Stranding data of Common Seals (*Phoco vitulina*) and Grey seals (*Halichoerus grypus*) in The Netherlands between 2009 and 2013

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Summary

Stranding data of 158 common seals (*Phoca vitulina*) and 22 grey seals (*Halichoerus grypus*) were collected from February 2009 till December 2013 by Utrecht University, dept. Pathobiology. Seals were found dead on the coast line or died within 24 hours in rehab. Stranded seals were collected by rehabilitation and education center "Ecomare" on Texel and by the Institute for Marine Resources (Imares) on Texel. The number of collected seals increased from 23 in 2009 to 71 in 2013. This has no association with the population size living in the Dutch waters (common seals P = 0.177; grey seals P=0.3745). In *Osinga et al (2012)* an association between population and stranded seals was found[9].
The total monthly stranding rate for common seals peaked in January(n=20), May(n=21) and July (n=20). Stranding rate in January peaked due to more stranded adult seals (n=9). Stranding rate peaked in December(n=7) for grey seals, due to more stranded juvenile animals.
There is no significant difference between male and female stranding for both species (0.15 ≤ P ≤ 0.20; P=0.20). In the study of *Osinga et al (2012)* they found frequently more male stranding than female stranding in grey seals[9]. In this study, mainly juvenile animals (n=52/180) stranded for both species. Most common seals (n=109/158) stranded on the coast line of Texel. Most grey seals (n=11/22) stranded on the coast line of the North Sea. This is a bit strange because there are no sandbanks in the North Sea which the grey seals can haul on. A few seals (n=3) stranded at an inland location.
Certain by-catch was seen three times between 2009 and 2013. Possible by-catch was seen on an average of four cases per year, except for 2013 when there were 18 cases of possible by –catch. The average of four cases per year was seen by *Osinga et al (2012)* as well[9]. In this study, by-catch was more frequent in juvenile animals (n=17), unlike *Osinga et al (2012)* were by-catch was more frequent in subadult and adult[9]. In previous studies, *Van Haaften (1982)*, by-catch was more frequent in young animals[13].

Introduction

Between 2009 and 2013 stranded seals were collected from the island Texel, the coast line of North Holland province and the coast line of mainland Wadden Sea in the Netherlands. Animals were collected by rehabilitation and education centre "Ecomare"[i] and by the Institute for Marine Resources[ii] on Texel. The seals were dead when found or euthanized later due to poor condition or sickness. Two species of seals occur in the Dutch sea, harbour or common seals, *Phoca vitulina*, or grey seals, *Halichoerus grypus* [1]*.* The aim of this study is to compare data with previous studies to monitor continuously the stranding patterns for early detection of changes and the possibility of taking timely management actions[9].

History of the population of seals in the Netherlands

In the 20th century seals were seen as competitors to the human fishery [2] and much effort was put into developing a hunting program. In 1900 the size of the population harbour seals in the Netherlands was close to 11 500 harbour seals[3]. In 1960 only 350 harbour seals were left[3]. By the second half of the 20th century, public opinion about marine mammals changed which led to complete protection of the seals and the population of seals began to recover [2].

Nowadays, the harbour seal is quite common and the grey seal is relatively rare[1], but this was different in the past. A decrease in the population grey seals is probably caused by an increase in human inhabitation around the Wadden Sea. Humans used grey seals for food and they used their fur and skin for clothing[1]. Grey seals are easy to obtain, especially during breeding season, because the adult and young remain on the land[1].

In the first half of the 20th century, observations of grey seals were so rare that the species was not considered to belong to the Dutch fauna[1]. From 1980 the population of grey seals increased, probably because of immigration of pups from the United Kingdom, leaving the breeding ground[1]. Only the young grey seals disperse, so the assumption was made that the former pups from the United Kingdom became subadult and adult grey seals and stayed in the Dutch Wadden Sea to cause an increase of the population of grey seals[1]. It is believed that the larger the population gets, the more pups will stay in the environment and attract other immigrants[1].

Common seal

Common seals are living among the coasts of the Atlantic and Pacific Ocean[4].
Pups of common seals enter the water shortly after birth at sandy shores, often at the first high tide[5]. It is important for the pups to rapidly develop diving skills and capability to catch enough food, because they are left after 3-4 weeks by their mother[5]. Pupping season of common seals is mid-May. It used to be mid June[6].

Grey seal

The grey seal is a large seal living in the coastal seas of the temperate North Atlantic[7]. Adult seals can grow up to 2.5 meters and 350 kg, while common seals can reach up to 2 meters and 130 kg[15]. Pups of grey seals are immature and white coated. They require a permanently dry breeding habitat[7]. Grey seals breed mainly on sandy or rocky shores. The pupping season is from November until January[7]. Pups go in the water once they have lost their fur[8].

Hypothesis

In this study no significant difference will be noticed in stranding data of dead seals by geographical distribution and numbers per year in association with population size compared with previous studies[9]. Also there will be no significant difference in seasonality of stranding,

[i] Ecomare; Ruijslaan 92, 1796 AZ De Koog
[ii] Imares; Landsdiep 4, 1797 SZ Den Hoorn

gender distribution and age category compared with previous studies[9].

Materials and methods

Between 2009 and 2013 necropsy was performed on 206 wild seals of which 26 of unknown seal, 158 *Phoca vitulina*, of which 88 female and 70 male and 22 *Halichoerus grypus*, of which 8 female and 14 male. These seals were used in this study.

Dead stranded seals were collected by rehabilitation and education centre "Ecomare" on Texel and by the Institute for Marine Resources (Imares) on Texel. When carcasses were found, an examination form with stranding location and stranding date had to be filled in by the person who found the seal, before the seals were stored.
Carcasses were stored at minus 20 degrees Celsius in the freezer in Bunnik, until necropsy was performed at Utrecht University, Faculty of Veterinairy Medicine, Dept. Pathobiology.

Necropsy

During necropsy a seal necropsy rapport has to be filled in, see addendum 1. Necropsy was performed according to *Siebert et al (2007)*[10]. Animals were first washed and weighed. Species was recognized by the shape of the head. Common seals have a round shape of the head and grey seals have a flatter forehead and a larger nose[15]. On the basis of body length, from snout to tail, age was determined using table 1.

Sex was determined by the presence of genital organs. All animals were examined macroscopically and pictures of entire body, head, snout, eyes, teeth and urogenital region were taken when possible. Some of the carcasses were too putrefied or scavenged to determine anything. By-catch was determined by external observations only[9].
Blubber thickness was measured in the neck and chest to determine the nutritive code(see

species	sex	category	age (years)	body length (cm)
Phoca vitulina	male	neonate		umbilical cord present
		juvenile	≤ 1	≤ 107
		subadult	1 ≤ 4.7	107 ≤ 142
		adult	> 4.7	> 142
	female	neonate		umbilical cord present
		juvenile	≤ 1	≤ 103
		subadult	1 ≤ 3.7	103 ≤ 129
		adult	> 3.7	> 129
Halichoerus grypus	male	neonate		neonate haircoat present
		juvenile	< 1	≤ 134
		subadult	1 ≤ 4.9	134 ≤ 174
		adult	> 4.9	> 174
	female	neonate		neonate haircoat present
		juvenile	< 1	≤ 126
		subadult	1 ≤ 4.0	126 ≤ 158
		adult	> 4.0	> 158

Table 1: Bron: *Osinga N, et al., Patterns of Stranding and Mortality in Common Seals (Phoca vitulina) and Grey Seals (Halichoerus grypus) in The Netherlands between 1979 and 2008, Journal of Comparative Pathology (2012), doi:10.1016/j.jcpa.2012.04.001*

table 2). When animals were very putrefied, no nutritive code was determined. For decomposition code see table 3.

Each organ was examined macroscopically and changes were written down in the necropsy report. Probable cause of death was written down at the end of the necropsy report.

Of each seal, samples were taken. When carcasses were fresh, samples for histopathological examination were taken from muscles, genital split, mammary gland or penis, placenta and umbilical cord if present and pancreas. These samples were fixed in 10% formalin and embedded in paraffin wax.
Of all seals, except very putrefied carcasses, samples were taken from the skin, gonad and reproductive tract, placenta and umbilical cord if present, lymph nodes (ileocecale, pre scapular, pulmonary), stomach, spleen, liver, kidney, lung, heart, blood and serum, cerebellum, cerebrum and intestine. These samples were stored at minus 80 degrees. A swab of the genital split, gonad and reproductive tract, lymph nodes (reproductive tract, pulmonary), spleen, liver, kidney, lung parasites if present, caecum and intestinal contents were stored at minus 20 degrees.

Samples of stomach, liver and lung were tested on parasites. Samples of inner and outer blubber, liver, kidney and lung were tested on vitamin A.

Of all seals, except very putrefied carcasses, samples of blubber, muscles, liver and kidney were send to Imares on Texel. Both mandibles, stomach and DNA samples of skin, hair and whiskers were taken of all seals, even the very putrefied ones, and were also sent to Imares.

This study

Seals were divided into three groups. One group common seals, *Phoca vitulina*, one group grey seals, *Halichoerus grypus* and one group unknown seals, which we call PV/HG. All data of each seal is collected in a database (addendum 2).
Date of stranding, stranding location, species, age and gender were used in this research. The data of wild seals is used, which means all stranded dead seals and the stranded seals that died in rehabilitation within 24 hours. When they stayed longer in rehabilitation, they do not count as wild seals because they probably received medication.

Charts were made for:

1. Quantity of seals per year
    a. Quantity *Phoca vitulina* per year and month
    b. Quantity *Halichoerus grypus* per year and month
    c. Table 4: distribution of PV/HG
2. Table 5: age distribution *Phoca vitulina*
3. Table 6: age distribution *Halichoerus grypus*
4. Seasonal distribution of stranded seals
    a. *Phoca vitulina*
    b. *Halichoerus grypus*
5. Stranding location
6. Possible by-catch per month
7. Table 7: population size of seals in Dutch waters

Statistical analysis
To compare gender distribution within species, a chi – square test was used. To check if there was any association between the total population of seals in Dutch waters and the quantity of stranding a correlation has been done.

Table 2 Determining nutritive condition

Code	Nutritive condition	Blubber thickness in mm	External factors and subcutaneous fat
1	Very well fed		Very good nutritive condition, very well nourished, abundant blubber, significant other subcutaneous fat present in the dorsal neck and sometimes on the lateral thorax, longissimus dorsi and neck are convex. The whole animal makes a "round, barrel-like" body shape
2	Well fed		A good nutritive condition, well nourished, abundant blubber, some subcutaneous fat, longissimus dorsi and neck are straight or slightly convex
3	Normal	>15	A normal nutritive condition, the blubber thickness is normal, no subcutaneous fat present, neck and longuisimus dorsi are straight, on movement of the animal sometimes slightly convex
4	Poor	11 – 15	A bad nutritive condition, the blubber thickness is on the thin side, skin thickness can be increased, neck and longuisimus dorsi are visibly concave
5	Very poor	< 11	A very bad nutritive condition, the blubber thickness is thin, skin thickness most often increased, longuisimus dorsi and neck are clearly concave.
6	Emaciated		An extremely bad nutritive condition, severely emaciated, the blubber thickness is very thin, neck an dlonguisimus dorsi are severely concave, the contour of the scapula (especially the spina scapulae) may be visible.

Table 2 Jauniaux, T., Beans, C., Dabin, W. 2005. Stranding, necropsy and sampling: collection data, sampling level and techniques. Student European Cetacean Society workshop.

Table 3; Decomposition code

Kuiken et al., Proceedings of the first ECS workshop on cetacean pathology: dissection techniques and tissue sampling, ECS Newsletter No. 17 – special issue (1991)

DCC
1. Very fresh
2. Fresh
3. Putrefied
4. Very putrefied
5. Remains

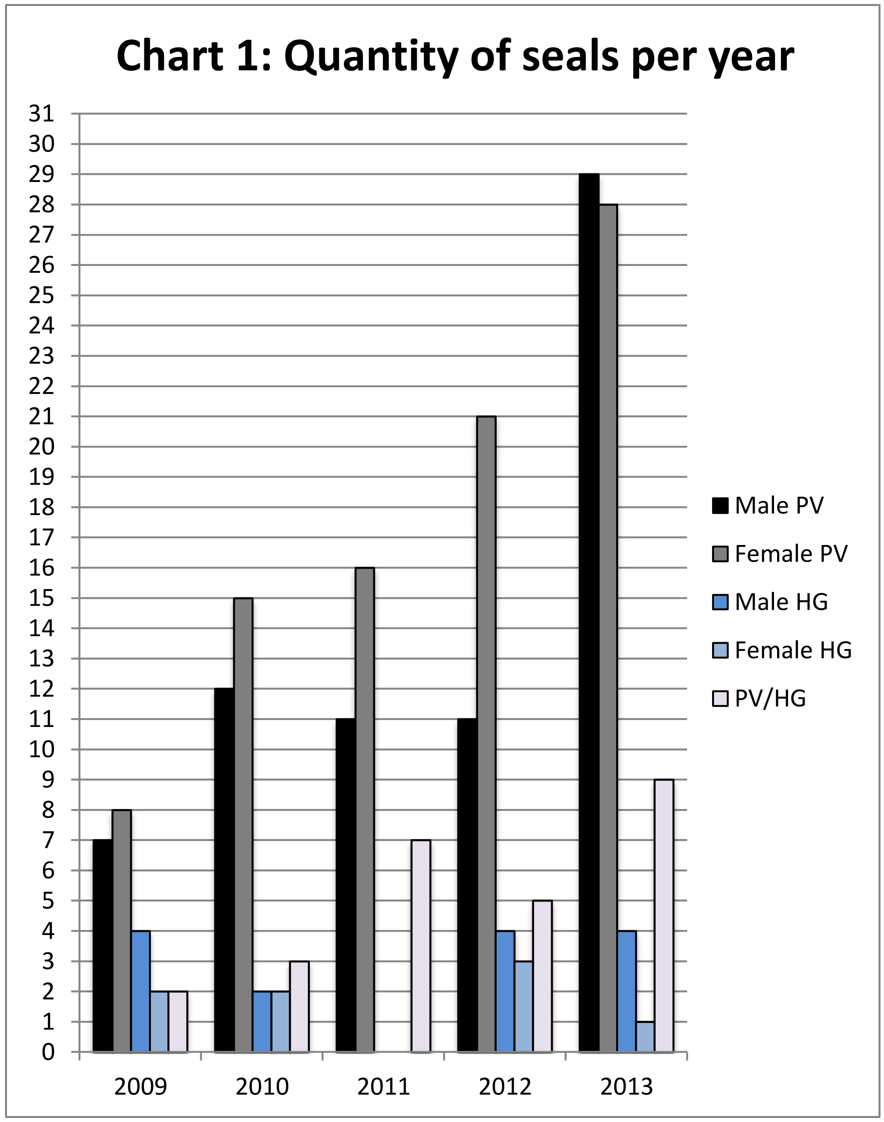
Results

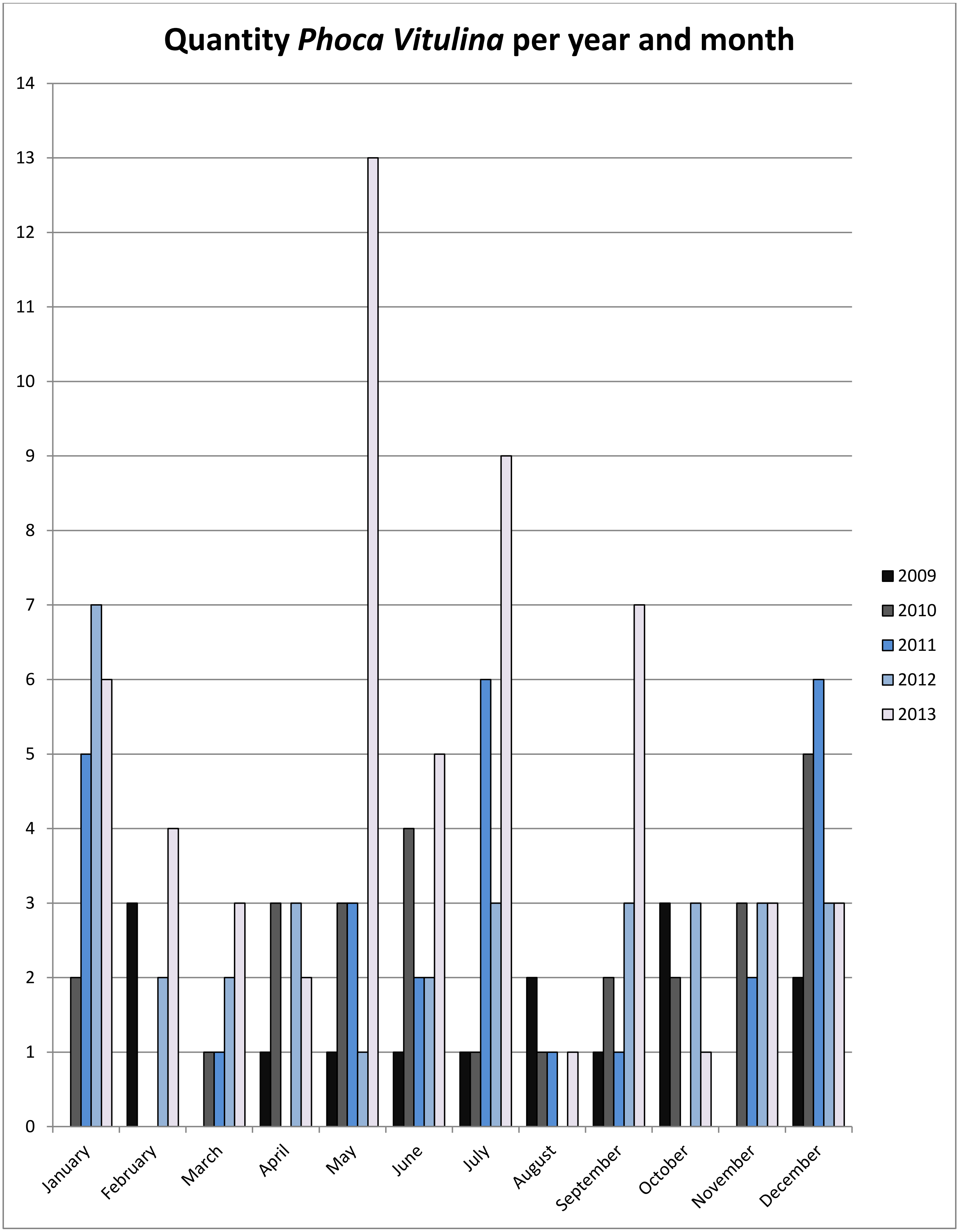
Results are categorized in quantity per year, divided into PV (*Phoca vitulina*) male/female, HG (*Halichoerus grypus*) male/female and PV/HG (unknown species), see chart 1.

As shown in chart 1, numbers are increasing, especially *Phoca vitulina*. In 2011 no necropsy was done on *Halichoerus grypus*. For distribution of stranding per month for common seals and grey seals and for distribution of stranding per year for PV/HG see chart 1a, 1b and table 4.

Annual numbers of dead stranded common seals were correlated with the annual numbers of common seals living in the Dutch waters [11] (P=0.177, P >0.05) suggesting that the increase of stranded common seals is not associated with population size in this study.

Annual numbers of dead stranded grey seals were correlated with the annual numbers of grey seals living in the Dutch waters[11] (P=0.3745, P >0.05), suggesting that the quantity of stranded grey seals is not associated with population size in this study.





Quantity *Phoca Vitulina* per year and month
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
January
February
March
April
May
June
July
August
September
October
November
December
2009
2010
2011
2012
2013

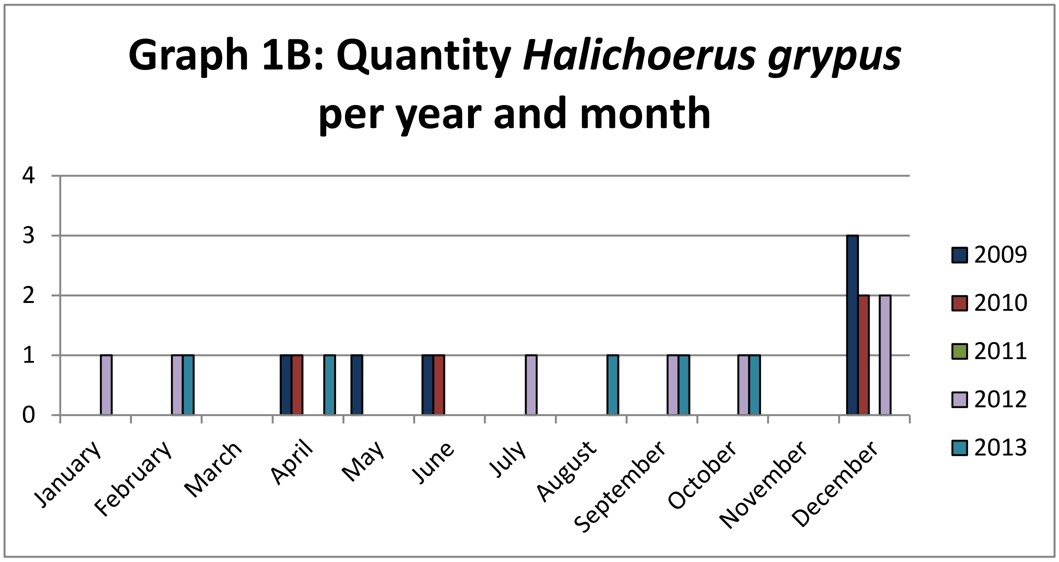


Table 4: Distribution of PV/HG

	Male PV/HG	Female PV/HG	Unknown PV/HG
2009		1 juvenile	1 neonaat
2010	1 neonaat 1 adult		1 subadult
2011	2 neonaat 1 unknown age	2 neonaat 2 juvenile	
2012	1 neonaat 1 subadult	1 neonaat 1 juvenile	1 unknown age
2013	1 neonaat 1 unknown age 1 unknown age	1 neonaat 1 juvenile 1 unknown age	1 neonaat 2 unknown age

Quantities of common seals per age

No difference was found in quantities between stranded female common seals and stranded male common seals (X^2=2.051, df = 1, 0.15 ≤ P ≤ 0.20).

	Neonate	Juvenile	Subadult	Adult	Unknown age
Male common seal (n = 70)	5 *(7%)*	44 *(62,9%)*	9 *(12.9%)*	11 *(15.7%)*	1 *(1.5%)*
Female common seal (n = 88)	7 *(7.9%)*	43 *(48.9%)*	14 *(15.9%)*	22 *(25%)*	2 *(2.3%)*

Table 5; age distribution *Phoca vitulina* (common seal)

Quantities of grey seals per age

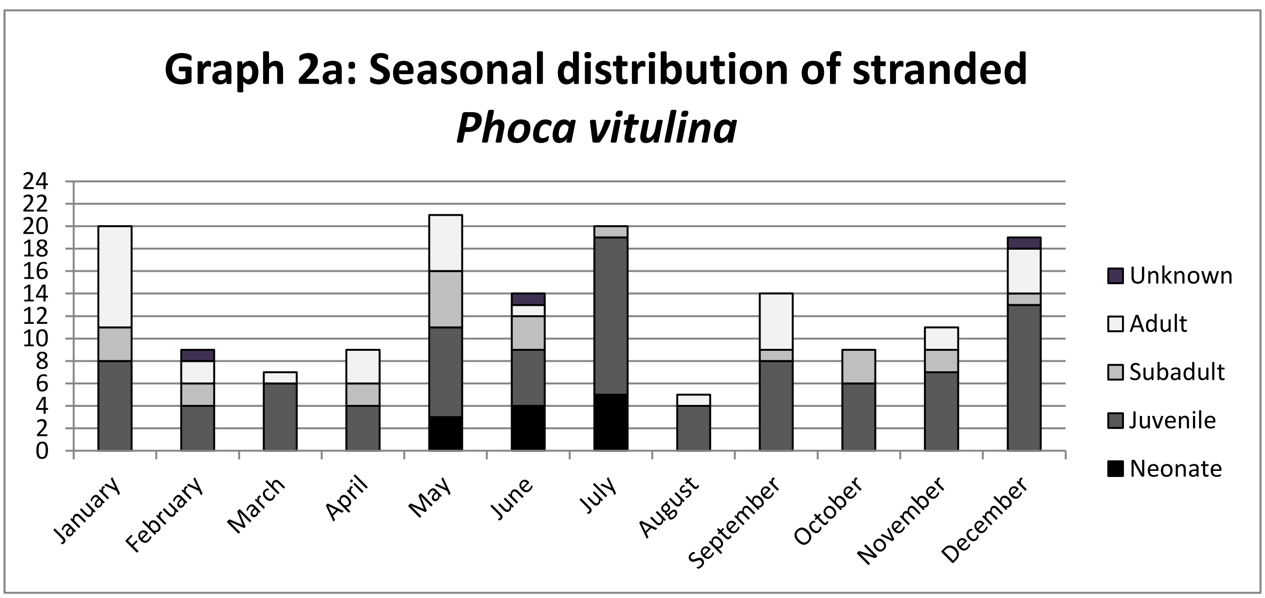
No difference was found in quantities between stranded female grey seals and stranded male grey seals (X^2=1.64, df=1, P=0.20).

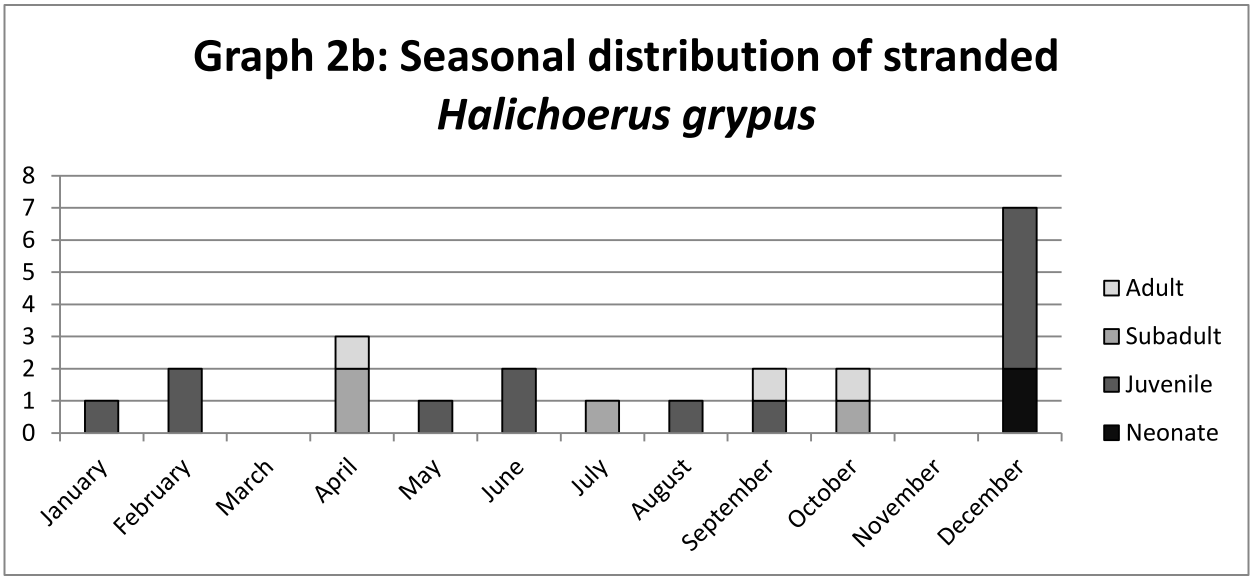
	Neonate	Juvenile	Subadult	Adult
Male grey seal (n=14)	1 *(7.1%)*	8 *(57.1%)*	3 *(21.4%)*	2 *(14.3%)*
Female grey seal (n=8)	1 *(12.5%)*	5 *(65.5%)*	1 *(12.5%)*	1 *(12.5%)*

Table 6: age distribution *Halichoerus grypus* (grey seal)

Seasonality distribution

The total monthly stranding rate of common seals peaked in winter, January (n=20, 12.7% of total) and summer: May (n=21, 13.3% of total) and July (n=20, 12.7% of total). Juvenile stranding peaked in July (n=14, 8.9%) and December (n=13, 8.23%). See graph 2a.
The total monthly stranding rate of grey seals peaked in December (n=7, 9.9% of total) see attachment 2, due to more stranded juvenile animals (n=5, 22.7%). See graph 2b.





Graph 2b: Seasonal distribution of stranded *Halichoerus grypus*
8
7
6
5
4
3
2
1
0
January
February
March
April
May
June
July
August
September
October
November
December
Adult
Subadult
Juvenile
Neonate

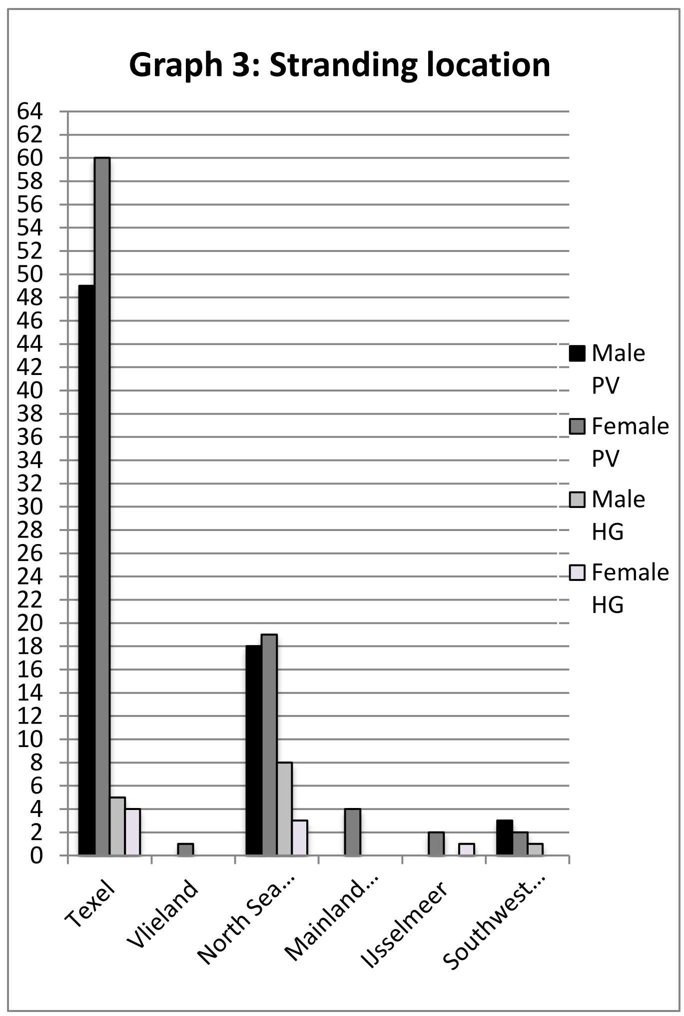
Geographical distribution of stranding

Stranding location is divided into 6 different parts of the Netherlands (see figure 1).
Most common seals stranded at Texel (n=109, 68.99%). Only one female common seal stranded at Vlieland.
Most grey seals stranded at the North Sea coast (n=11, 50%).
Two female common seals and one female grey seal stranded at the inland coast (IJsselmeer).

The relative stranding rate of common seals in this study, calculated as the average number of stranding per kilometer coast line[9], was highest at the coastline of Texel (3.63; 109/30km). The relative stranding rate of grey seals in this study, calculated as the average number of stranding per kilometer coast line[9], was highest at the coast line of Texel (0.3; 9/30).

By-catch

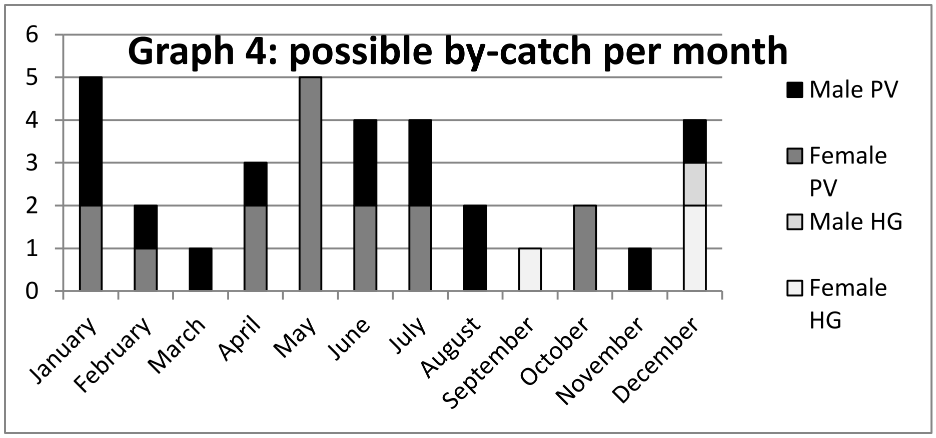
By-catch is based on external observations only[9]. When seals are found in nets or have marks of nets we speak of certain by-catch. Between 2009 and 2013 this happened to one male, juvenile, grey seal in June 2009, and two common seals; one subadult female and one adult male, both in September 2013.
When seals look healthy and fat, with no marks of nets or other things that could be the cause of death, we speak of possible by-catch[9].



In graph 4 possible by-catch is determined per month. It is seen by 29 common seals, of which 16 females and 13 males, and 4 grey seals of which 3 females and 1 male.
Possible by – catch peaked in January, with 3 male common seals and 2 female common seals, and in May, with 5 female common seals.
In spring and early summer, possible by – catch was seen more than rest of the year, except in winter (December, January).

For the first four years an average of 4 cases of possible by - catch per year was seen. In 2013 18 cases of possible by – catch were seen.

Of 30 common seals seen with possible by – catch, there were 14 juveniles (46.7%), 7 subadults (23.3%), 8 adults (26.7%) and 1 unknown age (3.3%).
Of 4 grey seals seen with possible by – catch, there were 2 juveniles (50%), 2 neonate (25%) and 1 adult (25%).



Discussion

Quantity of seals
In 2011 no necropsy was done on *Halichoerus grypus*. This does not mean that there were no dead *Halichoerus grypus*. The seals brought to Utrecht University are not a random sample of the population living in the Dutch waters. Not all dead seals wash up at the coast and not all stranded seals are brought to Utrecht University, dept. pathobiology. In 2013 most seals were brought to Utrecht University. This does not mean most seals stranded in 2013. Collection effort was not the same for each year. By the start of this study, seals were not the most important thing to collect. They were brought in together with other animals, which were considered far more important. When there was no place for seals, they were not taken to Utrecht University, dept. pathobiology for necropsy. In the last year of this study, seals were collected for necropsy and the collection effort was higher than the years before.

In 1994 a total of 8800 living common seals was reported[12]. This was after the outbreak of Porcine distemper virus in 1988, which caused a huge mortality among the seal population in the Dutch waters[9,12]. According to *P.J.H. Reijnders et al 1994* the population size in the Netherlands increased with an annual average of 21% in the years after the first outbreak of PDV[12]. In 2002 another massive outbreak of porcine distemper virus caused a decrease in the size of the seal population.

Nowadays, the international population size is estimate on 38.500 common seals of which 7605 in the Dutch Wadden Sea[8,11]. The population size of grey seals in the Dutch Wadden Sea is 1822 and in South West Delta 909[8,11]. It is not completely sure how these animals are spread over the North Sea[8,11].
In chart 1 it is shown that the quantity of stranded seals is increasing per year. Imares counts the population of seals every year[8,11]. In the last five years the population size in Dutch waters is shown in table 5.

	Common seal	Grey seal
2009	6649	2487
2010	6173	2418
2011	7735	3065
2012	7029	3894
2013	7605	2731

Table 7 *Bron: IMARES; Delta projectmanagement in opdracht van RWS/Provincie Zeeland*

A correlation has been made between quantities of dead stranded seals and population size, but this was not associated with each other. This correlation can be discussed, because Imares counted seals in the Wadden Sea and South West Delta, not in the North Sea[11].
According to the authors of *Osinga et al (2012),* an association between stranding rate and population size was found. This could be caused by the time frame of the study. *Osinga et al (2012)* collected and investigated seals for over

21 years and for this study only over 5 years seals were collected and investigated, with not the same collection effort for each year. In this study seals were mainly retrieved from the coast line of Texel, while *Osinga et al (2012)* retrieved seals from the coast line of almost all Wadden islands and the whole coast line of the Netherlands[9].

Quantities per age
In both species mainly juvenile animals stranded. This is equal to the study done by *Osinga et al (2012)*. For common seals most juvenile animals stranded in July and December. July can be explained by the leaving of the pups by their mothers 3-4 weeks after birth in May[6]. December is a bit harder to explain and it did not occur in the study done by *Osinga et al (2012)*.
In grey seals most juvenile animals stranded in December. Pupping season of grey seals takes place from November till January. The Dutch waters are not very reliable for grey seals to give birth[7]. Sand banks are flooded most of the time and pups are not capable to take care of themselves once taken away from their mother by the water before losing their fur[7].

No significant differences were found between quantities of females and males in both species. This is not exactly according to *Osinga et al (2012)*. The authors found that in case of grey seals, males stranded more frequently than females[9]. There is no explanation for this phenomenon[9].

Seasonality distribution
Stranding of common seals peaked in season of birth from May till July. Mostly young animals stranded. This is in accordance to *Osinga et al (2012)* who found an increase in stranding frequency in summer caused by an increase in stranding of juvenile[9].
In this study stranding of common seals also peaked in January, because of an increase of adult stranding (n=9). This might be explained by the fact that here is less food in winter, which causes a reducement in resistance against lungworm infections[14]. In *Osinga et al (2012)* adult stranding occured more in winter and summer.
Stranding of grey seals peaked in December, which is season of birth. In *Osinga et al(2012)* grey seal stranding occured mostly in January.

Geographical distribution of stranding
Most common seals stranded at Texel. This is in accordance to the population size of common seals in the Wadden Sea[11]. Grey seal stranding was less frequent in the Wadden Sea, this is also in accordance to their distribution[11].
Most grey seals stranded at the North Sea Coast, which is odd, because there are no strandbanks for the seals to haul on in the North Sea[9]. Common seal stranding was less frequent at the North Sea coast, but still more common seals stranded than expected due the environment. It could be possible that seals haul on the large strandbank Razende Bol at the border of the Wadden Sea and North Sea and are dragged along with the water to the North Sea coast.
One female common seal stranded at Vlieland. Stranding of seals on other islands is not known. The coast of some islands is not easy to reach and therefore it was not always possible to collect stranded seals. Seal stranding is expected to occur on the other islands in the Wadden Sea too, because of the population living there. When the seals strand on the other islands in the Wadden Sea, they were most of the time brought to SRRC Pieterburen[III] and not to Utrecht University, dept. Pathobiology.
A few seals (n=3) stranded at inland locations, which they reached through canals and locks[9]. This part of this study cannot be compared with the study of *Osinga et al (2012)*. They retrieved seals from the coast line of the whole Netherlands and almost all islands in the Wadden Sea, except from Texel, while we mainly retrieved seals from the coastline of Texel[9].

[III] Street 94a 9968 AG Pieterburen

By-catch

The total number of by-catch in the complete seal population could not be determined from our data, because not all dead seals, due to by-catch, washed on the coast and were sent to Utrecht University, dept. pathobiology.

An average of 4 cases of possible by-catch was recorded for the first four years of this study. In the last year 18 cases of possible by-catch were recorded. This can be explained by inter-observer variation. Different people had been working on this study and not all of them had the same way of determining by external observations only, whether or not by-catch had occurred. Still it is striking that there is such a big difference between the first four years and the last year of this study. In *Osinga et al (2012)* the authors recorded an average of by-catch of four to five cases per year on a total of 1286 seals.

In this study by-catch peaked in different season than other studies, where low numbers of by-catch were recorded during birth season[9] and high numbers of by –catch were recorded in March till May, and August[9]. This might be explained by the seasonality of different types of fishery, although we do not know by what type of fishery these seals drown. It is not entirely certain in what types of fishing gear seals can drown. Studies were done to investigate what type of fishing gear seals can drown, but more research is necessary[16].

In this study, by-catch was more frequent in juvenile animals (n=17). This is not in accordance with *Osinga et al(2012)* who found more subadult and adult by-catch. But it is in accordance to *Van Haaften (1982)* who found more young animals by-catch.

Stranding patterns of seals in Dutch waters needs to be monitored continuously to control the population of seals. Monitoring will allow early detection of changing in stranding patterns and make it possible to take timely management actions[9]. Studies in the future must be compared with previous studies to check if there is any difference between stranding patterns over years.

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Record forms SEAL Necropsies

Part 1 Identification	Number	……………………….	GLIMS	…………….
	Stranding date:			
	Autopsy date:			
	Autopsied by:			
Chip check[1]:				
□ yes / □ no	True location:	…………………………………………………….	NSO	…………….
negative / positive	Provided by:	□ EHBZ □ EcoMare □ Other		

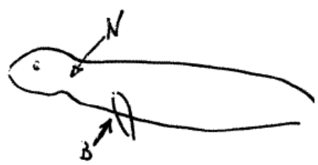

Diagram 1 – blubber thickness (including skin)

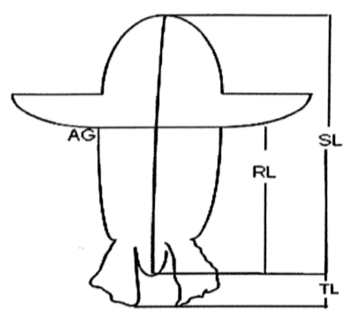

Diagram 2 - morphometry

Part 2 Biometrics	Morphometry (see diagrams above)	Blubber thickness **neck** (N)…………. mm Blubber thickness **breast** (B)……….. mm	**TL**……………………………………cm **SL**……………………………….cm **RL**……………………………….cm **AG** (axillary girth)…………..cm
Sex:	□ ♂ □ ♀ (certain / uncertain) □ sex unknown	♂ large anogenital distance ♀ vulva located just ventral to anus	
Body mass:	……………………………………………………………………kg	yes/ almost / no	
Nutritive condition code:	□NCC**1** □NCC**2** □NCC**3** □NCC**4** □NCC**5** □ NCC**6** □ unknown		
Storage:	□ Direct delivery □ Cooled (ca. ……hrs) □ Frozen		

Expected age:	□ Neonate □ Juvenile □ Adult □ Unknown
Decomposition DCC:	□ Very fresh DCC**1** □ Fresh DCC**2** □ Putrefied DCC**3** □ Very putrefied DCC**4** □ Remains DCC**5**
State of carcass:	□ fully intact □ peck or bite wounds □ incomplete □ skeletal parts, namely: ....
Bycatch: (based on external observation only)	□ certain □ highly probable □ probable □ possible □ no evidence □ unknown **Only wildlife**
Part 2 Photography	
Entire body	
Head only	
Snout	
Eyes	
Teeth	
Urogenital region	
External Observations (Specify lesion and location)	
Internal observations (Specify organ)	

Estimated significance of the presence/absence of criteria for the diagnosis of bycatch			
Criteria	**Presence**	**Absence**	**Observed**
1. Health state			**yes ? no**
A. Exclusion of other causes of death	**+**	**--**	□ □ □
B. Good nutritional condition	**+**	**-**	□ □ □
C. Evidence of recent feeding	**+**	**0**	□ □ □
2. Contact with fishing gear			
A. Superficial skin lesions			**yes ? no**
1. cuts in edge of mouth, fin or tail	**++**	**0**	□ □ □
2. encircling lesions around extremity	**++**	**0**	□ □ □
B. Bruises	**+**	**0**	□ □ □
C. Skull fractures	**+**	**0**	□ □ □
3. Lack of oxygen (hypoxia)			**yes ? no**
A. Oedematous lungs	**+**	**-**	□ □ □
B. Persistent froth in the airways	**+**	**-**	□ □ □
C. Bullous emphysema in the lungs	**+**	**0**	□ □ □
D. Epicardial and pleural petechiae	**+**	**0**	□ □ □
4. Damage during release of the net			**yes ? no**
A. Amputated fin, fluke or tail	**++**	**0**	□ □ □
B. Penetrating incision into body cavity	**++**	**0**	□ □ □
C. Rope around tail stock	**++**	**0**	□ □ □
D. Gaff mark	**++**	**0**	□ □ □
5. Other relevant characteristics			**yes ? no**
A. Sharp edged cuts or blubber defects on body	**++**	**0**	□ □ □
B. Sharp edged cuts or blubber defects on mandible	**++**	**0**	□ □ □
			□ □ □

Only in Wildlife!

++ consistent with bycatch   + bycatch possible   0 no significance for diagnosis   - bycatch less likely   -- bycatch unlikely

[1]Kuiken T. 1994. Review of the criteria for the diagnosis of by-catch in cetaceans. *In:* Kuiken T. (ed.) Diagnosis of By-Catch in Cetaceans. Proc. 2[nd]. ECS workshop on cetacean pathology, Montpellier, France, 2 March 1994. European Cetacean Society Newsletter 26: 38-43

Part 3 Pathology	Number	....	GLIMS	....
Necropsy form – 1				
External observations & lesions □ Scavenging				

	□ Severe □ Moderate □ Mild □ None
Subcutaneous observations & lesions	

□ Sub cut.fat	□ Absent □ Present, approximate thickness: ………………. □ Unknown

Part 3 Pathology	Number	……………	GLIMS	……………
Necropsy form - 2				

Internal observations & lesions

Abdomen (tick if normal, describe if abnormal) □ Urinary bladder □ Mesenteric LN □ Intestine □ Stomach □ Spleen □ Pancreas □ Liver □ Adrenal □ Kidney □ Genital tract □ Gonads	Sex □ ♂ □ ♀ □ ND Age □ Neonatal □ Juvenile □ Adult □ Undetermined
Thorax (tick if normal, describe if abnormal) □ Trachea □ Lungs	

□ Bronchial LN □ Heart □ Oesophagus □ Thymus (present/absent)	

Part 3 Pathology	Number	……………	GLIMS	……………
Necropsy form - 3				

Head and Neck (tick if normal, describe if abnormal) □ Larynx □ Thyroid □ Oral cavity □ Nostrils □ Eyes □ Teeth □ Auditory system □ Skull □ Brain	
Conclusions	

Probable cause of death	

Part 6 Sample Collection	Number	....	GLIMS	....
Sample list				

	HP	-80	-20	Parasites	Vit. A (- 20)	Brucella CVI (-20)	TX Alu	TX PL	Life History
	UU				*CVI*	*Texel*			
	Cass. Nr. formaline	*4 hoekig buisje*	*zakje*	*Schroefdop Alc. 70%*	*Bruin epje halfvol*	*Melk buisje*	*zakje*	*zakje*	*Epje Alc 70%*
Skin		Lesions	Lesions						Skin&Hair
Blubber					Inner + outer		3x TX	2xTX	
Muscle	Dcc1						TX	2xTX	
Genital split	Dcc1		Dcc1 Swab						
Mam.gland/penis	Dcc1								
Gonad & reproductive tract									
Reproductive tract LN									
Placenta, umbilical cord	Dcc1								
Urinary bladder									
Ileocecale LN									
Mesenteric LN									
Pre scapular LN									
Stomach				Parasites				SB	
Pancreas	Dcc1								
Spleen									
Liver				Parasites			3x TX	2xTX	
Kidney							3x TX	2xTX	
Adrenal									

Lung			Parasites	Parasites					
Pulmonary LN									
Heart									
Blood & / Serum									
Thymus									
Thyroid									
Eye									
Teeth									2x Mandible
Cerebellum									
Cerebrum									
Intestine			Caecum - WL						
Intestinal contents									
lungworm									
Collection/ DCC correlation	DCC 1		DCC 2				DCC 3	DCC 4 and 5	

BD: bijzondere dieren

WL: Wildlife

Caecum – WL – alleen bij niet gevroren dieren!!!

Serie	Carcass	Dd	Mm	Yy	Stranding location	Age	Sex	Bycatch based on external obs only
PV	1	22	2	2009	Texel paal 23	S	F	No evidence
PV	2	20	2	2009	Texel paal 20	S	M	No evidence
PV	4	22	5	2009	Texel paal 21	J	F	No evidence
PV	5	16	4	2009	Ijmuiden	J	M	Possible
PV	9	28	9	2009	Dollard	A	F	No evidence
PV	10	2	7	2009	Texel paal 23	J	M	Possible
PV	13	24	6	2009	Oudeschild, Texel	J	F	Unknown
PV	18	4	12	2009	De Hors, Texel	J	M	No evidence
PV	19	31	10	2009	Noord Slufter, Texel	J	F	No evidence
PV	23	26	10	2009	Texel paal 15,2	J	M	No evidence
PV	24	24	12	2009	Texel paal 8	J	F	No evidence
PV	27	7	8	2009	Texel paal 17	J	M	Possible
PV	28	31	8	2009	Texel paal 25	J	M	No evidence
PV	30	13	2	2009	Hondsbosche zeewering, KM 24	J	F	No evidence
PV	32	9	10	2009	Texel, pl 26,5	J	F	Possible
PV	14	27	12	2010	Texel paal 7	J	F	No evidence
PV	16	18	5	2010	Schoorl aan zee	A	F	No evidence
PV	20	11	4	2010	Texel paal 6	J	F	No evidence
PV	21	10	4	2010	Texel paal 7	J	M	No evidence
PV	25	19	3	2010	Norddeich	J	F	No evidence
PV	33	16	5	2010	Groote Keeten km 11	J	F	No evidence
PV	34	2	1	2010	Texel, pl 28	A	F	No evidence
PV	35	11	1	2010	Texel, pl 33	A	F	No evidence
PV	36	12	4	2010	Ijzerenkaap, Texel	A	F	No evidence
PV	37	3	9	2010	Julianadorp paal 13	J	M	No evidence
PV	38	26	7	2010	Texel paal 30	J	M	No evidence
PV	39	17	6	2010	Ceres, Texel	N	F	Unknown
PV	41	31	8	2010	Cocksdorp, Texel	A	M	Possible
PV	44	18	6	2010	Den Helder	J	F	Possible
PV	45	11	6	2010	Texel paal 20	S	F	No evidence
PV	47	21	5	2010	Texel paal 12	J	M	No evidence
PV	49	5	6	2010	Oudeschild, Texel	S	M	Possible
PV	51	17	12	2010	Texel paal 22	J	F	No evidence
PV	54	12	10	2010	Den Helder paal 5	J	M	No evidence
PV	56	17	12	2010	Texel paal 16	J	M	No evidence
PV	60	5	12	2010	Texel paal 23,4	J	F	No evidence
PV	62	12	12	2010	Den Helder paal 3	J	F	No evidence
PV	66	1	11	2010	Texel paal 23	J	M	No evidence
PV	72	1	11	2010	Groote Keeten, km 10	J	M	Possible
PV	75	13	9	2010	Vuurtorenstrand, Texel	A	F	No evidence

PV	76	24	10	2010	Camperduin, km 26	J	M	No evidence
PV	155	4	11	2010	Groote Keeten, km 9	S	M	Unknown
PV	15	11	1	2011	Texel paal 31	J	M	No evidence
PV	52	18	1	2011	Vuurtorenstrand, Texel	A	F	No evidence
PV	68	3	1	2011	Zwanenwater Noord-Holland	J	F	Possible
PV	69	23	3	2011	Texel paal 17	J	F	No evidence
PV	71	8	1	2011	Texel Mokbaai strand	J	M	Possible
PV	73	4	1	2011	Texel paal 9	A	F	No evidence
PV	78	14	12	2011	Texel, Paal 18	U	F	No evidence
PV	79	12	12	2011	Vuurtorenstrand, Texel	J	M	No evidence
PV	81	18	11	2011	Havenkantoor, dijk Texel	A	F	No evidence
PV	82	16	11	2011	Zuidermeerhaven, Den Helder	A	F	No evidence
PV	85	17	12	2011	Paal 31, Texel	A	M	No evidence
PV	86	21	12	2011	Huisduinen	A	F	No evidence
PV	87	17	12	2011	De slufter, Texel	J	F	No evidence
PV	88	26	12	2011	Petten, paal 19	J	M	No evidence
PV	110	3	7	2011	Zwanenwater km 14	J	F	No evidence
PV	111	4	5	2011	Dijksman Huizen, Texel	S	F	Unknown
PV	112	2	5	2011	Paal 34, Texel	A	F	Unknown
PV	114	4	5	2011	van de Harding rechts, Texel	S	F	No evidence
PV	115	14	7	2011	Cocksdorp, Texel	J	M	No evidence
PV	117	13	7	2011	Paal 20, Texel	N	M	Unknown
PV	118	16	7	2011	Cocksdorp, Texel	J	M	Unknown
PV	119	31	7	2011	Texel, km 12-50	J	M	No evidence
PV	121	25	6	2011	Paal 28, Texel	J	M	Unknown
PV	123	5	6	2011	Cocksdorp, Texel	N	F	Unknown
PV	124	21	7	2011	Marinehaven, Den Helder	J	F	Unknown
PV	128	20	8	2011	de Schans, Texel	J	M	No evidence
PV	133	22	9	2011	Paal 29, Texel	J	F	No evidence
PV	92	6	2	2012	Ijzeren Kaap, Texel	A	F	No evidence
PV	94	20	1	2012	Bergen aan Zee, Castricum	A	M	Probable
PV	96	19	1	2012	Callantsoog, km 13	S	F	No evidence
PV	99	19	1	2012	Paal 34, Texel	J	F	No evidence
PV	100	19	1	2012	Texel, Slufter	J	F	No evidence
PV	103	30	1	2012	Texel, Paal 28	J	F	No evidence
PV	104	30	1	2012	Ten noorden van de badweg	J	F	No evidence
PV	109	22	4	2012	Andijk, Ijsselmeer	A	F	Possible
PV	126	29	3	2012	Paal 12, Texel	J	F	No evidence
PV	132	4	2	2012	Slufter Paal 26 - 400	J	F	No evidence
PV	136	8	4	2012	Zeeburg, Texel	A	M	Unknown
PV	137	1	4	2012	Paal 18, Texel	S	F	No evidence

PV	138	24	5	2012	Vuurtorenstrand, Texel	J	F	Unknown
PV	141	26	6	2012	Paal 20,5, Texel	U	M	Unknown
PV	142	5	6	2012	Paal 28, Texel	J	M	Unknown
PV	143	18	9	2012	Camperduin km 26	J	F	No evidence
PV	144	19	3	2012	Paal 9,6, Texel	J	F	No evidence
PV	148	4	7	2012	IJzeren Kaap, Texel	N	F	Unknown
PV	149	4	7	2012	Julianadorp	N	F	No evidence
PV	151	9	7	2012	Wieringen	J	F	Unknown
PV	153	27	9	2012	Westen Schouwen	J	M	Unknown
PV	154	23	10	2012	Vlieland Boulevard, Texel	S	M	Unknown
PV	160	24	1	2012	Schoorl aan zee, km 29	S	M	No evidence
PV	161	24	10	2012	Groote keeten, km 10	J	M	No evidence
PV	162	27	10	2012	Vlieland	S	F	Unknown
PV	163	8	11	2012	Texel, pl 14	J	F	No evidence
PV	165	20	12	2012	Schoorl aan zee, km 30	J	F	No evidence
PV	167	5	11	2012	Den Helder	J	M	No evidence
PV	177	13	12	2012	Paal 17 Texel	J	F	No evidence
PV	179	17	12	2012	De hors, de mok	A	F	No evidence
PV	194	7	11	2012	Paal 26, Texel	J	M	No evidence
PV	197	30	9	2012	Den Helder	J	M	Unknown
PV	168	29	7	2013	Serooskerke, schelphoek	N	F	-
PV	169	19	3	2013	Slufter	J	M	No evidence
PV	170	18	2	2013	Waddenstrand	J	M	No evidence
PV	171	25	4	2013	Z. van Julianadorp, km 8	S	F	Possible
PV	172	31	3	2013	Schorren noord, paal 22.2	A	M	Possible
PV	173	3	5	2013	Oudeschild dijk	J	F	No evidence
PV	174	16	4	2013	Keele, km 10	J	M	No evidence
PV	175	25	3	2013	Bastricum	J	M	No evidence
PV	178	30	1	2013	Paal 21 Texel	J	M	No evidence
PV	180	13	1	2013	Nioz Haven	A	F	Probable
PV	181	13	1	2013	Krasseleet richting kaap	A	F	No evidence
PV	182	14	1	2013	Oudeschild dijk	A	F	No evidence
PV	183	15	8	2013	Ijmuiden, middensluis	J	F	No evidence
PV	184	11	9	2013	Den helder paal 0	A	M	Certain
PV	185	7	9	2013	Nioz haven, texel	A	M	No evidence
PV	186	-	7	2013	Walsoorden	J	F	No evidence
PV	188	14	7	2013	Razende bol	J	M	No evidence
PV	189	15	7	2013	Oudeschild jachthaven	J	M	No evidence
PV	190	2	9	2013	Texel paal 125,4	J	M	No evidence
PV	192	1	9	2013	Paal 28, Texel	S	F	Certain
PV	193	10	7	2013	Volharding, Texel	J	F	No evidence

PV	196	21	2	2013	Castricum P1 48.000	J	M	No evidence
PV	198	15	9	2013	Westerslag	J	F	No evidence
PV	201	12	11	2013	Paal 21 Texel	J	M	No evidence
PV	202	4	11	2013	Paal 18 Texel	J	M	No evidence
PV	203	1	12	2013	Paal 9 Texel	S	M	no evidence
PV	205	4	11	2013	Hondsbossche zeewering, paal 22	S	F	No evidence
PV	206	12	9	2013	Paal 28, Texel	A	M	Unknown
pv	207	1	12	2013	Noordkant, Schorre	A	F	No evidence
PV	208	12	10	2013	Oudeschild Dijk	S	F	Possible
PV	209	4	12	2013	Egmond a/d Hoef	J	M	Possible
PV	210	1	7	2013	Rotterdam	S	F	Possible
PV	212	13	2	2013	Texel paal 8	A	M	highly probable
PV	213	22	5	2013	Texel paal 10	S	M	Unknown
PV	214	2	5	2013	VT Texel	A	F	possible
PV	215F	29	5	2013	Texel paal 19.5	N	F	
PV	215	29	5	2013	Texel paal 19.5	A	F	No evidence
PV	218	17	9	2013	Camper Duin	J	F	No evidence
PV	219	11	5	2013	Mokbaai	S	F	Possible
PV	220	10	5	2013	Texel Paal 20	J	F	Possible
PV	221	24	5	2013	Texel Paal 24	A	F	No evidence
PV	221F	24	5	2013	Texel Paal 24	J	M	No evidence
PV	225	10	2	2013	NIOZ Haven	U	F	Probable
PV	226	18	6	2013	N102 haven-Texel	N	M	No evidence
PV	227	6	6	2013	Texel Paal 19	J	F	possible
PV	228	9	6	2013	Texel Ijzeren Kaap	A	M	No evidence
PV	229	30	5	2013	Oudeschild, nieuwe wadstranden	N	M	No evidence
PV	231	15	7	2013	Dijk, bij hotel 7	J	M	Possible
PV	232	21	5	2013	Texel Ten Noorden Paal 18-13	J	F	Possible
PV	233	7	6	2013	Hendrikpolder	N	M	unknown
Pv	234	27	5	2013	Teso haven Rechts	J	M	unknown
PV	236	16	7	2013	Hippolytus hoef	N	F	unknown
PV	238	15	7	2013	PH Polder	J	F	Possible
PV	243	31	1	2013	Ouddorp	A	M	possible
PV	246	18	5	2013	Texel, paal 11	S	F	Possible
PV	247	9	6	2013	Texel, Slufter	S	M	Probable
PV	248	27	1	2013	Renesse	S	M	No evidence

Serie	Carcass	Dd	Mm	Yy	Stranding location	Age	Sex	Bycatch based on external obs only
HG	5	17	6	2009	Maasvlakte	J	M	Certain
HG	6	15	4	2009	Texel paal 8	S	F	No evidence
HG	7	27	5	2009	Bergen aan Zee, km 31,5	J	M	No evidence
HG	1	21	12	2009	Egmond aan Zee	J	F	No evidence
HG	2	20	12	2009	Callantsoog	J	M	No evidence
HG	3	30	12	2009	Texel paal 18	J	M	No evidence
HG	4	5	4	2010	Togen, Texel	S	M	Unknown
HG	9	17	12	2010	Texel paal 17	J	F	Possible
HG	10	12	6	2010	Vuurtorenstrand, Texel	J	M	Unknown
HG	11	17	12	2010	Texel paal 26,4	J	F	Possible
HG	17	2	2	2012	Wijk aan Zee	J	M	No evidence
HG	19	24	9	2012	Breezand, Ijsselmeer	A	F	Probable
HG	131	30	7	2012	Fort Erfprins, Den Helder	S	M	No evidence
HG	14	19	1	2012	Hargen aan zee, km 27	J	F	No evidence
HG	25	14	12	2012	Volharding, Texel	N	M	Possible
HG	26	13	12	2012	Paal 33, Texel	N	F	No evidence
HG	30	15	10	2012	Schoorl aan Zee, km 29	S	M	No evidence
HG	24	26	2	2013	Petten	J	F	No evidence
HG	27	15	8	2013	Oudeschild dijk	J	M	No evidence
HG	28	18	10	2013	Callants oog, paal 15 thv zwanenwater	A	M	No evidence
HG	29	12	9	2013	Hondsbossche Zeewering, km 22	J	M	Unknown
HG	32	30	4	2013	Den Helder, bij de lange kaap	A	M	No evidence

Serie	Carcass	Dd	Mm	Yy	Stranding location	Age	Sex	Bycatch based on external obs only
PV/HG	12	2	7	2009	Dijk Zeeburg, Texel	N	U	Unknown
PV/HG	31	3	6	2009	Texel, pl 24,5	J	F	Unknown
PV/HG	11	23	4	2010	Texel paal 28	S	U	Unknown
PV/HG	48	22	5	2010	Texel paal 20	A	M	Unknown
PV/HG	50	14	6	2010	Vuurtorenstrand, Texel	N	M	Unknown
PV/HG	15	15	7	2011	Texel, Paal 20,8	N	M	Unknown
PV/HG	16	22	10	2011	Texel, Paal 19 - 20	N	F	Unknown
PV/HG	80	24	12	2011	Schorren, Texel	J	F	No evidence
PV/HG	83	28	11	2011	Lange Jaap, Den Helder	U	M	Probable
PV/HG	105	12	8	2011	Hondsbosche Zeewering, km22	J	F	Possible
PV/HG	120	30	4	2011	Cocksdorp, Texel	N	M	Unknown
PV/HG	122	5	5	2011	Schans, Texel	N	F	Unknown
PV/HG	135	19	3	2012	Paal 19,5, Texel	S	M	Possible
PV/HG	139	24	5	2012	Paal 33, Texel	N	M	Unknown
PV/HG	145	14	7	2012	Paal 24, Texel	U	-	Unknown
PV/HG	147	8	5	2012	Haven N/102, Texel	N	F	Unknown
PV/HG	150	15	5	2012	Mokbaai, Texel	J	F	Unknown
PV/HG	176	12	4	2013	Paal 13	U	U	Unknown
PV/HG	216	29	7	2013	Texel Paal 14	J	F	unknown
PV/HG	224	15	7	2013	Huisduinen Stichting Noordkop	U	F	unknown
PV/HG	230	12	7	2013	Waddendijk 16.2	N	F	unknown
PV/HG	235	17	7	2013	Het Aresenaal, Den Helder	U	M	unknown
PV/HG	237	25	7	2013	Nieuwe Schild	N	U	unknown
PV/HG	239	15	7	2013	Camping de Robben	U	M	unknown
PV/HG	240	25	7	2013	Waddendijk Texel Dijkmanshaven	U	U	unknown
PV/HG	241	8	6	2013	Texel Paal 21	N	M	No evidence