Cetaceans stranded in the Netherlands in 2008-2014

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Abstract: We present a validated list of cetaceans stranded from 2008 up to and including 2014. A total of 4406 cetaceans was found on the Dutch coast during this period, comprising 4346 harbour porpoises (*Phocoena phocoena*) (98.6% of all strandings) and 59 individuals of twelve other species. The next most numerous species was white-beaked dolphin (*Lagenorhynchus albirostris*) (14 individuals). All individual cases of stranded cetaceans are included, excepting those of harbour porpoise. During the present period, the years with the highest numbers ever of harbour porpoise have been recorded, although numbers in the early twentieth century or before may have been equally high. Largest numbers of harbour porpoise, both absolute and expressed as average per stretching kilometre, are found in the Wadden Sea area, with a gradually decreasing density further south.

Keywords: Cetacea, harbour porpoise, mortality, North Sea, *Phocoena phocoena*, sex bias.

Introduction

This report on cetacean strandings in the Netherlands is the 39th report in the series reviewing at least one entire year since the first report on the same topic by Van Deinse (1933). After his first review, Van Deinse regularly reported on strandings up to and including 1964 (van Deinse 1966). Van Deinse started his study of dead cetaceans in 1914 (Kompanje & Reumer 2002); this report therefore concludes an impressive period of an entire century of cetacean strandings. Reviewing Dutch cetacean strandings has become easier with the digital national strandings database in 2006, available at walvisstrandingen.nl. The database is updated on a weekly basis, and apart from special events, monthly and yearly overviews are published on its news page. All individual records are digitally accessible and often accompanied with photographs. Despite this, the overview becomes obscured by strandings of the numerous harbour porpoise (*Phocoena phocoena*), especially since 2004, making it harder than before to keep track of changes in the Dutch cetacean fauna. Hence, by reporting on a regular basis, we would be able to present data from a fairly considerable period without being out of topicality. Since the last update (Camphuysen et al. 2008) however, reports have been delayed.

Recently, extensive information on long-term strandings data of cetaceans in the Netherlands has been published (Broekhuizen et al. 2016), and we refer to that publication for more information on the status of cetaceans in Dutch waters. Although the data in Broekhuizen et al. (2016) are based on the same database as those in the present report, there may be slight differences, due to including

skeletal remains and floating corpses at sea.

Apart from merely reporting the strandings of the past couple of years, this publication is meant to be a validated list of recent stranded cetaceans in the Netherlands. Although information on parasites is collected, the data will not be presented in this overview; they can, however be viewed on www.walvisstrandingen.nl under the respective species. The purpose of reporting on strandings is not just to publish on recent findings of fresh carcasses. In order to gain insight in the cetacean community in the North Sea and adjacent waters, long-term monitoring not just involves surveying live animals offshore (e.g. Hammond et al. 2013, Scheidat et al. 2013) and nearshore (trektellen.nl), but also counting dead animals on the beach (Pyenson 2011), no matter whether these have died recently. Therefore, subfossil records are included in this report as well.

Methods

Following conventions in previous reviews of stranded cetaceans, details in this report are listed for each individual found ashore, whether alive or dead. An exception is made for harbour porpoise; results of this species are summarised with emphasis on temporal and spatial patterns in strandings, sex ratio and age composition. Some long-term trends are evaluated overseeing the period since 2000. Another exception is made for carcasses found floating in Dutch waters, or brought into a Dutch harbour on the bulb of a ship; these are included because they may have been found on the beach later on, for instance when they would slip off a ship's bulb.

All records mentioned in this publication have been reported to walvisstrandingen.nl through a number of parties within the Dutch cetacean network (see: Acknowledgements) and are incorporated in the national database, maintained by Naturalis Biodiversity Center in Leiden. Strandings of harbour porpoise are nowadays usually accompanied with digital photographs, which are added to the database. In case a species other than harbour porpoise is found, it is usually tried to get sufficient photographs in order to identify the species. Also, (part of) the skeleton or other material (tissue, parasites, stomach contents) is usually collected and stored by Naturalis or a provincial or regional museum. The database is publicly available on www.walvisstrandingen.nl. Collection numbers, if known, are also given below.

Area

The Dutch beach stretches from the border with Germany in the northeast to the border with Belgium in the southwest. To find out whether there are differences in densities in numbers of harbour porpoise washing ashore, the coastal area of the Netherlands is subdivided into three physically different parts (table 1; see also figure 3 in Camphuysen et al. (2008)): a. the Delta area, in the southwest, from the Belgian border up to and including Maasvlakte; b. the mainland coast between Hoek van Holland and Den Helder; and c. the Wadden Sea. The 'inner Delta' includes (open) rivers Westerschelde, and (partly closed) Oosterschelde and Grevelingenmeer. The mainland coast consists of provinces Zuid-Holland (but excluding Goeree, Voorne and Maasvlakte) and Noord-Holland. The division between the two in this report is the harbour of IJmuiden, about 15 km north of the administrative boundary. The Wadden Sea is divided into the North Sea coast of the islands and the Wadden Sea proper, which includes the Wadden Sea side of the islands, the northeastern part of Noord-Holland, the Afsluitdijk and the mainland coast of Friesland and Groningen. Razende Bol is combined with Texel (North Sea coast), Griend with Vlieland (Wadden Sea), and Engelsmanplaat with Schiermonnikoog (North Sea coast), while the easternmost islets Rottumerplaat and

Table 1. Total number of harbour porpoise in 2008-2014 in the Netherlands per subarea. Given are average density (*n*/km/year), sexual composition (percentage of males, with total number of sexed individuals between brackets), and percentages per length class (in cm; see text). See also the Methods section for the geographic subdivision.

	total	density	% males (*n*)	<90	90-130	>130	(*n*)
Delta (121 km)	1243	0.3	63.5 (854)	12.8	68.5	18.7	658
Zeeuws-Vlaanderen	28	0.3	60.0 (20)	15.0	40.0	45.0	20
Walcheren	439	1.5	64.4 (351)	11.2	71.9	16.9	249
Schouwen	215	1.3	60.7 (163)	16.7	56.8	26.5	132
Goeree	254	2.0	64.2 (106)	7.1	81.6	11.2	98
Voorne	31	0.5	65.4 (26)	6.3	87.5	6.3	16
inner Delta	201	0.1	64.2 (128)	18.7	68.2	13.1	107
Maasvlakte	75	0.6	62.5 (40)	8.3	61.1	30.6	36
mainland coast (119 km)	1415	1.3	57.8 (770)	13.5	60.6	26.0	936
Zuid-Holland	740	1.4	59.0 (434)	14.8	57.5	27.7	480
Noord-Holland	675	1.2	55.7 (336)	12.1	63.8	24.1	456
Wadden Sea total (431 km)	1688	0.6	51.02 (566)	14.0	60.9	25.1	1189
North Sea coast (111 km)	1415	1.9	53.5 (473)	15.6	60.4	23.9	927
Texel	410	1.8	53.4 (221)	14.9	59.2	25.9	316
Vlieland	413	2.0	57.1 (42)	16.1	62.9	21.1	299
Terschelling	179	2.3	40.5 (42)	17.9	60.7	21.4	56
Ameland	288	2.6	56.0 (150)	12.2	59.5	28.3	205
Schiermonnikoog	125	0.6	55.6 (18)	29.4	56.9	13.7	51
Wadden Sea (320 km)	273	0.1	39.8 (93)	8.4	62.6	29.0	131
Texel	54	0.3	57.7 (26)	9.5	61.9	28.6	42
Vlieland	26	0.3	50.0 (4)	5.3	63.2	31.6	19
Terschelling	40	0.2	16.2 (37)	6.3	56.3	37.5	16
Ameland	12	0.1	100.0 (3)	11.1	88.9	0.0	9
Schiermonnikoog	6	0.0	0 (0)	20.0	80.0	0.0	5
Rottum	41	0.6	50 (4)	0.0	36.2	63.6	11
Noord-Holland	7	0.0	66.7 (3)	14.3	71.4	14.3	7
Friesland	41	0.1	54.5 (11)	6.7	60.0	33.3	15
Groningen	28	0.1	20.0 (5)	14.3	71.4	14.3	7
total	4346	0.6	58.2 (2190)	13.5	62.6	23.9	2783

Rottumeroog are combined into 'Rottum' and included in the inner Wadden Sea area. The coastal length of the subareas is given in table 1.

Coverage

Coverage of the coastline in the Delta area is thought to be close to 100% as far as the sandy beaches bordering the North Sea are concerned; this means that probably all cetaceans are being found and reported to walvisstrandingen.nl. The mainland coast of Zuid-Holland and Noord-Holland is probably equally well covered, although we know that even on these busy beaches most harbour porpoises may be discovered, but not always reported. Coverage on the westernmost Wadden Sea island of Texel is also close to 100% on the western section (North Sea beach). Coverage of the remainder of the inner Delta area, the other Frisian islands and the mainland coast of the Wadden Sea varies from fair to very poor, partly because of the extensiveness of the areas and the low visiting rate,

Table 2. Relative proportion of harbour porpoise (including number, *n*) found in the three subareas (% porpoise) compared to the relative proportion of coastal length (% km). The same is presented separately for the Wadden Sea (breakdown Wadden Sea), where the sandy North Sea side of the islands is compared to the generally more muddy Wadden Sea proper.

	% porpoise	% km	*n* porpoise
Delta	28.6	50.4	1243
mainland	32.6	14.1	1415
Wadden Sea (total)	38.8	35.5	1688
breakdown Wadden Sea			
North Sea	83.8	27.9	1415
Wadden Sea	16.2	72.1	273

partly because of poor recording. It is therefore impossible to estimate the coverage of these areas, but see table 2 for an evaluation of missed porpoises.

Research

During 2008-2014 a total of 902 fresh and decomposed harbour porpoises has been collected for dissections performed by staff of the Faculty of Veterinary Medicine of Utrecht University. The corpses have been scrutinised for causes of death, in assignment of the ministry of environment (currently a subdivision of the ministry of economic affairs), and tissue samples and stomachs collected and deep-frozen for future research. The main conclusions of the dissections are at the moment of writing still under embargo.

Smaller cetaceans used to be transported directly to Naturalis in Leiden up to about 2009. Since then they are transported to the Faculty of Veterinary Medicine at Utrecht University. (Very) large cetaceans are dissected on the beach, in the past only by Naturalis personnel, presently also in cooperation with pathologists. All cetaceans are dissected and tissue samples are collected. Skeletons of species other than harbour porpoise are subsequently integrated in the Naturalis collection. Although research on dead cetaceans is not the scope of this publication, we will briefly report on interesting findings, for instance those that may shed light on the cause of death.

Systematic list

During 2008-2014 a total of 4406 beached cetaceans was recorded, representing at least twelve species; there were six small whales and/or dolphins that remained unidentified. In 2008 five different species were reported, in 2009 six, in 2010 and 2011 (at least) seven, in 2012 and 2013 (at least) six, and in 2014 nine. As usual, virtually all records (98.6%) referred to harbour porpoises. Of the 59 other whales, stranded along the entire coastline, 11 involved live strandings, at least 8 were suspected to have been ship-assisted, and 13 involved finds of subfossil bones. Remains kept in the scientific collection of Naturalis are preceded by 'RMNH'. The taxonomic order of the cetaceans follows Wilson & Reeder (2005).

Northern minke whale (*Balaenoptera acutorostrata*)

2008-2014: 5 records
2000-2007: 4 records
before 2000: 24 records

6/5/2008 North Sea north of Terschelling, Friesland. Sex and weight unknown, 600 cm (estimated). Fresh, complete. Discarded at sea. Reported by J. Smid.

22/8/2009 Ritthem, Zeeland. Probably female, 520 cm (estimated), weight unknown. Rotten, complete. Skull and tail vertebrae collected (RMNH.MAM.51190). Reported by J. van der Hiele.

19/5/2010 Wadden Sea near Wierum, Friesland. Sex and weight unknown, 400 cm (estimated). Rotten, incomplete. Vertebrae collected (RMNH.MAM.45228). Reported by A.R. de Boer, T. de Boer, G. Hoekstra and T. Talsma.

3/4/2011 Breskens, Zeeland. Male, 760 cm (estimated). Rotten and incomplete, remainder weighing 2600 kg (measured). Not collected. Reported by J. van der Hiele.

12/6/2014 Terschelling, near beach pole 8, Friesland. Sex, length and weight unknown. Broken and incomplete skull and skin fragments only. Not collected. Reported by A. and L. Duursma.

The minke whale from 6 May 2008 was seen floating at sea north of Terschelling (Visserijnieuws 18 mei 2008; http://tinyurl.com/p5w2bdp). It was taken on board N350 by the fishermen and discarded at sea after pictures were taken. It concerned a fresh minke whale, as can be seen on the picture in the news clipping, and probably complete, although the presence of head nor flippers can be evaluated properly from the photograph. The exact location is unknown.

The minke whale from Ritthem from 22 August 2009 was complete, but very putrefied. It could be fairly accurately measured, but it was impossible to establish the sex, because of the expanded and damaged abdomen. In all cetacean males the penis usually comes out after death, as the muscles relax, especially when the body starts to decompose. This was not the case in this individual.

A decomposing minke whale was floating in the Wadden Sea near Wierum, Friesland on 19 May 2010. It washed ashore some days later on the nearby island Engelsmanplaat, where the scapula and a single vertebra were collected. The remains refloated spontaneously during high tide and washed ashore on the eastern tip of Schiermonnikoog, near beach pole 13. A tail vertebra was collected on Schiermonnikoog and is now on permanent exhibition in the sea shell museum in the village of Schiermonnikoog.

The minke whales at Ritthem and Breskens were too decomposed to etablish the cause of death, but the proximity of the harbours of Vlissingen and Antwerp make them suspect of being ship-assisted. The minke whale from 19 May 2010 was the ninth since 2000 and the seventeenth for the Wadden Sea area (including Wieringen (1), the mainland coast of Friesland (1) and the North Sea coast of Texel (3)). The other ones stranded on the mainland coast of Noord-Holland (4), Zuid-Holland (4) and the Delta area (7). Out of the fifteen individuals sexed, there is a slight preponderance of females (9). Of 23 minke whales the length is known, but all carcasses prior to 1974, and a few after that year, have probably been estimated, considering the rounded figures: there are for instance four individuals of 900 cm. The average length was 661 cm. Males tended to be slightly smaller than females (592 versus 705 cm). If only measured lengths are included, all minke whales together measured 624 cm (n=16), males 606 cm (5) and females 675 cm (7).

Fin whale (*Balaenoptera physalus*)

2008-2014: 6 records
2000-2007: 4 records
before 2000: 27 records

30/8/2011 Rotterdam, Zuid-Holland. Male, 1300 cm (measured), weight unknown. Fairly fresh, complete. Skull, part of skeleton, tissue and baleens collected (RMNH.MAM.55014. a-d). Reported by Havenbedrijf Rotterdam.

15/1/2012 Vlissingen, Zeeland. Female, 877 cm (measured), ca. 6000 kg (measured).

Figuur 1. A 18.5 metres long fin whale draped over a the bulb of a ship at Rotterdam harbour, 6 June 2012. Baleen whales often collide with marine traffic; in the Mediterranean the entire fin whale population is even thought to be at risk because of this, with a shockingly high number of 16% out of 287 individuals having died from collisions with a ship (Panigada et al. 2006). *Photo: Havenbedrijf Rotterdam.*

Fairly fresh, complete. Skull, baleens, flipper, neck vertebrae and tissue collected (RMNH. MAM.55019.a-c). Reported by J. van der Hiele.
6/6/2012 Rotterdam, Zuid-Holland. Male, 1850 cm (measured), 49,000 kg (measured). Not fresh, complete. Not collected. Reported by Havenbedrijf Rotterdam.

2/8/2013 Rotterdam, Zuid-Holland. Female, 1250 cm (measured), 11,000 kg (measured). Rotten, complete. Tissue and baleens collected (RMNH.5000156.a-c). Reported by Havenbedrijf Rotterdam.
16/9/2013 ‘s-Gravenzande, Zuid-Holland. Male, 1650 cm (measured), weight unknown. Rotten, complete. Tissue and entire skeleton collected (RMNH.5000109.a-c). Reported by D. Frerichs and R. Noort.

20/8/2014 Katwijk, Zuid-Holland. Male, 1680 cm (measured), weight unknown. Not fresh, complete. Tissue and entire skeleton collected (RMNH.5069812.a-c). Reported by K. Kooimans.

All six fin whales that stranded during this period were proven or suspected to have been brought in on a ship’s bulb (figure 1). Since fin whales do not normally occur in the southern North Sea but are common in the Bay of Biscay in late summer (Chaudry et al. 2005), it is likely that they were brought in from that area. Fin whale also holds one or more populations in the Mediterranean (e.g. Notarbartolo di Sciara et al. 2003). Although at least two of the ships carrying fin whales had crossed the Mediterranean, and could thus have potentially brought fin whales from there, two individuals had fed in the North Atlantic and showed no connection with the Mediterranean fin whale population (Camalich et al. 2014). The dissected fin whales (all but those from 2013) were well nourished, and some showed various degrees of subcutaneous and/or intramuscular bleeding, indicating they were hit by a ship when still alive (IJsseldijk et al. 2014a).

The intestines of the female from 15 January 2012 contained remains of milk. She had an inflammation of the peritoneum. Although speculation, the inflammation may have caused the whale to be less mobile, which in turn may have resulted in it being hit by the ship. The stomach of the fin whale from 2 August 2013 contained northern krill (*Meganyctiphanes norvegicus*) and two otoliths of a *Myctophum* species, possibly *Myctophum punctatum* (M. Leopold, personal communication, Bravo Rebolledo et al. 2016).

The fin whale of 16 September 2013 was found floating 18.5 km west of Maasvlakte in the shipping lane, and stranded the next day at ‘s Gravenzande (figure 2). It was reported as being a container. Also the fin whale from 20 August 2014 was found floating in the shipping lane six km off Katwijk. Since it was a ‘possible hazard’ (traffic obstruction), it was to be towed away, and luckily could be landed at Scheveningen beach, to allow identification and proper dissection on the beach. This also gave the public the rare opportunity to see a large whale up close.

Figuur 2. This fin whale, photographed at 's-Gravenzande on 16 September 2013, is easily identified by the bicoloured set of baleens on the right side. Note the broken flipper. *Photo: Rinus Noort.*

Figure 3. Because of the high body temperature, and the perfect insulation layer of blubber, all cetaceans soon start to decompose after death. The developing gases cause the body to expand, sometimes to impressive proportions, like in this humpback whale at Ameland, 8 September 2009. After the gases have escaped from the body and the carcass is still at sea, it usually sinks to the sea floor. *Photo: Jan Spoelstra.*

Humpback whale
(*Megaptera novaeangliae*)
2008-2014: 4 records
2000-2007: 3 records
before 2000: 0 records

8/10/2009 Westgat, Hollum, Ameland, Friesland. Male, 850 cm (measured), weight unknown. Rotten, complete. Entire skeleton and baleens collected (RMNH.MAM.43465). Reported by D. Visser.

18/8/2010 beach pole 87, Katwijk, Zuid-Holland. Sex and weight unknown, about 450 cm. Rotten, incomplete. Ulna, radius and hand collected (RMNH.MAM.45229). Reported by K. Kooimans and A. Oosterbaan.

23/3/2012 mudflats off de Cocksdorp, Texel, Noord-Holland. Single vertebra. Ecomare collection number B2-78. Reported by J. Hottentot and A. Oosterbaan.
12/12/2012 Razende Bol, Noord-Holland. Female, 16,000 kg (measured), 1034 cm (measured). Live stranding, died 16/12/2012. Entire skeleton, skin samples and baleens collected (RMNH.MAM.55066.a). Reported by S. de Wolf and A. Oosterbaan.

The humpback whale found in 2009 at Hollum, Ameland, had died at least a week before it washed ashore. The rotting carcass floated between the islands of Terschelling and Ameland and was towed to the southwestern tip of Ameland (figure 3). It concerned a juvenile, probably not older than two years. The cause of death could not be established.

The individual found at Katwijk in 2010 was decomposed and very incomplete: only a fore flipper and a few other bones could be recovered from the rotting flesh, and the flipper was the only body part that could be measured. It was about 150 cm long. Flippers of humpback whales are about one-third of the total body length (Winn & Reichley 1985), so this individual must have been about 450 cm when it died. This is about the length baby humpback whales have when they are born, which means that a humpback whale gave birth in, or close to, the Southern Bight, something that has never been recorded before in this area.

The humpback whale that stranded on Razende Bol, a sand spit just southwest of Texel, caused a national stir, because it stranded alive. Hours after it stranded, the incoming tide got it floating again, and it is possible that it would have gotten away by

Figure 4. Common dolphins are known for their colourful hourglass pattern, but not much is left of it in this individual, probably because colours soon fade after death. 17 April 2011, Oostvoorne. *Photo: Jolanda Meerbeek.*

itself. However, it got stuck even higher up the beach after it was visited by boats and a helicopter at dusk. The next few days the living whale – named Johanna – was all over the news, and even made it into international newspapers, until it died on 16 December. The stomach and intestines of this humpback contained some sprat (*Sprattus sprattus*) remains (M. Leopold, personal communication). In a sample of the intestinal tract sixteen plastic particles were found, varying between 1 mm to 17 cm in length; if extrapolated, the total intestinal tract might have held 160 pieces of plastic (Besseling et al. 2015).

These humpback whales constituted only the fourth to sixth records of dead humpback whales for the Netherlands (excluding the record of 23 March 2012). The first humpback whale ever for the Netherlands was found as recent as 29 September 2003, floating in river Nieuwe Waterweg near Rotterdam, Zuid-Holland (Camphuysen et al. 2008). Just prior to and during the present reporting period, there have also been sightings of various living and apparently healthy individuals in Dutch waters (yearly from 2007 onwards, except 2010 (source: waarneming.nl)), while there have also been sightings after 2014. Although the sudden and remarkable occurrence in the North Sea of this spectacular, surface feeding and often coastal species still remains unexplained, humpback whales in the North Atlantic have increased to about 20,000 individuals over the past decades (Smith & Pike 2009, Ruegg et al. 2013). The population once comprised 112,000 individuals, but was hunted down to less than 1000 in the late 1960s (Katona & Beard 1990). On the one hand, the recent population growth seems a logical explanation for the increase in sightings, on the other hand, if the humpback whale population was so large in former times, why haven't there been any strandings or sightings since 1255 (the oldest record in walvisstrandingen.nl) and prior to 2003 on or near Dutch shores? A logical alternative explanation could be found in a change in feeding possibilities.

Common dolphin (*Delphinus delphis*)

2008-2014: 2 records
2000-2007: 2 records
before 2000: 82 records

17/4/2011 Oostvoorne, Zuid-Holland. Male, 153 cm (measured), 39 kg (measured). Live stranding. Entire skeleton collected (RMNH.MAM.45368). Reported by E. Everaarts and J. Meerbeek.

15/3/2014 Ouddorp, Zuid-Holland. Female, 189 cm (measured), 92 kg (measured). Rotten, complete. Entire skeleton and tissue collected (RMNH.5069675.a). Reported by J. van der Hiele.

The common dolphin from Oostvoorne stranded alive and was taken into care. It was in bad condition and died that night (figure 4). Considering the length it was probably two years old.

The individual found at Ouddorp was well-nourished and the stomach contained many fish bones and otoliths of herring (*Clupea harengus*), seabass (*Dicentrarchus labrax*), whiting (*Merlangius merlangus*), smelt (*Osmerus eperlanus*), plaice (*Pleuronectes platessa*), sand goby (*Pomatoschistus minutus*), two-spotted goby (*Gobiusculus flavescens*), European squid (*Loligo vulgaris*), bobtail squid (*Sepiola atlantica*) and two species of nereid worms (M. Leopold & G. Keijl, personal communication). Parasite burden appeared mainly mild, and was probably not the cause of stranding. Pathological results, like internal bleeding of the adrenal glands, suggested an acute traumatic death, so it possibly died in fishing gear.

Most stranded common dolphins – since the first in 1860 – have been found in August (30%), and just over half of them in July-October (53%). However, there appears to be a tiny peak in March-May as well (18%, *n*=14), and the two found during the present period were recorded exactly in these months. From all common dolphins, just over half stranded in the southern half of the Netherlands (58% in the Delta and Zuid-Holland, *n*=83).

Long-finned pilot whale (*Globicephala melas*)

2008-2014: 1 record
2000-2007: 2 records
before 2000: 18 records (124 individuals)

17/12/2014 Nieuw-Haamstede, Zeeland. Male, 381 cm (measured), 410 kg (measured). Rotten, complete. Entire skeleton and tissue collected (RMNH.5069954.a). Reported by R. van de Guchte and J. van der Hiele.

Long-finned pilot whale, a deep-water species, is a rare straggler in the southern North Sea. There appears to have been an increase in stranding records in the Netherlands since the 1950s: 1500-1950 8 stranding events (with three events concerning 37, 11 and 61 individuals), and 1950-2014 13 events (13 individuals). It is possible however that rotten and incomplete pilot whales in the past have been mistaken for other, similar-sized species.

The pilot whale from December 2014 (figure 5) died of asphyxiation because a common sole (*Solea solea*) got stuck in its nasal cavity (IJsseldijk et al. 2015). Other prey remains were sand goby, plaice, herring, river lamprey (*Lampetra fluviatilis*), brown shrimp (*Crangon crangon*) and common cuttlefish (*Sepia officinalis*). Pilot whales habitually feed on deep-water cephalopods, but stomach contents have shown them to at least occasionally feed on mesopelagic fish as well, which may have been taken around fishing vessels (Gannon et al. 1997).

White-sided dolphin (*Leucopleurus acutus*)

2008-2014: 1 record
2000-2007: 4 records
before 2000: 8 records

21/3/2008, beach pole 44, Castricum, Noord-Holland. Male, 238 cm (measured), 159.5 kg (measured). Fresh, complete. Entire skeleton collected (RMNH.MAM.43756). Reported by D. Bakker and M. Amoureus.

According to LeDuc et al. (1999) and May-Collado & Agnarsson (2006), the (former) genus *Lagenorhynchus* is polyphyletic (meaning that the various species in this genus originated from different ancestors); they put this species into the – monotypic – genus *Leucopleurus*. White-sided dolphin, a pelagic spe-

Figure 5. It is interesting to note that pilot whales, which largely feed on squid, have teeth in both upper- and lower jaws, clearly seen in this individual, while sperm whales, also specializing on squid, have teeth only in the lower jaws. Haamstede, 17 December 2014. *Photo: Jaap van der Hiele.*

cies occurring in deep water, is rare in the Netherlands.

The individual found at Castricum was malnourished, suffered from severe pulmonary edema and had a parasitic cyst on the bladder ligament. In the stomach otoliths from sandeel Ammodytidae were found, as well as several species of goby Gobiidae, among which a fair number of transparent goby (*Aphia minuta*) (M. Leopold, personal communication), a pelagic shoaling fish measuring up to five cm. This fish is rather rare in the Netherlands, though possibly overlooked (Ellis & Rogers 2015).

Out of the twelve white-sided dolphins stranded in the Netherlands thus far, five were found in March and four in December (together 75%). Remarkably, of the six stranded since 1985, three were still alive, while the other three were extremely fresh and possibly stranded alive as well, or died immediately prior to or during stranding. The first white-sided dolphin for the Netherlands was captured alive near Vlissingen on 20 December 1863 (van Deinse 1961). Another seven followed in the twentieth century and four since 2000. No details are known from the first individual, but since white-beaked dolphins are a gregarious and fast moving species from deep water, it is unusual for a healthy individual to be caught nearshore. The skeleton (and possibly skin as well) are kept in the zoological museum of the University of Gent, Belgium (figure 6).

White-beaked dolphin (*Lagenorhynchus albirostris*)

2008-2014: 14 records
2000-2007: 43 records
before 2000: 171 records

2/2/2008, Vliehors near beach pole 37, Vlieland, Friesland. Female, 290 cm (estimated), weight unknown. Rotten, complete. Skull and tissue collected (RMNH.MAM.46032). Reported by W. Stel and F. Janssens.
3/2/2008, Kaloot, Borssele, Zeeland. Female, 249 cm, 197 kg. Fresh, complete. Skull and tissue collected, RMNH.MAM.43753. Reported by M. Geerse, J. van der Hiele and A. Dijkstra.
16/10/2008, Texel, Noord-Holland. Female, 240 cm (estimated), weight unknown. Rotten, complete. Not collected. Reported by K. Uitgeest and A. Oosterbaan.

26/12/2009, Maasvlakte, Zuid-Holland. Female, 201 cm, 107 kg. Fresh, complete, possible live stranding. Entire skeleton collected (no RMNH-number yet). Reported by A. Schrauwen and J. van der Hiele.
27/12/2009, Ameland, Friesland. Female, 176 cm (measured), 68.5 kg. Fairly fresh, complete. Apparently not collected. Reported by J. Krol.

Figure 6. Detail of the first white-sided dolphin for the Netherlands, captured alive in the former water Sloe, running between the former islands Walcheren and Zuid-Beveland, Zeeland, on 20 December 1863. The skeleton is preserved in Museum voor Dierkunde, Universiteit Gent. *Photo: Guido Rappé.*

27/12/2009, Ameland, Friesland. Female, 246 cm (measured), 204.5 kg. Live stranding, euthanised. Skull and tissue collected (RMNH.MAM.55022.a-b). Reported by J. Krol.

16/2/2010, Neeltje Jans, Oosterschelde, Zeeland. Female, 175 cm (measured), 72.5 kg (measured). Fresh, complete. Entire skeleton collected (RMNH.5000002). Reported by H.L.J. Eland.
7/3/2010, beach pole 10, Ouddorp, Zuid-Holland. Male, 182 cm (measured), 61 kg. Rather fresh, complete. Apparently not collected. Reported by J. van der Hiele.

14/4/2011 Terschelling, beach pole 7, Friesland. Sex unknown, 300 cm (estimated), weight unknown. Rotten, complete. Locally buried. Photos of skeleton. Reported by A. Voorbergen.
12/6/2011 Bloemendaal, beach pole 58, Noord-Holland. Sex unknown, 160 cm (estimated), weight unknown. State of carcass unknown, complete. Locally buried, no photos. Reported by K. Kooimans and R. Noort.
12/6/2011 Ameland, beach pole 18, Friesland. Male, 220 cm (measured), 134 kg (measured). Live stranding, refloated. Reported by R. Knoeff & J. Krol. Stranded again and taken into care, died 12 December 2011. Skull kept by SOS Dolfijn in Harderwijk (LA111205). See: van Elk et al. (2014).
4/12/2011 Den Helder, Noord-Holland. Female, 158 cm (measured), 52.2 kg (measured). Live stranding, taken into care, died 5 December 2011. Reported by zeezoogdieren.org. Skull kept by SOS Dolfijn in Harderwijk (LA111211). See: van Elk et al. (2014).

3/1/2012 Between Dishoek - Zoutelande, Zeeland. Male, 274 cm (measured), 255 kg (measured). Fresh, complete. Reported by A. Dijkstra and J. van der Hiele. Entire skeleton and tissue collected (RMNH.MAM. 55020.a-b)

25/1/2014 Petten, Noord-Holland. Only left lower mandible, no recent stranding, in private collection.

The adult female found on the Kaloot, Borssele, just east of Vlissingen, on 3 February 2008, was malnourished. There were fractures of three vertebrae and multiple lateral spinous processes in the tailstock at the level of the pelvic bones, with a large hematoma, new bone formation and remodelling, and probable osteomyelitis. She also suffered from severe pulmonary edema. The oesophagus/stomach contained remains of ten cod (*Gadus morhua*) though, and, remarkably also two stalked sea squirts (*Styela clava*) (Tunicata, Styelidae). These are not known to be part of the dolphin's regular diet (e.g. Jansen 2013) and may have been secondary prey (i.e. eaten by the cod). Given the poor condition how-

ever, it is possible that this female had been unable to hunt and turned to anything edible. Apart from food remains, the stomach contained a large quantity of the parasitic nematode *Anisakis simplex*, a parasitic worm often found in stomachs of white-beaked dolphins.

The immature female found on Maasvlakte on 26 December 2009 was very fresh, complete and full of blood smears when found, so it had possibly stranded alive. It was reported to walvisstrandingen.nl as harbour porpoise, but could be identified, and preserved, thanks to the excellent photographs attached to the digital report. It was emaciated, even though there were remains of whiting in the stomach. It suffered from lung edema and slightly inflamed intestines.

Two white-beaked dolphins were reported from Ameland on 27 December 2009: a juvenile female lying dead on the water line when found, and an adult female that stranded alive a while after. The juvenile was slightly undernourished and had a haemorrhage on the left lower jaw. The stomach contained large quantities of the parasitic nematode *Anisakis simplex*, brown shrimp and the bobtail squid. The large individual, supposed to be the mother of the calf, was lactating (Keijl & Cremers 2010). She was slightly underweight, but did not show signs of trauma or illness. The stomach contained a few heavily worn otoliths of whiting.

Autopsies performed on the female from Neeltje Jans from 16 February 2010 and the male from Ouddorp from 7 March 2010 did not reveal any (obvious) causes of death: both were slightly undernourished, while the male showed haemorrhage and edema around the scapula and mandible. Curiously, the male had its dorsal fin tip missing.

The individual from 12 June 2011 was taken into care, and lived until 12 December of that year. See van Elk et al. (2014) for a description of health status, behaviour in captivity, and autopsy results from this individual and the one that stranded on 4 December 2011 in Den Helder.

Even though white-beaked dolphin is the most common cetacean in Dutch waters after harbour porpoise, it is still uncommon, with on average six strandings per year during 1980-1999 (range 1-13) and four in 2000-2014 (range 0-11). There are some sightings of live animals near the coast during the same period (see for instance: waarneming.nl). Prior to 1980 it was rarer, with a total of only 38 stranded individuals reported, and on average 1.3 strandings per year during 1945-1980. Strandings have occurred in all months (figure 7). Over the years since 1970, the stranding pattern of this species is undulating (see figures in: Camphuysen et al. 2008 and Keijl & Cremers 2010). After an apparent influx of white-beaked dolphins during the 1990s, we are presently apparently in a 'low'. It remains to be seen whether this species will keep on occurring in the southern North Sea during the warming climate, or will retreat northwards.

Out of the total of 228 stranded white-beaked dolphins, 156 (68%) have been sexed. There is a preponderance of females (62% on average, since 1886, i.e. a sex ratio of 1.6 female to 1 male) and though the sex ratio fluctuates slightly through time, there have always been more females than males on the beach, at least since 1961 (n=144). A skewed sex ratio for white-beaked dolphins has been recorded elsewhere in the North Sea as well (e.g. 1.2 female to 1 male in British waters (Canning et al. 2008)). The reason for this is unknown. Interestingly, a skewed sex ratio was found in fetuses of the related dusky dolphin (*Lagenorhynchus obscurus*) in Peru (1.3 female to 1 male; Van Waerebeek & Read 1994). There is no information on sex ratio in fetuses of white-beaked dolphins. A skewed sex ratio of up to 1 male : 13 females for dusky dolphins in New Zealand was explained as a seasonal effect: females with young were said to keep closer inshore than males (Würsig et al. 1997, Harlin et al. 2003). The latter seems a less likely explanation for the Dutch situation though, since the calving season of white-beaked dolphin is summer while most of the strandings on the Dutch coast take place in

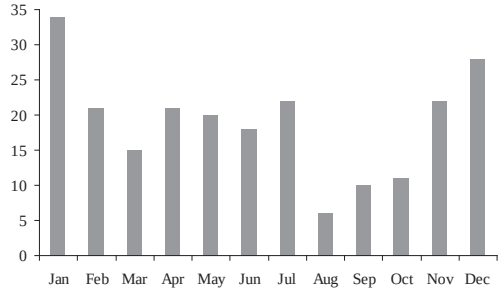

Figure 7. Total number of white-beaked dolphins per month since the first stranding in 1886, up to and including 2014 (*n*=228).

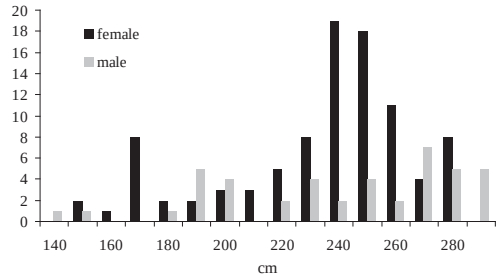

Figure 8. Size distribution of stranded male and female white-beaked dolphins in the Netherlands, 1886-2012, *n*=147.

winter, and first-year calves, with an estimated length below 170 cm (cf. Galatius et al. 2013; calves measure 110-125 cm at birth) are rare among the stranded animals (two males from July and October, three females from July, November and December; figure 8).

In our sample there is no difference in length between the sexes (females 237.7 cm (*n*=94), males 238.2 cm (*n*=53)), but the largest individuals were males (longest female 285 cm, longest male 297 cm, with five males exceeding 285 cm). The maximum length reached by females is about 270 cm, so the high number of females measuring 240-270 cm (51%, *n*=48) indicates that these involved mature individuals. According to the model presented in Galatius et al. (2013), this length is reached at about eight years of age. White-beaked dolphins can live over thirty years. A similar length distribution pattern would be expected for males; the absence of a distinct peak is therefore possibly caused by the smaller sample size.

Killer whale (*Orcinus orca*)

2008-2014: 4 records
2000-2007: 0 records
before 2000: 27 records

12/9/2009 Scheveningen, Zuid-Holland. Skull only, kept in private collection.

22/6/2010 Lauwersoog, Friesland. Female, captured alive, 350 cm (estimated), weight unknown. Kept in captivity (nowadays on Tenerife, Canary Islands, Spain). Reported by K. Kruijer and N. Osinga.

25/6/2013 Texel, Noord-Holland. Male, lower right mandible, 40 cm (measured). Reported by J. Waverijn and A. Oosterbaan.

11/8/2014 Noordwijk, Zuid-Holland. Lower right mandible, 75 cm long (measured). Kept in private collection.

Remarkably, three subfossil killer whale remains were found during this period. See http://tinyurl.com/ova2jzy and http://tinyurl.com/pvp6rj4 for information on the lower mandible found on Texel. The skull found in the surf zone at Scheveningen was not very recent, but the whale, considering its state, likely died somewhere nearby during the early twentieth century. All mentioned killer whale remains are kept by the respective finders.

On 22 June 2010 a living 'large dolphin or small whale' was reported in the (shallow) Dutch Wadden Sea just north of Lauwersoog, Friesland. It was the 29th for the Netherlands and the first 'complete' one in 47 years: the previous killer whale in Dutch waters concerned a female of about 500 cm washed ashore on 18 October 1963. The calf from 2010, the 13th for the Wadden Sea area, did not actually wash ashore, but more or less floated around

Figure 9. This living striped dolphin superficially resembles the common dolphin depicted in figure 4. It is however easily identified by the dark stripe from the eye across the flank to the tailstock, and the characteristic broad blue-grey stripe above it, which divides halfway between the eye and the dorsal fin, with the upper part pointing towards the dorsal fin. 31 March 2010, Vlieland. *Photo: Folkert Janssens.*

close to the dike. It was captured on 23 June, brought to SOS Dolfijn at the dolphin park Dolfinarium Harderwijk, Gelderland, where it recovered, and subsequently to Loro Parque on 29 November 2011, a dolphin park at Tenerife, Canary Islands, Spain, where a pod of killer whales lives in captivity. Once arrived in Loro Parque, research performed by an international team of scientists showed that her hearing is severely impaired, meaning that she would probably never had been able to communicate normally with her relatives or other conspecifics, and would never have been able to hunt for herself, nor to navigate (K. Lucke, personal communication).

Striped dolphin (*Stenella coeruleoalba*)
2008-2014: 1 record
2000-2007: 2 records
before 2000: 6 records

31/3/2010 Beach at north-east side of Vliehors, Vlieland, Friesland. Sex and weight unknown, 170 cm (estimated). Stranded alive, refloated. Reported by F. Janssens.

A striped dolphin stranded alive on the Wadden Sea island Vlieland (figure 9). It was lively and looked unharmed, except for some light scarring on the left flank and a small bruise on the lower jaw, possibly from wriggling in the shallows or from being tossed around in the surf. It was refloated three kilometres offshore in the North Sea, where it swam away. Five days later, on 4 April, a jumping dolphin was seen from the beach of Vlieland by Jan Koning, but information on this sighting is lacking, so it remains unknown whether this concerned a (or the same) striped dolphin. The stranding constituted only the ninth record of this southern and pelagic species for the Netherlands. Surprisingly, four (possibly five) out of nine striped dolphins found in the Netherlands stranded alive. Also in Scotland, just over half – 29 out of 52 – were live strandings (Santos et al. 2008). In the United Kingdom, sightings and strandings occur increasingly further north along the coast, thought to be indicative of a changing climate (MacLeod et al. 2005). An increase in numbers obviously causes an increase in chance of stranding, but does not elucidate the reason for live stranding. The first record for the Netherlands concerned a male near Delfzijl, Groningen, as recent as 17 April 1967. Although numbers in the Netherlands are not high, all excepting the first were found after 1986 (one in 1987, four in the 1990s, three since 2000).

Bottlenose dolphin (*Tursiops truncatus*)
2008-2014: 6 records
2000-2007: 1 record
before 2000: 338 records (largely incomplete)

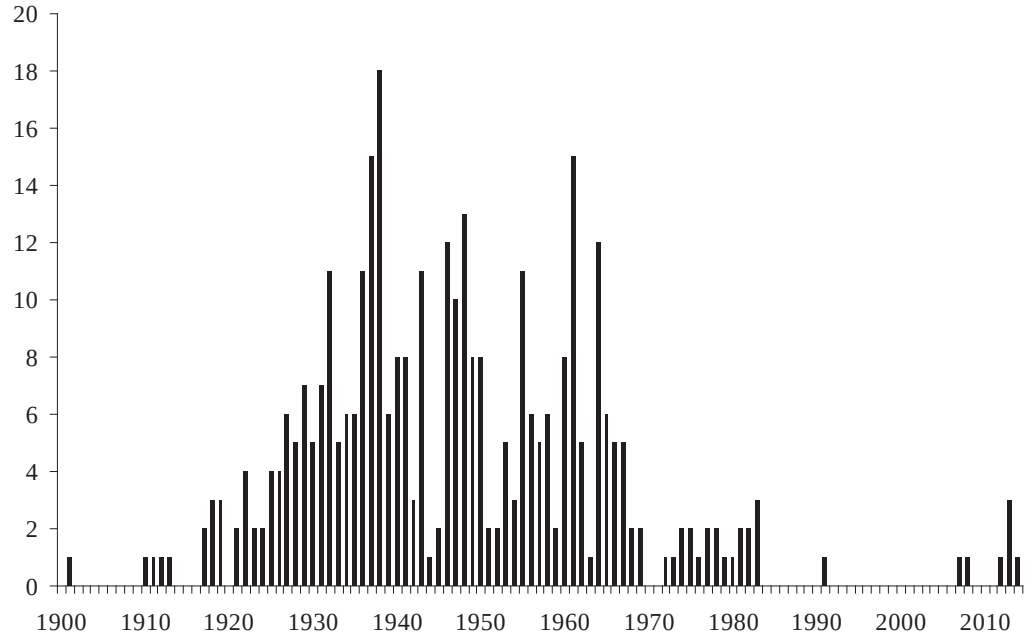

Figure 10. Stranding pattern of bottlenose dolphin between 1914-2014 (*n*=353).

26/11/2008, Terschelling, Friesland. Skull. Reported by Persbureau Ameland, H. de Jong and D. Visser. Probably in private collection.

14/4/2012 Vlieland, Friesland. Lower left mandible, in private collection.

29/1/2013 Ameland, Friesland. Vertebrae, in private collection.
20/4/2013 Texel, Noord-Holland. Single vertebra, in private collection.
27/6/2013 Krabbendijke, Zeeland. Female, 266 cm (measured), 196.5 kg (measured). Fresh, complete, probably live stranding. Entire skeleton and tissue collected (RMNH.5000093).

0/8/2014 Terschelling, Friesland. Lower right mandible, 42.5 cm (measured). In private collection.

The only record of a complete bottlenose dolphin in 2008-2014 was a fresh female on 27 June 2013. It was seen alive in the area since 18 June 2013 before it stranded. Although dead when found, the body was warm and the internal parasites were still alive, so it died nearshore or on the beach. This single sighting in seven years is in stark contrast with the numerous strandings of this species in former times (figure 10).

Harbour porpoise (*Phocoena phocoena*)

2008-2014: 4346 records*
- 2008: 345 records
- 2009: 500 records
- 2010: 437 records
- 2011: 872 records
- 2012: 746 records
- 2013: 873 records
- 2014: 573 records

2000-2007: 1846 records

* The numbers presented here are the numbers at the time of writing. Especially those in recent years are regularly corrected due to e.g. individuals double-counted or missing from the database (see also: http://tinyurl.com/h5y2y3u; viewed 22 November 2016).

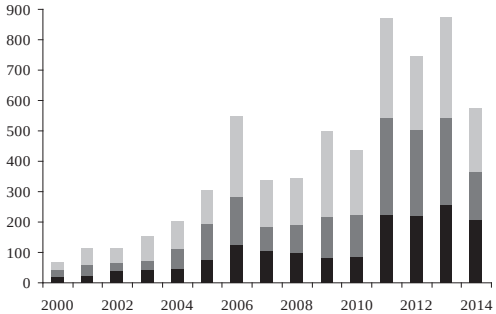

Figure 11. Number of dead harbour porpoise in 2000-2014 along the Dutch coast (walvisstrandingen.nl, *n*=6192). Light grey = Wadden Sea, dark grey = mainland, black = Delta.

before 2000: 2307 records (largely incomplete)

Still higher numbers

In their review of cetaceans stranded during 1998-2007 Camphuysen et al. (2008) extensively reported on the presence of living and dead harbour porpoise. Early in the twentieth century the species was so common in the Dutch part of the North Sea, Wadden Sea and IJsselmeer that records on strandings were only collected opportunistically (e.g. van Deinse 1931). Porpoises strongly decreased from the 1950s onwards, and increased again since the late 1980s, with a particularly steep increase since the early 2000s, clearly reflected in the strandings pattern (figure 11). During 2008-2014, dozens were reported per month, and hundreds per year. The year 2006 saw a (then) unprecedented high number of 546 dead harbour porpoises (Camphuysen et al. 2008 mentioned 539, but a few more records have been received since). Yearly numbers in 2008-2014 were higher still, in line with the increase of the species in the southern North Sea since 1994 (trektellen.nl, Hammond et al. 2013).

Numbers per subarea

Most dead porpoises have been reported from the Wadden Sea area (table 1, table 2, figure 12), as expected, because from the three geographical subareas the Wadden Sea has the longest coastline. A significantly higher proportion is reported from the (sandy) North Sea side of the islands than from the (mainly muddy) Wadden Sea proper. The density of 0.6 dead porpoises per km per year for the entire Wadden Sea area is greatly influenced by the low density in the Wadden Sea itself, as the average density on the sandy shores is 1.9. This is notably higher than the average on the mainland coast, which in turn is higher than the density in the Delta.

On the narrow sandy beach of the mainland coast, no dead porpoise goes unnoticed, although it may not be reported. In the Delta area, higher densities are noticed on Walcheren, Schouwen and Goeree, and overall reporting rate is very high due to a tight and

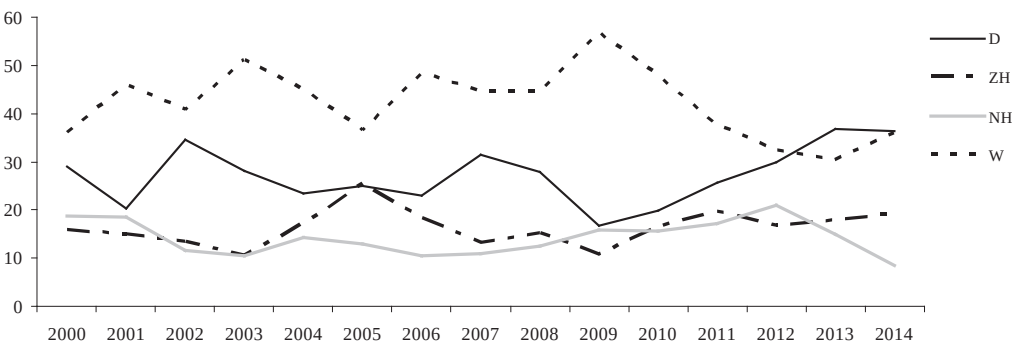

Figure 12. Proportion of dead harbour porpoise in four subareas, 2000-2014. In this graph, subarea mainland coast has been subdivided per province (NH and ZH). W = Wadden Sea, NH = Noord-Holland, ZH = Zuid-Holland, D = Delta area. See table 1 for numbers.

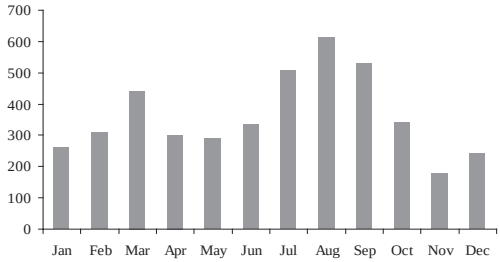

Figure 13. Cumulated number of dead harbour porpoise per month for 2008-2014 (*n*=4346).

well-kept local network. The high reporting rate in this area is explained by the narrow sandy beaches on these former islands. The stranding rate is higher in these areas because of their exposed (more westerly) position. The beach of neighbouring Voorne, for instance, is sandy as well, equally narrow, equally well visited, and stretches for only nine km, but lies hidden behind Schouwen from the prevailing south-westerly wind. The sandy coast of adjacent protruding Maasvlakte, a well-exposed artificial sand spit, is less visited, which is reflected in a lower average per kilometre.

Numbers per month

Data per month are fluctuating, but show two distinct peaks: the largest in July-September (37.9% of the total) and a smaller one in March (10.2 %, figure 13). It largely resembles the yearly recurrent pattern (see also: Camphuysen et al. (2008), who found a comparable pattern over 1998-2007). The stranding pattern however may vary considerably if single years are considered (e.g. in 2009 the spring peak started in February; in 2013 the spring peak was higher than usual and lasted until May; in October 2008 a second large peak occurred, after a low in September 2008). A true 'mass stranding' occurred in 2011, when mainly rotten carcasses washed ashore from late June until late September, with monthly numbers reaching three times those of the long-time average. The peak moved like a wave along the coast from south to north and also reached the Wadden Islands. Although the strandings network was alerted and a total of 355 carcasses was collected for research, the cause of the mass stranding has until now not been elucidated.

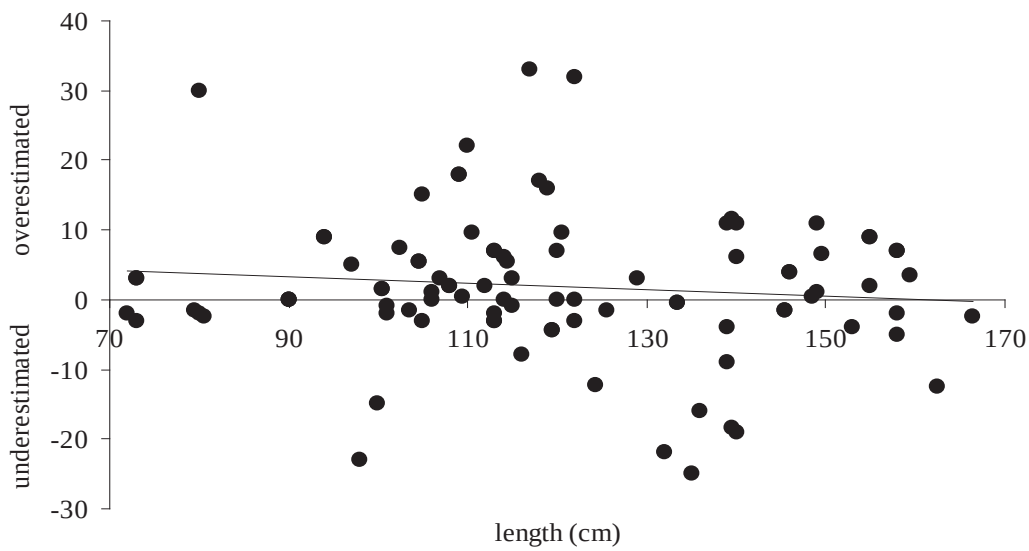

Figure 14. Deviation of length (in cm, y-axis) of harbour porpoise measured or estimated on the beach by various people, and subsequently measured at the Faculty of Veterinary Medicine of Utrecht University (*n*=99). The equation of the line is y=-0.0524x + 8.1029, r^2 = 0.0167

Length
From 64.0% of the porpoises total length was reported. Although some corpses were not measured but estimated, length estimates appear to be fairly reliable (figure 14). Although estimates, or even measurements, on the beach may deviate as much as 33 cm, 58% lies within 5 cm of the true length, and 79% within 10 cm (correct length is considered the length measured during autopsy at Utrecht University). Size is a rough indication of age: those smaller than 90 cm are generally called juvenile, those from 91-130 cm immature, and larger ones sexually mature (M. Addink, personal communication). The size classes (age categories) seem to be fairly similarly distributed along the entire coast (table 1). Neonates make up 13.5% of the total number of strandings, comparable to that in 1998-2007 (12%), and the amount of immatures during both study periods was similar (72% *versus* 63%, chi-square test with Yates' correction, chi^2=0.079, *P*=0.78). There seems to be a gradient in the number of neonates reported along the coast, which, if mortality would be the same in all subregions, could be an indication for more young to be born (or more young dying) in northern waters. Geelhoed et al. (2013) observed calves both off the mainland coast, off Texel, and in the Dogger Bank area, but not in the Delta area; note however that their study covered only one month in a single year, July 2010. (Also in the summers of 2014-2015 aerial surveys have been performed, but the reports (Geelhoed et al. 2014, 2015) do not mention the distribution of the calves in those years.) Dead adults were also slightly more common in the north than in the south. In the past this has not been analysed.

Sex ratio
A total of 2171 individuals was sexed (50.4%), either on the beach, afterwards from photographs, or during autopsy. Almost 1 out of 10 porpoises turned out to have been sexed wrongly (9.9% out of a sample of 91), even by regular observers. Some mistakes are corrected afterwards, if the record is accompanied by photographs showing the ventral side. However, mistakes are made 'both ways' (six males reported as female, three females reported as male), and it is considered unlikely that these will greatly influence the overall picture. The percentage of males fluctuates between years, for instance during the present study period from 53.2% in 2010 to 65.9% in 2013, but there is always preponderance of males (58.2% on average). Interestingly, the percentage of males decreases from south to north (table 1; GLM with binomial distribution and logit link, F1,2175=15.83, *P*<0.001). Camphuysen et al. (2008) noticed a similar trend, although it was not significant during their study period. Both juveniles (64.4 %, *n*=191) and immatures (61.2 %, *n*=1161) had a male-biased sex ratio, but it was reversed in adults (41.5 %, *n*=451; age categories estimated from length, see below).

Causes of death
A major cause of death is by-catch, during the period discussed here to be calculated at 14-20% (*n*=902; Begeman et al. 2013, IJsseldijk & Gröne 2015). Other causes of death are infectious disease (11-35%) and emaciation (13-20%) (Wiersma & Gröne 2009, Begeman et al. 2010, 2011, 2012, 2013, IJsseldijk & Gröne 2015), while starvation (3-9%) is mainly seen among neonates. However, a large category of over 40% remains of which the cause of death could not be established, for instance because the collected corpses were too decomposed to be properly evaluated.

Other comments
Three remarkable strandings have come to our knowledge during this reporting period:
- on 2 March 2008 a harbour porpoise became trapped on a flooded meadow during extreme high tide near Paesens, Friesland. It was swimming around in the still flooded but very shallow water on the meadow, trying to find a way out. The observer went into the water and

caught it by hand. The animal looked fit and healthy and was released into the Wadden Sea (R. Cazemier, personal communication);
- on 27 December 2009 a harbour porpoise stranded alive near the pier of Holwerd, Friesland, during low tide. It stayed on the mudflat until it refloated during the next rising tide and swam away apparently unharmed (lauwersmeer.com);
- three dead harbour porpoises were reported from Grevelingenmeer, Delta area (on 27/3/2003, 5/8/2014 and 3/9/2014), the largest salt water lake in Europe. The lake was completely closed off from the North Sea during 1971-1978 and slowly turned into a fresh water lake. Although only a single harbour porpoise is supposedly present in this area (J. van der Hiele, personal communication), some harbour porpoise apparently occasionally sneak in since the opening of the sluices in 1978. It is interesting to see whether this area will also be, or turn into, an ecological trap, as has recently been described for nearby Oosterschelde (Jansen et al. 2013).

An exceptional case of a twin foetus was found during dissections in the uterus of a female found in March 2011 (IJsseldijk et al. 2014b). Cetaceans give birth to a single young only, and twinning in Phocoenidae has been described only once before (Nakamatsu 2001).

Sperm whale (*Physeter macrocephalus*)

2008-2014: 5 records
2000-2007: 4
before 2000: 57

16/4/2011 Rottumeroog, Groningen. Subfossil lumbar vertebra, kept by finder. Reported by H. Mellema, T. van Nus and E. Kompanje.
3/11/2011 Stellendam, Zuid-Holland. Male, 1400 cm (estimated). Live stranding, swum away. Reported by the press.

15/12/2012 Razende Bol, Noord-Holland. Male, 1500 cm (estimated), weight 26,800 kg (weighed). Fresh, complete. Entire skeleton, tissue, parasites and ambergris collected RMNH.5000068a-c and Ecomare B2-150. Reported by K. Kooimans.

Figure 15. Lower jaw of the sperm whale from Terschelling, 29 July 2013. The teeth were initially thought to be malformed, which in turn was assumed to have been caused by the broken jaw. Recently though, stranded sperm whales with normal jaws also showed these peculiar teeth. *Photo: Bas Perdijk.*

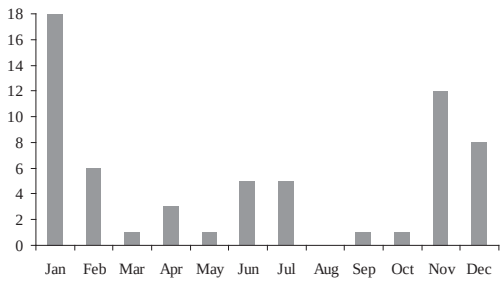

Figure 16. Strandings of sperm whales per month, 1306-2014 (*n*=61).

29/7/2013 easternmost tip of North Sea beach of Terschelling, Friesland. Male, 1350 cm (measured), weight 31,000 kg (measured). Live stranding. Entire skeleton and tissue collected (RMNH.5000152.a-e). Reported by J. Stokroos. Figure 15.

25/6/2014 between Wassenaar and Scheveningen, Zuid-Holland. Sex, length and weight unknown. Rotten. Tissue and neck vertebrae collected (RMNH.5069793). Reported by A. de Schelpenvisser and K. Kooimans.

The sperm whale at Stellendam from 3 November 2011 got stuck in a gully nearshore. Thanks to the incoming tide, and with a little help from ships, it was able to struggle free and to find its way back to deeper water. Since it was impossible to get good photographs of the tail, we will never know whether the sperm whale that stranded on 17 November 2011 on the German Wadden Sea island Pellworm concerned the same individual.

The sperm whale from Razende Bol on 15 December 2012 got much less attention than stranded sperm whales usually get, because it stranded close to a humpback whale that got ashore on 12 December and was still alive on the 15th. Even though this sperm whale was the 65th for the Netherlands, it was unusual in that its stomach contained a large amount of ambergris (supposedly 83 kg). The stomach further contained a large amount of squid beaks from the following species: *Gonatus fabricii*, *Haliphron atlanticus*, *Histiotheutis bonellii*, *Teuthowenia megalops* and *Todarodes sagittatus*.

The next two sperm whales were equally notable, because both stranded in summer. The first of these (Terschelling, 29 July 2013) stranded alive. Attempts to refloat it failed, and it died within a few hours (see: http://tinyurl.com/neah2qd for video footage). Its lower mandible was shorter than usual and the tip had been broken off in the past, while the teeth were possibly malformed (figure 15). This whale was well-fed, but its stomach virtually empty: it only contained remains of rose fish (*Sebastes marinus*), pollack (*Pollachius pollachius*), blue whiting (*Micromesistius poutassou*) and lumpsucker (*Cyclopterus lumpus*) (M. Leopold, personal communication). These seem unusual prey for a sperm whale and may have been taken because normal foraging was hampered by the shortened jaw.

The sperm whale from 25 June 2014 was spread out over several kilometres of beach; identification on basis of the neck vertebrae was confirmed by DNA-analysis.

Most sperm whales strand in winter (62.3% in November-January, figure 16); strandings in summer are uncommon, but, as the figure shows, strandings can be expected in any month. August is up till now the only month in the Netherlands without any records.

Sowerby's beaked whale (*Mesoplodon bidens*)

2008-2014: 4 records
2000-2007: 1 record
before 2000: 16 records

8/8/1957 Veere, Walcheren, Zeeland. Sex and weight unknown, estimated 300 cm. Probably fairly fresh, skeleton probably lost. Reported by J. van der Hiele.

4/10/2009 Maasvlakte, Zuid-Holland. Sex and weight unkown, 450 cm (estimated). Stranded alive, refloated. Reported by H. Klein.

18/7/2010 Egmond aan Zee, Noord-Holland. Male, 446 cm (measured; see below), 1090 kg (measured, see below). Stranded alive, refloated. Reported by Egmondse Reddingsbrigade.

10/8/2011, Ameland, near beach pole 16, Friesland. Only single vertebra, kept by finder. Reported by J. Krol.

18/7/2013 Schiermonnikoog, near beach pole 9, Friesland. Female, 366 cm (measured), weight unknown. Stranded alive. Entire skeleton and tissue collected (RMNH.5000154.a-c). Reported by A. Talsma, K. Tuinenga en D. Dijk.

Beaked whales are notoriously difficult to identify, especially in the field, but also on the beach. Adult males are easiest to name, based on the position of the teeth in the lower mandible.

Recently, Jaap van der Hiele came across a picture of a Sowerby's beaked whale published by Midavaine (1996). It had been published previously in a local newspaper (Anonymous 1957), but had remained invisible to cetacean investigators until now, aptly suiting the species. This whale beached near the Campveerse

tower in Veere, Walcheren, on 8 August 1957. A severe cut of about twenty centimetres on the head was mentioned ('perhaps caused by a ship's screw'), but whether this was (suspected to be) the cause of death was not indicated. The weight was estimated at 800-1000 kg, the length 300 cm. The body was disposed of; only a flipper was collected by a tourist, but its whereabouts are presently unknown. This Sowerby's was at the time the eleventh record for the Netherlands.

The beaked whale that stranded alive on Maasvlakte on 4 October 2009 was found by surfers and refloated as quickly as possible. Luckily it was photographed, so it could be identified as beaked whale (*Mesoplodon* sp.). Teeth are not visible, but identification was clinched on basis of the shape of the head and the length of the individual. Since the underside was not photographed, the sex was not established.

On 18 July 2010 a mirror-case to the one on Maasvlakte occurred at Egmond aan Zee, where an unidentified beaked whale stranded alive and was refloated immediately. It had a piece of plastic in its blowhole, which was removed. Although it was photographed and videod, it could not be identified since the pictures were taken from a distance and the head was not visible. Four days later, on 22 July 2010, a freshly dead beaked whale stranded in Seasalter, Kent, South-east England. It was photographed, measured, collected and autopsied. Good photographs were now available, and some stills could be fabricated from a video from the Egmond individual. The whale turned out to be the same individual, with the pictures convincingly showing the matching scarring. The sex was now determined, as were weight and measurements (see above). No other cause of death than 'live stranding' could be established. Pictures of the whale at Egmond and in England, where the scarring is compared, can be viewed on tinyurl.com/z39r8dd and tinyurl.com/noh6zkt.

The third Sowerby's beaked whale that stranded alive during this period was found on Schiermonnikoog. It died soon after finding. The lungs contained a lot of sand, probably inhaled during prolonged rolling in the surf. The cause of stranding remains unclear. The stomach was empty.

Of the twenty strandings of this species in the Netherlands, only three happened outside the period July-September (February, October and December). Until now six have stranded alive, of which four females and one male.

Unidentified cetaceans

Small whale

4/9/2010 Rottumerplaat, Groningen. Rotten, incomplete, sex and length unknown. Vertebrae in collection of Natuurmuseum Fryslân (Frisian Natural History Museum). Reported by J. de Boer.

3/5/2013 Vlieland, Friesland. Single rib, in private collection.

A carcass of a small whale was found on the uninhabited island Rottumerplaat, east of Schiermonnikoog, on 4 September 2010. The skull was missing and identification on the spot proved impossible. A shoulder blade was reportedly collected by Zeehondencrèche Pieterburen, but is presently missing. The whale was initially identified from the pictures as 'definitive long-finned pilot whale (*Globicephala melas*)', but later on, on basis of a single tail vertebra, as 'probably a baleen whale' (E. Kompanje, P. Koomen & A. Oosterbaan in litt.). It was not the minke whale found on Schiermonnikoog in June 2010 (see above).

Dolphin

7/1/2010, beach pole 0, Terschelling, Friesland. Length 150 cm (estimated), sex unknown. No information on completeness or decomposition state. Destructed or locally buried. Reported by H. Wiegman and Zeehondencrèche Pieterburen.

1/1/2012 Zandvoort, Zuid-Holland. Part of right lower mandible, in private collection.
17 September 2012 Wassenaar, Zuid-Holland. Complete left lower mandible, in private collection.

6/5/2013 Wadden Sea southwest of Terschelling, Friesland. Condition unknown. Reported by MS charter Mermaid through Diny Dijk RWS.

From the dolphin from Terschelling in January 2010 no details are known, no photographs were made and no bones were collected. The finder is familiar with harbour porpoise.

The dolphin of May 2013 was found floating in the Wadden Sea southwest of Terschelling. The reporter was familiar with harbour porpoise, and this individual was 'definitely much larger', although no length estimate was given. No photos were taken and the individual was not collected.

White-sided / white-beaked dolphin *(Leucopleurus acutus / Lagenorhynchus albirostris)*

16/9/2010 Texel, Noord-Holland. Sex and weight unknown, 210 cm (measured). Rotten, incomplete, not collected. Reported by S. de Wolf.

The dolphin stranded on Texel in September 2010 was reported as white-beaked dolphin, but was transported to a destruction centre without being photographed and without any parts being collected, failing us with the correct specific name, as e.g. white-sided dolphin could not be excluded.

Discussion

The total number of 13 cetacean species recorded over 2008-2014 is high for the Dutch part of the North Sea, considering the waters are shallow and sandy; most of these species prefer deep water. Basically only minke whale, white-beaked dolphin and harbour porpoise can be considered to be regular guests, albeit offshore. Nevertheless, also during the previous ten years a large number of species was reported (15; Camphuysen et al. 2008). Although 24 species have been recorded in the Netherlands thus far, the average number of species washing ashore per year since 1950 is only four (walvisstrandingen.nl) and, indeed, in most years (58%) only 3-4 species are reported. Up to and including 2014 there have been only four years with seven species, of which three after 2000 (1935, 2006, 2010, 2011), while in 2014 even nine species were found. Consequently, there is a slight (but not statistically significant) increase in average number of species: 3.5 in 1985-1994, 4.2 in 1995-2004 and 6.2 in 2005-2014 (figure 17).

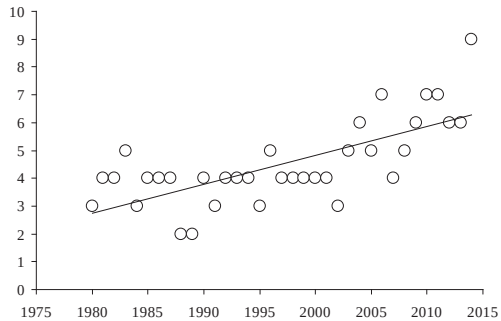

Figure 17. Number of stranded cetacean species in the Netherlands, 1980-2014 (r^2 = 0.499).

More and more photographs are taken of stranded cetaceans. Pictures have turned out to be very important for validating: not only do they substantiate a record, they also sometimes offer the possibility to (re-)identify the species afterwards, provide information on the state of the carcass, on the sex, and on specific marks and wounds. The majority of photographs is shown on walvisstrandingen.nl and together build an important archive. A striking example are those of a 'harbour porpoise' found on Maasvlakte on 26 December 2009: the photographs attached to the e-mail showed a fresh white-beaked dol-

Figure 18. Badly damaged harbour porpoises are now thought to have died from grey seal predation. Characteristic are the sharp cuts and the scratches on the body, the latter caused by the seal's nails. Note however that porpoises feeding on pelagic fish are attacked from a different angle, and thus show different wounds than this one; this porpoise, with the so-called zigzag pattern, had been feeding on demersal fish (gobies) when attacked. Scheveningen, 23 March 2014. *Photo: Huib den Heijer*.

phin. Another example are the photographs from walvisstrandingen.nl used by Leopold et al. (2015) to evaluate patterns of attack and estimate mortality rate inflicted by grey seals (*Halichoerus grypus*) (see below). Nevertheless, it is important to collect (parts of) the skull and/or skeleton for other purposes, like for instance DNA extraction for post hoc identification.

Camphuysen et al. (2008) discussed the strandings pattern of harbour porpoises along the coast over a period of ten years, and by comparing densities concluded that at least four out of fifteen subregions were under-recorded. However, physical features of the coast are probably more important than previously thought: it has been shown repeatedly that strong and onshore winds cause a rise in dead harbour porpoises washing ashore (see for instance: the monthly and yearly reviews on the news page of walvisstrandingen.nl). The beach of Zeeuws-Vlaanderen on a sunny day is just as crowded as that of, for instance, the mainland coast, and a dead cetacean is soon found and readily reported. Hence, low densities from some areas, notably Zeeuws-Vlaanderen and Voorne, considered too low by Camphuysen et al. (2008), are more likely caused by their exposure, while others, such as the eastern Wadden Sea islands and Maasvlakte, but also the extensive shores of the Westerschelde, are definitely under-recorded. Apart from that, strong and onshore winds cause a rise in dead harbour porpoises washing ashore (see for instance the monthly and yearly reviews on the news page of walvisstrandingen.nl), a phenomenon independent from the yearly pattern (Peltier et al. 2013). It seems as if there is an endless stock of dead harbour porpoises floating offshore; we are only becoming aware of it with onshore wind. To properly evaluate differences in coastal subareas, a more in-depth study would be necessary.

The recurrent seasonal pattern of harbour porpoise strandings, with peaks in spring and autumn, was only vaguely visible in the 1990s and early 2000s, and has become pronounced due to larger numbers. The cause of this pattern is still not understood, but possibly both reflect north-south migration (e.g. Geelhoed et al. 2013), as well as inshore-offshore movement. A downward trend in stranded numbers immediately after 2006 was noticed after the strong increase since the late 1990s, and raised speculation on a decline of harbour

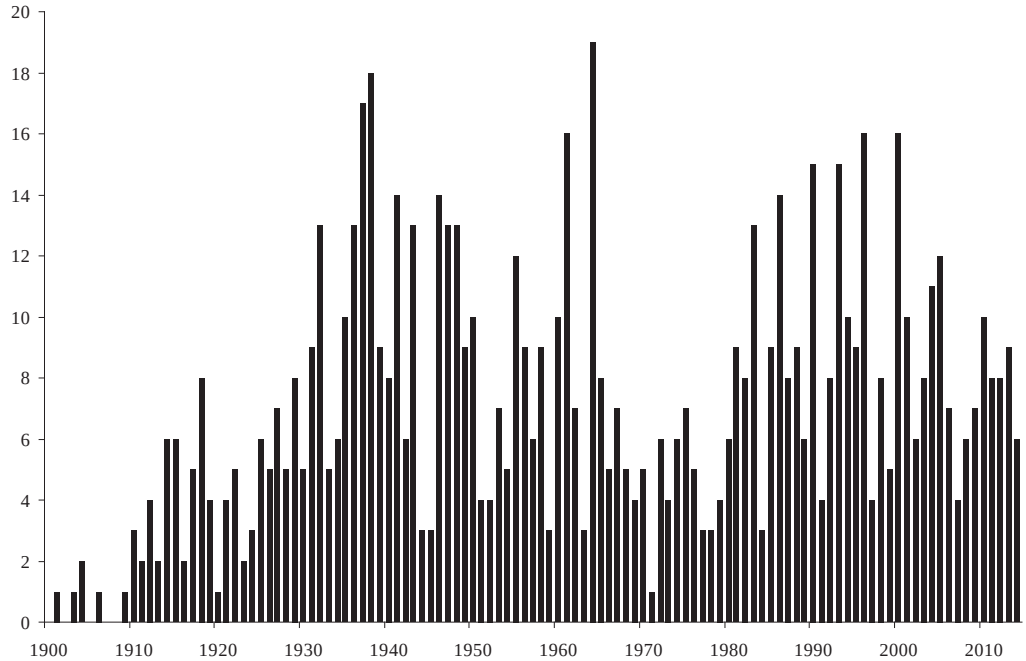

Figure 19. Total number of stranded cetaceans per year in 1900-2014 without harbour porpoise, but including unidentified whales and dolphins (*n*=799).

porpoises in the Dutch part of the North Sea (Camphuysen 2008, Camphuysen et al. 2008). The increase of the number of dead harbour porpoise after 2008, and the decrease since 2013, however shows that the numbers have again fluctuated strongly since 2006 (cf. Haelters & Geelhoed 2015), and that long time series are needed to properly evaluate trends.

With respect to causes of death during 2008-2014, results from during 2008-2014 deviate strongly from those in previous periods (Begeman et al. 2013, IJsseldijk & Gröne 2015): harbour porpoise carcasses ripped apart were until recently allegedly damaged by fishermen (e.g. Camphuysen & Oosterbaan 2009, Begeman et al. 2011) or sand dredgers (Oudenaarden 2012, Leopold et al. 2013). Hence, the percentage of harbour porpoise having drowned in fishing nets was estimated to be 50% or even higher (e.g. Camphuysen & Siemensma 2011). Research however has shown the grey seal to have become an increasingly important predator of harbour porpoise since 2003 (figure 18; Haelters et al. 2012, van Bleijswijk et al. 2014, Leopold et al. 2015): grey seals – probably adult males only – are now thought to be responsible for mutilated porpoise carcasses.

The number of dead cetaceans on the Dutch coast keeps on rising, caused exclusively by harbour porpoise. If the total number of stranded whales and dolphins without harbour porpoise is considered since 1900, it is obvious that all other species are infrequent visitors at best: only twelve years exceed fifteen individuals per year (figure 19). The period with many strandings, from the mid-1930s until the mid-1960s, reflects a time when the Netherlands still harboured an indigenous population of bottlenose dolphin, while during that same period common dolphins made a brief but regular appearance; both species were repeatedly found on the beach during that time. Figure 19 also reflects

the marked influence of A.B. van Deinse, who started registration of dead cetaceans in 1914. During the first years, he still had to build his network, visible by slowly increasing numbers, while his death in 1965 is also visible: there is a gap with few records in the late 1960s and early 1970s. The increase in numbers from the early 1980s onwards is especially due to white-beaked dolphin being relatively numerous.

The study of dead cetaceans found on the Dutch coast is needed to gain more knowledge on the current state of the population (cf. Pierce et al. 2015), and this goes especially for harbour porpoise. About one-third of the world population of this species is said to occur in the North Sea (Hammond et al. 2008, 2013), and all bordering countries, having ratified the ASCOBANS-agreement, have an obligation to protect it. Wild animals die of natural causes in any population, and since porpoises have increased in the southern North Sea in recent times, more individuals washing ashore could be expected. However, every year a number is proven or suspected to have died of non-natural causes, be it fisheries, pollution, or underwater noise. A review showed that 38-52% of harbour porpoise in the Netherlands probably drowned after being accidentally by-caught during fishing activities (Camphuysen & Siemensma 2011), but this figure now seems to be reduced by more than half, because casualties from grey seal attacks were not recognised as such.

Although harbour porpoise in declined in Dutch waters since the Second World War (Viergever 1955, van Deinse 1956), the pollution during the 1960-1970s no doubt took its toll on cetaceans as well, particularly by toxic organochlorine pesticides (e.g. Koeman 1971), which in Dutch waters caused a crash in marine piscivorous bird populations and common seal (*Phoca vitulina*) (e.g. Reijnders 1980, Brenninkmeijer & Stienen 1992). The situation has improved from the 1980s onwards, but neither population of common or bottlenose dolphin returned. The fact that harbour porpoises have returned could be a positive sign. It could equally fill us with concern, as the marine environment gets more and more crowded by human traffic and construction and is still not healthy and safe for marine mammals; it has even been suggested that the increase of harbour porpoise in the southern North Sea is caused by a shift from more northern waters, induced by increased fisheries (e.g. Hammond et al. 2013). Hence, persistently registering top predators, like whales on the beach, is an important tool for monitoring the marine environment (Pyenson 2011). Compiling reviews like this one requires a solid network of people reporting stranded cetaceans. The dip in the late 1960s in figure 19, after the death of van Deinse, is a clear illustration of the energy that should be put into keeping an efficient network. Virtually all people presently reporting dead cetaceans on a more or less regular basis are volunteers. They spend time patrolling the beach, report the animals, and often collect them as well, either to send them to destruction facilities or transport them for further research. Support of this network should be endorsed by governmental agencies.

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Samenvatting

Gestrande walvisachtigen op de Nederlandse kust in 2008-2014

In de jaren 2008-2014 zijn in totaal 4406 walvisachtigen dood of levend op de Nederlandse kust gevonden, behorend tot 13 soorten. Het meest bijzonder waren bultrug (drie exemplaren, de vierde tot en met de zesde vondst), witflankdolfijn (twaalfde), orka (28e, maar de eerste sinds 1963), en gestreepte dolfijn (negende, maar al de vierde of vijfde die levend is gestrand). De bultrug van augustus 2010 moet, berekend aan de hand van de flipper, ongeveer 4,5 meter lang zijn geweest; deze lengte past bij een pas geboren bultrug, wat er op wijst dat dit jong waarschijnlijk in of vlakbij de zuidelijke Noordzee geboren is. Alle zes in deze periode gemelde gewone vinvissen zijn zeker of hoogst waarschijnlijk op de boeg van een schip aangebracht, en hetzelfde geldt voor twee (van de vijf) dwergvinvissen. De andere soorten zijn gewone dolfijn (1), griend (1), witsnuitdolfijn (14), tuimelaar (6), bruinvis (4346), potvis (5) en gewone spitssnuitdolfijn (1). Alle individuele meldingen in dit verslag worden genoemd, ook losse beenderen, behalve die van bruinvis. Deze laatste was de talrijkste walvisachtige op onze kust: het aantal bruinvissen bedroeg 98,6% van het totale aantal meldingen. In de besproken periode zijn de hoogste aantallen bruinvissen gevonden, met pieken tot bijna 900 exemplaren in zowel 2011 als 2013. Er zijn er in de geschiedenis van

de walvisstrandingenregistratie nog nooit eerder zo veel gemeld, hoewel we ons dienen te realiseren dat dode bruinvissen pas vanaf de jaren 1970 goed zijn bijgehouden: in het begin van de twintigste eeuw werd de soort 'te talrijk' geacht voor registratie en spoelden dus misschien wel vergelijkbare aantallen aan. De meeste zijn gemeld uit het Waddengebied; naar het zuiden toe neemt de dichtheid geleidelijk af. Het strandingspatroon in deze periode komt overeen met dat tijdens de vorige in Lutra besproken periode, 2000-2007, met pieken in maart en augustus. In juli-oktober 2011 vond een 'massastranding' van bruinvissen plaats: het totaal van deze maanden was ongeveer drie maal hoger dan gebruikelijk. Landelijk gezien is er een licht overschot aan mannetjes (58,2%, *n*=2171) en dat geldt zowel voor juvenielen (64,4%, 191; leeftijd gebaseerd op lengte) als subadulten (61,2%, 1161), maar niet voor adulten (41,5 % mannetjes, 451). De meerderheid van de aangespoelde bruinvissen is subadult (100-120 cm; 62,9%). Pasgeboren bruinvissen ('neonates'; 15,6%) worden meer uit het noorden van het land gemeld, waar ook het hoogste aandeel vrouwtjes wordt gevonden (48,9%). Het aantal levend gestrande bruinvissen beschouwd over 2005-2014 bedraagt 160 individuen (2,9% van het totale aantal bruinvisstrandingen). Het aanspoelpatroon van levende bruinvissen lijkt sterk op dat van alle bruinvissen, maar de voorjaarspiek is twee keer hoger dan de piek in de nazomer, andersom dus dan voor alle strandingen. Ook spoelen er wat meer levende vrouwtjes aan (55,7%), met name in maart (68%). Zwangerschapsproblemen liggen echter niet voor de hand, want verreweg de meeste levend gestrande bruinvisvrouwtjes zijn subadult (88%). Door de jaren heen neemt het aandeel levend gestrande bruinvissen af. Het aandeel bijvangsten lijkt enorm te zijn gedaald sinds het onderzoek naar doodsoorzaken is gestart; dit is echter schijn, want de ernstig verscheurde bruinvissen, waarvan men eerder meende dat ze slachtoffer waren van bijvangst, blijken ten prooi te zijn gevallen aan grijze zeehonden; het aandeel bijvangst is daarmee gedaald van ongeveer 50% naar maximaal 20%. Andere belangrijke doodsoorzaken zijn infectie (11-35%) en vermagering (13-20%). Verhongering wordt vooral geconstateerd onder pas geboren jongen; vermoedelijk zijn die dan ook hun moeder kwijt geraakt.

Sinds 1980 is het gemiddelde aantal soorten walvissen per jaar gestegen, hoewel de toename niet significant is. In de discussie wordt het belang van goede documentatie (foto en/of verzamelen van skelet(delen)) van een gestrande walvis benadrukt. Registratie geeft een beeld van het huidige voorkomen, en van veranderingen daarin op de lange termijn. Bovendien is up-to-date-registratie een 'vinger aan de pols' van het mariene milieu. Zo is de plotselinge toename van de bruinvis in Nederland sinds de jaren 1980 nog altijd onverklaard, maar is het twijfelachtig of het een signaal is van een gezonde leefomgeving. Eveneens van belang is het onderhouden van het netwerk van vrijwilligers die strandingen melden, omdat zonder hen een goede registratie onmogelijk is. In totaal zijn in deze periode van 1086 personen of instanties meldingen ontvangen.

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