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Report of the Working Group on Marine Mammal Ecology (WGMME)

27–30 March 2007

Vilm, Germany

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Contents

Executive summary

The number of porpoises stranded on the Dutch coast doubled between 2005 and 2006, as part of a continuing trend probably reflecting a movement (evident from other sources) of porpoises into the southern North Sea. WGMME reviewed new information on population sizes, by-catches and mitigation measures for fisheries that have a significant impact on small cetaceans and other marine mammals. Additionally, so far as it was possible, the working group summarized the planned observations to meet requirements of EU Regulation 812/2004 by ICES area member state for 2007.

Also, the WG reviewed and reported on the preliminary results of the SCANS II project. The results from SCANS II are vital to estimate by-catch rates and will also provide recommendations for establishing monitoring objectives and suggesting monitoring methods to address the requirements of the Habitats Directive. Additionally the results will be useful in relation to a range of European Directives and international agreements as well as other ICES Working Groups.

Furthermore, the current status of the planning of a workshop on marine mammal health was summarized and the outline of this workshop was finalized. At the moment it is planned to hold this workshop at the beginning of 2008 in Liége, Belgium.

Finally the working group assessed information on how changes in hydrodynamics and sea temperature affect changes in the distribution, population abundance and condition of marine mammals in the OSPAR maritime area. The main conclusion was that pagophilic species such as polar bears or ice breeding seals will be the most likely species to be impacted by an increase in sea temperature.

1 Opening of the meeting

The Working Group on Marine Mammal Ecology (WGMME) met at the German Federal Agency of Nature Conservation (Bundesamt für Naturschutz) on the island of Vilm, Germany from 26 March–30 March 2007. The list of participants and contact details are given in Annex 1.

The Working Group members were welcomed by Wolfgang Dinter from the German Federal Agency of Nature Conservation (Bundesamt für Naturschutz) and Stefan Bräger from the German Oceanographic Museum. The Terms of Reference for the WGMME meeting were discussed on the morning of March 27th and a work schedule was adopted for the meeting.

Terms of Reference for the meeting were:

a) Review and report on any new information on population sizes, by catches or mitigation measures and suggest relevant advice in response to the European Commission standing request regarding fisheries that have a significant impact on small cetaceans and other marine mammals;

b) Review and report on the outputs of the SCANS II project and report on the usefulness of future work for ICES;

c) Review and report on intersessional work on the development of a web based report structure;

d) Review and report on the progress report of the Planning Group for the WGMME Workshop on Environmental Quality and Marine Mammal Health;

e) Assess and report on changes in the distribution, population abundance and condition of marine mammals in the OSPAR maritime area in relation to changes in hydrodynamics and sea temperature [Further details on the interpretation and handling of this ToR was provided by ACE in November 2006].

WGMME will report for the attention of ACE by 20 April 2007.

Justification of Terms of Reference

a) This work is required in relation to MoU between the European Commission and ICES. This also addresses Goal 1 of the ICES Strategic Plan.

b) Many of the results from SCANS II will be considered under ToR ‘a’ but some additional aspects will be helpful to the WGMME in interpreting the request for advice from the EU.

c) This will improve the efficiency of WGMME work

d) Marine mammals are upper trophic level predators that accumulate high levels of pollutants. This addresses Goal 2 in the ICES Strategic Plan.

e) This is in support to a request from OSPAR

1.1 Acknowledgements

The Working Group thanks the German Federal Agency of Nature Conservation (BfN) for their invitation to conduct the meeting on the island of Vilm. The Working Group would especially like to thank the international Naturschutz Akademie for the professional and friendly service on the island. The Working Group also gratefully acknowledges the support given by several additional experts, among them: Arne Bjørge, Phil Hammond, Jan Haelters, Mervi Kunnasranta, Kit Kovacs, Jennifer Learmonth, Kjell T. Nilssen, Daniel Pike, Dominic Rihan, Tero Sipilä and Mark Tasker. They all kindly provided information and/or reports for use by WGMME and reviewed parts of the report.

The Chair also acknowledges the diligence and commitment of all the participants before, during and after the meeting, which ensured that the Terms of Reference for this meeting were addressed.

2 TOR A) Population sizes, by-catches and mitigation measures of marine mammals

The term of reference states: in relation to fisheries that have a significant impact on small cetaceans and other marine mammals, review and report on any new information on population sizes, by-catches or mitigation measures.

2.1 New information on population sizes

2.1.1 Cetaceans in the North Sea and European Atlantic shelf

All marine mammals are potentially subject to by-catch in fishing operations, and it is not possible to make an *a priori* judgement on whether such by-catches are significant. Any known by-catches need to be considered in relation to the best information available on population size and structure. The WG therefore considered it appropriate under this term of reference to review new information on population size of any marine mammals in the ICES area, and will continue to do so under this ToR in future years as such information becomes available.

The SCANS II survey was completed in July 2005, but analysis and report writing is ongoing, with a final report due to the Commission at the end of March 2007. Preliminary results of abundance estimates have been provided to ASCOBANS in 2006, and were also presented at a special SCANS II conference held in Edinburgh in December 2006. A summary of the small cetacean abundance estimates is given below, and a more detailed account of the information that has been made public so far is given in Section 2 under ToR 2 below.

Table 1: Summary of SCANS II Abundance Estimates.

Species	*Abundance estimate N (Coefficient of variation)*
Harbour porpoise	*386 000 (0.20)*
Common dolphins	*63 400 (0.46)*
White-beaked dolphins	*22 700 (0.42)*
Bottlenose dolphin	*12 600 (0.27)*
Minke whale	*18 600 (0.30)*

After harbour porpoises, common dolphins are probably the most frequently caught marine mammal in fishing operations in the ICES area. Although the EU by-catch project “PeTraCet” and national reporting schemes under Council Regulation 812/2004 of the EC have provided and continue to provide partial estimates of by-catch for this species, abundance estimates have been restricted to summer surveys, largely on the shelf, whereas common dolphins are distributed widely over deep water throughout the northeast Atlantic and further afield during the summer time. In order to obtain a more realistic estimate of the population abundance, an offshore (off-shelf) survey has been planned for July 2007. This project (Cetacean Offshore Distribution and Abundance in the European Atlantic CODA) originally sought funding from the EU, but this was refused, and a restricted survey area will now be surveyed with funding exclusively from four member states (Spain, France, Ireland, UK) of the EU. The exact area is not yet fixed but the survey will involve four ships surveying an area of approximately 900,000 square km from about 42 to 62 degrees north and west to at least the 200 nm EEZ as far as resources allow. The survey is timed to coincide with the TNASS (Trans North Atlantic

Sightings Survey) in more northerly waters, which includes surveys in waters of Norway, Faeroe Islands, Iceland, Greenland and Canada (see Figure 1). The TNASS will also join up with US aerial surveys (SNESSA) being conducted at the same time over US shelf waters and the western portion of the Scotian Shelf. Results are expected from the CODA part of this synoptic survey by September 2008.

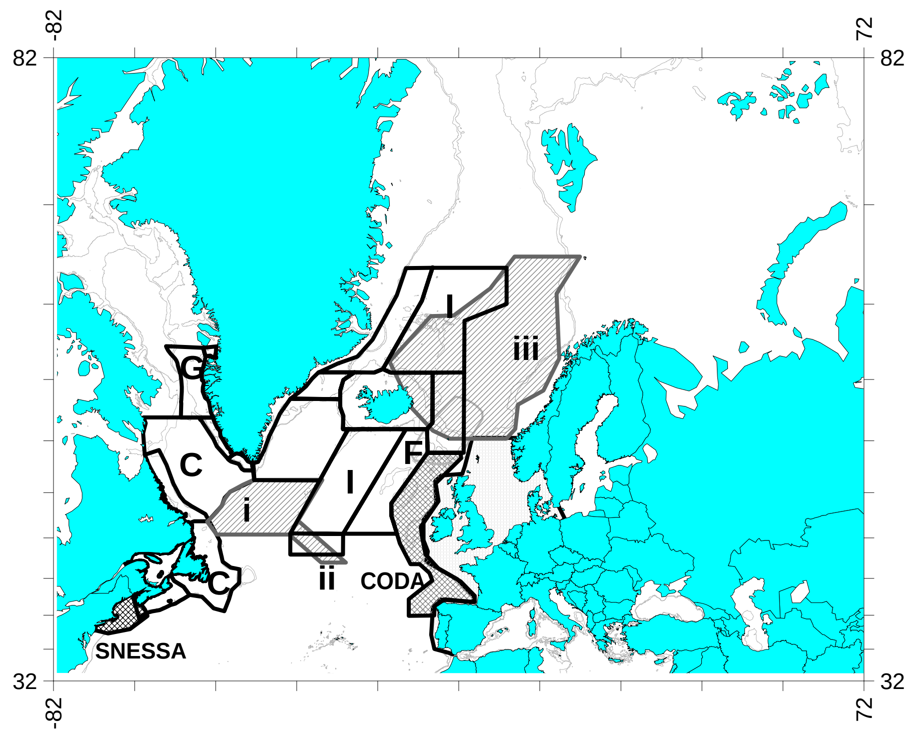

Figure 1: T-NASS and associated survey areas. Planned survey area for the T-NASS, showing the main survey area, survey extensions (diagonal hatched) and associated American (SNESSA) and European (CODA) surveys (cross hatched). The SCANS-II survey area is also shown (dotted). The Norwegian survey area is uncertain and not shown. C–Canada; G–Greenland; I–Iceland; F–Faroes; i.–ICES Redfish survey extension; ii.–MAR-ECO survey extension; iii.–Norwegian/Russian Ecosystem Survey extension.

Evidence of increased numbers of porpoises in the southern North Sea in recent years has continued to accumulate. From sightings during two aerial observation flights (modified pollution control flights) performed by MUMM (Management Unit of Mathematical Models for the North Sea, in Brussels) it was (roughly) estimated that the average density of porpoises in Belgian waters in March and April 2004 was between 0.2 to 0.6 per square km, or 650 to 2100 animals (Haelters & Jacques, 2006). Numbers of porpoises in Belgian waters in summer and autumn are much lower.

Long-term passive acoustic monitoring has been conducted in the German Baltic Sea from August 2002 to December 2005 with porpoise detectors (T-PODs). Results show seasonal as well as geographical variation in harbour porpoise presence (and therefore abundance), with decreasing detections from west to east and more porpoises in the summer months than in winter (Verfuß *et al.*, 2007). 2006 data show similar results (Verfuß, pers. comm.).

2.1.2 Baltic seals

The WG learned that synchronous grey seal surveys in the most important grey seal areas of Estonia, Finland, Russia and Sweden during moulting time are carried out each year *(Mervi Kunnasranta (Finnish Game and Fisheries Research Institute) pers comm.).* These coordinated grey seal censuses have been conducted since 1999. The figure for 2006 was 20 700 which equates to an annual increase of 13% over this period. (www.rktl.fi).

In 2005, during a three-day period (31st May–2nd June), the total number of grey seals counted was approximately 18 300 individuals while in 2006, during a five-day period (29th May–2nd June), the total number of grey seals counted was approximately 20 700 individuals. Rounded numbers by sea area for the two years are given below (Table 2):

Table 2: Grey Seal Counts in the Baltic by Area, 2005–2006.

AREA	2005	2006
Bothnian Bay + North Quark	1 270	800
Sea of Bothnia excl. Åland archipelago	610	1 150
Waters around SW Finnish archipelago including Åland	8 040	9 870
Swedish Baltic proper between Gulf of Bothnia and 58°N (northern tip of Gotland)	4 460	5 350
Gulf of Finland	880	760
W Estonia	2 660	2 340
Swedish Baltic proper south of 58°N	350	430

Due to migrations, distribution of the grey seal population could be different during other parts of the year. Over the entire period of 2000–2006 the total numbers of grey seals counted have increased as follows:

Table 3: Total seal counts for each year 2000–2006.

YEAR	2000	2001	2002	2003	2004	2005	2006
No. of individuals	9 700	10 300	13 100	15 950	17 640	18 300	20 700

This series of figures demonstrates a clear increasing trend in grey seal numbers. However it should not be taken to express the true rate of increase because many factors other than real growth may be involved. Continuous development of the census methods and even chance resulting from only a few repeats may play a role in the observed trend.

A table of the number of Baltic grey seals hunted between 2000 and 2006 was also provided to the WG.

Table 4: Grey Seal numbers hunted in the Baltic 2000-2006 (numbers in brackets indicate hunting quotas outside specified areas).

Year	Sweden		Finland (Mainland)		Åland		Total
	Quota	Catch	Quota (1.8.–31.7.)	Catch	Quota	Catch	catch
2000	0	0	100	60	84	30	90
2001	150	57	180	92	89	54	203
2002	150	79	230	134	203	95	308
2003	190 (170+20)	85	395	233	203	82	394
2004	170 (170+13)	85	490	292	293	150	523
2005	170 (170+16)	92	635	334	250	118	535
2006	170 (170+20)	117	675		390		
Total		**515**		**1 145**		**529**	**2 053**

2.1.3 North Sea seals

2.1.3.1 Harbour seals

Harbour seals occur around most of the North Sea. In 1988 and 2002 outbreaks of a phocine distemper virus (PDV) affected seals particularly in the southern parts of the North Sea (ref). In 2002, harbour seal populations on mainland Europe (Netherlands, Belgium, Germany, Denmark and Sweden) were reduced by approx 50% but have since increased rapidly, following a pattern similar to that seen in 1988. In contrast, the population on the west side of the North Sea (around The Wash), where 22% mortality was recorded, has not yet started to recover.

Surveys of harbour seals in Shetland and Orkney in 2006 showed a decline of over 40% from the previous surveys in 2001 (Lonergan *et al.*, 2007). A similar decline appears to exist in other areas of the UK bordering the North Sea.

Harbour seal counts were conducted along the Norwegian coast during mould in 2003–2006. The numbers are based mainly on aerial photographic surveys, and in sub-areas also on visual counts. From surveys carried out between 1994 and 2005, approximately 46 000 harbour seals were counted. Surveys were carried out during the annual moult and represent between 55%–70% of the total population.

Table 5. Recent counts of harbour seals around the North Sea.

LOCATION	COUNT	YEAR OF SURVEY
Wadden Sea Germany	9 100	2005
Wadden Sea Netherlands	3 450	2005
Wadden Sea Denmark	1 720	2005
Lijmfjorden Denmark	1 407	2003
Kattegat/Skagerrak	11 700	2003
Norway S of 62°N		
ICES IVa (south of 62°N)	685	2003–2006
ICES IIIa (Norwegian Skagerrak)	291	2003–2006
Norway N of 62°N		
ICES I (East Finmark)	207	2003–2005
ICES IIa (West-Finmark to 62°N)	5485	2003–2005
UK Shetland	3 021	2006
UK Orkney	4 256	2006
UK Scotland east	1 819	2005
UK England east	3 617	2005
Total	**46 758**	

2.1.3.2 Grey seals

Pup production is the monitored parameter from which total population size can be estimated. In some areas pup production is monitored annually and less frequently at others.

Table 6. Grey seal pup production around the North Sea.

Location	Count	Year of survey
Germany	66	2005/2006
Netherlands	200	2006
Norway S of 62°N		
ICES IVa (south of 62°N)	35	2003
Norway N of 62°N		
ICES I (East Finmark)	106	2001–2003
ICES IIa (West-Finmark to 62°N)	1 036	2001–2003
UK Shetland	700	2005
UK Orkney	17 644	2005
UK North Sea colonies	5 132	2005
Total	**24 919**	

Grey seal pup production estimates (based on pup tagging, counting and staging) were conducted along the entire Norwegian coast in October-December 2001–2003. Estimates for grey seal adults in Norway are about 140–170 animals in the areas north of 62°N and about 4570–5370 in the areas south of 62°N.

In the ICES I area along the Russian Murman coast from 1987–1991 the abundance of grey seal adults is approximately 3400.

2.1.4 Atlantic seals

2.1.4.1 Harbour Seals

On coasts bordering the east side of the North Atlantic, approximately 19 000 harbour seals were counted during the moulting period between 2002 and 2005–see Table 7. These populations did not appear to have been affected by the PDV outbreak in 2002, although there was some mortality in Northern Ireland and on the Scottish west coast (Firth of Clyde) in 1988.

Table 7. Counts from the European Atlantic are (*numbers approximate, not based on surveys).

UK Outer Hebrides	2 098	2003
UK Scotland west coast	12 507	2000/2005
Ireland north	1 248	2002
Ireland south	2 905	2003
France	200*	2006?
Total	**18 958**	**2000 to 2005**

2.1.4.2 Grey Seal

Table 8. Grey seal pup production in the European Atlantic.

East Atlantic	unknown	Year
UK Inner Hebrides	3 387	2005
UK Outer Hebrides	12 297	2005
S Ireland	unknown	
N Ireland	80 approx	2005
UK south-west	1 750	1994
France	unknown	
Russia/Finmark	unknown	
Total	**>18 000**	

2.2 New Information on By-catches

Note that EU Council Regulation 812/2004 required reporting on by-catch observations by member states in certain prescribed fisheries by June 2006. Reporting on the observational requirements of the Regulation are dealt with separately below (see Section 2.3)

2.2.1 Baltic Sea

2.2.1.1 Harbour Porpoises

In the Swedish detailed logbook system covering approximately 5% of the fishing effort in the inshore fishery with nets and static gears no harbour porpoise by-catches were reported between 2001 and 2006.

Strandings and by-caught marine mammals are collected in Mecklenburg-West Pomerania, Germany, on a regular basis by the German Oceanographic Museum. In 2006, six by-caught animals were delivered, three of them caught in cod-nets, one in a salmon-net, two unknown. Three by-caught harbour porpoises in 2006 were also reported to the FTZ for Schleswig-Holstein. Two of them were found in gillnets, one of them was a stranding with indications of having been by-caught.

A database on sighted, stranded and by-caught harbour porpoises in the Baltic Sea is being organized by the Research and Technology Centre West Coast (University of Kiel) and can be found on www.balticseaporpoise.org.

2.2.1.2 Baltic Seals

One by-caught Grey Seal was delivered to the German Oceanographic Museum in Mecklenburg-West Pomerania Germany in 2006.

A detailed logbook system in Sweden were fishermen are contracted to keep a detailed log of fish catches, seal disturbance and by-caught marine mammals (Lunneryd *et al.*, 2005) started in 2001. The program ended in 2006. The schedule covered approximately 5% of the fishing effort in the inshore fishery with nets and static gears. Preliminary figures indicate that the by-catches have been stable during those years with a total amount of annual by-catch of grey seal, ringed seal and harbour seal less than 500 specimens in the Swedish fishery.

2.2.1.3 Ladoga Seals

Fisheries' by-catch data of Ladoga ringed seals has been made public in 2006 and 2007 (Agafonova *et al.*, 2007, Verevkin *et al.*, 2006). They interviewed 36 fishing crew leaders from southern Lake Ladoga and 17 from the north in 2006. At least 483 seals were by-caught in 2003, which corresponds approximately to 10–16% of the population size, while official statistics recorded only 60 cases. Data by fishing plant are given below.

Table 9: Fishery related mortality of Ladoga seal in 2003 (data collated by interview) (from Verevkin *et al.*, 2006).

FISHING PLANT	NO. SEALS KILLED
Shilsselburg	133
Novaiy Ladoga	152
Priozerks	7
Olontes- Vilitsa	50
Valaam	9
Northern Karelian Republic*	132
Total	**483**

***Includes Pitkäranta, Sortavala and Lahdenpohja fishing farms.**

2.2.2 North Sea

2.2.2.1 Harbour porpoises

In Germany, strandings and by-caught marine mammals are collected in Schleswig-Holstein on a regular basis by the Research and Technology Centre West Coast (FTZ), Büsum (University of Kiel). No by-catch data were reported for any of the German North Sea in 2006.

In 2006, 92 harbour porpoises stranded on the Belgian coast (89 in 2005). As in the preceding three years most of the strandings (60%) occurred from March to May, though another peak was observed in August 2006 (15%). In May 2005, a relatively high number of decayed harbour porpoise carcasses washed ashore in a short period of time. The most probable cause of death of most of these animals was determined as by-catch. A model developed at MUMM demonstrated that the most probable region where the animals had died was the southern North Sea–eastern Channel. The results of this investigation were presented at the 2006 ICES Annual Science Conference (Haelters *et al.*, 2006). All of the 92 strandings in 2006 were necropsied. The mortality of these animals due to by-catch was between 29% and 68%: 26 certain by-catches, 5 most probably by-catches, 30 unknown causes, 29 natural causes and 2 live strandings (RBINS/MUMM, unpublished data). One adult male white-beaked dolphin that stranded in Belgium in December 2006 was also diagnosed as being by-caught.

In the Netherlands 509 porpoises stranded in 2006 between January and September with a peak in spring, of which 64 were necropsied (special necropsy session organized at IMARES, Texel, in September 2006). When the cause of death was established, a minimum of 64% of deaths in fishing nets was reported (Leopold M.F. & C.J. Camphuysen, 2006). On average the number of animals stranding per year in the period 2000 to 2006 was 204 (see Figure 2).

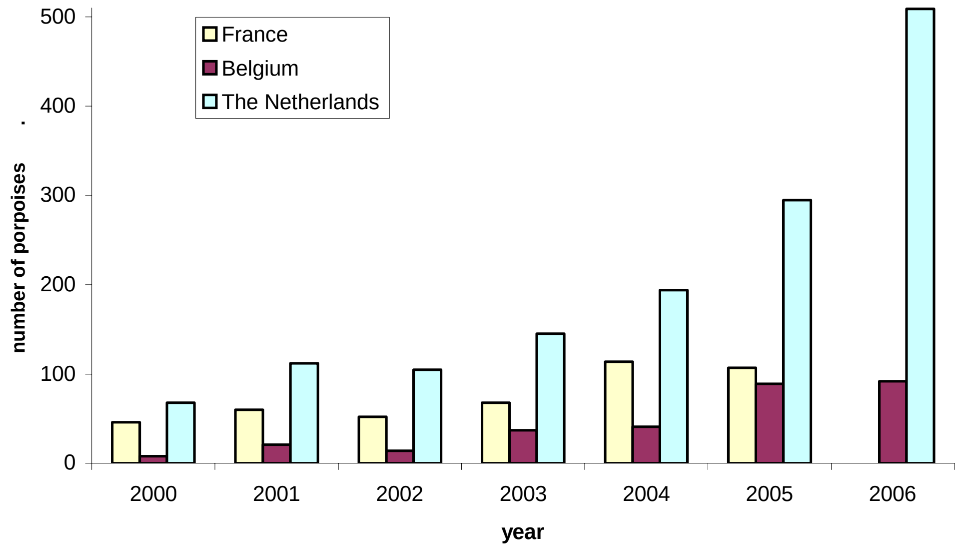

Figure 2. Increase of porpoises strandings on the French, Belgian and Dutch coasts between 2000 and 2006 (no data for the French coast for 2006 available yet) (compiled from RBINS/MUMM, unpublished; ASCOBANS 2007).

The national stranding network (RNE) managed by the CRMM, University of La Rochelle, collects information and samples on the stranded marine mammals along the French coasts. From 1996 to 2005 an increase in strandings of harbour porpoises has been observed (Figure 2). In northern France of 10 fresh porpoises collected in 2006, 7 were considered as being by-caught.

2.2.2.2 Porpoises in Norwegian waters

In 2006 a monitoring programme for coastal gillnetters was conducted. A total of 149 harbour porpoises were by-caught (Table 10).

Table10: Overview of Norwegian harbour porpoise by-catch (coastal gillnetters).

Species	Area/Stock	Incidental Mortality		
		Observed	Estimated	Source
Harbour porpoise	ICES area Ia	1	Not avail.	Gill net
Harbour porpoise	ICES area $IIia_2$	134	Not avail.	Gill net
Harbour porpoise	ICES area IIIa	10	Not avail.	Gill net
Harbour porpoise	ICES area IVa	4	Not avail.	Gill net

2.2.2.3 Seals

Luque *et al.* (2007) reported on observations made on board Scottish pelagic trawlers fishing for herring and mackerel. Several records of seal by-catch (but none of cetacean by-catch) were reported, but these were confined to a relatively few times and places and no extrapolation to a total number was made.

In 2006 in the Norwegian coastal gillnetters 27 harbour seal, 10 grey seal, 8 harp seal were recorded as by-catches.

2.2.3 Atlantic waters–VII and VIII

2.2.3.1 Common dolphins in pelagic trawl fisheries (VII, VIII)

The report of the Petracet project was submitted to the European Commission in July 2006. 952 pelagic trawl operations were adequately monitored over an 18 month between December 2003 and May 2005. 36 different vessels from France, the UK, Ireland the Netherlands and Denmark covering five target species in six fishery strata (tuna, horse mackerel, anchovy, mackerel and bass in the Channel (VIIde) and bass in the Bay of Biscay (VIII)). The UK Pelagic trawl fishery for bass was not included in this study as it is the subject of an intensive nationally funded observation program (see below). It was estimated that the total European pelagic trawl fleet effort in Divisions VII and VIII amounted to slightly less than 20 000 operations in 2003–2004, so that the observed effort was equivalent to roughly 5% of total effort for a single year. Cetacean by-catches were recorded in 21 of the observed operations (or 1 in 45 tows), with an average group size of 4.4 animals and a total of 89 common dolphins, 3 striped dolphins and a single Risso's dolphin which was caught together with some common dolphins. Thus 93 small cetaceans were recorded altogether, but these were only recorded in three of the six fishery strata, namely in the two bass strata (Channel and Biscay) and the tuna (albacore) fishery. Despite observations in 371 anchovy fishery operations, no dolphins were recorded in that fishery or in the mackerel (92 observed hauls) or horse mackerel (42 observed operations) fisheries. The best estimate for the total annual mortality is therefore based only on by-catches occurring in the tuna and bass fisheries alone, and amounts to just over 600 animals in these fisheries.

In the **UK** during the winter of 2005–2006, nine of 54 observed fishing operations in the pelagic pair trawl fishery for bass resulted in a total of 77 common dolphin mortalities. The total fleet effort was estimated at 58 hauls, so the estimated by-catch for the whole fleet this season was 84 common dolphins (+/- 1, CV=0.03).

Although no by-catches were observed during the Petracet project in the mackerel or horse mackerel fishery, three common dolphins were observed caught in the **Dutch horse mackerel fishery** in 2005 (see also Section 2.3 below), suggesting a total mortality of a few tens of animals in this fishery, which was not picked up by the Petracet project.

Overall, it seems likely that the total mortality of common dolphins in European pelagic trawl fisheries in the ICES area is currently probably around 800 animals per year, though large inter-annual variability has been noted in the bass and tuna fisheries. By-catches of common dolphins are also known to occur in other fisheries including VHVO trawls (see below), bottom trawls and static nets (ICES 2005).

2.2.3.2 Common dolphins in VHVO bottom pair trawlers (VIII)

During 2006 four surveys or observer trips were carried out by AZTI on board VHVO bottom pair trawlers in the context of the EU-project "Necessity". During these trips 59 hauls were observed, 8 in ICES Division VIIIc and 51 in ICES Divisions VIIIab. The observations in ICES Division VIIIc were between May and June and no by-catch was observed. The trips in ICES Divisions VIIIab were conducted in May (27 hauls) and between October and November (24 hauls). In the first trip no by-catch was observed while in the second trip common dolphin by-catch was observed. During both trips in VIIIab, schools of dolphins were sighted from the boats during the fishing operation, one school during each trip. No by-catch was recorded even though one of the schools was between the two boats.

Additional observations have been conducted in 2006, but data from these trips are still being processed.

The 2005 observations on the VHVO bottom pair trawlers for ICES Divisions VIIIabd are presented in Table 11. Common dolphin by-catch was recorded in 2 of 70 (2.85%) hauls. Both incidental takes were in the first quarter of the year (Table 11).

Table 11: Total number of hauls observed and number of individuals caught by quarter during year 2005 for bottom pair trawlers with very high vertical opening nets (VHVO) in Divisions VIIIa,b,d.

	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	TOTAL 2005
Hauls observed	34	9	10	17	70
Hauls with by-catch	2	0	0	0	2
Nº of individuals	2 (1,1)	0	0	0	2 (1,1)

2.2.3.3 Other marine mammal by-catch observations-Spanish vessels

During 2006 AZTI has run a project funded by the Basque Government to monitor the activity of purse seiners in the anchovy (*Engraulis encrasicholus*) fishery. During this project observers were on board of several boats with the aim of quantifying the anchovy catches and to obtain biological samples of this species, apart from information on marine mammal by-catch was also observed. Between April and May, in 56 days at sea 105 hauls were observed in ICES Divisions VIIIbc were the fishery takes place with no marine mammal by-catch.

During 2006 the Spanish Institute of Oceanography placed observers on board vessels operating in several fisheries in the North Atlantic.

The corresponding number of fishing operations and incidental catches observed are as follows:

<u>Longline fishery for swordfish</u>: 78 sets were observed. Two incidental catches (two specimens) of false killer whales (*Pseudorca crassidens*) were reported. The animals were released alive.

<u>Trawl fisheries in the North Atlantic</u>: Hatton Bank: 374 tows observed; Svalbard: 104 tows observed; Reikjanes Ridge: 42 tows observed. No incidental catches were reported in any of these fisheries.

<u>Trawl fisheries in ICES areas VII, VIII and IX</u>: 594 tows observed. No incidental catches were reported.

2.2.3.4 Distant water fleets of the EU

Between 1993 and 2001, observers spent a total of 2540 days at sea on board Spanish fishing vessels (check gear–trawl?) fishing around the Falkland Islands. Their main task was to sample the fish and cephalopod catch and by-catch but they also recorded incidental sightings and by-catches of marine megafauna (seabirds and marine mammals). Sightings or catches of protected marine megafauna were recorded during 25 fishing trips.

Several species of seabirds and marine mammals were reported incidentally caught in the fishing nets. However, the 15 records over nine years include three cetacean specimens in an advanced stay of decay when caught. The mammals observed to be killed in the fishing gear included three hourglass dolphins (*Lagenorhynchus cruciger*), one crabeater seal (*Lobodon carcinophagus*), one South American sea lion (*Otaria byronia*) and one South American fur seal (*Arctocephalus australis*) and one “grey seal”. The overall by-catch mortality for marine mammals was approximately three mammals per 1000 observer days at sea, with the highest mortality (>1 animal per 100 days at sea) being seen in 1993. Thus the by-catch rate in this distant water fishery is apparently low (Martínez Portela *et al.*, 2001).

2.3 By-catch Observation schemes under EU Reg 812/2004

Working by e-mail and on the basis of the experience of members present, the WG reviewed progress in implementing observer programmes to monitor marine mammal by-catch in EU fisheries as required by the EU Council Regulation 812/2004.

In **Denmark** monitoring requirements include observations of pelagic trawlers in Division VII, and the monitoring of pelagic trawlers in the North Sea, and set nets in IIIbcd. An observer scheme has been established to cover these requirements and the scheme was initiated in early 2007.

A national monitoring scheme has been in place in **France** since 2006, but France also participated in the Petracet project during 2004–2005 to estimate by-catch in pelagic trawl fisheries, and France also organised a separate project called Procet that was designed to assess the effects of acoustic pingers in reducing dolphin by-catch in pelagic trawls. Overall in both surveys over 1200 operations were monitored. Data from both projects will also be considered during the final phases of the Necessity project (due to report to the European Commission in June of 2007). Pelagic trawl and static net monitoring is ongoing, following the planned observation level of 2600 days at sea that were reported at last year's WGMME meeting. No estimates of by-catch have yet been made from the current national monitoring scheme.

In **Germany**, dedicated observer programs or pilot studies have not been set up yet, but the regular sampling scheme through the current DCR (Data Collection Regulation under EU1581/2004) ensures that all major German fisheries are covered. Fishery observers have been instructed to record any marine mammal by-catch.

The **UK** monitoring scheme has been in operation since early 2005 and includes some observations made by fishery discard officers under the Data Collection regulations (1543/2000 and 1639/2001) as well as dedicated observations directed towards the provisions of 812/2004. Overall during 2005, 39 days of monitoring were achieved on gillnetters and 163 days on pelagic trawlers, while in the period January to May 2006 a further 170 days on board pelagic trawlers was achieved. No cetacean by-catches were observed in these days at sea, though the bass pelagic pair trawl fishery is not included in these figures (see above) as the boats involved are less than 15m. A further 250 days observation was carried out in gillnet and other fisheries in the same period, and these data are currently being analysed for reporting to the National Authority in April 2007, but are not part of the 81/2004 regulation requirement.

In **Ireland**, no explicit funding is available to implement the requirements of EU Regulation 812/2004 and therefore most observation work has been carried out in conjunction with other research projects. This has meant that coverage has been sporadic. Without an explicit funding programme and given the many different pelagic and gillnet fisheries in Irish waters, it has been difficult to provide good spatial and temporal coverage to provide statistically significant results. From the period June 2004–June 2006 a total of 23 trips comprising 128 hauls in five different pelagic fisheries in Areas VI, VII and VIII were observed. There was a total observed by-catch of 3 common dolphins. A by-catch was only recorded in the Albacore tuna fishery. For the same period from 21 trips comprising 92 sets with gillnet and tangle net gear in Areas VI and VII a by-catch of 3 harbour porpoises, 1 common seal and 1 grey seal was observed. By-catch was only recorded with hake or cod gillnets. There was no by-catch with tangle net gear other than one grey seal. From a further 47 single day trips comprising 117 observed sets in the salmon drift net fishery in Area VIa, no cetacean by-catch was observed. One basking shark was recorded as a by-catch. From the period June 2006–April 2007, a further 10 days comprising 45 days and 125 hauls have been observed in the hake gillnet and wreck net fisheries in Area VIIb,j,g. These trials were carried out as part of acoustic deterrent trials and a total by-catch of 3 porpoises, 3 common dolphins and 1 striped dolphin was recorded. Two further observed trips are due to carried out in these fisheries in April-May 2007. A total of 32 days comprising 6 trips and approximately 35 hauls have been observed in the Albacore tuna pair pelagic, mackerel, horse mackerel and blue whiting fisheries in Areas VI, VII and VIII. No by-catch has been observed. A further two observer trips are scheduled for the Albacore tuna fishery in August-September 2007 and 3–4 trips in the mackerel and horse mackerel fisheries in early autumn.

Dutch monitoring under EC Regulation 812/2004 is integrated with the collection of discards data under the EC Data Collection Regulations. During the 2004/2005 winter pelagic trawl fishing season 98 observer days were sampled on Dutch boats from a total of 834 days at sea in the area covered by Regulation 812/2004 (11.8% coverage). Three common dolphins were recorded by-caught in two hauls of 143 observed (0.02 dolphins per haul). In the 2005/6 season no dolphin by-catches were observed in 24 days of observation, which covered 31% of total recorded effort by the Dutch pelagic trawl fishery in the area covered by the Regulation 812/2004. Total mortalities are thought to be a few tens of animals per year at present (Couperus 2006).

According to the **Belgian** report to the Commission on the implementation of regulation 812, the Belgian fleet comprised 121 units on 31 December 2005, of which three were vessels using entangling nets. These three boats fished mainly in the southern North Sea (IVc: 228 days at sea) and the eastern English Channel (VIId: 58 days at sea). No specific observer monitoring scheme has been devised, since Annex III of the regulation (812/2004) does not contain legal obligations applicable to the Belgian fleet either in terms of area or in terms of fishing gear. Despite this fact, independent observers have been placed on board vessels using entangling nets in two cases. No by-catch of marine mammals was observed during these two trips.

In **Norway** data to estimate total by-catches within monitored fisheries are collected, but validated estimates are not yet available. During a 2006 monitoring programme for coastal gillnetters 149 harbour porpoises, 27 harbour seals, 10 grey seals and 8 harp seals were caught.

In **Sweden** an observer scheme started in August 2006. During 2006 30 observer days were covered which correspond to 5% of the fishing effort. No harbour porpoise were by-caught. The pilot study for smaller gillnet vessels (>15 m) is still under preparation.

In **Finland** an observer programme was started during the second half of 2006. According to the 2005 fishing effort 329 hours should be covered during this period. The observers covered 595 hours (9% of the total effort in 2006). No porpoise by-catch was recorded.

As far as this WG was aware the **Spanish** fishing administration has recently been in contact with the institutes IEO and AZTI in order to plan an observer programme to address the Spanish obligations of Regulation 812/2004. The figures given in Table 12 on the number of days at sea needed to meet the requirements of the EU Regulation are an estimate that refers only to the boats based in the ports of the Basque Country. They are not official data from the Spanish Fisheries Administration, and data from the rest of Spain would be needed for a full estimate of the number of observer days required to fulfil the obligations of Regulation 812/2004. The information collected during 2006 by the different observer programmes run by IEO and AZTI is unlikely to cover the 5% required by the Regulation 812/2004.

The working group received no information from Portugal, Poland, Latvia, Lithuania or Estonia.

In 2006 the WG had reviewed the intended levels of sampling by each EU member state under the requirements of Regulation 812/2004. The WG was not able to determine the extent to which these targets had been met, because the reporting cycle requires member states to report to the Commission in June for the previous year's sampling, which means that the levels of sampling achieved in 2006 will not be available until after June 2007, and will not therefore be available to the WGMME until its 2008 meeting. The WG also discussed possible sampling plans for 2007, but information on this topic was limited at the time of the meeting, and it was felt that sampling levels in 2007 would likely be similar to those planned for 2006. For these reasons the table compiled for 2006 was not altered in 2007 and is presented again below.

Table 12: Planned Observations to meet requirements of EU Regulation 812/2004 by ICES area member state for 2006/7 ("–": No national fishing effort to observe. ">" indicates minimum values).

AREA	GEAR	START DATE IN REGULATION	FLEET SEG-MENT	OBS. COVE-RAGE	DK (OBS. DAYS)	FR (OBS. DAYS)	UK (OBS. DAYS)	DE (OBS. DAYS)	NL (OBS. DAYS)	BE (OBS. DAYS)	PT (OBS. DAYS)	SW (OBS. DAYS)	S (OBS. DAYS)	IR (OBS. DAYS)
A1. ICES sub areas VI, VII & VIII	Pelagic trawls (single & pair),1 Dec. to 31 March	1 January 2005	≥ 15 m	10%	20	480	~200	70	~200*	-	-	-	-	26
			< 15 m		-	*20*	*10*	*0*	-	-	-	-	-	-
A2. ICES sub areas VI, VII & VIII	Pelagic trawls (single & pair), 1 April to 30 Nov.	1 January 2005	≥ 15 m	5%	20	570	20	30	+	-	-	-	-	60
			< 15 m		-	*60*	*10*	*0*	-	-	-	-	-	-
B. Mediterranean Sea (east of the line 5º36'W)	Pelagic trawls (single & pair)	1 January 2005	≥ 15 m	5%	-	213	-	-	-	-	-	-	-	-
			< 15 m		-	-	-	-	-	-	-	-	-	-
C. ICES div. VIa, VIIa,b, VIIIa, b, c, IXa	Bottom-set gillnet or entangling nets using mesh sizes ≥ 80 mm	1 January 2005	≥ 15 m	5%	-	810	46	-	-	-	100	-	>70	<40
			< 15 m		-	*447*	*18*	-	-	-	*0*	-	*>504*	+
D. ICES IV, div. VIa & subarea VII (excl.VIIc) & VIIk	Driftnets	1 January 2006	≥ 15 m	5%	-	-	-	-	-	-		-	-	
			< 15 m		-	-	*60*	-	-	-	*0*	-	-	
E. ICES sub areas IIIa, b, c, IIId south of 59°N, IIId north of 59°N (1 June–30 Sept.), IV & IX	Pelagic trawls (single and pair)	1 January 2006	≥ 15 m	5%	795	-	100	10	+	-	-	162	-	
			< 15 m	*5%*	*58*	-	*10*	-	-	-	-	-	-	
F. ICES sub areas VI, VII, VIII & IX	High-opening trawls	1 January 2006	≥ 15 m	5%	-	-	-	-	-	-	-	-	>205	
			< 15 m		-	-	-	-	-	-	-	-	-	
G. ICES sub areas IIIb, c, d	Bottom-set gillnet or entangling nets using mesh sizes ≥ 80 mm	1 January 2006	≥ 15 m	5%	21	-	-	-	-	-	-	17	-	
			< 15 m	*5%*	*50*	-	-	-	-	-	-	-	-	
					71	***2600***	***474***	***0***	***~200***	***0***	***100***	***179-***	***>779+***	***126***

The schedules 200 days is the total for the Dutch pelagic trawl fleet and will be apportioned among temporal and spatial strata at a later date.

2.4 New Information on mitigation measures

2.4.1 Fishery Restrictions

The Belgian authorities have reacted to the high level of by-caught animals stranding on the Belgian coast in recent years. Although the environment administrations pleaded strongly for a ban on the recreational use of gillnets on the beach, especially between March and May, this could not be agreed upon by the fishermen and the fisheries minister. The measures taken in 2006 were:

- a ban on the use of 'trémail' (trammel) nets, one of the types of gillnet used by recreational fishermen;
- a limit on the height of the gillnets which can now only be up to 80 cm high, except for March to May when they can only be 60 cm high;
- a limit on the total length of gillnets per fisherman to 50 m between March and May, and 100 m in the other months; a limit of 50 m had already been installed in certain coastal communities for years, and the use of any gillnet had already been banned by the coastal community of Ostend, although difficulties in the interpretation of the local legislation exist.

The effects of the measures on the number of by-caught porpoises will be evaluated in spring 2007.

In order to prevent or reduce by-catches of seals and seabirds, professional gillnet fishing in the immediate vicinity of the outer port of Zeebrugge was banned: a distance limit of 200 m was installed.

One of the three Belgian professional gillnet fishermen (who is often active outside ICES Area IVc–and who may therefore be required to use pingers under the 812 regulation) has made enquiries about obtaining pingers. He had experienced difficulties in trying to purchase pingers in 2006. One recreational beach fisherman will voluntarily deploy a pinger on his net from 2007 onwards.

For the Baltic Sea, fishery restrictions for 2006 are given in Annex II and III of the council regulation (EC) No 52/2006 of the Official Journal of the European Union L16 which include seasonal closures to various gear types including gillnets for two month periods in subdivisions 22–27, and mesh size restrictions for gillnets. These may have the additional benefit of partially reducing porpoise by-catch.

Other regulations affecting fishing gear usage throughout the EU can be found in the council regulation (EC) No 51/2006 of the Official Journal of the European Union L16 (http://eur-lex.europa.eu/). Some of these may affect marine mammal by-catch rates, but the WG did not have time to analyse all of these regulations with respect to marine mammal by-catch.

2.4.2 Technical measures

2.4.2.1 Alternate gears

In Germany, 16 fish traps had been purchased form a Norwegian Company in the course of the Jastarnia Plan recommendation to replace gillnets by fish traps. Experiments should have started in 2006 in the western Baltic to establish catch rates. Further 100 traps hoped to be purchased in 2007 for a full-scale study if tests were successful (ASCOBANS 2006). Fish traps had been tested on the Swedish West coast and also in the Baltic Sea. On the West Coast the trials had been abandoned because of the large number of seals caught in the traps. Fish traps had been tested in a smaller study on the Swedish West Coast. A high by-catch rate of harbour seals was revealed but a simple solution with mounting a thread in the entrance significantly decreased the by-catch towards zero. It is not properly investigated if this modification affected the fishing rate. (Sven Gunnar Lunneryd (Swedish Board of Fisheries), pers comm.).

2.4.2.2 Exclusion devices for pelagic trawls

Exclusion devices in pelagic trawls are being investigated in the Neccesity project which is due to report to the EC in June 2007.

2.4.2.3 Acoustic measures in relation to pelagic trawls

Under the Neccessity project different deterrent signals are being tested on dolphins in a variety of circumstances, and based on such studies a new acoustic deterrent device suitable for pelagic trawls in under development in France. These and other deterrent devices are being trialled in the UK and France though no details are yet available.

2.4.2.4 Mitigation measures in set net fisheries

There has been little progress in deployment of pingers in many areas due to the problems identified in the report of the WGMME in 2006. However, a trial was conducted in the Danish North Sea hake gillnet fishery in July-September 2006 to determine if the spacing of the Aquatec AQUAmark 100 pinger could be increased from the recommended 200 m without reducing the effectiveness of the pinger in reducing harbour porpoise by-catch. The trial was designed as a controlled experiment with full observer coverage, where nets without pingers formed the control group and nets with pingers spaced at 455 m and 585 m, respectively, formed the two experimental groups. Total effort included 108 hauls with altogether 48 porpoises caught. Nets without pingers had a by-catch rate of 0.54, nets with pingers spaced at 455 m had a by-catch rate of 0 and nets with pingers spaced at 585 m had a by-catch rate of 0.12 porpoises per haul. The by-catch rates for the two experimental groups were both significantly different from the by-catch of the control group ($P<0.0001$). The results show that spacing for the AQUAmark 100 pinger could be increased relative to current legislation without loss of by-catch mitigation efficiency.

The concept of reducing by-catch by deploying so-called ‘alerting pingers’, *i.e.* pingers that emit sounds, which stimulate porpoises to echolocate, was tested in the Danish North Sea hake gillnet fishery in July-August 2006. Deployed on gillnets, these alerting pingers should stimulate the porpoises to echolocate at the nets and thereby help them to detect the nets. The test was designed as a controlled experiment with full observer coverage, where the control group consisted of nets with dummy pingers and the experimental group consisted of nets with alerting pingers spaced at intervals of 180 m. The custom made pingers emitted click trains (series of clicks, SL=125–138 dB peak-peak re 1µPa @ 1 m, 50–2500 clicks per sec) simulating the clicks porpoises often use investigating targets. A total of 17 porpoises were by-caught in the nets with active alerting pingers and 15 porpoises were by-caught in a similar number of nets with dummy pingers. It was concluded that alerting pingers of this type are not efficient in reducing porpoise by-catch.

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3 TOR B) SCANS II survey results

The term of reference states: review and report on the outputs of the SCANS II project and report on the usefulness of future work for ICES.

3.1 Summary

The information in this paper was taken from several sources in which preliminary results from SCANS II were presented. None of the information presented here is final and readers should refer to the Final Report of the SCANS II project, which is due to be submitted to the EC at the end of March 2007.

Sources:

Hammond PS and Macleod K., 2006. SCANS II - Report on Progress. Document for ASCOBANS Meeting of Parties, Egmond aan Zee, September 2006.

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Acknowledgements: Phil Hammond and Mark Tasker for comments on the draft of this report.

3.2 Interpretation of terms of reference:

1) Presentation of preliminary results of the SCANS II project in addition to those presented under ToR a).

2) Discussing SCANS II results in the context of the work carried out by ICES and its relevance to European and international agreements.

3.3 Overview

The SCANS II survey was completed in July 2005, but analysis and report writing is ongoing, with a final report to the European Commission due at the end of March 2007. The WGMME reviewed those preliminary results that have been made public so far and discussed their relevance to ICES work. This review presents information on the abundance estimates obtained for some small cetaceans in European Atlantic continental shelf waters, on the draft recommendations about monitoring procedures, and on the development of a framework for by-catch management. Examples are given of how SCANS II results may be used.

3.4 Background

In 1994, surveys were carried out to assess Small Cetacean Abundance in the North Sea (SCANS I). Abundance was estimated based on line transect surveys from ships and aircraft. Sampling from these surveys was stratified into 14 areas of the North Sea (including the western Baltic and Celtic Shelf). Estimates of abundance were presented in Hammond *et al.* (2002).

In 2005, surveys for the SCANS II project (www.biology.st-andrews.ac.uk/scans2) were undertaken. This provided the first comprehensive estimates of abundance of small cetaceans in the whole west European Atlantic continental shelf region. The three main objectives of the SCANS II project were:

1) To determine the absolute abundance of small cetaceans in European Atlantic continental shelf waters, particularly of harbour porpoise, white-beaked dolphins, minke whales, common dolphins and bottlenose dolphins inhabiting shelf waters of the Atlantic margin, the North Sea and adjacent waters.

2) To develop and test methods to monitor cetacean populations.

3) An essential (required by the Habitats Directive) part of long-term management of cetacean populations is a means of monitoring their abundance and distribution. SCANS II developed and tested potential methods for monitoring and a series of recommendations will be made, mainly for harbour porpoise, bottlenose dolphin and common dolphin, so that trends in abundance in time and space can be better determined between major decadal surveys.

4) To develop a framework for management of by-catch.

5) The information on abundance is essential to assess the impact of by-catch and other anthropogenic threats to cetacean populations. SCANS II is developing a management model for determining safe by-catch limits for small cetaceans.

3.5 Preliminary results

3.5.1 Objective 1. To determine the absolute abundance of small cetaceans

A total of 19 900 km was surveyed by ship in the SCANS II area in 2005 (Figure 3). In addition to the area surveyed during SCANS I, the project covered continental shelf waters to the west of Britain, Ireland, France, Spain and Portugal, from about 62° N to the Straits of Gibraltar. Figure 4 shows the extended survey area of SCANS II compared to SCANS I area. The vast majority of the effort was carried out in sea states of Beaufort 4 or less, and about half in Beaufort 2 or less. Due to the difficulty of detecting porpoises at higher sea states, only data from Beaufort 2 or less are used to estimate their abundance. A further 15 800 km were surveyed in suitable conditions by aircraft. These distances were surveyed within a total sea area of 1 370 000 km^2.

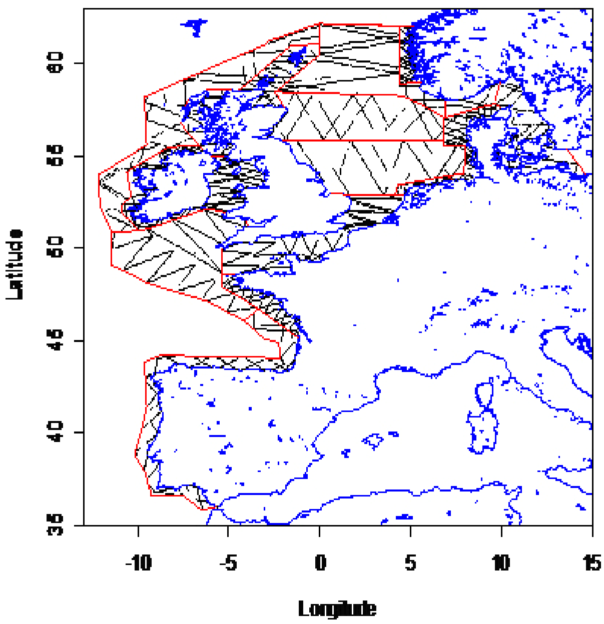

Figure 3. Sampling lines flown or steamed during the SCANS II surveys in July 2005.

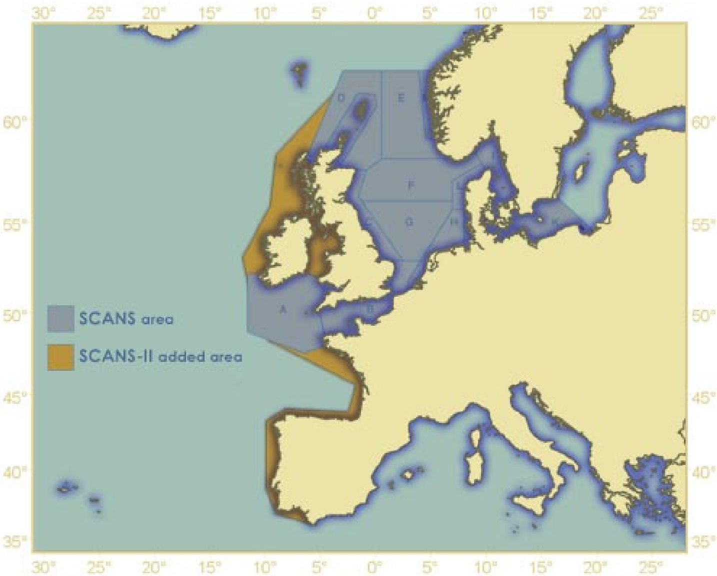

Figure 4. Map showing the areas covered by the SCANS I and SCANS II surveys.

As expected, the most commonly sighted species was the harbour porpoise, which was present in all survey strata. There were far fewer sightings of all other small cetacean species, and the other species were not encountered in all survey strata.

3.5.2 Harbour porpoise

The harbour porpoise was the most commonly encountered and widely distributed species but there were few sightings south of 47ºN. In total there were around 1000 sightings of harbour porpoises. The abundance estimate for the North Sea and adjacent waters (equivalent to the SCANS–94 survey area) was 335 000 (CV=0.21) (see Table 13). Overall abundance of harbour porpoises in the North Sea and adjacent areas has not changed between the two SCANS surveys. Harbour porpoise numbers in the whole area were estimated to be 386 000 (Coefficient of variation, CV=0.20). Porpoise density was lowest in strata along the outer shelf to the west of Britain and Ireland and off the Atlantic coasts of France, Spain and Portugal (<0.1 animals/km^2). It was highest in the south central North Sea and coastal waters of northwest Denmark (~0.6 animals/km^2). Elsewhere there was relatively little variation in porpoise density. Harbour porpoise distribution, however, has undergone a southward shift with a two-fold increase in the number of porpoises in the southern North Sea strata while porpoise numbers in the northern North Sea strata have halved (Table 13). The reasons for this southward shift of harbour porpoise distribution are unknown; however, a change in distribution and availability of prey species is considered the most likely explanation, although other explanations are possible.

Table 13. Provisional estimated abundance of harbour porpoises in the North Sea, in the summers of 1994 and 2005.

AREA SURVEYED	1994	2005
Northern strata	239 000	120 000
Southern strata	102 000	215 000
Total area surveyed	341 400 (CV=0.14)	385 600 (CV=0.20)
SCANS–94	341 400 (CV=0.14)	335 000(CV=0.21)

Table 14. Provisional estimated abundance and density (animals/km^2) of harbour porpoise in summer 2005.

LOCATION	ABUNDANCE	DENSITY	CV
South Central North Sea	88 143	0.56	0.23
Skagerrak/ Kattegat	23 227	0.34	0.36
Celtic Sea	80 613	0.41	0.50
North Central North Sea	47 131	0.29	0.37
Northern North Sea	23 766	0.18	0.33
Western Scotland and Irish outer shelf	10 002	0.07	1.24
Iberian shelf	2 646	0.02	0.80
Southern North Sea and Channel	40 927	0.33	0.38
Netherlands coast	3 891	0.36	0.45
Scottish Northern Isles	10 254	0.27	0.36
Coastal NW Denmark	11 575	0.56	0.43
Coastal Norway	3 948	0.31	0.38
Coastal Western Scotland	12 076	0.39	0.43
Irish Sea	15 230	0.34	0.35
Coastal Ireland	10 716	0.28	0.37
North Sea coastal Germany/Denmark	1 473	0.13	0.47
Coastal NW France	0	0	-

3.5.3 Common dolphins

Common dolphins were encountered in the waters of Britain and Ireland, in the Channel, and in the shelf waters of France, Spain and Portugal. Abundance in the entire survey area was estimated to be 63 366 (CV=0.46) (Table 15). The highest densities occurred in the coastal waters of Ireland. Common dolphins are also widely distributed offshore and the number of animals in the continental shelf area may vary substantially from year to year. It was not possible to compare between SCANS I and SCANS II because the animals' responsive movement to the observation platform was not assessed in the 1994 surveys.

Table 15. Provisional estimated abundance, with coefficient of variation, of small cetaceans in the summer of 2005.

SPECIES	LOCATION	ABUNDANCE N (CV)
Common dolphins	Total area	63 366 (0.46)
White-beaked dolphins	Total North Sea	10 562 (0.29)
	Total Western areas	12 103 (0.74)
Bottlenose dolphins	Total area	12 643 (0.27)
Minke whales	Total North Sea	10 541 (0.32)
	Total western areas and Channel	8 072 (0.33)

3.5.4 White-beaked dolphins

White-beaked dolphins were found in the northern and central North Sea and west of Britain and Ireland. Abundance estimates for each broad region are given in Table 15. Abundance in the entire survey area was estimated to be 22 665 (CV=0.42). The highest densities occurred in the coastal waters of western Scotland.

3.5.5 Bottlenose dolphin

Bottlenose dolphins were encountered around the coast of Britain, Ireland, France, Spain and Portugal. They were also found in outer shelf waters of Scotland and Ireland and in the Celtic Sea. Abundance in the entire survey area was estimated to be 12 643 (CV=0.27) (Table 15). The highest densities occurred in the Celtic Sea and around Spain and Portugal.

3.5.6 Minke whale

Minke whales were found in the northern and central North Sea and west of Britain and Ireland. Abundance estimates for each broad region are given in Table 15. Abundance in the entire survey area was estimated to be 18 613 (CV=0.30). The highest densities occurred in the coastal waters of Ireland.

3.5.7 Density surface modelling

Preliminary abundance estimates for survey strata are now finalised but this provides information at a coarse spatial scale only. More detailed information on the distribution and abundance of animals can be obtained by applying density surface modelling techniques. These techniques use models to describe how density is related to a range of habitat variables (such as depth, distance from the coast) using data collected along the survey transects. This model is then extrapolated to the whole survey area to provide a picture of how density varies at a fine spatial scale, and can be used to estimate density and abundance for regions other than the pre-defined survey strata (regional estimates however are only valid for areas that are relatively large; of about the same size as survey strata). Density surface modelling has now been carried out for harbour porpoises, common dolphins and minke whales and has allowed for a direct comparison to be made between estimates for harbour porpoises and minke whales for the SCANS II and the first SCANS 1994 surveys.

Model-based abundance estimates did not differ significantly from the previously presented stratified estimates for any of the species considered. Predicted density surfaces, however, provide more detail on the broad scale southward shift in abundance of harbour porpoises. In 1994, no porpoises were sighted in the English Channel and adjacent waters of the southern North Sea and high density areas of porpoises were observed off SE Scotland and NE England. In 2005, high density areas shifted southwards (Figures 5 and 6). Higher densities of porpoises were also observed in the Celtic Sea in 2005 compared to 1994. The high density of porpoises around the north and west coast of Denmark in 1994 occurred further offshore in 2005.

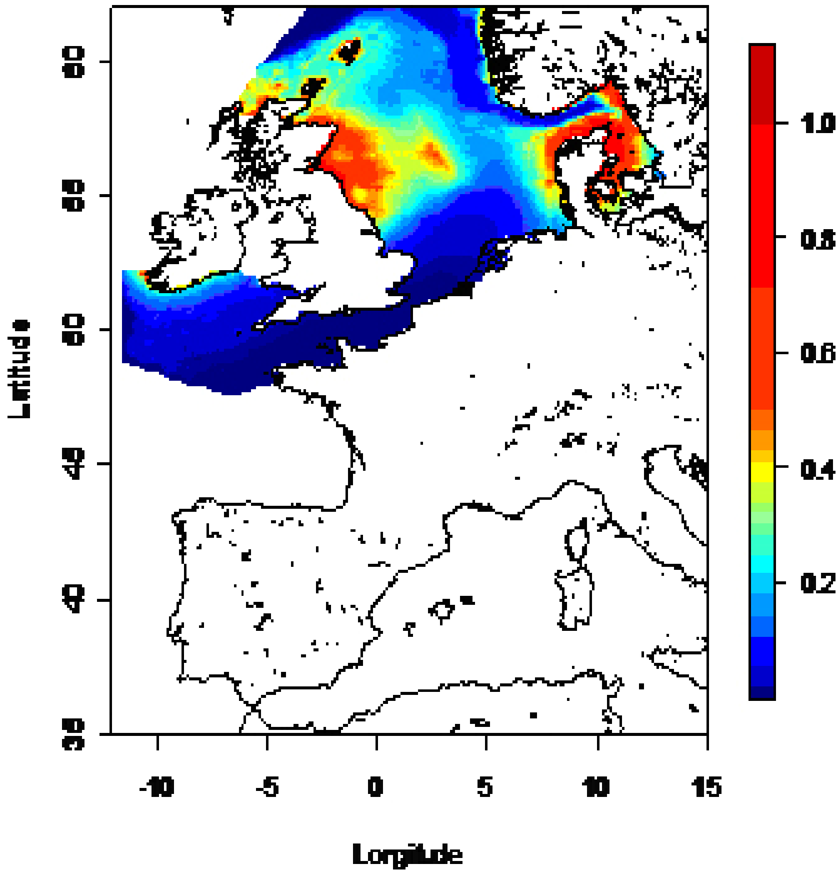

Figure 5. Density surface of harbour porpoise abundance from the SCANS I survey in 1994 (animals.km^{-2}). Note the main concentrations off East Scotland and north-east England and around Denmark. Surveys were not conducted in the Irish Sea and west of Scotland.

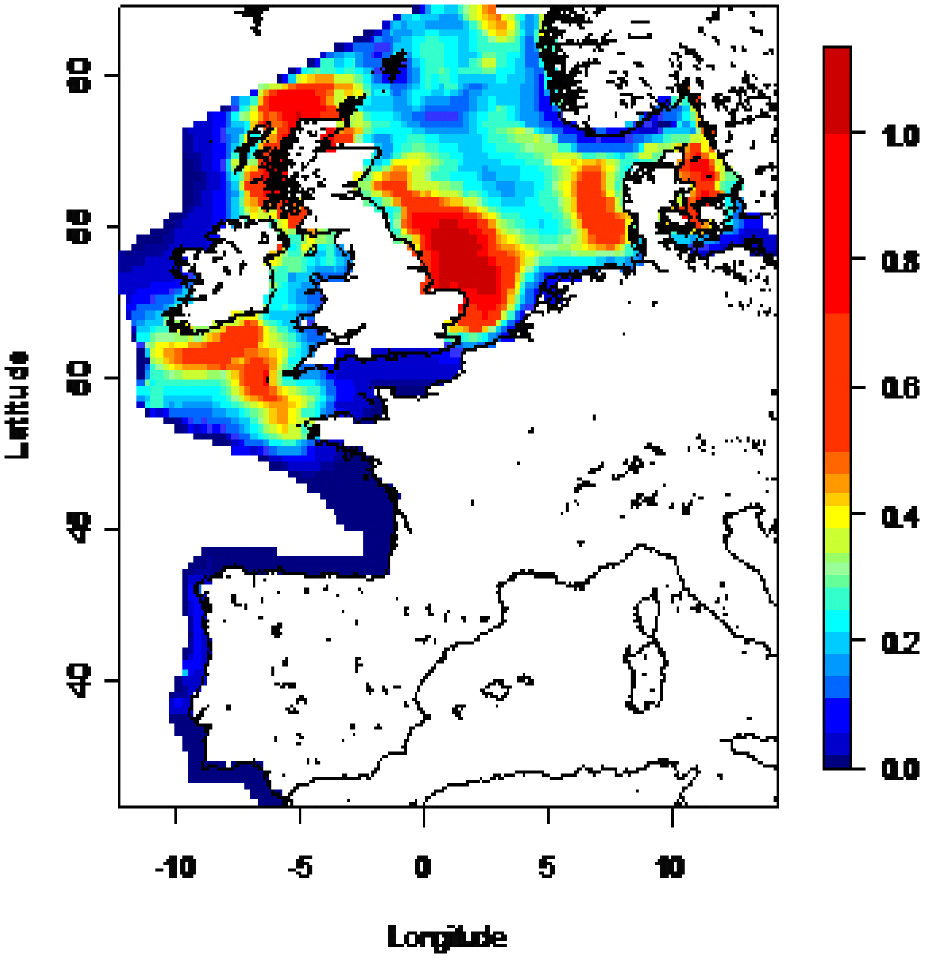

Figure 6. Density surface of harbour porpoise abundance from the SCANS II survey in 2005 (animals.km^{-2}). Note that the main concentration in the North Sea is now off East England and North Scotland, also the increased densities on Celtic Shelf. The concentration to the west of Denmark is further offshore.

3.5.8 Objective 2. To develop and test methods to monitor small cetacean populations

Undertaking surveillance on the conservation status of a population is essential to ensure that appropriate management measures are put in place and to ensure that "Favourable Conservation Status" is maintained (i.e., "a situation where a habitat type or species is prospering (in both quality and extent/population) and with good prospects to do so in the future as well"). EU member states are obliged to undertake surveillance of the conservation status of species listed in Annex IV of the Habitats Directive (all cetaceans) as well as to designate SACs for species under Annex II.

Quantitative objectives for the conservation status assessments of cetaceans have yet to be set by policy makers. This will be crucial to the development of a monitoring (long-term systematic observation) strategy. SCANS II will recommend quantitative monitoring objectives which will be used as part of this project to assess the efficacy of different monitoring methods in detecting trends in distribution and abundance of small cetaceans.

In order for monitoring to be effective, long-term year-round surveys need to be conducted, and these need not only to be able to detect trends but also to be cost-effective. Monitoring methods were compared under two broad monitoring types:

1) monitoring the status of a whole species/population,
2) monitoring of a specific region used by a subset of the population (e.g. within a SAC).

Specific objectives for monitoring at population level (e.g. to detect if relative abundance of a population changes by more than 10% per year over a 6 year period) and at regional level will be recommended in the final report.

The difficulties in observing cetaceans at sea (e.g. they can occur in low densities, are highly mobile, and spend most of their time underwater) present some challenges to monitoring methods. Existing methods developed to address these limitations were compared under this objective; these include:

1) visual surveys (ship, aircraft, platform of opportunity or land);
2) acoustic surveys; towed hydrophones;
3) stationary acoustic systems; e.g. T-pod;
4) Photo-identification;
5) Satellite telemetry.

The advantages and limitations of each of the methods were assessed, including power to detect change, and logistic and cost-benefit considerations.

The Final Report of SCANS II will also highlight important considerations that should precede choice of monitoring methods, i.e. identify the target species, choose whether to monitor the population or a region, define the population, define monitoring objectives, conduct statistical power analyses to find the best method to meet monitoring objectives, consider logistics for monitoring an area, and conduct a cost benefit analysis.

A preliminary sensitivity or power analysis was used to compare how well the data generated by different monitoring methods can reveal changes in populations over time. The analysis estimated the variation in encounter rate within an area and between years using data from each monitoring method, and determined how informative these data were with respect to inferring changes in population. SCANS II has also collected new data using different potential monitoring methods and analysed these for comparison. Visual, towed acoustic array and static acoustic data were collected simultaneously during a survey in the North Sea. Effort and efficiency of visual and acoustic monitoring in the North Sea were compared in relation to day length and weather. In addition, the use of acoustic data from the SCANS II survey was compared to the European Seabirds at Sea database. Detection rates were also compared between visual ship-based, acoustic and aerial surveys. Each method is associated with variation (both in sampling and due to survey conditions) and this affects the power of the methods to detect changes in relative abundance. The variation in the detection rates and the density estimates can then be used to calculate the power of each method.

The preliminary recommendations arising from the investigations carried out under this objective were:

1) towed and stationary acoustic, visual and aerial surveys can be used for monitoring;
2) sea state and day length negatively affect visual data collection to a much higher extent than acoustic methods;
3) the method that provides more statistical power to detect changes depends on assumptions made about the dependency of the errors;

4) using the same platform and survey conditions reduces variation and improves power;
5) aerial surveys, towed acoustic surveys and visual surveys using platforms of opportunity are less costly than dedicated visual ship surveys.

Data from any of the previous methods tested can be used to model density and to predict animal density in any part of the surveyed area, since density modelling does not rely on a randomised survey design provided that there is sufficient survey coverage. This modelling can then be used to estimate abundance and detect environmental factors influencing animal density.

Further work on the development of acoustic monitoring methods was also undertaken. Analysis of data from preliminary trials of bow-mounted hydrophones showed high levels of noise and problems in discriminating bearings to animals. The bow mount was then redesigned and improvement was evident. Data from the bow mount array are now being compared with data collected concurrently from towed hydrophone arrays of differing lengths to understand the "availability" of porpoises for detection for both types of acoustic monitoring tools.

3.5.9 Objective 3. To develop a framework for management of by-catch

Two management frameworks have been developed as candidates for setting safe upper limits to by-catch. A computer model for testing these management frameworks has been completed and simulation tests have been undertaken. The initial simulations were generic in nature and highlighted the important decisions that need to be made before a management framework can be finalised for individual species, such as harbour porpoises.

Of primary importance are the conservation objectives that the management framework should achieve. Again, quantitative objectives for the conservation status assessments of cetaceans have yet to be set by policy makers. These conservation objectives may include population size (relative to carrying capacity), minimum population size at which by-catch would be allowed and the delay in recovery of a depleted population under the management framework. Interim conservation objectives (based on the one provided by ASCOBANS) were defined for harbour porpoises, including the recovery of depleted populations to 80% of their carrying capacity (with 95% probability) over a period of 200 years. The simulation model was then used to compare the performance of the two management frameworks and tune these in light of the conservation objectives chosen.

The two management frameworks/procedures (based on the USA's Potential Biological Removals, PBR and the IWC's Catch Limit Algorithm, CLA) take information about the population as input (e.g. time-series of estimates of population size, maximum population growth rate) and then output a by-catch limit. They explicitly incorporate uncertainty in the estimates of population size and can be tuned to account for directional bias in the estimation of by-catch. Population size was assumed to be estimated via decadal SCANS type surveys. However other potential sources of information could be used, such as data from different types of acoustic and visual surveys (e.g. European Seabirds at Sea). The PBR framework calculates appropriate limits to removals from a population (e.g. by-catch) given a current estimate of population size. The second management framework, an adapted CLA calculates appropriate limits to by-catch given time-series of estimates of population size, relative population size and by-catch. The CLA procedure specified an initial period with a by-catch limit of zero, which aided short-term recovery. The overall timing of recovery, however, did not differ between procedures under this scenario.

One of the advantages of performance simulation testing is the ability to examine the performance of the management procedures under different scenarios regarding uncertainty in our knowledge of small cetacean population dynamics, stock structure, environmental variability, potential selective removal by by-catch of a part of the population (e.g. age or sex), etc. By changing the parameters of the operating model (e.g. maximum population growth rate, number of stocks, dispersal rates) we can examine the performance of the procedures under worst-case scenarios. The procedures can then be tuned to ensure that management objectives would still be achieved with a high level of certainty despite our uncertainty about the system. Therefore, age structure and reproductive rates of stranded and by-caught porpoises have been collected as well as information on genetic differentiation and movements in the study area. Estimates of by-catch for several countries will be presented in the final report, and these were derived using information on by-catch rates from observer programmes in combination with data on fishing effort.

It is important to bear in mind that anthropogenic factors, other than by-catch, could also impact on cetacean populations. The estimated by-catch limits should take into account the other non-natural removals of animals from the population since, for example, carrying capacity will be reduced by poor habitat quality. However, at present, by-catch is the only known source of human-induced mortality for cetaceans for which mortality rates could be estimated reliably and so it would be difficult to include other human-induced causes for population decline.

3.6 The usefulness of SCANS II for the work of ICES

In terms of **by-catch management**, SCANS II not only provides abundance estimates for the main small cetacean species that are by-caught in fishing gear but has also developed management frameworks for setting safe by-catch limits.

In terms of addressing the requirements of the **Habitats Directive**, in particular the assessment of species' Favourable Conservation Status, SCANS II will provide recommendations for establishing monitoring objectives and suggesting monitoring methods to assess trends in abundance and distribution between inter-decadal surveys. Monitoring of abundance and distribution is amongst the main actions required to assess the conservation status of populations and its trends. Although large scale surveys like SCANS provide estimates of small cetaceans population abundance in certain areas, they represent a single snapshot of distribution in the area surveyed for one particular month in one year (July 2005). Because they were carried out 11 years apart, it is impossible, based on SCANS surveys alone to detect intra-decadal and intra-annual trends in abundance in time and space. This latter limitation is particularly important for species that occur both on and off the continental shelf (e.g. common dolphin) and for which there are large scale seasonal changes in density.

In addition, the SCANS survey results, on their own, should not be used for identifying fixed areas to protect cetaceans. However, further development of SCANS data using density surface modelling can be used to identify hotspots of small cetacean species density during both surveys. This could provide some indication of areas worth monitoring in the future.

Other **ICES Working Groups,** such as the Study Group on Multispecies Assessment in the North Sea will need to use SCANS II abundance estimates of some species for tasks such as multi-species and ecosystem modelling.

The SCANS II results from all three objectives will be useful in relation to a range of European Directives and international agreements, including the work of the **OSPAR** Convention for the Protection of the Marine Environment of the north-east Atlantic and Agreement for the Conservation of Small Cetaceans in the Baltic and North Seas (**ASCOBANS)**.

Further surveys planned

Further surveys such as the one planned for the summer of 2007, Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA, Figure 7), in which the common dolphin is a target small cetacean species, aim to estimate abundance, and investigate habitat preferences of cetaceans in European waters beyond the continental shelf. Other projects (e.g. T-NASS) will be complementary to CODA and help build a picture of cetacean distribution in North Atlantic waters off the continental shelf.

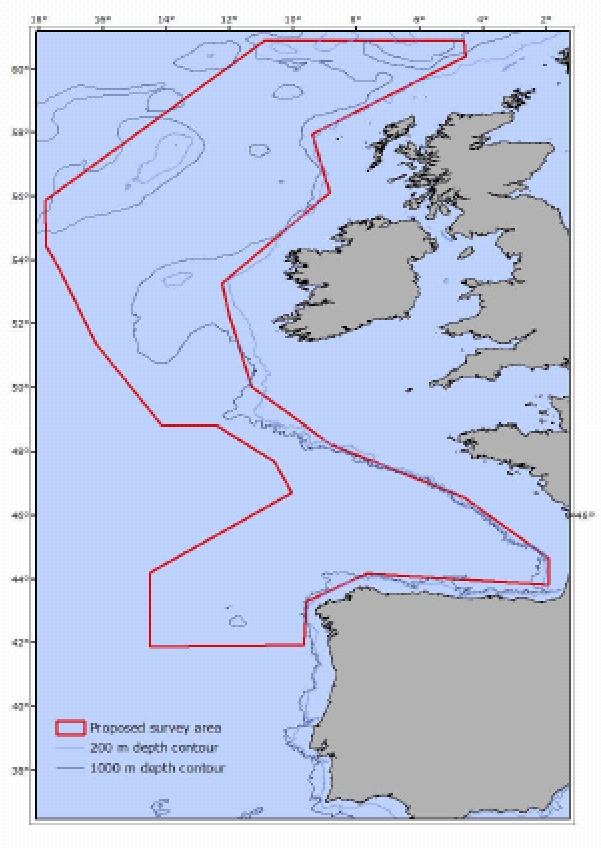

Figure 7. Proposed CODA survey area.

3.7 References

Hammond PS, Berggen P, Benke H, Borchers DL, Collet A, Heide-Jørgensen MP, Heimlich S, Hiby AR, Leopold MF and Øien N., 2002. Abundance of harbour porpoise and other cetaceans in the North Sea and adjacent waters. Journal of Applied Ecology 39:361–376.

4 TOR C) using a web based report structures

The term of reference states: Review and report on intersessional work on the development of a web based report structure.

4.1 Background

This TOR was initiated in 2006 following a discussion within the working group that highlighted the need to avoid having to use outdated data that have taken a long time to reach final reports. The main idea was that as a first step a web page could be developed with access limited to members of the WG. Data such as abundance estimates or by-catch information could then be uploaded to the website regularly between meetings. Information would in this way be readily available, easily accessible and hyper-linked in appropriate ways, and this would allow new members to get a good overview and existing members to keep abreast of developments. It would facilitate involvement of members of the WG who cannot attend the meeting in person.

Recently the “SharePoint” program as implemented by ICES has been used by working groups in preparation for meetings and for the compilation of data. The program also allows some flexibility in how it is used and what kinds of data are uploaded. One of the advantages of using “SharePoint” is that it is maintained by ICES and thus a certain amount of consistency can be assured.

4.2 Recommendation

The WG proposes to use SharePoint not only for the initial planning but also, if internet is accessible, during the actual meetings of the working group. Its basic structure could be expanded to allow a set up of a database of working papers, new developments, etc. This would greatly facilitate the compilation of the annual report, and in the long term parts of this work could be opened to other working groups that might need specific data.

The original proposal of the WG for a web page structure (see WGMME Report 2006) could be implemented to some degree on the SharePoint website. At this point making the data public is not recommended as this would mean we would need to implement a review process and might compromise the willingness of members of the WG to share their unpublished data.

5 TOR D) WGMME workshop on threats to marine mammals

The term of reference states: Review and report on the progress report of the Planning Group for the WGMME Workshop on Environmental Quality and Marine Mammal Health.

5.1 Workshop planning status

5.1.1 Workshop set up

The current status of the proposed workshop is as follows:

Provisional title: Threats to marine mammal health: current status, future trends, and priorities for monitoring, research and conservation:

When: January 2008, 3 days.

Where: Royal Belgian Institute of Natural History, Brussels.

Who: scientists, representatives from national and international authorities, NGOs.

How many: max. 50 attendees.

How to announce: through ICES, ECS and MARMAM lists and related conferences.

Funding: conference facilities will be provided free of charge by the Royal Belgian Institute of Natural History. Delegates will be responsible for their own accommodation and travel expenses.

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5.1.2 Aims and structure of the workshop

Aims of the workshop: the workshop will bring together active "actors" related to pinniped and cetacean health, ecology and conservation to:

1) Identify and quantify significant threats to population health status for marine mammals, with a particular focus on ICES waters, highlighting geographical patterns and predicted future trends,
2) Discuss practical measures to improve knowledge about threats and identify future monitoring, research and management priorities.

Structure of the workshop: It is planned to have a series of presentations covering "hot topics" and state of the art, followed by discussions in sub-groups and subsequent reporting back and general discussion in plenary session.

Presentations: Each day will start with three 30–minute presentations in plenary session, which will cover:

- Day 1 (Diseases and pollution) - Morbillivirus epidemics, Pollutants, Models and experimental approaches.
- Day 2 (Updating necropsy protocols)–Noise pollution, By-catch, Emerging diseases and new threats.
- Day 3 (Monitoring and research priorities)–Stranding networks and necropsy protocols, International database and tissue banks, Modelling impacts at the population level.

Brainstorming sessions: Following the opening plenary sessions, on each day, three subgroups will be organized, each with morning and afternoon sessions (i.e. 2 x 1.5 hours each). Each sub-group will have a Chair and rapporteur. Participants will be divided between subgroups, with a maximum of 15 people per sub-group and the opportunity for participants to move between sub-groups. Sub-groups will discuss specific topics, with discussion structured around specific related questions (prepared by the Steering Committee, subgroup chairs and speakers).

Reporting back: In the final plenary session of each day, sub-group chairs will summarise the discussions and findings of their sub-groups, followed by general discussion.

5.1.3 Anticipated outcomes

Anticipated outcomes of the workshop:

A synthesis of the presentations and discussions will be written up as a report to WGMME, and could also be published in the ICES Cooperative Research Report series.

6 ToR E) OSPAR request changes in distribution, abundance and condition in relation to changes in sea temperature–A preliminary report

The term of reference states: Assess and report on changes in the distribution, population abundance and condition of marine mammals in the OSPAR maritime area in relation to changes in hydrodynamics and sea temperature.

6.1 Introduction

Based on the ICES interpretation of the OSPAR request, this report is focusing on the effects of climate change and variation.

Within the OSPAR region, the marine mammals that will be most affected by climate change are those that live in close association with the arctic ice or in the cold temperate to polar seas influenced by arctic ice. These species include the polar bear, ringed seal, harp seal, bearded seal, hooded seal, narwhal, beluga whale, bowhead whale and walrus. Climate change may also affect species that undertake large-scale seasonal migratory patterns including the baleen and toothed whales that summer in the Arctic. In addition to bowhead whales, six other baleen whales are found in the OSPAR area: blue, fin, minke, sei, humpback and Bryde’s whales. Additionally, the summer distributions of sperm whales, northern bottle-nose whales, long-finned pilot whales, killer whales and white-beaked dolphins extend into OSPARs northern regions. Several recent studies discuss the effects of climate change on marine mammals (Kovacs, 2004, Loeng *et al.*, 2005, Learmonth *et al.*, 2006, Simmonds and Isaac, 2007, Laidre *et al.*, in press).

The aim of this report is to present evidence of the effects of climate change on marine mammals in the OSPAR area. The WG focussed on:

1) the OSPAR listed species,
2) arctic species,
3) large migratory baleen whales and
4) any other marine mammal species listed in the Habitats Directive Annex II.

ACE recommended that the WG restrict their review to a short-term time scale, of 10–20 years, and also within the last 50 years. However, evidence shows that between the 1930s and the 1970s, the negative phase of the North Atlantic Oscillation may have altered the distribution of some marine mammals. Therefore, we considered a longer time scale of 100 years. Where no published or documented effects of climate change are available, due to either a lack of detectable effects or lack of research in this area, a short description of the “possible” effects of climate change is included in this report.

ACE requested the WG to highlight actual changes in distribution, abundance and condition related to climate change. However, there is a general lack of reliable baseline information on distribution, abundance and condition of marine mammals within the OSPAR area. Therefore the WG decided to outline the species that may be affected by climate change within the OSPAR region, and why. Furthermore, due to the lack of information on the effects of climate change for most species, we have produced a table summarizing relevant aspects of migratory patterns, population structure, dietary preferences etc. for all marine mammals discussed in this report (Annex 3). The table may be useful for future assessments/discussions of the effects of climate change on marine mammals, which are the top predators in the ecosystem. The information in the table was assembled based on a literature review and expert judgement.

6.2 Ecological indicator species

ICES interprets 'Ecologically indicative species' as any species that show responses to hydrodynamics and sea temperature. The species the WG selected are species that may be affected by the extent of the arctic ice: polar bear, hooded seal, harp seal, ringed seal, bearded seal, walrus, beluga, narwhal and bowhead whale.

6.3 OSPAR listed species

OSPAR has listed four marine mammal species on its list of "threatened and/or declining species and habitats". These are the harbour porpoise, bowhead whale, northern right whale and the blue whale. The bowhead whale will be reviewed later in the text under the section on arctic species. It is not known if a discrete **northern right whale** (*Eubalaena glacialis*) population exists in the Northeast Atlantic, however if one does occur, the population size may only be in the low tens of whales (IWC 2001). Furthermore, the majority of reported sightings of this species in the OSPAR region are suspected to be individuals from the western Atlantic population (population estimate n=350). Due to this uncertainty, the WG will not consider this species further in this review. However, it should be noted that demographic projections for the western North Atlantic population indicate that if the birth and mortality rates remain comparable to those observed during the early 1990s, the population will become extinct in less than 200 years (e.g. Caswell *et al.*, 1999). It was also suggested that climate variability and change, through their effects on calving rates, may make this species more vulnerable to extinction than previous population projections predicted (Greene & Pershing, 2004).

Very little information is available on **blue whales** (*Balaenoptera musculus*) within the OSPAR region, particularly evidence of the effects of climate change on this species. This species undertakes seasonal migrations with animals moving between tropical calving grounds and summer high latitude feeding grounds. However, some individuals may remain in high northern latitudes throughout the winter (Charif & Clark, 2000). There is no overall abundance estimate for this species in the OSPAR region, although this species has been depleted by whaling in the North Atlantic.

The most recent SCANS survey in 2005 identified a southern shift in the distribution of **harbour porpoises** (*Phocoena phocoena*) in the North Sea, since the first survey in 1994 (www.biology.st-andrews.ac.uk/scans2). It has been suggested that the southern movement may be attributable to a change in the distribution of prey species. During the SCANS 1994 survey, harbour porpoises were not observed in the entire English Channel, or in the southern North Sea, although 32 280 individuals were reported in the Celtic Sea and adjacent Bay of Biscay shelf waters (Hammond *et al.*, 2002). In comparison, the SCANS 2005 survey estimated an abundance of 121 500 animals for the Celtic Sea, English Channel and contiguous southern North Sea, with 80 600 of these individuals reported in the Celtic Sea and adjacent Bay of Biscay shelf waters. In recent years (mainly since 2000), there has been a notable increase of sightings and strandings along the French Channel, Belgian and Dutch coasts (Camphuysen, 2004, Kiszka *et al*., 2004, WGMME, 2006), which indicates a gradual movement of animals into this area.

6.4 Polar Bears

Polar bears (*Ursus maritimus*) spend the majority of their lives on sea ice. Polar bears inhabit ice-covered waters of the circumpolar Arctic, where sea ice provides access to their primary prey, ringed seals (*Phoca hispida*). Polar bears require sea ice as a transportation platform and as their primary hunting habitat. Females emerging from dens with their small cubs in the springtime are particularly dependent on quite stable sea ice to travel between denning sites, and good foraging areas for ringed seals on first-year land-fast ice, where ringed seal lair densities are high. The distribution of polar bears is largely a function of the distribution of arctic sea ice conditions (Stirling, 1988), and predicted declines in the thickness and extent of arctic sea ice were immediately met with concerns regarding the impact of these environmental changes on polar bears (Stirling and Derocher, 1993). Predicted spatial and temporal sea ice changes will lead to shifts in trophic interactions involving polar bears, through reduced availability and abundance of their main prey, as well as reducing their habitat; most polar bears traverse vast areas using sea ice as a transport route (Derocher *et al.*, 2004). Ringed seals prefer land-fast and secondarily stable first-year pack ice for pupping (Heidi-Jørgensen and Lydersen, 1998, Wiig *et al.*, 1999).

Polar bears accumulate most of their annual energy requirements during late spring, prior to ice break-up, when they can capture older pre-weaning ringed seals (Stirling *et al.*, 2004, Macdonald *et al.*, 2005). Initially, polar bears may benefit from an increase in leads in the ice, as it would increase the availability of suitable seal habitat. However, as the ice thins further, they will have to travel more, using energy to keep in contact with their favoured habitat (Derocher *et al.*, 2004). Earlier emergence by polar bears might also result in them preying on younger ringed seals, with a lower energy content, which could shift the predator-prey balance (Rosing-Asvid, 2006). In the Hudson Bay and James Bay, Canada, sea ice is melting earlier in the spring and forming later in the autumn. This has resulted in a reduction of the annual foraging time for the species on the ice. In western Hudson Bay, a significant decline in the condition of adult male and female polar bears has been reported. There has also been an overall decline in the proportion of independent yearling cubs between 1981 and 1998, a period when the break-up of the sea ice had been occurring earlier, causing the bears to come ashore in poorer condition (Stirling *et al.*, 1999).

In the polar bear population at Svalbard, Norway, between 1988 and 2002, the mean age of both females and males increased, litter production rate and natality declined, and body length of adults decreased (Derocher, 2005). Derocher, (2005) reported that variation in reproduction and body mass in the population showed a relationship between large-scale climatic variation (Arctic Oscillation index) and the upper trophic level in the Arctic marine ecosystem. However, the increase in the mean age of both sexes and a decline in the litter production and natality rates may also be due to an increase in population abundance (Kovacs, per. commn.). It has become increasingly clear though over the past decade that polar bears are already showing declines in body condition and reproductive output, which are attributed to changes in physical conditions in the southern parts of their range, particularly the decline in the duration of the sea ice season (Stirling, 2002, Derocher *et al.*, 2004, Obbard *et al.*, 2006, Parks *et al.*, 2006, Stirling and Parkinson, 2006).

6.5 Arctic pinnipeds

Four species of pagophilic seals (harp seals *Pagophilus groenlandica*, hooded seals *Cystophora cristata*, ringed seals *Phoca hispida*, and bearded seals *Erignatus barbatus*) inhabit OSPAR Region 1 (Figure 8). Their life history is closely linked to the annual ice, and for ringed seals also snow conditions, in northern temperate and arctic waters (Ridgway & Harrison, 1981, Kovacs, 2002, Lavigne, 2002, Anonymous, 2006). Climate change in the northern latitudes is predicted to lead to a marked decline in the ice coverage, which will have a significant negative impact on these populations (Tynan & DeMaster, 1997, Würsig *et al.*, 2002, Learmonth *et al*., 2006, Loeng *et al*., 2005, WGHARP, 2006, Simmonds & Isaac, 2007).

The **ringed seal** is a keystone species in the Arctic that depends on sea ice year-round (Heide-Jørgensen and Lydersen, 1998, Ferguson *et al*., 2005). Two stocks have been proposed by NAMMCO (NAMMCO, 1997) to exist within the OSPAR region:

1) East Greenland and the Greenland Sea east to Svalbard,
2) the Barents and Kara Seas east to the Severnaya Zemlya.

Ringed seals are the most vulnerable of the high arctic pinnipeds to climate change, because so many aspects of their life-history and distribution are tied to the sea ice (Kovacs, 2004).

Ringed seals are the principal prey of polar bears and an important food resource for Arctic foxes (*Alopex lagopus*) and ravens (*Corvus corax*). Walrus, Greenland sharks and killer whales also prey on ringed seals. It is also critical for subsistence, culture, and economy of indigenous communities (NAMMCO, online document-b). Ringed seal recruitment is closely linked to ice conditions and snowfall. Females construct lairs in the snow on top of land-fast ice or pack ice, where pups are born and spend their first six weeks of life. A reduction in the extent and duration of sea ice cover will directly reduce the habitat available to ringed seals. Earlier melting will also lead to increased pup mortality due to the early destruction of birth lairs (NAMMCO, online document-b). Poor snow conditions also increase the probability of predation (i.e., by polar bears or Arctic foxes). In Western Hudson Bay, a significant reduction in ringed seal recruitment during the period 1990–2001 was attributed to climate warming (Ferguson *et al.*, 2005). Within the OSPAR region, declining ice conditions have impaired research activities designed to monitor climate change impact on marine mammal populations. Norwegian ringed seal studies on the west coast of Svalbard in 2006 and 2007 were cancelled due to extremely poor ice conditions at a long-term study site (Lydersen, pers. commn.). In the southern Baltic Sea, a series of nearly ice-free winters from 1989–1995 led to very high pup mortalities (Härkönen *et al*., 1998, NAMMCO, online document-b).

If the extremes in climate change predicted do indeed occur, and there is no summer sea ice in the Arctic (ACIA, 2005), it is difficult to envisage how ringed seals will survive (Kovacs, in prep). Ringed seals do not normally haul out on land and performing this behavior would be a rather dramatic change to the species behavioral repertoire (Kovacs, in prep). Apart from a direct reduction in habitat, there are a number of indirect effects of climate change on ringed seals, including;

1) changes to their forage base (species shifts, density shifts, and distributional shifts of prey species, etc.);
2) increased competition from temperate species and other seal species (ACIA, 2005);
3) increased predation rates from polar bears (Rosing-Asvid, 2006) and arctic foxes (at least initially) as well as killer whales;
4) increased disease and parasite risks (Harvell *et al.*, 1999);
5) greater potential for exposure to increased pollution loads (AMAP, 2003, MacDonald *et al.*, 2005);
6) and impacts via increased human traffic and development in previously inaccessible, ice-covered areas (Kovacs, in prep.)

The life cycles of **harp**, **hooded** and **bearded seals** are strongly associated with pack ice (Kovacs, 2002, Loeng *et al.*, 2005). Pupping and pup survival are linked to suitable ice conditions at highly traditional locations. Harp seal foraging is also largely associated with the ice edge. During poor ice-years massive pup mortality in harp and hooded seal populations have been reported (Kovacs, 2004). Bearded seal distribution is associated with the distribution of seasonally ice-covered shallow waters, and during summer they haul out on coastal sites (Ridgway and Harrison, 1981). They are shallow water benthic feeders, utilizing the epibenthos and infauna, pelagic and demersal fishes (Burns, 1967, Hjelset *et al*., 1999).

Within the OSPAR area, three **walrus** (*Odobenus rosmarus rosmarus*) subpopulations have been proposed: off the eastern Greenland; Svalbard and Franz Joseph Land; and in the Kara Sea, southern Barents Sea and Novaya Zemlya, although smaller local stocks may exist within the three subpopulations (NAMMCO, online report). Walrus undertake seasonal movements between summer coastal areas and offshore wintering grounds, where open-water can be predictably found in the pack ice. Walrus distribution is mainly confined to continental shelf waters, where they can access benthic prey. In the winter, walrus are often found in small leads or polynyas, which stay ice free all year round and where the ice is thick enough to support their weight (Born *et al*., 1995). In the summer, groups of walrus haul out on land at traditional sites, which are often located close to their feeding grounds (NAMMCO, online report, and references therein). In general, walruses invest considerable maternal resources (up to 2 years or more) while caring for calves on seasonally ice-covered continental shelves, and only rarely separate from their young (Cooper *et al*., 2006).

Walruses have been hunted extensively in the Barents region and their numbers were severely depleted. The pre-exploitation size of the walrus population in the Barents and Kara Seas is thought to have numbered between 70–80 thousand animals (Fedoseev, 1976). In Svalbard, the walrus was nearly completely extirpated due to hunting (Wiig *et al*., 2000). This subpopulation has been protected since the 1950s, and as a result is increasing in size; a 2006 population survey estimated approximately 2 000 animals in Svalbard during summer (Born *et al*., 1995, Lydersen, personal communication). No recent estimates are available for the Laptev, Kara or Pechora Seas.

It has been suggested that walrus which rely on suitable ice substrate for resting, calving and moulting, may be particularly vulnerable to changes in sea-ice extent and rising sea level (Learmonth *et al*., 2006). However, walruses in some population's area capable of calving and moulting on land, therefore a decrease in the sea ice will predominately impact this species through the local availability of prey from their terrestrial haul-out sites. Additional concerns for walruses in relation to climate change include, the potential for hunting pressure from humans, polar bears and killer whales to increase, as the amount and duration of ice cover in arctic regions declines (NAMMCO, 2005).

Under conditions of rapid sea-ice retreat, Pacific walrus (Canada Basin) calves were separated from adult females in July and August 2004 (Cooper *et al*., 2006). These conditions appear to have been related to the transport of warm Bering Sea water into the area (north of Alaska). It was suggested that these observations indicate that the Pacific walrus population may be ill adapted to rapid seasonal sea-ice retreat off Arctic continental shelves (Cooper *et al*., 2006), although this needs to be investigated further.

Some walrus also eat seals, a behaviour that may be more common when they do not have access to shallow water areas (DFO SCIENCE, 2002). Reduced benthic production could theoretically lead to walruses consuming more seals. This shift in their trophic position could alter their contaminant intake by a factor of 10 or more (Muir *et al*., 1999, Macdonald *et al*., 2005). Relatively high levels of organochlorines such as DDT and PCBs have already been found in walruses that prey on seals in Svalbard (Wiig *et al*., 2000, NAMMCO, online report).

6.6 Other Arctic species

The **Bowhead whale** (*Balaena mysticetus*) is listed as an OSPAR threatened species. In the OSPAR region, the Spitsbergen stock (Greenland stock) was reduced from an estimated 25 000 to 100 000 individuals (in pre-exploited period; Allen and Keay, 2006, Wiig *et al*., in press) to a few "tens" of whales in the 1990's, as a result of whaling (Christensen *et al.*, 1990). A second Barents Sea stock may exist (Shelden & Rugh, 1995), although this has not been clarified yet. It has been reported that if a further reduction of the sea-ice occurs (a decline of more then 50% of the summer sea ice has been predicted by the end of this century, ICES Climate change report), this may limit the recovery of the bowhead whale (Taylor, 2003).

Bowhead whales undergo longitudinal migrations and minor latitudinal migrations, but on the whole, their distribution is closely linked to movements of the sea ice, and they never leave arctic waters (Burns *et al.*, 1993). However, movements of animals in the North-east Atlantic i.e., the "Spitsbergen" stock are not that well known (Shelden & Rugh, 1995). Whalers described the migration of animals hunted between Greenland and Spitsbergen as following a counterclockwise circuit (Southwell, 1898 in Ross, 1993, Shelden & Rugh, 1995). The whales would winter in waters near Iceland and Jan Mayan, and then move northeastwardly as the ice front retreated during March and April. From May to June, the animals summered along the ice edge between Greenland and Spitsbergen before moving south again, with the advancing pack ice (Southwell, 1898 in Ross, 1993, Shelden & Rugh, 1995). Whilst there is evidence that the long-lived and slow breeding bowhead whale has been able to change its patterns of habitat use several times in the last 11 000 years, the current extremely low reported population size of tens of individuals in the OSPAR region, may result in the population not being as adaptable as before.

Bowhead whales depend on access to specific species of lipid-rich zooplankton, and community shifts in the Arctic to more temperate zooplankton species could have nutritional effects or cause changes in movement patterns of bowhead whales. The timing and composition of the zooplankton blooms, related to extension and residency of sea ice, is critical for optimal feeding opportunities for bowhead whales (Heide-Jørgensen & Laidre, 2004).

In the OSPAR region, **beluga whales** (*Delphinapterus leucas*) tend to spend winter in polynyas and ice leads in the Barents, Kara and White Seas. Aerial and telemetry studies of beluga whale have clearly indicated that they are positively associated with sea ice and in many areas follow the sea ice edge during their seasonal movements (e.g. Richard *et al.*, 2001, Suydam *et al.*, 2001). Beluga whales in Svalbard tend to spend most of their time close to coastlines, moving between glacier fronts in the area during the summer (Lydersen *et al.*, 2001). These areas are known to have a high abundance of potential prey species for beluga whales, so foraging is the probable reason for this behaviour. Satellite telemetry tags reported they can move thousands of kilometres, over a few months (Suydam *et al.*, 2001), and in the Canadian North during summer, the whales migrate into shallow bays and estuaries of large northern rivers (NAMMCO, online document-a). Overall, their seasonal movements depend on both oceanographic conditions (primarily the dynamics of ice cover) and the distribution of their primary prey species.

Two management units have been proposed for beluga whales (*Delphinapterus leucas*) in the OSPAR area:

1) Svalbard and Franz Josef Land
2) Karskaya (western Siberia).

There are no populaton estimates for beluga whales in the OSPAR region, however the IWC (2000) suggests that there may be 300–3 000 animals in the Svalbard area and between 500 and 1 000 animals inhabiting waters off western Siberia (Barents - Laptev Sea; IWC 2000). In 2000, the IWC (2000) proposed that the Svalbard stock was likely to be a depleted stock.

Telemetry studies have shown that beluga whales are often located in areas with greater than 90% ice cover (Lowry *et al.*, 1999, Richard *et al.*, 2001, Suydam *et al.*, 2001). However, a study analysing data on beluga whales from the Canadian Beaufort Sea by Nadoronzy and

Shea (2003) showed that adults in this area, not travelling with young calves, were not associated with the edge of the sea ice. As the ice retreated further north, the mean distance that the whales were observed from the sea ice generally increased. This strongly suggests that the whales, at least in this area, may follow a fixed route that is not dependent on the variation in the extent of the sea ice. However, belugas with young calves travelled along the sea ice edge, possibly in order to provide some protection from open water and potential predators, as well as having easy access to prey items such as arctic cod (Barber *et al*., 2001, Nadorozny & Shea, 2003).

The distribution of the **narwhal** (*Monodon monoceros*) has also been closely linked to the movements of the arctic pack ice. It has been reported that narwhals follow the distribution of the ice and move towards coastal areas, when these are ice free. During the winter, the coastal areas are abandoned and the narwhals move offshore (Heide-Jorgensen, 2002), to deeper waters (up to 2 000 m). Observations from airplanes suggest that narwhals over-winter in small groups within heavy pack ice; few animals were observed in loose pack ice or open water in winter (Born, 1994).

There is genetic evidence that east Greenland narwhal are distinct from those in West Greenland and Canada (NAMMCO, 2005). In the Eurasian sector of the Arctic, the only known estimate of narwhal numbers is from Scoresby Sund and King Oscar Fjord in East Greenland. A conservative figure of only 176 animals was obtained from an aerial line transect survey carried out in September 1983 (Larsen *et al*., 1994). Born (1994) confirms that more detailed data is lacking, and it was suggested that in this sector, narwhals prefer areas distant from the coast and may number, at most, a few thousand individuals. Narwhals in the Eurasian section probably over-winter in the Greenland Sea and the Barents Sea, although the Denmark Strait may be another wintering area for this population (Hay & Mansfield, 1989).

Narwhals utilize leads and cracks for access to air in dense ice. Narwhals feed heavily while at their wintering grounds and are dependent on access to open water for breathing between deep foraging dives. However, narwhals (and belugas) are not capable of breaking breathing holes in the ice and are occasionally found trapped in large numbers (Heide-Jørgensen & Laidre, 2004). Due to their strong site fidelity in Baffin Bay, it has been suggested that they are highly sensitive to any increase in pack ice, as they inhabit areas with the least amount of open water (Heide-Jørgensen & Laidre, 2004). It has been suggested that the regional decrease of open water of 1.0% per decade detected in Baffin Bay, will clearly impact narwhals inhabiting this area (Heide-Jørgensen & Laidre, 2004).

In conclusion, both bowhead whales and belugas range widely in search of food, and their migration varies in time and space, largely dependent on the location of ice edges, and prey species associated with the sea ice edge. Furthermore, open water areas such as annual recurring polynyas (areas within the pack ice that are almost always clear of ice) are critical for several marine mammal species such as belugas, narwhals and the walrus and as well as for bowhead whales (Heide-Jørgensen & Laidre, 2004). Walrus and bowhead whales (although the latter are only able to break thick new ice) are capable of breaking breathing holes in the ice, whereas narwhals and belugas are not, and are therefore more susceptible to being trapped in the pack ice (Heide-Jørgensen & Laidre, 2004).

6.7 Other pinnipeds in the OSPAR region–harbour and grey seals

There is negligible evidence, and a lack of published research into the effects of climate change on either harbour or grey seals in the OSPAR region. The main factors which might affect either species are considered to be:

- Rise in sea level

- Increased storm activity
- Increased precipitation
- Change in sea temperature affecting prey stocks and/or prey distribution

Seals of either species, at the extreme limits of their range (north and south), and individuals with a restricted distributional range, e.g. harbour seals in Svalbard, may be most susceptible to changes induced by climatic variation. **Harbour seals** (*Phoca vitulina*) in Greenland frequently use ice floes for hauling out, and increasing temperature and decreasing Arctic ice may result in their using terrestrial sites more frequently. At terrestrial haul out sites they may be more vulnerable to local hunting pressure; harbour seal skins are used in part of the traditional dress in West Greenland (Rosing-Asvid, 2006).

There is some available evidence of the effects of climate change on the breeding behaviour of **grey seals** (*Halichoerus grypus*). Twiss *et al*. (2007) suggested that increased rainfall increases the availability of small pools in some breeding colonies. Females aggregate around pools enabling fewer males to monopolise access to females as they enter oestrus. Conversely, in dry conditions females disperse more widely providing additional males with the opportunity to mate.

In general, harbour and grey seals do not like to haul ashore when it is raining (Grellier *et al*., 1996, Watts, 1996). It has been suggested that increased rainfall could have a detrimental effect particularly during the seals' respective breeding and moulting seasons, when seals spend an increased amount of time ashore. Increased storm (wave) activity, particularly during the respective breeding seasons, may affect pup survival. Breeding colonies (grey) or sites (harbour) may be flooded or increased wave action may separate newborn pups from mothers, leading to increased pup mortality. Harbour seals give birth to pups below the high water mark and mothers may be more frequently separated from newborn pups. Grey seals breeding in caves, on low lying islands or on cliff-backed beaches, may also increasingly lose young pups during severe weather.

Rising sea levels may inundate existing breeding sites (harbour) or colonies (grey), reducing the area available for breeding, requiring some seals to find alternative breeding locations. However, changes are likely to occur slowly, so seals may have some time to colonise alternative locations. As some colonies become inundated, other areas may become isolated and newly available as potential breeding sites. Similarly with haul out sites, increasing sea level will change the availability of haul out sites around the coast of any country. Existing haul out sites are likely to be permanently underwater but alternatives should become available.

6.8 Baleen Whales

Baleen whales undertake annual migration from food-rich high latitudes to food-poor low latitudes where they breed. It has been argued that since baleen whales are highly mobile and may use currents, salinity and temperature cues to locate regions of high prey abundance, they may be less affected by climatic shifts and by general reduction in marine productivity, compared with cetaceans inhabiting confined riverine and coastal habitats (Kenney *et al*., 2001, Taylor, 2003). However, because these species travel large distances, it cannot be ruled out that climate change and variation may affect some point of their life cycle, which may not be so adaptable to change. Whatever the adaptive purpose of migration (Kshatriya & Blake, 1988, Lavigne *et al*., 1990, Corkeron & Connor, 1999, Clapham, 2001), any general depression of high latitude production and any poleward shift of feeding grounds, could place increased energetic costs on migrating whales. However it is thought that baleens have considerable flexibility, and some females may actually reproduce short of traditional breeding grounds and non-breeding females may avoid migration altogether (Craig *et al*., 2002, Taylor, 2003).

6.9 Sperm whales

It is speculated that climate change could affect distribution of sperm whales indirectly through changes in the distribution of their main prey (squids) (Robinson *et al.*, 2005). The northern extent of their range may also be temperature limited (males migrate into the Arctic in summer but return south before the coldest periods) (Whitehead *et al.*, 1992, Robinson *et al.*, 2005). Females and younger animals are restricted to lower latitudes.

One possible climate change scenario is that weakening or failure of the Gulf Stream would dramatically reduce productivity in Northeast Atlantic waters. In this case, abundance of sperm whale prey could be substantially reduced, and effects on sperm whale condition and, ultimately, abundance are therefore also possible. It has been reported that off the Galápagos Islands, a decline in the reproductive success of female sperm whales was associated with periods of warm sea surface temperature, usually caused by El Niño Southern Oscillation events (Whitehead, 1997). A decline in the female reproductive success was attributed to poor foraging during these events.

6.10 Other species

Long-term changes in large-scale distribution have been reported for the **bottlenose dolphin** *Tursiops truncatus,* **common dolphin** *Delphinus delphis* and the **white-beaked dolphin** *Lagenorhynchus albirostris* in the North Sea, with an increase in strandings between the 1920s to the 1970s (Bakker & Smeenk, 1987).

The increase in strandings of common dolphins along the Dutch and Danish coastlines (1920s–1950s) (Bakker & Smeenk, 1987) coincided with a decline in strandings (1930s–1970s) along the Irish and English coasts, which strongly suggests a shift in the distribution of this species in western European waters at that time (Evans & Scanlan, 1989, Murphy, 2004, Murphy *et al*., 2006). The decline in strandings along the English coastline appeared to coincide with changes in fish stocks off the southwest coast of England. During a warming period in sea surface water temperatures (SST) between the 1930s and the 1960s, herring *Clupea harengus* and whiting *Merlangius merlangus* (along with other fish species) decreased in abundance (Southward, 1963, Evans & Scanlan, 1989, Southward *et al*., 2005). It was suggested that at this time, fish species shifted their distribution northwards and it is believed that common dolphins followed (Fraser, 1934, Evans & Scanlan, 1989, Murphy *et al*., 2006). Since 1965, a change in plankton abundance has occurred off the southwest coast of England, and many of the conditions prevailing in the 1920s returned, along with an increase in strandings of common dolphins along the southwest coast of England (Evans and Scanlan, 1989) and the southern and western coasts of Ireland (Murphy, 2004). The decline in strandings along the Irish coastline during the 1930s and the 1970s occurred during the negative phase in the NAO (Murphy, 2004). In recent years, a change in the dynamics of marine mammal species off the Northwest Scottish coast was reported since the 1948, with a decline in cold water species, and an increase in warm water species attributed to an increase of sea water temperature in the region (Macleod *et al*., 2005).

6.11 Summary

Assess and report on changes in the distribution, population abundance and condition of marine mammals in the OSPAR maritime area in relation to changes in hydrodynamics and sea temperature.

- Apart from ice-dependent species, where climate change may show a disruption to breeding, feeding habitat and food availability, most other species should show fairly plastic responses, as they are long lived and are likely to show some degree of adaptation to slowly developing change.
- A decline in reproductive output and body mass in polar bears in Svalbard, Norway, between 1988 and 2002, was linked to both large-scale climatic variation (Arctic Oscillation index) and the upper trophic level in the Arctic marine ecosystem. Although changes in these vital rates could also be as a result of an increase in population abundance in the area.
- However in the Arctic over the last decade, polar bears are showing declines in body condition and reproductive output that are attributed to changes in physical conditions in the southern parts of their range, particularly due to the decline in the duration of the sea ice season.
- Declining ice conditions impaired research activities designed to monitor the impact of climate change on marine mammal populations in Svalbard, Norway. Norwegian ringed seal studies on the west coast of Svalbard in 2006 and 2007 were cancelled due to extremely poor ice conditions at the study site.
- Ringed seals are the most vulnerable of the high arctic pinnipeds to climate change, as so many aspects of their life-history and distribution are tied to the sea ice.
- Within the OSPAR area, possible long-term changes in large-scale distribution in the bottlenose dolphin, common dolphin, and the white-beaked dolphin over the last 100 years, which may linked to changes in sea surface temperature (and the North Atlantic Oscillation), changing the distribution of their prey.
- Changes in the distribution of harbour porpoises have been reported in the last 10 years in the North Sea and English Channel, although it has not been fully investigated what may have caused the southern shift in their distribution.
- Apart from this, no other published studies have found any causal relationship between climate change and variation with changes in distribution, abundance or condition of marine mammals, within the OSPAR area.
- For the majority of species within the OSPAR region, especially non-Arctic spp., it will be very difficult to demonstrate causal relationships between changes in distribution, abundance or condition with climate change and variation, due to a lack of baseline data, and a lack of relevant long-term datasets.
- For most Arctic animals and baleen whales it is not known how they will adapt. However, as relative population sizes are at low levels due to earlier exploitation, they may not be as adaptable (and more susceptible) to climate change and variation.
- Unpublished data might exist, but were not available to the WG.

6.12 Ecological indicator species

- Polar bear
- Ringed seal
- Hooded seal
- Harp seal
- Bearded seal
- Walrus
- Beluga whale
- Bowhead whale
- Narwhal

6.13 Potential effects for Arctic species

The ICES (2006) report on marine and coastal dimensions of climate change in Europe stated that "Air temperature in the Arctic has increased as much as 3–4ºC in the past 50 years and is expected to rise up to 7ºC during the next century (ACIA, 2005). The average sea-ice extent has decreased accordingly by about 8% over the past 30 years, and is projected to decline by more than 50% in summer with some models indicating a complete ice-free summer Arctic Ocean by late this century (Johannessen *et al.*, 2004). In addition to a significant reduction of sea ice, an intensification of the hydrological cycle and thawing permafrost is modifying the salinity, the density of the surface waters, and the surface albedo, with profound modification in the water circulation and multiple implications for the Arctic marine biota."

Because the edge of the sea ice is considered as one of the most biologically active areas in the Arctic, concerns have been raised as to how extreme advances and retreats in the sea ice will influence the structure and species composition of the sea-ice edge pelagic food web (Tynan & DeMaster, 1997). Tynan and De Master (1997) suggested that alteration in the extent and productivity of ice-edge systems may affect the density and distribution of important ice-associated prey of marine mammals, such as Arctic cod Boreogadus saida and sympagic ("with ice") amphipods. Changes in sea ice extent and concentration thus have the potential to alter the distribution, range and migration patterns of cetaceans (and seals) associated with ice habitats, and thus indirectly affect nutritional status, reproductive success, and ultimately the abundance and stock structure of these species (Tynan & DeMaster, 1997).

Overall some important predator–prey match–mismatch issues will probably occur. The timing of reproduction in many seal species is thought to match the availability of large zooplankton and small fishes at the time when pups are weaned. Further, polar bears emerge from dens during the peak reproductive period of their favourite prey, ringed seal (ACIA, 2005).

The dynamics within the Arctic ecosystem are complex. A reduction in the sea ice may lead to an initial increased predation of, and competition between species. Following this, a gradually decline in the body condition of a large number of marine mammal species may occur, due to reduced food availability. However, the long-term changes are, on the whole, unpredictable.

6.14 References

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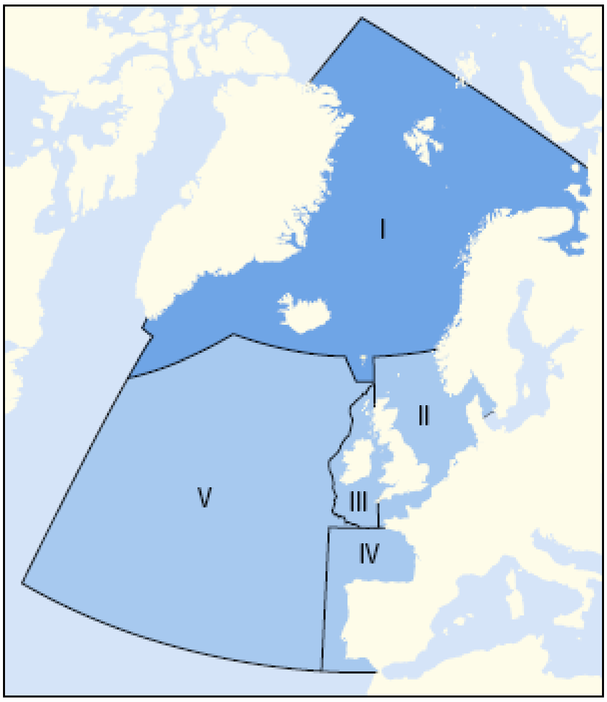

Figure 8. The OSPAR Regions are:

i) **the Arctic**: the OSPAR maritime area north of latitude 62°N, but also including Iceland and the Færoes;

ii) **the Greater North Sea**: the North Sea, the English Channel, the Skagerrak and the Kattegat to the limits of the OSPAR maritime area, bounded on the north by latitude 62°N, on the west by longitude 5°W and the east coast of Great Britain, and on the south by latitude 48°N;

iii) **the Celtic Seas**: the area bounded by, on the east, longitude 5°W and the west coast of Great Britain and on the west by the 200 metre isobath (depth contour) to the west of 6°W along the west coasts of Scotland and Ireland;

iv) **the Bay of Biscay/Golfe de Gascogne and Iberian coasts**: the area south of latitude 48°N, east of 11°W and north of latitude 36°N (the southern boundary of the OSPAR maritime area);

v) **the Wider Atlantic**: the remainder of the OSPAR maritime area.

7 Recommendations for future activities

7.1 Recommendation I

We have considered the terms of reference for a meeting in 2008 and included these as ANNEX 2. Further details on ToR b are given in Annex 3.

→The working group **recommends** that ACE adopts these terms of references for WGMME.

7.2 Recommendation II

Using SharePoint intersessionally would potentially improve the work process. Information would in this way be readily available, easily accessible and hyper-linked in appropriate ways, and this would allow new members to get a good overview and existing members to keep abreast of developments.

→The working group **recommends** that ICES considers the use of SharePoint for the WGMME on a continuous basis.

7.3 Recommendation III

The membership of the WGMME confirmed their readiness to meet for 4–5 days in 2008. The meeting place still needs to be determined. It was agreed that the best time for such a meeting is end of February of 2008.

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Annex 2: WGMME terms of reference 2008

The **Working Group on Marine Mammal Ecology** [WGMME] (Chair: M. Scheidat, Germany) will meet in February 2008 to:

a) Review any new information on population sizes, by catches or mitigation measures and suggest relevant advice in response to the European Commission standing request regarding fisheries that have a significant impact on small cetaceans and other marine mammals.

b) Review progress with the current initiative by the Royal Belgian Institute of Natural Science to create a European Marine Mammal Tissue Bank. This initiative aims to create a resource for researchers working on pathology, life history and ecology of marine mammals in European waters.

c) To review the results of the 2008 “Threats to Marine Mammal Health” Workshop which is planned to take place end of January.

d) Review the SCANS II recommendations on quantitative conservation objectives and the IUCN or other conservation criteria. In the light of this review and realistic monitoring options, provide recommendations for quantitative conservation objectives for cetaceans that could be used in the ICES area and review any further (beyond those described in 2007) results from SCANS II and provide relevant recommendations for ICES.

e) Design and collate a database of historical and current data on abundance of regional seal populations.

f) Recommend a new chair for 2009.

Supporting Information

PRIORITY:	High.
SCIENTIFIC JUSTIFICATION AND RELATION TO ACTION PLAN:	Action Plan No: Term of Reference a) This work is required in relation to MoU between the European Commission and ICES. This also addresses Goal 1 of the ICES Strategic Plan. Term of Reference b) Marine mammals are upper trophic level predators that accumulate high levels of pollutants. This addresses Goal 2 in the ICES Strategic Plan. Term of Reference c) Accumulation of pollutants in marine mammals potentially affects population status. This addresses Goal 2 in the ICES Strategic Plan. Term of Reference d) The recommendations on quantitative monitoring objectives and approaches will contribute to developing strategies for cetacean surveillance and monitoring and in considering the use of quantitative conservation objectives as a tool for the assessment of the conservation status of cetaceans in the ICES area. Term of Reference e) This work will facilitate future work of the WG.
RESOURCE REQUIREMENTS:	No specific requirements beyond the needs of members to prepare for, and participate in, the meeting.
PARTICIPANTS:	The Group is normally attended by some 10–20 members.
SECRETARIAT FACILITIES:	None.
FINANCIAL:	None.
LINKAGES TO ADVISORY COMMITTEES:	The WGMME reports to the ACE (Advisory Committee on Ecosystems).
LINKAGES TO OTHER COMMITTEES OR GROUPS:	
LINKAGES TO OTHER ORGANIZATIONS:	
SECRETARIAT MARGINAL COST SHARE:	

Annex 3: Justifications of Recommendations

Justification of Recommendation for a 2008 ToR: To review the results of the 2008 "Threats to Marine Mammal Health" Workshop which is planned to take place end of January.

There are marine mammal stranding networks in different areas of the North Sea and adjacent waters, involved in necropsy and collection of samples of stranded or by-caught cetaceans and seals. Marine mammals are investigated, allowing the determination of the causes of death but also with complete sampling. Such samples (formalin-fixed tissues, paraffin-embedded blocks, frozen samples or fixed in ethanol) allow research in ecology, genetics, life history, microbiology, toxicology and pathology. Gathering samples of marine mammals from various European areas will provide a geographical overview and identify regional variations in life history parameters. In addition, as there are variations in cause of death, gathering together data from tissues in such collections will help the research community to highlight the global health status of the marine mammals in the ICES area, taking into account also geographical and historical aspects.

One tissue bank has been developed under the auspices of ACCOBAMS to gather samples of marine mammals from Mediterranean and the Black seas but, up to now, there is no internationally recognized marine mammal tissue bank for the ICES area. Nevertheless, the Royal Belgian Institute of Natural Sciences (Brussels) has started such a project gathering samples (>10 000) of selected cetaceans and seals from Belgium, France, Ireland and the Netherlands. A databank is associated with the tissue bank, containing relevant information associated with the sample (species, age, sex, lesion, etc). The collection of the tissue bank is maintained and continuously augmented by collaborations between national stranding networks, collaborators duplicating samples from selected animals. One duplicate stays with the provider, available for investigation, while the second, along with a copy of all associated data is sent to RBINS (Brussels). The tissue bank, with the associated database, is accessible through a specially dedicated website hosted at the Belgian Marine Data Centre (BMDC) of the RBINS (department of the Management Unit of the North Sea Mathematical Models), Brussels. The museum accepts responsibility for long-term stewardship. The existing tissue bank could be considered as a tool to facilitate tissue exchanges. Scientists can request tissues from the tissue bank following their priorities (selection by species, area, age, sex, tissues, year and conservation procedure). People are informed every year (annual report on the state of the tissue bank) about the use of the samples that they collected and on the results and publications generated by the research. Contacts are made with other countries, to extend the collection to create a European Marine Mammals Tissue Bank (EMMTB). Workshops will be organized to develop common protocols for sampling, for selection of parameters recorded in the database (species, location, date, sex, length, age, etc), and to finalize the form of the collaboration agreement which should be accepted by all users.

The objectives of the EMMTB are:

- to continue to develop and maintain a common tissue bank integrating samples of selected animals from different areas of the North Sea and gathering them in a single storage facility;
- to reinforce and optimize collaborations between different research teams;
- to provide long-term storage of tissue samples and
- to distribute samples for scientific and conservative purposes under a collaborative agreement.

As an important resource for research on European marine mammals this proposal is directly relevant to the ICES WGMME.

Table for ToR e (Chapter 7)

Species	Common name	OSPAR threatened spp.	Seasonal Migratory patterns?	Number of populations in the OSPAR region	General changes in population abundance	General changes in condition of population	Ecological indicator spp. for climate change	Changes in distribution (recent and in the last 100 yrs)	OSPAR region where spp. normally occurs	Restricted distribution?	Calving / pupping season	Diet composition	Observed or possible effects (reproduction & survival) as a result of changes in climate	Current large-scale Anthro-pogenic removal
Ospar threatened spp. List														
Balaena mysticetus	**Bowhead whale**	Yes	Migrations linked to sea ice	2?	Depleted by whaling	Unknown	Yes	Unknown	**I**	Restricted to Arctic waters	Unknown	Zooplankton, other invertebrates, epibenthos	Possibly heat intolerance; effected by changes in prey distribution	No
Balaenoptera musculus	**Blue whale**	Yes	Seasonal migrations	1?	Depleted by whaling.	Unknown	No	Unknown	**All**	No	Winter	Zooplankton, occasionally small fish	Unknown	No
Eubalaena glacialis	**Northern right whale**	Yes	Unknown	Unknown	Depleted by whaling, no recovery	Unknown	No	Unknown	**All?**	No	Winter	Zooplankton	Unknown	No
Phocoena phocoena	**Harbour porpoise**	Yes	Indications of seasonal movements	Possibly between 8 and 11	No detected changes between 1994 to 2005	High contaminant levels; large number die of infectious and non-infectious disease.	No	A possible southwards movement within North Sea from 1994 to 2005	**All**	No	May to August	Prey variable with region; fish, such as sandeels and whiting	Unknown	Yes - Indirect
Dolphin														
Tursiops truncatus	**Bottlenose dolphin**	No	Possible seasonal movements	Resident circ. 5, offshore popln status unknown	Decline to 30 animals (Sado estuary PT)	Contaminant levels, skin lesions.	No	Movement of Moray Firth population to St Andrews Bay, off Scotland. Increase in abundance in the southern North Sea – 1920s - to 1950s	**II, III, IV, V**	No, but patchy	Summer	Generalist; fish species, cephalopods	Unknown	No
Large toothed whales														
Physeter macrocephalus	**Sperm Whale**	No	Males move to northern latitude feeding grounds	1?	Depleted by whaling. An increase noted since 1980s	Unknown	No	Strong decadal scale fluctuations	**All**	No, but strong seasonality for males	Summer (mainly July-September)	Specialists; prey variable with region; squid, fish	*Off the Galápagos Islands, a decrease in reproductive success of females associated with El Niño Southern Oscillation events.	No

Species	Common name	OSPAR threatened spp.	Seasonal Migratory patterns?	Number of populations in the OSPAR region	General changes in population abundance	General changes in condition of population	Ecological indicator spp. for climate change	Changes in distribution (recent and in the last 100 yrs)	OSPAR region where spp. normally occurs	Restricted distribution?	Calving / pupping season	Diet composition	Observed or possible effects (reproduction & survival) as a result of changes in climate	Current large-scale Anthro-pogenic removal
Baleen whales														
Megaptera novaeangliae	**Humpback Whale**	No	Seasonal migrations	2	Depleted by whaling	Unknown	No	Changes linked to availability of prey (capelin).	**All**	No	Winter	Pelagic fish, zooplankton	Possibly effected by changes in prey distribution	No
Balaenoptera borealis	**Sei Whale**	No	Seasonal migrations	?1	Depleted by whaling	Unknown	No	Possible changes due to whaling of other whales	**All**	No	Winter	Pelagic fish, zooplankton	Possibly effected by changes in prey distribution	No
Balaenoptera physalus	**Fin Whale**	No	Seasonal migrations	1	Depleted by whaling.	Unknown	No	Unknown	**All**	No	Winter	Prey variable; pelagic fish, zooplankton, also cephalopods	Possibly effected by changes in prey distribution	Yes - Direct
Balaenoptera acutorostrata	**Minke Whale**	No	Unknown; local seasonal movement	1 or more	Unknown	Unknown	No	Changes linked to availability of prey (herring).	**All**	No	Winter	Prey variable with season and region; pelagic fish, krill	Possibly effected by changes in prey distribution	Yes - Direct
Narwhals and Belugas								Unknown						
Monodon monoceros	**Narwhal**	No	Movements linked to sea ice	1 or more	Unknown	Unknown	Yes	Unknown	**I**	Restricted to arctic waters	July-August	Pelagic fish species associated with ice undersides, demersal species, cephalopods, zooplankton	Possibly heat intolerance; reduction in sea ice will effect survival and reproduction.	Yes - Direct
Delphinapterus leucas	**Beluga Whale**	No	Movements linked to sea ice	1? 2 possible stocks	Unknown	*Gulf of St. Lawrence Belugas immune system dysfunction linked to PCB exposure	Yes	Unknown	**I**	Restricted to arctic waters	Variable with population late spring-early summer	Opportunistic; prey variable with region; fish	Possibly heat intolerance; reduction in sea ice will influence reproduction	No

Species	Common name	OSPAR threatened spp.	Seasonal Migratory patterns?	Number of populations in the OSPAR region	General changes in population abundance	General changes in condition of population	Ecological indicator spp. for climate change	Changes in distribution (recent and in the last 100 yrs)	OSPAR region where spp. normally occurs	Restricted distribution?	Calving / pupping season	Diet composition	Observed or possible effects (reproduction & survival) as a result of changes in climate	Current large-scale Anthro-pogenic removal
All pinnipeds														
Odobenus rosmarus	**Walrus**	No	Movements linked to sea ice	Possibly 3 sub-populations	nearly extirpated due to hunting; in Svalbard increase to 2,000 animals.	unknown	No	Local reduction in range	**I**	Circumpolar, pagophilic	Late winter (April-early June)	Bivalves and some seals	Calving on ice floes. Possibly change in prey species (from benthic to seals)	Yes - Direct
Phoca vitulina	**Harbour Seal**	No	No	5 to 6	Changes in abundance due to PDV epidemics in 1988 and 2002.	High contaminant burdens linked to reduced reproductive potential	No	Unknown	**I , II, III, IV**	No, other than Greenland	June to July	Opportunistic; prey variable with season and region; benthic fish, fish, cephalopods	Change in sea level likely to affect availability of haulout and/or breeding sites. Affected along with any that use ice for breeding/hauling out	Yes – Direct & indirect
Halichoerus grypus	**Grey Seal**	No	No	Circ. 7	Increase of populations	Unknown	No	Unknown	**I , II, III, IV**	No	September to November	Opportunistic; prey variable with season and region; benthic fish, fish	Change in sea level likely to affect availability of haulout sites; increased rainfall may influence reproduction	Yes – Direct & indirect
Cystophora cristata	**Hooded Seal (Greenland stock)**	No	Movements linked to sea ice	1 to 2	Depleted by hunting. decline from the 1940s to the 1980s	Unknown	Yes	In response to ice conditions.	**I**	Pack ice needed for pupping, prey associated with ice-edge	March/April on the West Ice east of Greenland	Prey variable on life stage and season; invertebrates, fish, squid	Life history is strongly associated with pack ice	Yes – Direct
Phoca groenlandica	**Harp Seal**	No	Movements linked to sea ice	3	Depleted by hunting. Historically more abundant.	Unknown	Yes	In response to ice conditions and change of prey (capelin) abundance.	**I**	Pack ice needed for pupping, prey associated with ice-edge	February to mid-March	Catholic diet; prey variable with life stage, season and region; polar cod and amphipod	Life history is strongly associated with pack ice	Yes – Direct
Phoca hispida	**Ringed Seal**	No	Movements linked to sea ice	1 popln, 2 stocks	Unknown	Unknown	Yes	Unknown	**1**	Yes, restricted to fast or pack ice	Late March or April	Opportunistic; prey variable on life stage, region; fish and invertebrates	Life history strongly related to ice & snow conditions. Females build birth lairs in the ice	Yes – Direct
Erignatus barbatus	**Bearded Seal**	No	Movements linked to sea ice	1	Unknown	Unknown	Yes	Unknown	**I**	Yes, restricted to pack ice and floes	Mid-March to early May	Opportunistic; prey variable by region; fish and invertebrates	Life history is strongly associated with pack ice	Yes – Direct

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Others														
Ursus maritimus	**Polar Bears**	No	Movements linked to sea ice	2	Barents Sea over 3,000. About 1,500 around Svalbard.	* In Hudson Bay, decreasing condition and reproductive rates due to early ice breakup	Yes	Unknown	**I**	Yes	April and May	Ringed seals and some bearded and harp seals	A decline in reproductive output and body mass in polar bears in Svalbard, was linked to both large-scale climatic variation and the upper trophic level in the Arctic marine ecosystem.	Yes – Direct

***outside of OSPAR region**