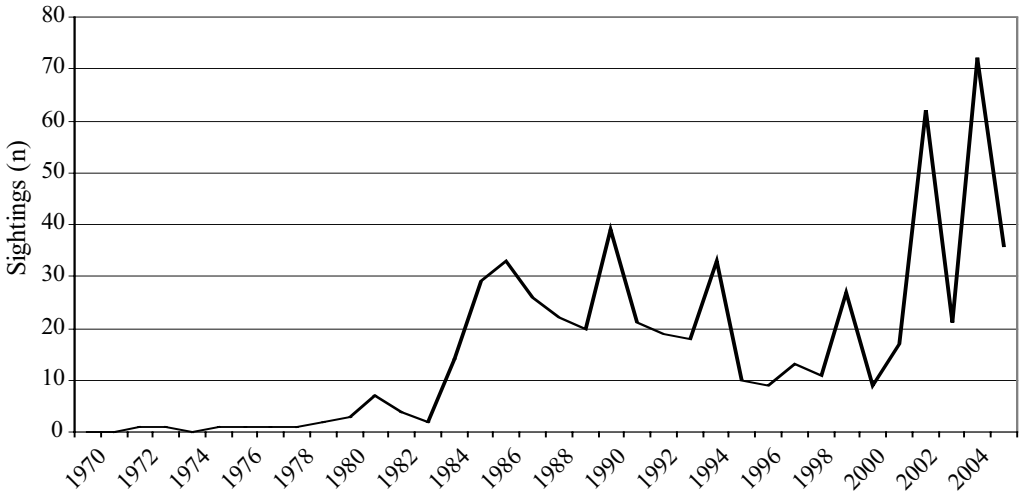


Figure 8. Sightings of whales and dolphins in the southern North Sea, Marine Mammal database 1970-2005.

ing involved a mixed school of white-beaked (40) and white-sided dolphins (80) at the Botney Grounds and was seen by birdwatchers temporarily stationed at a gas production platform on 11 December 1984 (Haase 1987).

From the map (figure 5a), it appears that white-beaked dolphin sightings came mostly from waters immediately around the Dogger Bank in the north, with frequent sightings between the Outer Silver Pit, the mainland coast of Noord-Holland, de Bruine Bank (Brown Ridge) in the central Southern Bight and waters in the Northern Channel. Ship-based surveys suggest a clear "offshore" distribution of sightings (figure 6), with frequent encounters in the central Southern Bight (51°25'-54°N, 2°30'-3°30'E), rather than close to the shore. Incidental sightings have largely filled the

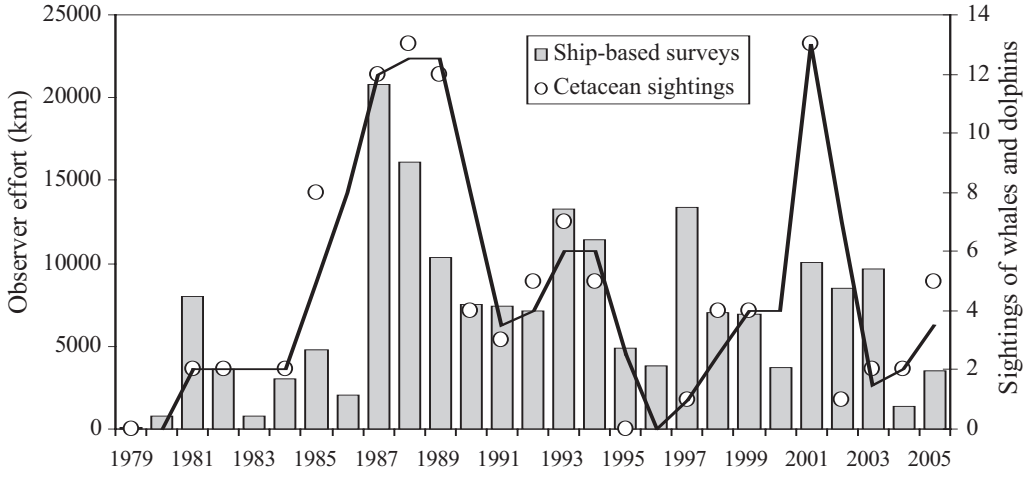


Figure 9. Ship-based seabird surveys in the southern North Sea: variability in observer effort (km steamed on effort, black bars) and sightings of whales and dolphins, 1979-2005 (white dots). The line shows the running mean of sightings per annum (based on a two year period).

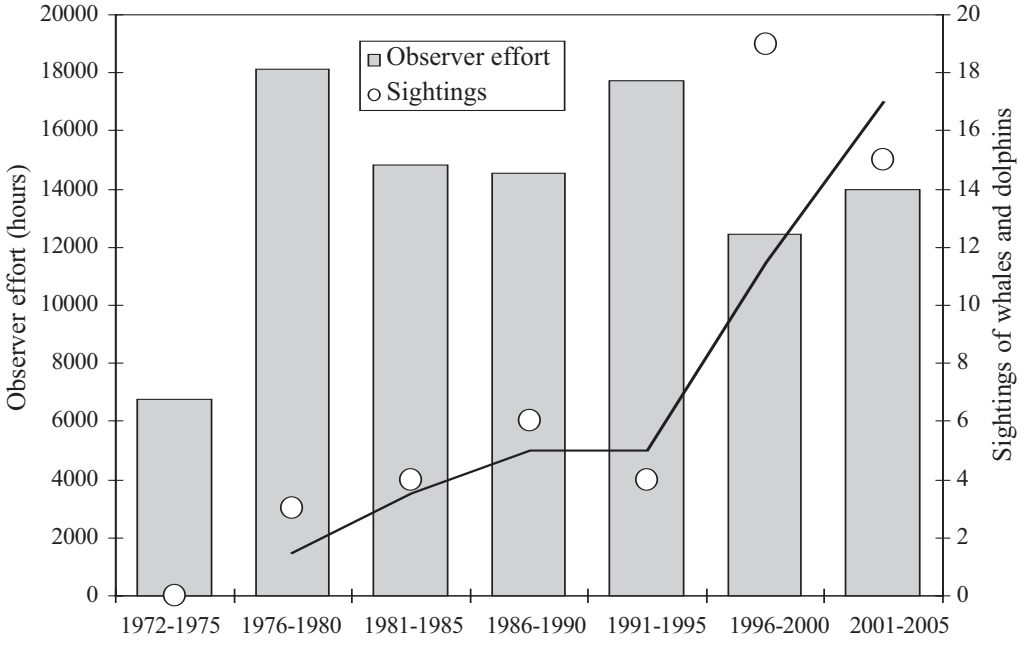


Figure 10. Seawatching in the Netherlands: observer effort (hours observed; black bars) and sightings of whales and dolphins, 1972-2005 (white dots). The line shows the running mean of sightings per period (based on a two year period).

gap between the central Southern Bight and the shore (figure 5a), but it should be noted that the majority of reports stems from yachts, off-effort research vessels and other boats working at least 10 km from the coast. The seasonal pattern in reported sightings is clearly bi-modal, with peaks in sightings in late-spring (March-May) and mid-winter (December) (table 4; figure 7). This pattern does not correspond with seasonal fluctuations of observer effort.

White-sided dolphins (*Lagenorhynchus acutus*) have been recorded on twelve occasions (figure 5b). One sighting was mentioned earlier (mixed school with 80 white-sided dolphins at Botney Grounds, 11 December 1984; Haase 1987), one sighting comprised a group of circa 100 animals, seen 1 August 1988 at the Dogger Bank and this school also contained circa 20 white-beaked dolphins (de Boer 1989). The other records were of solitary individuals seen during aerial surveys (n=5) and several live-strandings (Breskens 1973, Texel 1985, Ameland 1999, and Knokke 1999). One individual seen at Camperduin on 28 February 1997 was apparently sick, although no strandings have been reported associated with this record. There are two records of white-sided dolphins in August, both in the northern extreme end of the study area. All other records were in winter (December-April) (table 4).

There have been two possible sightings of Risso's dolphins (*Grampus griseus*), but the descriptions of the observations were essentially incomplete. With only five documented strandings of Risso's dolphins in the Netherlands since 1895 (van Deinse 1931, van Deinse 1961, Husson & van Bree 1972, Husson & van Bree 1976), these records need to be viewed critically and probably rejected.

Temporal trends

The temporal analysis of the cetacean sightings suggests an increase in the number of sightings in the southern North Sea between 1970 and 2005 (figure 8). The increase started in the early 1980s, but this coincided with the start of offshore surveys in the area (Baptist 1987, Camphuysen & Leopold 1994). Incidental reports gradually increased from 0.5 per



Humpback whale (*Megaptera novaeangliae*) off Katwijk aan Zee, 52°06'N, 04°09'E, 18 December 2003, mother and calf. The hump in front of the round dorsal fin is characteristic. This is the calf that stranded a few days later. *Photograph: KNRM*.

annum between 1970-1979 (or once every two years), to 3.8 per annum between 1980-1989, 9.0 per annum between 1990-1999 and 27.8 per annum between 2000-2005. Interpreting this trend is problematic, for it could just as well be a social artefact, solely reflecting an increase in the general (public) interest in marine mammals in the Netherlands. Results from systematic surveys (i.e. all available ship-based surveys and published aerial surveys) made the largest contribution to the database between 1984 and 2003, creating a 'hump' in an otherwise gradually increasing trend. This 'hump' is entirely the result of fluctuations in observer effort, related to ship-based surveys at sea in the area (figure 9). Only a fairly short period of results of aerial surveys was covered in publications and therefore available.

Results from seawatchers are more consistent, and here observer effort can be fully taken into account. The data collected from coastal sites suggest an increase in whales and dolphins in the late 1990s and early 21st century (figure 10). Unfortunately, the number of sightings by seawatchers is rather small. Therefore these data cannot be seen as a proof that the frequency of occurrence of cetaceans in the southern North Sea is indeed rising as a whole.

Discussion

The harbour porpoise and bottlenose dolphin were traditionally considered the only indigenous cetaceans in Dutch waters (IJsseling & Scheygrond 1943). Both species declined and almost disappeared in the southern North Sea in the early 1960s and cetaceans of any kind were very rare in the 1960s and 1970s (Camphuysen 1982, Smeenk 1987, Bakker & Smeenk 1987, Bakker & Smeenk 1990). Uncertainties about the current status of either species resulted in the *Red data book of threatened mammals in the Netherlands* (Hollander & Van der Reest 1994) listing porpoises as 'seriously threatened' and bottlenose dolphins as 'extinct in the Netherlands'. The same publication only briefly mentioned white-beaked dolphins in an appendix as 'not-selected indigenous mammals'. Neither whales nor dolphins were included in the Atlas of Mammals in the Netherlands (Broekhuizen et al. 1992). We turn now to briefly discuss the listed whales and dolphins in the context of their distribution and status in the North Sea and in the northeast Atlantic, and compare the data for sightings and strandings.

Baleen whales

Large baleen whales are oceanic and typically rare in the North Sea (Reid et al. 2003). Fin whales are distributed mainly along, or beyond, the 500 m depth contour and are thought to migrate between arctic regions and warmer waters along the shelf edge to the west of Britain and Ireland. In the northern North Sea, there have been some recent sightings of fin whales (Camphuysen & Winter 1995, Camphuysen 1998),

but otherwise both strandings data and sightings records around the North Sea suggest that the species is rare (Meyer 1994, Kinze 1995, Evans et al. 2003). Four fin whales (1998, 2001, and two in 2004) and three sei whales (1972, 1986, and 2005) were washed ashore in the Netherlands in the period under consideration. With the sightings of large Balaenopterids in the southern North Sea, these events suggest that very small numbers migrate through the area, possibly towards the Channel and on to the Atlantic Ocean. The clustering of sightings near the shore (figure 2a) is an effort effect, and we may expect future sightings in deeper parts of the southern North Sea if fin whales are truly (rare) passage migrants in the area.

Minke whales are among the most common and widely distributed of all cetaceans in the North Sea (Reid et al. 2003, Camphuysen 2004b). In the southern North Sea, however, very few confirmed sightings have been collected, except north of 54°N latitude in summer. Minke whales occur throughout the northern and central North Sea, as far south as the Yorkshire coast, but are relatively scarce in the east (Skagerrak, Danish waters and the German Bight). In general they prefer coastal, relatively shallow waters. Although the species occurs all year-round on the north-west continental shelf, most encounters were in summer (July-September, Reid et al. 2003). Only ten minke whales have been washed ashore in the Netherlands since 1970 (0.3 annum^{-1}) and minke whales are rare in the eastern Channel. There is apparently no frequent exchange between minke whales in the Celtic Sea and western Channel and those along the English and Scottish east coast through the southern North Sea. Incidental sightings from platforms and ships in the northern part of the study area, coupled with abundant sightings just to the north and northwest of the Dogger Bank, suggest that more sightings of minke whales in Dutch waters may be due to more systematic effort in the relevant appropriate areas (>54°N latitude, <4°E longitude).

Humpback whales are rare within the North Sea, but there have been signs of an increase in British and Irish waters since 1980 (Evans et al. 2003). Recent sightings have been concentrated in three main regions: Shetlands to eastern Scotland, south-west Scotland and the Irish Sea, and southern Ireland south to Cornwall (Evans et al. 2003). The sightings reported in this paper coincided with strandings of humpback whales at Maasvlakte in October 2003 (Smeenk et al. 2003) and at Vlieland in June 2004, which provided the first four ever recorded humpback whales in the Netherlands. It is highly interesting, however, to note that one adult humpback spent at least several months feeding off the Dutch mainland coast in winter (despite the loss of its calf). In recent years (2004-2006) wintering concentrations of piscivorous seabirds and marine mammals (notably harbour porpoises and two species of seals Pinnipedia) along the mainland coast of Noord- and Zuid-Holland have increased markedly, apparently attracted by large concentrations of herring (*Clupea harengus*) and sprat (*Sprattus sprattus*) (RIVO, Alterra, and Royal NIOZ, unpublished data). This suggests that foraging conditions for large baleen whales may also have improved during this time.

Sperm whales

Sperm whales have a worldwide distribution in tropical, temperate and subarctic seas, but typically occur in deep waters (generally beyond the 1000 m depth isobath (Reeves et al. 2002, Evans et al. 2003). Male sperm whales occur off the coast of northwest Europe, mainly west of the British Isles, around the shelf break and beyond (Reid et al. 2003). Strandings of sperm whales are not rare on Dutch coasts, with the oldest known strandings dating back to 1255, with at least 61 strandings recorded since. In the late 1980s and early 1990s, the frequency of sperm whale strandings in the northeast Atlantic apparently increased. Berrow et al. (1993) has reported a gradual increase in both sightings and strandings around the British Isles since the 1970s, but strandings along the Norwegian coast peaked in 1988 (27 strandings, 9 corpses afloat; Christensen 1990) and 1990 (circa 20 strandings; Camphuysen 1996). A group of eleven sperm whales were stranded in Orkney in 1994, and smaller groups were reported from Belgium and the Netherlands (Addink 1994, Evans 1994, Jacques & Lambertsen 1997). Mass-strandings have also occurred in Denmark and Germany (Kinze 1995, Kompanje & Remmer 1995, Kinze et al. 1998, Santos et al. 1999, Kinze et al. 2003). Live-strandings in the southern North Sea occur periodically and have an invasive

character, as noted in earlier centuries (Sliggers & Wertheim 1992). The 1990s and early 21st century saw such a phase of frequent strandings throughout the North Sea, this following a period of more than a century with rather fewer records. The cause of these 'influxes' has not yet been properly explained (Camphuysen 1996). The sightings of unfit individuals and near-live-strandings listed in this paper fit the pattern: all the animals were recorded after 1989, when the increase in strandings in northwest Europe began. There were 16 reported strandings in the Netherlands in the period concerned here, of which, 14 occurred since 1990. Our data also indicate that sperm whales are not necessarily doomed when entering the shallow waters of the southern North Sea. Several pods and solitary animals were seen that were apparently able to leave the area without running aground.

Beaked whales

Beaked whales (Ziphiidae) are deep-water cetaceans that typically occur in waters of at least 1000 m depth. Most sightings come from the Greenland and Norwegian seas, north and west of Scotland, and in deep canyons in the southern Bay of Biscay (Weir 2001, Reid et al. 2003). Sowerby's beaked whales are very difficult to identify at sea and are therefore are mostly known from strandings. A high percentage of all the Ziphiids found in the Netherlands (including historical strandings) was still alive when found, and several were pregnant adult females that gave birth prior to or during the stranding. These and other observations suggest that beaked whales in the southern North Sea are typically in distress. As with sperm whales, they almost certainly cannot forage and feed in these shallow seas. Since 1970, five Sowerby's beaked whales, three bottlenose whales and a single (pregnant) Blainville's beaked whale (*Mesoplodon densirostris*) were found.

Pilot whales

Long-finned pilot whales are common in deep waters to the west of the British Isles, around the Faeroes and in the Bay of Biscay (Evans et al. 2003, Reid et al. 2003). There have been numerous sightings from the Channel area, including the Straits of Dover (van Franeker et al. 1987, Kiszka et al. 2004). Long-finned pilot whales are rare further to the north, as the present review indicates. There is a discrepancy between the analysis of Reid et al. (2003) and Evans et al. (2003) over the status of long-finned pilot whales off the east coast of Scotland. The former group of authors suggests that pilot whales are very rare within the North Sea (except in the Norwegian Deep and around the Shetlands), while the latter suggest that pilot whales are common in Orkney, in the Moray Firth and off Aberdeenshire. Recent extensive ship-based surveys in these waters have demonstrated that pilot whales are rare in the northwest North Sea, certainly in summer (Camphuysen et al. 2006). As such, movements between the Channel and the central or northern North Sea are unlikely to happen and an absence of pilot whales in the shallow waters of the southern North Sea seems logical. The cluster of sightings off the Belgian coast indicates the northern boundary of pilot whales within the Channel area. Since 1970, nine pilot whales have been washed ashore in the Netherlands, but only one since 1990. Several of the carcasses were long dead and badly decomposed, indicative of a prolonged period afloat at sea.

Beluga

The beluga is normally restricted to Arctic and sub-Arctic seas (Reid et al. 2003), but some animals have been known to wander and reach low latitudes on the European west coast. Slijper (1967) reported that during1964–1966 an unusually large number of white whales were sighted along the Swedish and Scottish coasts and in the Baltic (see also Jensen et al. 1987). The species habitually enters estuaries and river mouths in summer (Lukin & Vasil'ev 2004). On 15 May 1966 a beluga entered the River Rhine, where it stayed until 16 June (Slijper 1967, Gewalt 1967, Peet et al. 1992). The sightings in the *Marine Mammal Database* are amongst the furthest south of any sighting of belugas within Europe. While there are several (recent) sightings in the southern North Sea, there is only a single account of a stranded beluga in the Netherlands (some bones found in 1919 in IJmuiden; van Deinse & Junge 1945).



White-beaked dolphin (*Lagenorhynchus albirostris*), near Noord-Hinder, 51°59'N, 02°19'E, seen from yacht X&triek, 19 May 2004. The tall, concave dorsal fin is characteristic for this species. *Photograph: K. Reurekas*.

Dolphins

Bottlenose dolphins are widely distributed in tropical and temperate seas throughout the world. In Europe, the species is locally common in coastal areas, where it frequents river mouths, bays and estuaries. In Britain and Ireland, several fairly isolated, resident populations are found, with examples in Galway Bay and the Shannon Estuary (western Ireland), Moray Firth and further south to the Firth of Forth (eastern Scotland), Cardigan Bay (Wales, Irish Sea), and in the western half of the English Channel (Parsons et al. 2002, Stockin & Weir 2002, Evans et al. 2003, Kiszka et al. 2004). An offshore type of bottlenose dolphin occurs along the shelf edge, often in association with long-finned pilot whales (Evans et al. 2003, Reid et al. 2003). The confirmed sightings in the southern North Sea are all rather southerly, suggesting a connection with stocks in the Channel area. For stragglers such as *'Dony'*, the area of origin is indeed the Channel, but for large groups such as those observed in August and September 2004, it is unclear if there would be enough dolphins in the Channel area alone to form a travelling aggregation and trigger an influx such as witnessed in the Wadden Sea. A journey by a large number of Scottish dolphins into the southern North Sea is even more unlikely, however, and an aggregation of over 50 bottlenose dolphins would have meant that a substantial number of the dolphins of East Scotland would have travelled into the southern North Sea (Hammond & Thompson 1991, Sini et al. 2005, Stockin et al. 2006). Scottish bottlenose dolphins frequently occur in river mouths and between harbour breakwaters. Similarly, most confirmed sightings of bottlenose dolphins were near-shore events, with the large school(s) in 2004 penetrating the western Wadden Sea, as in the 1940s and 1950s when the species was a common resident. Offshore sightings, anywhere in the North Sea, are suspect (cf. Reid et al. 2003).

Table 5. Sightings and individuals observed in the southern North Sea and individuals found stranded in the Netherlands between 1970 and 2005. Stranding data from: Husson & van Bree 1972, Husson & van Bree 1976, van Bree & Husson 1974, van Bree & Smeenk 1978, van Bree & Smeenk 1982, Smeenk 1986, Smeenk 1989, Smeenk 1992, Smeenk 1995, Smeenk 2003, and unpublished material from the *Naturalis* strandings network.

Group	Sightings		Individuals		Strandings	
	n	%	*n*	%	*n*	%
Baleen whales	48	1.0	66	0.5	20	1.0
Sperm whales	11	0.2	23	0.2	16	0.8
Beaked, white, and pilot whales	24	0.5	250	2.0	18	0.9
Unidentified dolphins	114	2.5	837	6.6	23	1.1
Bottlenose dolphins	66	1.4	400	3.2	21	1.0
Common and striped dolphins	43	0.9	65	0.5	11	0.5
White-beaked and white-sided dolphins	264	5.7	2160	17.0	171	8.5
Harbour porpoises	4046	87.3	8841	69.8	1735	86.0
Unidentified and others	20	0.4	28	0.2	2	0.1
Total	4636		12670		2017	

Striped dolphins are a tropical, subtropical and warm temperate oceanic species, mostly occurring well beyond the continental shelf with depths of 1,000 m or more. The southern half of the Bay of Biscay can be seen as the northern edge of their regular distribution area (Reeves et al. 2002). The southern North Sea is clearly beyond the area where this species is abundant, and striped dolphins can therefore expected to be rare, as this study found.

Common dolphins are an oceanic species common in shelf-edge waters of tropical, subtropical and temperate seas (Reeves et al. 2002, Evans et al. 2003). They are abundant and widely distributed in the eastern North Atlantic, reaching Scottish and occasionally Icelandic waters in exceptional cases. Common dolphins occur mostly along or beyond the 200 m isobath (mainly 200-500 m). The species can be common between May and October in the western half of the English Channel and the southern Irish Sea. In some years, it may occur further north and east into the northern North Sea (Evans et al. 2003). It is generally rare in the central and southern North Sea and eastern portion of the English Channel (Reid et al. 2003). Our data and other sightings during ship-based surveys elsewhere in the central North Sea confirm that small schools occasionally penetrate into the Southern Bight. The core distribution area of common dolphins is quite westerly, however, suggesting that their occurrence is restricted to straggling individuals or small schools. The close association with metal buoys, as observed in several of the (semi-)resident individuals in Dutch coastal waters in recent years (Camphuysen 2004c), has also been found in Danish waters (Jensen & Kinze 2005). Observations of the behaviour of these solitary animals suggest that the normally highly social dolphins seek some kind of "feeling of security" near these objects. There are only five recent strandings in the Netherlands, including a stranding of the individual that was associated for many months with a buoy in the Westerschelde (Delta area). Common dolphins were considerably more abundant in the North Sea in the 1930s-1950s, at the end of the 1850-1950 Atlantic climatic amelioration (Burton 1995), when dozens of animals washed ashore (at least 63 were recorded in the Netherlands). There were, and are, very few confirmed sightings near our coast, however, except from solitary individuals with rather strange behaviour.

White-beaked dolphins are restricted to temperate and sub-arctic seas of the North Atlantic, covering large parts of the northern European continental shelf (mainly in waters of 50-100 m depth, and almost entirely within the 200 m depth contour; Northridge et al. 1995, Northridge et al. 1997, Evans et al. 2003). The species is abundant in the central and northern North Sea across to northwest Scotland (particularly the north Minch and western Sea of Hebrides). Their occurrence in the southern North Sea has invasive

Table 6. Proposed status of cetaceans in the Netherlands, based on the frequency of strandings and sightings reported between 1970 and 2005. Figures between parentheses show the number of years in which the species was represented.

Status:	Resident or annual visitor	Regular visitor or passage migrant	Irregular visitor	Vagrant
Number of years found or observed in:	≥ 32 years;	18-31 years	4-17 years	<4 years
Percentage of years found or observed in:	>90%	50-90%	10-50%	<10%
Species:	White-beaked dolphin (34) Harbour porpoise (36)	Bottlenose dolphin (23)	Fin whale (9) Minke whale (16) Sperm whale (13) Sowerby's beaked whale (6) Long-finned pilot whale (16) White whale (4) Bottlenose whale (4) Striped dolphin (6) Common dolphin (11) White-sided dolphin (11)	Sei whale (3) Humpback whale (2) Risso's dolphin (3) Blainville's beaked whale (1)
Number of species:	2	1	10	4

characteristics, with periods of an apparent absence alternating with periods of frequent sightings. The bimodal seasonal pattern is intriguing, but cannot be validated in the absence of sufficient, effort-corrected data. This is also true of the distribution pattern, with a near-absence in the northeastern part of the study area. Future, systematic, investigations are required to learn more about the habitat requirements and fluctuations in abundance of this common and currently clearly indigenous species (adults as well as young calves are frequently seen in Dutch waters, suggesting the presence of a breeding population). For seawatchers, sightings of white-beaked dolphins are still highly exceptional, underpinning the fact that this is an offshore species that avoids the shallow waters close to our coast. In Scotland, with deeper waters along the coast, records of white-beaked dolphins from vantage points along the shore are common. Ship-based and aerial survey results suggest a truly offshore distribution (figure 6), and the fact that incidental sightings have 'filled in' the area between the Brown Ridge (Bruine Bank) in the central Southern Bight and the Dutch coast (figure 7) suggests that the animals visit near-shore waters, but only briefly.

White-sided dolphins are widely distributed offshore, mainly around 100-300 m depth and in deeper waters of temperate and sub-arctic seas in the North Atlantic. They are common around the Hebrides and Orkney and Shetland, in the northern and central North Sea and in the Norwegian Sea. The species also occurs regularly off southwest Ireland, occasionally entering the southern Irish Sea, and the English Channel (Evans et al. 2003, Reid et al. 2003). Some large pods have been seen in the southern North Sea, but otherwise, the white-sided dolphin was generally very rare.

Sightings versus strandings

The white-beaked dolphin is, together with the harbour porpoise (Camphuysen 2004a), the most frequently encountered cetacean in the southern North Sea. *Lagenorhynchus* dolphins comprised 5.7% of the sightings (*n*=4,636 including harbour porpoises), and 17.0% of the individuals (*n*=12,670) observed. The harbour porpoise, not covered in the present paper, was represented in 87.3% of all sightings (69.8% of the individuals observed). These figures correspond very well with strandings data: between 1970 and 2005 8.5% of the animals found ashore were

Lagenorhynchus dolphins and 86.0% were porpoises (table 5). Baleen and sperm whales were slightly less often observed than expected from strandings data. There were, however, considerable differences between the number of sightings and strandings of bottlenose dolphins in the southern North Sea. Between 1972 and 1983, with an intact strandings network (co-ordinated efforts to record strandings and sufficient active volunteers), bottlenose dolphins were found at least annually, but since 1991 only a single corpse has been found Between 1972 and 1983 we know of sightings in only two years, while between 1987 and 2005 there are sightings in eleven out of 19 years (60%). This discrepancy between sightings and strandings data is difficult to explain, but suggests that the dolphins that do occur here are in good condition.

Status

Apart from the harbour porpoise, only four species have been seen in numbers exceeding 100 animals since 1970: long-finned pilot whale, bottlenose dolphin, white-beaked dolphin and white-sided dolphin. For at least two species, long-finned pilot whale and white-sided dolphin, very few sightings of sometimes particularly large numbers have contributed to this result. The common dolphin would be third in the ranking of the highest number of sightings of specifically identified cetaceans (41 records), but due to repeated sightings of resident individuals, these sightings refer to, at best, 22 different individuals.

In an attempt to evaluate the status of all cetaceans recorded in the southern North Sea, we have ranked species according to the frequency of occurrence between 1970 and 2005 from sightings and strandings data (table 6). The occurrence in any of the 36 years spanning this period was counted, and animals that were represented either alive or dead on the beach in at least 32 years (90% of the entire period) were listed as *"Residents or annual visitors"* (i.e. indigenous species according to current data). Only two species qualified as residents according to these criteria: harbour porpoises and white-beaked dolphins. Both species occur year-round, albeit in highly variable numbers in the southern North Sea and their relative abundance in recent years is such that a status as (common) residents seems an acceptable conclusion. Small calves have been seen at sea and have been found washed ashore, suggesting that both species reproduce within or in the immediate vicinity of the southern North Sea.

Perhaps rather arbitrarily, we ranked animals that were seen in 18-32 out of the 36 years of study (50-90%) as *'regular visitors or passage migrants'*, animals that were recorded in at least four, but less than 18 years (10-50%) as *'irregular visitors'*, and species that occurred in less than four out of 36 seasons (<10%) as *'vagrants'*. One species qualified as a regular visitor or passage migrant (bottlenose dolphin), ten species as irregular visitors and four as vagrants (table 6).

The bottlenose dolphin is an interesting species. Known as a common resident in Dutch coastal waters, probably at least until the early 1960s, it then disappeared completely. It took a number of years before even stranded bottlenose dolphins became a rarity (strandings were an annual occurrence until 1983, but there has been only one single stranding since). The recent sightings of rather large schools of bottlenose dolphins are therefore of considerable interest. The absence of strandings suggests that these were due to very brief influxes into the southern Bight, with 'healthy' animals appearing and disappearing without a trace. Dutch coastal waters are, after all, a prime bottlenose dolphin habitat, at least under the conditions that prevailed in the first half of the 20th century. Nevertheless the status as 'regular visitor' is perhaps still a high for a dolphin that has been rather rare in recent years. However, there have been clearly more reports of bottlenose dolphins than any other species within this category during the study period, and therefore we propose to maintain this *'status aparte'*.

The two remaining categories are sufficient for distinguishing groups of species that are exceptionally rare (vagrants) and those that may be seen with some regularity. Further observation work in the northern half of the southern North Sea would doubtlessly increase the number of minke whale sightings, and sperm whales may nowadays travel annually (but in very small numbers) through the Southern Bight. These two species are perhaps the best candidates for a future upgrading as regular visitors or passage migrants. Pilot whales are quite regular in the French Channel (Kiszka et al. 2004), but extensive surveys in

Belgian waters failed to produce sufficient sightings to warrant a status as regular visitor in the southern North Sea.

Conclusions

This study revealed that between 1970 and 2005, a 36 year period, 14 species of cetaceans were observed in the southern North Sea (51°-56°N, 2°-7°E). If we include the harbour porpoise, not specifically addressed in this paper, and two other species found stranded in that period (sei whale and Blainville's beaked whale) the list comprised a total of 17 species, including at least four baleen whales, sperm whale, three species of beaked whales, white and pilot whales, six species of dolphins and the harbour porpoise. Two species can be described as common residents: the harbour porpoise and the white-beaked dolphin. The bottlenose dolphin qualified as a regular visitor or passage migrant. The remaining species were qualified as irregular visitors (10 species) or vagrants (4 species). The distribution of confirmed sightings of long-finned pilot whales and bottlenose dolphins suggest a connection with stocks in the Channel area. The distribution of sightings of minke whales, white-beaked dolphins and white-sided dolphins connect to larger populations in the northern North Sea. Future conservation measures should focus on white-beaked dolphins and harbour porpoises, which are the most abundant and widespread species in the southern North Sea. The data suggest a gradual increase in the occurrence of whales and dolphins in the southern North Sea, even although offshore surveys show results that are rather more variable.

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Samenvatting

Verspreiding en diversiteit van walvissen en dolfijnen (Cetacea) in de zuidelijke Noordzee: 1970-2005

Gegevens van waarnemingen van cetaceeën (walvissen en dolfijnen) in de zuidelijke Noordzee zijn verzameld in de *Marine Mammal Database* van de Nederlandse Zeevogelgroep. Deze database bestaat uit zowel incidentele waarnemingen als waarnemingen verzameld tijdens systematische tellingen en zeetrektellingen, wat het corrigeren van fluctuaties in waarnemingsinspanning bemoeilijkt. Op basis van de gegevens is het voorkomen van de verschillende soorten walvissen en dolfijnen geanalyseerd. Daarnaast is er gekeken naar mogelijke trends in de verdeling van soorten in ruimte en tijd. Van de aanwezige soorten is de bruinvis (*Phocoena phocoena*) in dit artikel buiten beschouwing gelaten, behalve in de discussie, waar de resultaten worden vergeleken met eerdere gegevens van strandingen en het voorkomen van soorten in omliggende wateren. De gegevens van de 17 soorten walvisachtigen aanwezig in de zuidelijke Noordzee tussen 1970 en 2005 (36 jaar) zijn geanalyseerd op frequentie van voorkomen (dood en levend). Twee soorten zijn resident: de bruinvis en de witsnuitdolfijn (*Lagenorhynchus albirostris*). Beide soorten werden sinds 1970 vrijwel jaarlijks, en

tegenwoordig bovendien in flinke aantallen, vastgesteld. Van beide soorten zijn de laatste jaren ook veel waarnemingen van adulte dieren met jonge kalfjes in de zuidelijke Noordzee gedaan. De tuimelaar (*Tursiops truncatus*) is een reguliere bezoeker of doortrekker (in 23 van de in totaal 36 jaren vastgesteld). Tien walvisachtigen zijn onregelmatige bezoekers van de zuidelijke Noordzee (in 4-18 van de in totaal 36 jaren vastgesteld) en vier soorten zijn dwaalgasten (minder dan vier jaar aanwezig). De ruimtelijke verdeling van de waarnemingen van grienden (*Globicephala melas*) en tuimelaars suggereert een relatie met in het Kanaal aanwezige populaties van deze soorten. Tussen 1970 en 2005 is de frequentie van waarnemingen van walvisachtigen toegenomen, maar het is niet bekend in hoeverre de toenemende populariteit van walvisachtigen daar aan heeft bijgedragen. Tellingen vanaf de kust, waarbij de waarnemingsinspanning bekend is, laten een vergelijkbare toename in waarnemingen zien, maar gegevens die verzameld werden tijdens tellingen op zee hebben een grotere variatie in de frequentie.

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