



## Identification of the first harbour porpoise (*Phocoena phocoena*) calving ground in the North Sea

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### Abstract

We investigated the occurrence of harbour porpoises in the North Sea off Schleswig-Holstein by conducting aerial surveys with emphasis on calves. Fourteen per cent of the sighted porpoises off the islands of Sylt, Amrum and southern Rømø were calves, whereas the average calf proportion for the whole North Sea as established during the 1994 SCANS survey was only 5.4%. The significantly higher proportion of calves off Sylt and Amrum indicates that these coastal waters are used as a preferred calving ground for harbour porpoises. Analysis of stranding data showed that the identified calving ground does not extend south of Amrum and that harbour porpoise calves are present off Sylt and Amrum all year round. The combination of sighting and stranding data demonstrates the special importance of the investigated area for harbour porpoises as a calving and nursing ground. The area should therefore be protected. © 1999 Elsevier Science B.V. All rights reserved.

**Keywords:** *Phocoena phocoena*; harbour porpoise; North Sea; calving ground

### 1. Introduction

The harbour porpoise (*Phocoena phocoena*) is the most abundant cetacean in the North Sea. To obtain quantitative information on the distribution and abundance of harbour porpoises, an intensive EU-co-funded sighting survey was carried out in 1994 by nine ships and two planes. Based on this survey with the acronym SCANS, a total of ca. 268 000 harbour porpoises have been estimated for the North

Sea (Hammond et al., 1995). Their numbers are considerably affected by by-catch mortality caused by bottom-set net fisheries. Vinther (1995) estimated in 1993 and 1994 a by-catch of 4449 porpoises a year for the Danish bottom-set net fishery on turbot and cod. As there are very few data available from other fisheries (e.g. British set-net fishery), it can be assumed that the annual by-catch is even higher than this figure. These levels of by-catch mortality may not be sustainable according to the recommendations of the International Whaling Commission because they may exceed 50% of the maximum growth rate of the population (Bjørge and Donovan, 1995; IWC, 1996).

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This threat to the North Sea harbour porpoise population makes it important to identify areas such as those used for calving because they are essential to the continued existence of porpoises.

The island of Sylt is a popular spot to watch porpoises from the coast and large numbers of porpoise calves have been reported there (Kremer, 1990; Kremer et al., 1994). In addition to incidental sightings, numerous calves have been found stranded on the beaches of Sylt. These observations and the considerable number of calf sightings during an aerial survey suggest that the waters off Sylt and Amrum (Fig. 1) may be a calving and nursing ground for the species (Benke, unpubl. data; Heide-Jørgensen et al., 1993).

We therefore conducted two aerial surveys and re-analysed the survey data of the SCANS survey (Hammond et al., 1995) for sightings of calves. Because there are only data from ship surveys available for large parts of the North Sea and because we cannot exclude the fact that it is easier to distinguish between calves and adults from the air than from ships, we estimated a correction factor for possibly missed calves and analysed the data with and without this factor.

For further tests we also analysed the stranding records for the North Sea coast of Schleswig-Holstein to obtain information on the southern extension of the hypothesised calving ground.

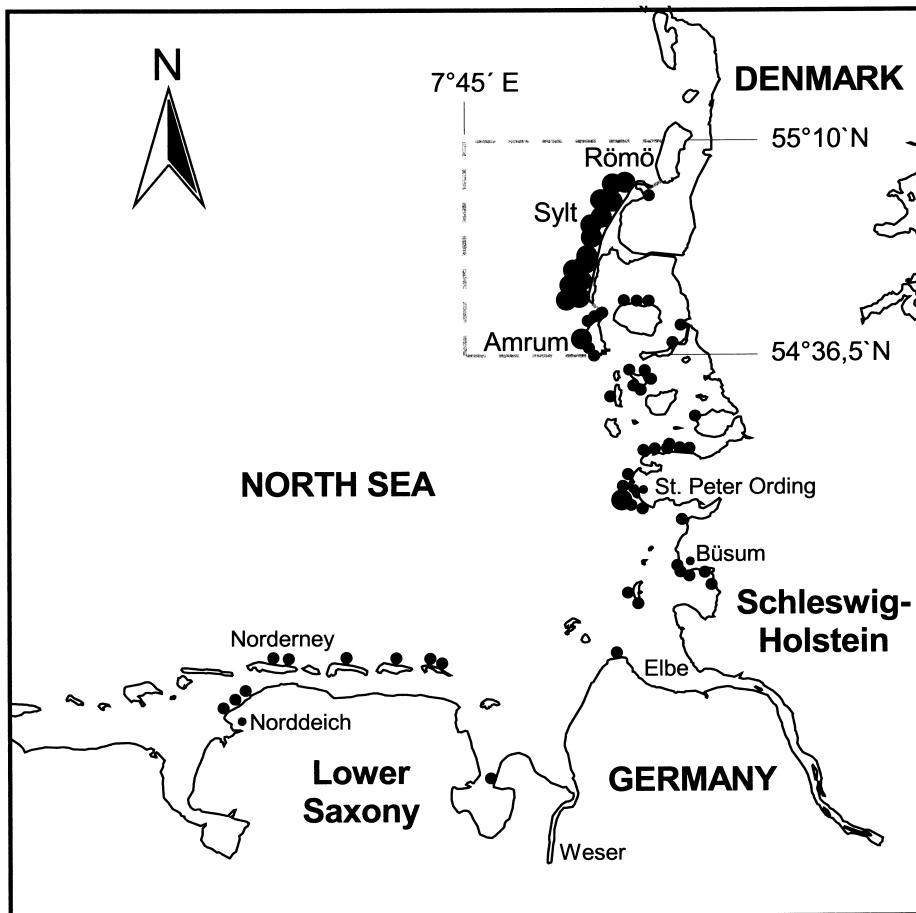


Fig. 1. The North Sea coast of Germany showing the investigated area and the harbour porpoise calves stranded between January 1990 and January 1997 (data from Lower Saxony from Stede, 1994; M. Stede, pers. comm., 1996). Small dots = one calf; large dots = ten calves. Sylt/Amrum area indicated with dashed line.

## 2. Methods

### 2.1. Aerial surveys

Aerial surveys were conducted off the west coast of Schleswig-Holstein, Germany. The main objectives were to investigate the area off the coast of Sylt and Amrum for the occurrence of mother–calf pairs and to determine the abundance of porpoises in German waters. The abundance results will be published elsewhere.

A high-winged, twin-engine plane (Partenavia Observer PN 68) equipped with bubble windows on both rear seats was used for the survey. Flights were made along zig-zag tracks designed before the start of the survey. The survey altitude was 182 m (600 ft) with an approximate ground speed of 166.7 km h<sup>-1</sup> (90 knots). For more detailed information

about the methodology of the aerial survey, we refer to Hammond et al. (1995).

In the aerial surveys of 1995 and 1996, approximately 673 and 979 km, respectively, were flown during wind speeds below Beaufort 3 along the North Sea coast of Schleswig-Holstein. As young calves are considerably smaller than adults, each group of two porpoises in which one was only about half the size of the other was considered a mother–calf pair. In 1996 the main effort was put in the area around Sylt and Amrum to obtain enough sightings to allow statistical analysis (Fig. 2).

In addition to this survey, sighting data from the SCANS-survey (Hammond et al., 1995; maps from SCANS-blocks also in Bjørge and Donovan, 1995; IWC, 1996) and from an aerial survey conducted 1992 in German waters (Heide-Jørgensen et al., 1993) were re-analysed for the occurrence of mother–calf pairs.

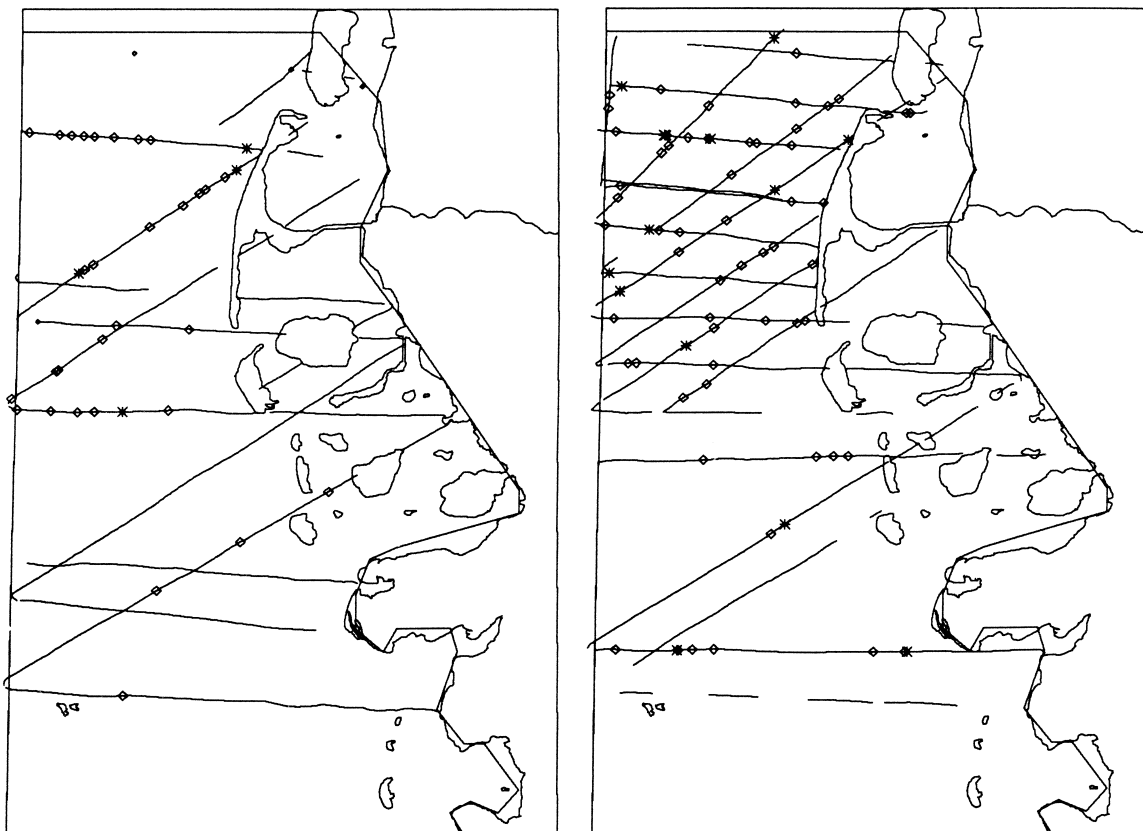


Fig. 2. Survey area showing the tracklines flown in 1995 (left) and 1996 (right) and the sighted harbour porpoises.  $\diamond$  = Sightings of harbour porpoise groups without calves;  $*$  = sightings of harbour porpoise groups with calves

Table 1  
Calf ratios seen during aerial surveys in the North Sea and Kattegat area

Investigated area	Calves/ porpoises <sup>a</sup>	Percentage of calves <sup>b</sup>	Pods with/pods without calves <sup>c</sup>
Sylt (Pilot Study 1992)	7/39	17.9	7/22
Sylt/Amrum area (SCANS 1994)	3/31	9.6	3/23
Sylt/Amrum area (German Survey 1995)	4/36	11.1	4/26
Sylt/Amrum area (German Survey 1996)	11/73	15.1	11/47
Sylt/Amrum area (pooled data from 1992, 1994, 1995, 1996)	25/179	14.0	25/118
West coast Schleswig-Holstein (German Survey 1995)	4/40	10.0	4/30
West coast Schleswig-Holstein (German Survey 1996)	14/91	15.4	14/58
Danish and German Wadden Sea (SCANS Block Y)	10/71	14.1	9/43
Danish Northwest coast (SCANS Block L)	8/69	11.6	8/37
Norwegian coast (SCANS Block M)	3/56	5.4	3/42
Shetland and Orkneys (SCANS Block J)	0/40	0.0	0/32
SCANS aerial survey 1994 (all aerial survey blocks in the North Sea)	21/236	8.9	20/154
Inner Danish waters (SCANS Block I')	10/198	5.1	10/156

<sup>a</sup> Numbers of calves and porpoises sighted.

<sup>b</sup> Percentage of calves in an area.

<sup>c</sup> Numbers of harbour porpoise pods with and without calves.

Table 2  
Calf ratios seen during SCANS ship surveys in the North Sea and Skagerrak/Kattegat area

Investigated area	Calves/ porpoises <sup>a</sup>	Percentage of calves <sup>b</sup>	Pods with/pods without calves <sup>c</sup>
Irish Sea (SCANS-Block A)	6/118	5.1	6/66
British coastal waters (SCANS-Block C)	10/300	3.3	10/172
Northern Scottish waters (SCANS Block D)	12/195	6.2	12/125
Northern North Sea (SCANS Block E)	5/122	4.1	5/75
Central North Sea (SCANS Block F)	13/337	3.9	13/218
Central North Sea (SCANS Block G)	19/280	6.7	19/174
Dutch and German coastal waters (SCANS Block H)	0/21	0.0	0/14
SCANS ship survey 1994 (all ship survey blocks in the North Sea)	59/1255	4.7	59/778
SCANS survey 1994 (all survey blocks in the North Sea)	80/1491	5.4	79/932
Skagerrak and Kattegat (SCANS Block I)	8/362	2.2	8/240

<sup>a</sup> Numbers of calves and porpoises sighted.

<sup>b</sup> Percentage of calves in an area.

<sup>c</sup> Numbers of harbour porpoise pods with and without calves.

The 1995 and 1996 surveys were carried out in June and July, so they can be compared with the SCANS and the 1992 surveys. For statistical analysis we pooled sightings from the area off Amrum, Sylt and southern Rømø (between 54°36.5'N and 55°10'N, western boundary 7°45'E) (Fig. 1) in 1992, 1994 (SCANS Block Y), 1995 and 1996 (Table 2).

In order to correct the ship data for potentially missed calf sightings, we assumed that there is an even distribution of mother–calf pairs outside the

proposed calving ground and calculated a correction factor by comparing the proportion of mother–calf pairs in the SCANS aerial and ship surveys.

We compared these data, with and without the correction factor using two-tailed Pearson chi-square tests, with SCANS sightings from the whole North Sea (Tables 1 and 2) excluding the sightings of the area mentioned above. Tests were based on the number of groups with and without calves.

## 2.2. Strandings

As part of a national research project on the abundance, health status and migration of cetaceans in Germany, all stranded harbour porpoises were examined and age was determined in post-mortem examinations by reading growth layer groups in teeth according to Myrick et al. (1983). All animals less than one year old were considered calves. As harbour porpoises normally mature between three and four years of age (Read, 1990; Bandomir-Krischak, 1993; Read and Hohn, 1995), we considered those over one and under four to be sub-adult.

Using a Pearson chi-square test we compared relative proportions of harbour porpoise calves, sub-adults and adults found on the island of Sylt with the strandings from other parts of the west coast of Schleswig-Holstein, Germany.

## 3. Results

In the SCANS ship survey of the North Sea, 837 harbour porpoise groups were sighted, including 59 groups containing calves. In the aerial survey outside the Sylt/Amrum area, SCANS-observers sighted 148 groups, including 17 groups with calves. This results in a 1.63 times higher proportion of groups containing calves in the aerial survey. Assuming that mother–calf pairs are distributed evenly in the North Sea with the exception of the Sylt–Amrum area, we used 1.63 as a possible correction factor for ship-based sightings with the result that 113.2 groups of the 982 harbour porpoise groups sighted in the North Sea would contain calves instead of 76.

### 3.1. Aerial survey

The pooled data of the 1992, 1994 (SCANS), 1995 and 1996 surveys showed a proportion of 14% calves west of Amrum, Sylt and southern Rømø. Table 2 shows the data for each of the surveys

Analysis of the SCANS-data showed a calf percentage of 5.4 for the North Sea (5.27% for the North Sea excluding Sylt/Amrum) ranging between 0 (block J with the Shetlands and Orkneys) and 14.1% (block Y which includes Sylt, Amrum and southern Rømø) (Tables 1 and 2). The statistical

analysis shows a significant ( $P < 0.01$ ) difference between Sylt/Amrum and the rest of the North Sea and significant differences ( $P < 0.05$ ) between Sylt/Amrum and each of the individual blocks of the SCANS-survey except blocks L and M, which covered the area north of the Wadden Sea along the Danish and the Norwegian coasts, respectively.

Using the estimated correction factor for the ship-survey data we still found a significant difference ( $P < 0.05$ ) between Sylt/Amrum and the rest of the North Sea.

### 3.2. Biological sampling of strandings

Of the 521 harbour porpoises found stranded between January 1990 and January 1997 along the North-Sea coast of Schleswig-Holstein, 434 could be aged (Table 3). 197 (45.4%) were calves (under one year old) ranging in length between 66 cm and 107 cm. The majority of these calves (141 = 71.6%) stranded on the island of Sylt (Fig. 1).

Carcasses of stranded neonates (defined by remnants of the umbilical cord) were found only between the end of May and the end of July, but small numbers of older calves stranded throughout the year except in March and November (Fig. 3).

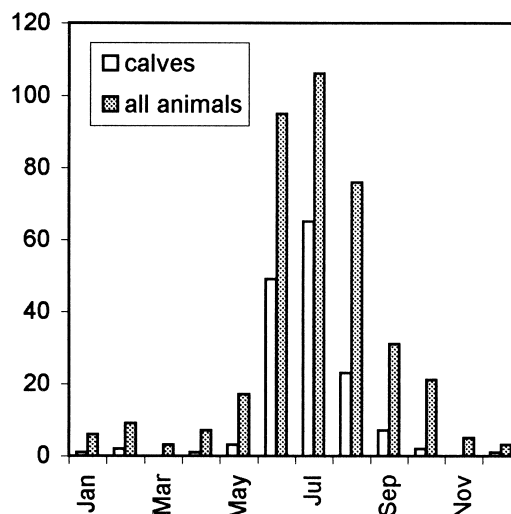


Fig. 3. Monthly distribution of harbour porpoises stranded between January 1990 and January 1997 north of 54°36.5'N at the west coast of Schleswig-Holstein, Germany. The shaded columns represent all strandings whereas the white ones show only calves.

Table 3  
Stranded harbour porpoises with known age divided into age groups

Investigated area	Calves	Sub-adult	Adult	Total
Area between 54°36.5'N and 55°10'N	161	56	107	331
Area south of 54°36.5'N	36	32	42	103
West coast Schleswig-Holstein incl. Sylt	197	88	149	434

Animals under one year old are considered calves and animals over one and under four are considered sub-adult.

Comparing the strandings of harbour porpoises by age group in different locations, we found a significantly ( $P < 0.01$ ) higher proportion of calves north of 54°36.5'N (the southern tip of Amrum). There was a lower proportion ( $P < 0.025$ ) of sub-adult porpoises in the northern part. There was no significant difference ( $P > 0.05$ ) in the distribution of adults (Table 3).

#### 4. Discussion

In the SCANS-surveys, a significantly higher number of calves were observed during the aerial surveys (8.9%) (Table 1) than in the ship surveys (4.7%) (Table 2) of the North Sea. This is not surprising considering that the area with the highest calf proportion was investigated by aerial survey. But when the data from Sylt/Amrum are excluded from the aerial survey and the aerial and ship data outside the calving ground compared, the statistical comparison does not show any significant difference in calf sightings ( $P > 0.05$ ). Nevertheless, in order to correct for potentially missed calves, we also analysed the data with a correction factor for missed or not identified calves. The factor is based on the conservative assumption that mother–calf pairs are distributed evenly throughout the North Sea, with the exception of the Sylt/Amrum area as a preferred breeding ground. If there are other preferred breeding grounds along the Danish and the Norwegian coasts, as indicated in SCANS, this correction factor would be lower. Therefore, the difference between Sylt/Amrum and the rest of the North Sea would result in a higher level of significance.

The SCANS data from the North Sea showed that during June and July — their main calving period (Bandomir-Krischak, 1993; Lockyer, 1995) — harbour porpoise calves can be found all over the North

Sea, except in the coastal waters off the Netherlands, where no calf-sightings were documented during SCANS or during systematic ship-based counts of seabirds between 1987 and 1992 (Camphuysen and Leopold, 1993). Other areas seemed to be preferred calving grounds but there were not enough data for statistical comparison.

Therefore we pooled data from the Sylt/Amrum area; the significantly higher proportion of calves in the area off Sylt, Amrum and southern Rømø shows that this is a highly preferred calving ground for porpoises of the North Sea. To our knowledge no other preferred calving grounds have so far been identified in the North Sea.

There seems to be a similar situation in other parts of the range of harbour porpoises with comparably high calf proportions in small areas surrounded by areas with low calf proportions. For example in the waters around Deer Island in the Bay of Fundy in Canada (Smith and Gaskin, 1983; Gaskin and Watson, 1985) or in the coastal waters off southwestern Ireland, where a proportion of 15% calves has been seen (Leopold et al., 1992) compared to 5.1% for the whole Celtic shelf found in SCANS (Table 2).

Unfortunately there are not enough survey data for the area south of Amrum to determine the borders of this calving ground. Therefore we have used stranding data for statistical comparison.

The investigation of the present data showed a significantly ( $P < 0.05$ ) higher proportion of calves in the Sylt/Amrum area than in other areas of Schleswig-Holstein. In contrast, presumably sub-adult porpoises (between one and four years of age) showed a significantly higher proportion in the strandings south of Sylt/Amrum. This indicates some segregation of actively reproducing porpoises and sub-adult porpoises in German waters.

Unfortunately there is no comparable stranding network for harbour porpoises along the Danish

coast (Kinze, pers. comm., 1996), so we cannot say how far this breeding area stretches northward.

It is important to conduct more surveys on breeding and nursing harbour porpoises to investigate the extension of this calving ground off Schleswig-Holstein and to identify other possible calving grounds. This is especially important in order to understand why certain areas are preferred by mothers with calves.

We do not yet know why the Sylt/Amrum area is a calving ground. The Wadden Sea may, in general, be a favourable area for calving porpoises, and there is some evidence from incidental sightings that the waters off the Dutch coast were often used by mother–calf pairs prior to 1960 (Verwey, 1975). Several reasons have been discussed for the decline of harbour porpoises in the southern part of the North Sea along the Dutch coast. Smeenk (1987) and Van Bree (1977) think the primary reason for the decline is pollution, whereas Reijnders (1992) did not find evidence for this by comparing former and present residue levels in porpoises. All three authors agree that the high by-catch incidences seriously affect harbour porpoise numbers, and the possible disturbance by shipping movements along the southern coast of the North Sea is mentioned by Reijnders (1992) and Van Bree (1977). Reijnders (1992) sees the possibility of a synergistic effect in sub-optimal areas (e.g. with limited food resources).

Aerial surveys have only been conducted in summer, so we do not have sighting data on the proportion of calves in autumn and winter. However, as there have been incidental sightings of porpoise calves in winter and autumn (Kremer et al., 1994) as well as some strandings (Fig. 3), the area near Sylt seems to be used as a nursing area as well.

In addition to having a high proportion of porpoise calves, at least in summer 1994 the Sylt area harboured the highest density of porpoises in the North Sea. In the SCANS-survey a density of 0.81 porpoises km<sup>-2</sup> was calculated for block Y including the waters off Sylt compared to 0.37 porpoises km<sup>-2</sup> for the rest of the North Sea (Hammond et al., 1995).

The high proportion of calves combined with the high density of harbour porpoises suggests that the waters off Sylt, southern Rømø and possibly off Amrum play an important role both for calving and nursing. According to Annex 2b of ASCOBANS,

this area should therefore be considered an area of special importance to the survival of porpoises (Anonymous, 1993).

Therefore we suggest the creation of a small cetacean sanctuary off Sylt, Rømø and Amrum and to take appropriate measures to provide the necessary level of protection for the area.

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