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

February 25–29 2008

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Executive summary

During the 2008 meeting the WGMME considered a wide range of issues. Within the term of reference considering `the assessment of changes in the distribution and abundance of marine species in the OSPAR maritime area in relation to changes in hydrodynamics and sea temperature` data collated by other working groups were considered. In the 2007 report WGMME concluded that the highest impact of climate change is to be expected for arctic marine mammals. During this year's meeting it was considered that there are currently no reliable long-term time series for abundance (or abundance indices) available for endemic arctic marine mammals. The lack of this data makes it difficult to reliably assess current impacts of changes in climate on these species' populations.

When assessing the new information available from the SGBYC (Study group on bycatch) it became clear that despite all the observations made under EC Regulation 812/2004, no current bycatch estimates for marine mammals in the North Sea are available. Furthermore, although required by the EC regulation, data on bycatch of seals is not reported at all. The WG considered the potential effect of bycatch on seals to be substantial.

Cetacean conservation objectives and criteria were reviewed and realistic monitoring options considered, including those recommended by the SCANS II project. The WG also discussed new results from the SCANS II project. The project evaluated and developed methods for monitoring trends in abundance of small cetacean species and provided a comparison of cost-effectiveness of the different methods. Additionally, a simulation model considering a wide range of parameters and incorporating uncertainties in e.g. abundance estimates, was used to tune a specific bycatch management procedures so that one would expect to achieve the conservation objective in practice. The results of the SCANS II work also showed that uncertainties within abundance estimates need to be considered when assessing bycatch of marine mammals in a reliable way.

Two seal species were of particular concern to the WG during this meeting. The Saimaa and Ladoga ringed seals are fresh water seals, which are not only impacted through bycatch in fishery, but are also suffering from climate change. The increase in temperature causes a lack of snow, which is needed for the seals to build lairs for their young. This in turn causes a decrease in successful pup production. The lake Saimaa ringed seal has been studied for several decades and this allows for a rare opportunity of monitoring the abundance and reproduction rate as well as the impact of human activities and climate change. Sadly, this close monitoring reveals that both the Saimaa and Ladoga ringed seals are in danger of extinction and that further conservation actions are urgently needed to protect these species.

A further focus of the work was to consider how data collected in different countries can be brought together in common databases. One example is the proposal of a database for data on harbour and grey seal population indices. First steps were made to decide on a format which would allow not only the assessment of time series but will also allow the highlighting of lack of data, e.g. in specific areas, or the usefulness of current definitions of management areas. A second approach to facilitate research and monitoring on an international level is the Marine Mammal Tissue Bank set up by the Royal Belgian

Institute of Natural Science (RBINS). The WG recognises the value of this sample and data bank and encourages an extension of this to a larger international community.

1 Opening of the meeting

The Working Group on Marine Mammal Ecology (WGMME) met at the University of St. Andrews in Scotland, UK from 25 February to 29 February 2008. The list of participants and contact details are given in Annex 1.

The Working Group thanks the Sea Mammal Research Unit for their invitation to conduct the meeting in St. Andrews. The Working Group gratefully acknowledges the support given by several additional experts that 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 Adoption of the agenda

The following Terms of Reference and the work schedule were adopted on February 25th.

a) Consider the reports of the Ad Hoc Groups on:

i) Hydrographic Attributes

ii) Trend Analyses and Quantifying Relationships

iii) Formulating Hypotheses and Predictions about Mechanisms

iv) Selecting Species for More Intensive Investigations

and use their recommendations concerning (1) recommended time series, (2) analytical methods and suitable software, (3) hypotheses and guidance for their use, and (4) a suggested list of species for intensive study, to complete 'the assessment of changes in the distribution and abundance of marine species in the OSPAR maritime area in relation to changes in hydrodynamics and sea temperature.

b) Taking account of the results of SGBYC, review and provide draft advice 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.

c) Provide an evaluation of the status of grey seals, of harbour seals and of bycatch of harbour porpoise in relation to the following Ecological Quality Objectives being applied by OSPAR in the North Sea:

i) Harbour seal population size: Taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea. These sub-units are: Shetland; Orkney; North and East Scotland; South-East Scotland; the Greater Wash/Scroby Sands; the Netherlands Delta area; the Wadden Sea; Heligoland; Limfjord; the Kattegat, the Skagerrak and the Oslofjord; the west coast of Norway south of 62°N.

ii) Grey seal pup production: Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years), and in breeding sites, within any of nine sub-units of the North Sea. These sub-units are: Orkney; Fast Castle/Isle of May; the Farne Islands; Donna Nook; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Heligoland; Kjørholmane (Rogaland).

iii) Bycatch of harbour porpoise: Annual bycatch levels should be reduced to below 1.7% of the best population estimate.

d) 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.

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

f) 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.

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

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

WGMME will report by 1 April 2008 to ACOM.

Supporting Information: Scientific Justification and relation to Action Plan:

a) Completion of a requested two-year process in ICES to provide a background document on effects of hydrographic change for OSPAR's QSR 2010.

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

c) This is a response to OSPAR request no. 2 and aims to contribute to the evaluation of the results of the EcoQO system in the North Sea and the QSR 2010.

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

e) Accumulation of pollutants in marine mammals potentially affects population status. This addresses Goal 2 in the ICES Strategic Plan.

f) 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.

g) This work will facilitate future work of the WG.

h) A repeat of ToR from last year as the report to be reviewed was then not available.

3 ToR a. Consider the reports of the Ad Hoc Groups on

a) Hydrographic Attributes

b) Trend Analyses and Quantifying Relationships

c) Formulating Hypotheses and Predictions about Mechanisms

d) Selecting Species for More Intensive Investigations

and use their recommendations concerning (1) recommended time series, (2) analytical methods and suitable software, (3) hypotheses and guidance for their use, and (4) a suggested list of species for intensive study, to complete 'the assessment of changes in the distribution and abundance of marine species in the OSPAR maritime area in relation to changes in hydrodynamics and sea temperature

3.1 Introduction

WGMME only received reports from the ICES Working Group on Oceanic Hydrography (WGOH) and the Study Group on Working Hypotheses Regarding Effects of Climate Change (SGWRECC). In addition to these reports the WG reviewed information contained in the 2007 WGMME report (TOR 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*), and documents provided by participants (http://www.ices.dk/reports/ACOM/2007/WGMME/WGMME07.pdf).

3.2 Hydrographic attributes of the OSPAR sub-regions

WGOH recommended some key hydrographic indices that may be used to investigate interannual to decadal changes in the marine ecosystems of the OSPAR region. These included atmospheric (North Atlantic and Arctic Oscillations), and sea ice (Barents Sea and Arctic Sea) indices, as well as hydrographic attributes for each sub-region (e.g., temperature and salinity at 50 m depth at Ocean Weather Station "Mike", 66°N2°E in the Norwegian Sea). WGOH noted that the Arctic and shelf seas (OSPAR regions I–IV) are predicted to show warming at a significantly greater rate than the wider North Atlantic (region V).

WGMME concurs that there exists a suite of environmental indices that are sufficient to monitor impacts of climate change on the North Atlantic environment. Further, the WGOH statement regarding the impact on the Arctic is consistent with advice contained within WGMME 2007 report "Within the OSPAR region, the marine mammals that will be most affected by climate change are expected to be those that live in close association with the Arctic ice and/or in the cold temperate to polar seas influenced by Arctic ice."

However, it is clear that marine mammals inhabiting the remaining OSPAR regions could also be affected by climate change, as effects of changing temperature and oceanographic conditions would, for example, affect their prey resources (Beaugrand *et al.*, 2002). Changes in the distribution, depth distribution timing of and migration in some fish species which are known prey of marine mammals have already been documented (Arnott and Ruxton, 2002; Perry *et al.*, 2005; Rose, 2005; Evans *et al.*, 2005) and this could have implications for the marine mammals (i.e. higher risk of bycatch, higher energetic costs, phenological changes, etc.).

The WG noted that the impact of global warming in terms of the potential emergence of infectious diseases in marine mammals, as described for terrestrial environment, and the increase of harmful algal bloom must also be considered (Harvell *et al*., 2002, 2005; MacDonald *et al*., 2005; Peperzak, 2005).

3.3 Trend analyses and quantifying relationships

No information on these topics was provided to the working group but some general comments can be made. Even though environmental indices are available, detection of relationships between species distribution/abundance and climate change obviously also requires appropriate time series on the species of interest.

In long-lived species such as marine mammals, the entire available abundance series may refer to the reproductive output of only a single generation: effects such as individual senescence should be taken into account. For less abundant species, detection of statistically significant trends in abundance may be particularly difficult (Gerodette, 1987; Forney, 2000; Taylor *et al*., 2007). Given that distribution is difficult to define quantitatively, and that to do so requires extensive survey data, especially at the edges of the range, detecting trends in distribution is also difficult.

To be able to detect changes in the distribution and abundance of selected marine mammal species and taking into consideration that dedicated surveys such as SCANS cannot take place every year it is important to make sure information is collected on a systematic basis using other means. The use of platforms of opportunity such as those provided by survey vessels (i.e. acoustic, demersal, etc.), which carry out annual surveys to evaluate the abundance of commercially important fish species, to collect information on marine mammals is a good example. Separate observer programs are at present running on board fishery surveys in different EU countries (Anon., 2006). The international coordination of these programs would allow a better use of the information.

Several generic issues apply to the detection of trends in single time-series and quantifying relationships between multiple time-series: these include questions about model selection, model fitting, testing predictions, decisions about scale, incorporating environmental effects that are displaced in space and/or time (time-lags and teleconnections), autocorrelation, seasonal patterns and unexplained trends, interactions between variables, identification of data distributions, variance structure and linearity of relationships. Adequate testing of predictions is needed to eliminate spurious (coincidental) relationships: as noted by Solow (2002), time-series correlations often disappear once longer series become available.

Time series can be modelled using regression, generalised linear or additive models (GLM or GAM), but such models may be invalidated by temporal auto-correlation, i.e. non-independence of adjacent values of the response variable, which can inflate apparent statistical significance by up to 400% (Zuur *et al*., 2007). Whether autocorrelation is an issue can be confirmed by testing the model residuals for temporal autocorrelation. Otherwise, solutions include Generalised Additive Mixed Modelling (GAMM), Seasonal and Trend decomposition using Loess (STL), Autoregressive Integrated Moving Average Models (ARIMA) or Dynamic Factor Analysis (DFA, a multivariate extension of STL). On a cautionary note here, the autocorrelation, moving average, seasonal and trend terms in such models capture variation without explaining it. Environmental parameters may however, be included. Time-lagged relationships with environmental variables can also be detected using cross-correlation analysis; some authors recommend so-called "pre-whitening" (de-trending) of series prior to analysis. However, common trends thus removed may indicate a genuine causal link (Pierce *et al.*, 2006; Zuur *et al.*, 2007).

3.4 Formulating hypotheses and predictions about mechanisms

SGWRECC (2008) identified a suite of potential changes in marine ecosystem components due to climate change, particularly within UK waters. The UK Marine Climate Change Impacts Programme (http://www.mccip.org.uk/default.htm) was the basis for their report. In summary, the hypotheses pertaining to ocean mixing, plankton production, fish recruitment, intertidal processes, harmful algal blooms, coastal erosion, etc, within UK waters refer to predominantly negative effects. For example, changes in surface stratification and nutrient levels may impact timing of plankton production resulting in a miss-match with larval fish production. However, the effects of other drivers (e.g., fishing mortality) may make it difficult to differentiate the effect of climate change on commercially exploited fish stocks. The SGWRECC 2008 report made mention of apparent shifts in odontocete range off south-west Scotland (MacLeod *et al*., 2005; Evans *et al*., 2003, 2005), and noted that it was not possible to definitively link this to climate change.

3.5 Selecting species for more intensive investigations

No information on these topics was provided to the working group but some suggestions can be made based on work by WGMME members and recent reviews (e.g. Robinson *et al*., 2005; Learmonth *et al.*, 2006). In 2007, the WGMME identified Arctic species (e.g., polar bear, *Ursus maritimus*, harp seals *Pagophilus groenlandica*, hooded seals, *Cystophora cristata*, ringed seals, *Phoca hispida*, bearded seals, *Erignatus barbatus*, walrus, *Odobenus rosmarus rosmarus*, beluga whales, *Delphinapterus leucas*, narwhal, *Monodon monoceros*, and bowhead whale, *Balaena mysticetus*) that would be very susceptible to climate warming, however no long-term time series were identified for the OSPAR region. Further, poor baseline data will make it more difficult to track changes in Arctic marine mammal populations (Kovacs and Lydersen, in press).

Reduction of ice coverage in the Arctic has been predicted to result in a more northern distribution of marine mammals adapted to the habitats provided by ice. However, if projected losses of summer sea-ice occur, then the future survival of ice-breeding seals, such as ringed seals, might be compromised. For land locked species such as Baikal, Caspian, Ladoga, Saimaa and Baltic seals, the future of their populations is even more uncertain, since shifting distributions to follow the ice in more northerly latitudes is less of an option. There has been a lack of suitable ice for breeding for Baltic ringed seals in the Gulf of Riga over the past decades, and in some years pre-weaned pups drift ashore and die. The current climatic conditions are suggested to drive a rapid decline in the southern Baltic ringed seal stock, which was estimated to 1400 hauled out seals in 1996 (Harkonen *et al*., 1998). Sporadic surveys over the past five years suggest this number could have been reduced by 50%.

Baltic grey seals alternate between land- and ice breeding, depending on ice conditions. Mean pre-weaning mortality rate on land is about 21%, and correlated with birth density. Mean mortality rate on ice was 1.5%. Mean weights of pups born on ice were significantly greater (48.3±8.1 kg) at the onset of moult, compared with pups born on land (37.4±7.8 kg) (Jussi *et al.*, in press). Since indices of life time net reproductive rate (pup survival) and pup quality (weaning weight and health) were more auspicious on ice as compared with land, diminishing ice fields will result in lower and more variable growth rates in this species. At this meeting it was noted that the time series data on Saimaa ringed seal (*Phoca hispida saimensis*) provides a suitable example of a species dependent on typical weather conditions (i.e., suitable snow level for building lairs). Current weather patterns lead to snow levels unsuitable for successful pup rearing, (see below).

The minimum and maximum observed population size of Saimaa ringed seal were 190 in 1990 and 280 in 2005. The present population size is around 260 seals. The mean growth rate of the Saimaa seal population was around 1.02 during the five year period from 1990–2004 (Sipilä *et al.*, 2005), but only 1.005 during 2002–2007 (Sipilä and Kokkonen, 2008). Abnormal high lair mortality of pups in the years 2006 and 2007 concurrent with bycatch mortality had decreased the population size.

In winters 2005–06 and 2006–07 in Lake Saimaa there was a lack of suitable snowdrifts on the shorelines for ringed seal to dig the lairs. Some pups were born on open ice, some in roofless lairs (snow hollows on the shoreline) and some inside normal lairs. Due to abnormally poor lairing conditions in spring 2006 and 2007, respectively, 27% and 31% of pups were still-born or died soon after birth (Table 1.1; Sipilä and Kokkonen, 2008). Climate warming will likely exacerbate this trend. In contrast during the winters 1980–2000 the percentage of pups found dead in lairs was 11.7 % (Sipilä, 2003).

Table 1.1 Estimated lair mortality of Saimaa seal pups in the years 2006 and 2007.

BREEDING AREA MORTALITY	MEAN NUMBER	PUPS BORN		LAIR MORTALITY	
	Pups born 2000–05	2006	2007	2006	2007
Pyhäselkä-Jänisselkä	0	0	0	0	0
Orivesi	1	0	0	0	0
Pyyvesi-Enonvesi	3	2	2	1	0
Joutenvesi (+Ruunavesi)	6.5	8	6	5	1
Kolovesi	4.5	3	3	1	0
Haukivesi (+Matari)	14.3	13	12	4	6
Pihlajavesi	19	19	21	3	6
Tolvanselkä-Katosselkä	2.5	2	3	1	0
Lietvesi	1.3	1	2	0	2
Luonteri	0	0	0	0	0
Pajusaarenselkä-Petraselkä	3.7	4	5	1	0
Ilkonselkä	0.2	0	0	0	0
Total (Lake Saimaa)	56	52	55	16	15

According to ecological risk analysis, if seal mortality in Lake Saimaa increases by five seals per year when population growth rate is 1.02 there will be high risk of extinction during the next 100 years (Ranta *et al.*, 1996). Prior to present high lair mortality the observed mortality of Saimaa ringed seal was concentrated on age class less than 1 year;

about 70% of all cases were mainly due to high bycatch mortality (e.g Kokko *et al*., 1998; Sipilä, 2003; Ranta and Lundberg, 2006). The present high pup mortality suggests that there are two extremely small age classes; less than 1 year and 1–2 years. This will likely decrease pup production in Saimaa seal population in years 2010–11 when those age classes reach the maturity age.

Although Arctic species must have the highest priority for monitoring, WGMME 2008 discussed that monitoring non-Arctic water species (e.g., harbour porpoise, *Phocoena phocoena* and bottlenose dolphins, *Tursiops truncatus*) might also be of relevance. It was noted that the conservation of both harbour porpoises and bottlenose dolphins is specifically considered under the Habitats Directive through the establishment of marine protected areas (MPA). Impacts of climate change (i.e. on the prey species via changes in currents creating a shift in retention, concentration areas) could make an area previously important for either porpoises or bottlenose dolphins unsuitable in future years. Therefore monitoring of the habitat use of these species may possibly provide an indicator of effects of climate change.

3.6 Summary

The two Ad hoc reports made available to WGMME provided minimal guidance regarding items (1–4) in the aforementioned ToRs. However, the available time series of hydrographic and atmospheric data are deemed sufficient for monitoring changes in important oceanographic conditions. As such, WGMME recommends that the aforementioned Arctic species receive the highest priority (Stirling, 2005; Rosing-Asvid, 2006; Simmonds and Isaac, 2007; Kovacs and Lydersen, in press) for intensive study. However, within the OSPAR region there are no long term reliable time series of abundance data, or even trend indicators, for endemic Arctic marine mammals (Kovacs, pers. comm.). Further, a set of statistical models as appropriate analytical tools need to be developed to assess changes in the distribution and abundance of marine species in the OSPAR maritime area in relation to changes in hydrodynamics, and sea temperature.

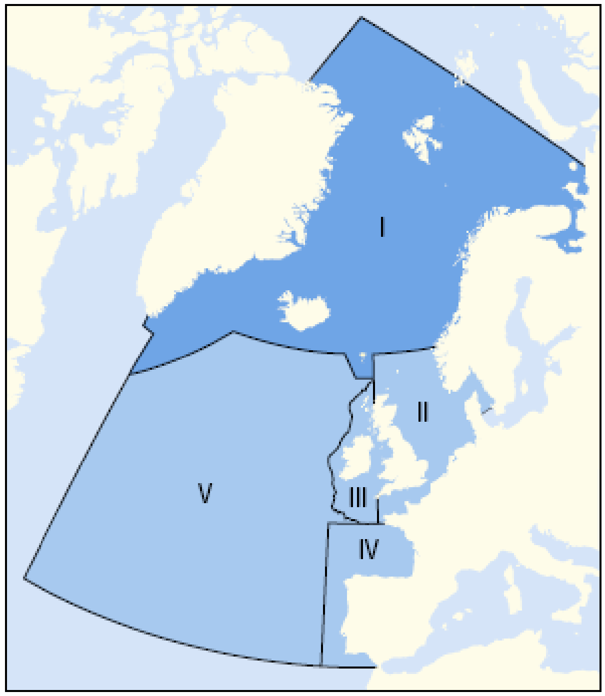

Figure 1 The OSPAR Regions

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.

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4 ToR b. Taking account of the results of SGBYC

Review and provide draft advice 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.

4.1 New information on population sizes

New small cetacean abundance estimates are available from the SCANS II survey. These are presented below in Table 4.1.1.

Table 4.1.1 Abundance estimates for small cetaceans from the SCANS II survey.

Species	Geographical Area	SCANS-II blocks	Abundance Estimate	CV
Harbour porpoise	Inner Danish waters, Kattegat & Skagerrak	S	23 227	0.36
	Northern North Sea	J,M,T	37 968	0.23
	Central North Sea	L,V	58 706	0.31
	Southern North Sea & Channel	B,H,U,Y	134 434	0.19
	Western shelf waters	N,O,P,Q,R	128 637	0.33
	France, Spain, Portugal shelf waters	W	2 646	0.8
Common dolphin	Western shelf waters	N,O,P,Q,R,W	63 400	0.46
Whitebeaked dolphin	Northern and central North Sea	J,T,U,V	10 562	0.29
	Western shelf waters	N,O,Q,R	12 103	0.74
Bottlenose dolphin	Northern & central North Sea	J,T,V	652	1.07
	Western shelf waters & Channel	B,N,O,P,Q,R	7 687	0.36
	France, Spain & Portugal shelf waters	W,Z	4 304	0.35
Minke whale	Northern & central North Sea	J,T,U,V	10 541	0.32
	Western shelf waters & Channel	B,O,P,Q,R	8 072	0.33

4.2 New information on bycatches

4.2.1 New estimates of bycatch

There are very few recent estimates of bycatch available from European waters. SGBYC has reviewed National Reports on Council Regulation 812/2004. The only extrapolated estimates of annual bycatch reported in the 812/2004 Nation Reports were from the UK and France. Bycatches of porpoises in UK setnets and of common dolphins in UK setnets and pelagic pair trawls for ICES subdivisions VIIefgh were presented in the UK National Report on 812/2004. An estimate for French albacore trawl fisheries was presented in the French National report on 812/2004. An additional estimate for porpoise bycatch was provided at the SGBYC meeting for Irish gillnet fisheries. These estimates are shown in Table 1.2.

For the Belgium and northern France coastline, the potential impact of marine mammals capture is evaluated by the establishment of the cause of death of stranded specimens. At the end of nineties, it was estimated that ca. 20% of stranded porpoises were bycaught. Since 2000, there has been a significant increase in the number of porpoises stranding in the area, from less than 10 (average per year) during the nineties to more than 80 for recent years. In addition, when the cause of death can be determined, it is estimated that ca. 40% of porpoises are bycaught. For the Netherlands, in 2006, more than 500 porpoises stranded on the Dutch coastline, of which 62 were necropsied. When the cause of death was identified, 57% of porpoises were bycaught.

Based on the necropsy, it is concluded that bycatch is a very significant cause of death for porpoises stranded on the continental coastline of the southern North Sea.

Table 4.1.2 Recent estimates of European bycatch from Annex 8 of the Report of SGBYC.

Species	Area	Nation	Gear Type	Year	Estimated Bycatch
Harbour Porpoise	Celtic Sea	UK	Gill and Tanglenets	2005	453
		UK	Gill and Tanglenets	2006	728
		Ireland	Gill and Tanglenets	2005-2007	350
Common Dolphin	Celtic Sea	UK	Gill and Tanglenets	2005	221
			Gill and Tanglenets	2006	544
			Pair trawl bass	2005	155
			Pair trawl bass	2006	40
	VII	France	Pair trawl albacore	2006	55

4.2.2 New records of bycatch from ongoing observer schemes

SGBYC reviewed the extent of observer coverage during 2005 and 2006 under Council Regulation 812/2004. Details of which fisheries were sampled and the levels of observer coverage are given in Annex 6 of the SGBYC Report. Very few records of bycatch were reported. Some additional records that were NOT extrapolated to estimates of total bycatch are summarised below. These also include records from an ongoing Norwegian bycatch monitoring scheme, and more recent bycatch records from France that were not included in the 2007 French National Report on 812/2004.

Table 4.1.3 Additional records of bycatches that were not extrapolated to estimates of total bycatch.

Species	Area	Nation	Gear Type	Year	Observed Bycatch
Harbour porpoise	ICES area Ia	Norway	Gillnet	2006	1
Harbour porpoise	ICES area IIa2	Norway	Gillnet	2006	134
Harbour porpoise	ICES area IIIa	Norway	Gillnet	2006	10
Harpour porpoise	ICES area IVa	Norway	Gillnet	2006	4
Grey seal	ICES area IIa	Norway	Gillnet	2006	10
Harbour seal	ICES area II a2	Norway	Gillnet	2006	23
Harbour seal	ICES area IIIa	Norway	Gillnet	2006	1
Harbour seal	ICES area IVa	Norway	Gillnet*	2006	3
Harp seal	ICES area Ia	Norway	Gillnet	2006	8
Common dolphin	VIa – VIIj	Netherlands	Pelagic trawl	2004–5	3
White-sided dolphin	VIa-VIIj	Netherlands	Pelagic Trawl	2006	1
Common dolphin	VIa, VIIb, VIIa, VIIj, VIIg	Ireland	Pelagic trawl (herring survey)	2006	4
Common dolphin	VII, VIII	Ireland	Pelagic pair trawl albacore	2004	2
Common dolphin	VII	Ireland	Gillnet, hake cod	2006	3
Striped dolphin	VII	Ireland	Gillnet, hake cod	2006	1
Common dolphin	VII	France	Setnets	2007	1
Harbour porpoise	VIII	France	Setnets	2007	8

***Two harbour seals taken in gillnets, one harbour seal taken in fish traps**

Within the observations on French pelagic pair trawls in 2007 the bycaught species recorded were common dolphin for the sea bass fishery, and some individual bottlenose dolphins, striped dolphins and pilot whales in the tuna fishery. The bycatch data will be raised to the fleet level and also to métier level at a later date.

For French setnets in area VIII, coverage was less than planned due to some difficulties with pilot studies for vessels under 15m, as the observed boats are not exactly representative of the population of vessels because of new regulations on safety and access on board of vessels.

The bycatch of the 8 porpoises reported in French setnets in area VIII was observed in fisheries for several target species including pollack, sole, monkfish, red mullet and bass. This suggests that bycatch can occur whatever the mesh size and type of setnets (gillnet, trammelnets, tanglenets). The raising of these samples still has to be done, but the raised data will probably lead to an estimate in the hundreds of porpoises caught in setnets in the Bay of Biscay.

Although not required under regulation 812/2004, the French fishing industry has implemented a monitoring scheme of setnets in area VII. In Paimpol (VIIe), an observer spent 60 days at sea and recorded one bycatch of a common dolphin over the six months.

The fishing industry is now enlarging the coverage to all the ports of the French coasts of the Channel (VIIe and VIId).

Irish bycatch observations have only been used to extrapolate porpoise bycatches so far, as there are concerns about the representativeness of the samples in which common and striped dolphins were recorded.

4.2.3 Bycatch impacts at the population level

The Study Group noted that despite all the observations made under EC Regulation 812/2004, very few extrapolated estimates of small cetacean bycatch have yet been made, and nowhere has a comprehensive estimate been obtained for all nations' fleets fishing in any single region.

Estimates for common dolphin bycatch in areas VII and VIII include those for UK setnet fisheries and pelagic trawl fisheries, and French albacore pair trawl fisheries. These total 639 for 2006, which is just over 1% of the SCANS II estimate of common dolphin abundance for western waters. However, the estimate of bycatch is definitely a minimum estimate as it does not include bycatch estimates of common dolphins in Irish, Spanish or Portuguese fisheries, nor of bycatches in French bass pair trawls for 2006 or French setnet fisheries. On the other hand the SCANS II estimate was made during summer months of 2005, and was confined to shelf waters, while common dolphins are distributed more widely than this. Furthermore, densities in the Celtic Sea and the Western English Channel appear to be much higher in the winter time compared to the summer (ICES, 2005). Information on abundance of common dolphins is currently incomplete making a comparison between the estimate of total common dolphin bycatch and the SCANS II (summer/shelf) estimate of common dolphin abundance difficult.

Estimates of porpoise bycatch for U.K. and Irish setnet fisheries add up to 1078 for 2006 which is 0.8% of the SCANS II abundance estimate for porpoises in western waters. Once again the bycatch estimate does not include Portuguese, Spanish or French fisheries (the latter thought to involve several hundred animals), and once again the geographical limits of the porpoise population are undefined, although this species is largely restricted to the SCANS II survey area of shelf waters.

4.3 Recommendations on bycatch estimation

WGMME **recommends** that SGBYC compiles the best current estimates for common dolphin and harbour porpoise bycatch in Areas VII and VIII for all fisheries that have been monitored to provide overall bycatch estimates for this region.

The Working Group noted that there are no recent estimates of porpoise or other marine mammal bycatch for the North Sea, the most recent dating back to the late 1990s. The Working Group **recommends** to the European Commission that observer monitoring should be extended to the North Sea in order to obtain more recent estimates of bycatch in this region.

The Working Group noted that despite all of the observations made under EC Regulation 812/2004, there is little mention in national reports of any seal bycatch, and **recommends** to the European Commission that bycatches of seals and other protected species should be reported by observer programmes established under the 812/2004 regulation as well as those conducted under Data Collection Regulations for discard sampling.

4.4 New information on bycatch mitigation

SGBYC reviewed the implementation of pinger deployment requirements under Regulation 812/2004. It was recognised that implementation of Article 2 of regulation 812/2004 has been problematic. The fishing industry has been reluctant to adopt a technology widely seen as expensive and unreliable. Research work has focused on the possibility of using fewer pingers or louder pingers that may reduce the financial burden on the industry. The Working Group was not aware of any technological developments that might make existing pingers any more reliable or less expensive.

4.5 Saimaa seal: Present population status and by catch estimates

The observed mortality of Saimaa ringed seals (*Phoca hispida saimensis*) is concentrated on animals less than 1 year of age, and about 70% of all recorded mortalities are due to fishery bycatch (e.g. Kokko *et al*., 1998; Sipilä, 2003; Ranta and Lundberg, 2006). As an overall management action, voluntary fishing restrictions have been implemented from mid April to the end of June in the major breeding areas of the Saimaa ringed seal starting in 1982, with the aim of preventing seals drowning in fishing gear (Sipilä, 2003).

The extant data on seasonal mortality of seals less than one year of age, fatally entangled in various fishing gears, shows that 71% died in the period April–June (1962–1984, *n* = 44). The corresponding figures for 1992–2000 (*n* = 34) is59 % and for 2000–2007 is 48% (Sipilä, 2003; Sipilä and Kokkonen, 2008).

The survival rate of weaned pups to the age of two years is approximately 10% higher in the fishing restriction areas (15th April–30th June) than in areas without restrictions (Sipilä *et al*., 1990; Sipilä, 2003). The difference is small, but in the long run it may turn out to be a significant factor contributing to the dynamics of the ringed seal population size in Lake Saimaa in the years 1990–2005.

These voluntary fishing restrictions are based on water owners and appear to protect Saimaa seals. During last few years (2005–2007), however, the total surface area of fishery closure has not increased (Figure 4.5.1), and it is assumed that no further increase in the voluntary protected area on Lake Saimaa is likely.

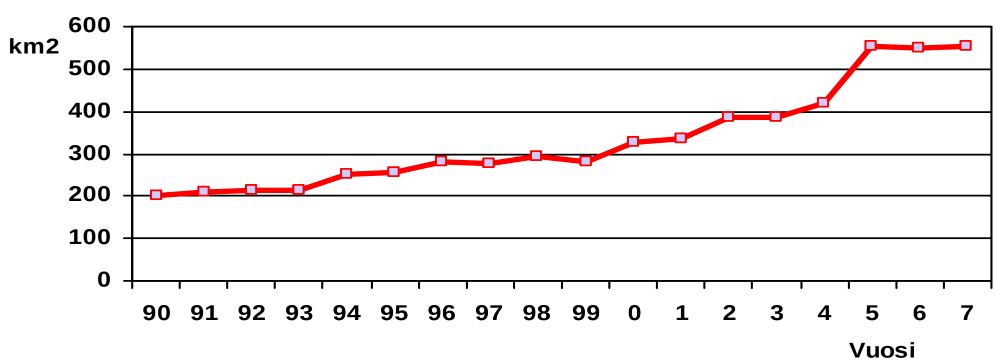

Figure 4.5.1 The total surface area of voluntary fishing restrictions area in Lake Saimaa between the dates of 15.4–30.6. in the years 1990–2007.

The mean estimated juvenile annual survival rate for Saimaa seals is currently ca 0.73 (Ranta and Lundberg, 2006), which means that only about 21% of pups survive to maturity at age 5 years. In the late 1990s it was estimated that ca. 23% of new born pups reached maturity. The mean lair mortality rate is 11.7%, so much of the rest of the juvenile mortality is caused by entanglement in fishing gear. In the years 2000–2007 30 carcasses of seals less than 1 year of age were collected, and in 67% of cases the cause of death was fishing gears, and in 33% cases the cause of death was not determined as the bodies were too rotten for post-mortem studies (Sipilä and Kokkonen, 2008).

It appears therefore that bycatch mortality of juveniles is prohibiting the growth of the Saimaa seal population. In the years 2006 and 2007 Lake Saimaa lair mortality rose to around 30% of new born pups, mainly due to lack of suitable snow piles for lairing. In both years the population size decreased, by around 4% per year. The combination of mortality due to entanglement in fishing nets with an abnormally low number of living pups found on Lake Saimaa may be fatal to the Saimaa seal population.

Annual pup production and population size can be determined quite precisely by annual lair censuses. Annual lair studies also provide good estimates of the rate of lair mortality. In population monitoring only ca. 40% of dead seal carcasses were found. It appears that current measures to address the conservation of the Saimaa ringed seal population do not meet the requirements of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)-Article 12/4.

> "12/4 Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned."

Given the increasing levels of pup mortality of Saimaa Ringed seals, combined with sustained levels of bycatch mortality, the Working Group **recommends** that Finland makes strenuous efforts to decrease bycatch mortality in this population.

4.6 Bycatch of Ladoga seals

Verevkin *et al*. (2006) reported that during the open water period there was a total of 450 km of fishing nets in daily use on the Lake Ladoga. Interviews of 36 fishing crew leaders, mainly fishing ship captains, from southern Lake Ladoga, and 17 from northern Lake Ladoga were made in 2003. According to the crew leaders a minimum of around 480 Ladoga ringed seals (*Phoca hispida ladogensis*) had been entangled in fishing gear during 2003 (Table 4.6.1, Figure 4.6.1). Official statistics from the same year list only 60 bycatches in Lake Ladoga (Verevkin *et. al*., 2006).

Table 4.6.1 Ladoga seals mortality due to fishing tackle in 2003 according to interviews.

Fishing plant	No. of seals
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.**

Figure 4.6.1 Main fishing ports of Lake Ladoga.

The figures from 2003 suggest that at present the mortality rate of seals entangled in fishing gear is most likely the main cause of death to seals in Lake Ladoga. Increasing fishing pressure in Lake Ladoga will lead to stronger interactions between seals and fisheries, and it seems likely that fishing will pose a serious threat to the seal population in the long run (Sipilä *et al.*, 2002).

In 2001, the aerial survey of seal haul out sites on ice yielded an estimate of the hauled out population size as 2000 (±70) individuals. The total population is estimated at between 3000–5000 animals. In 2003, fisheries bycatch resulted in the death of at least 483 seals, which corresponds to approximately 10–16% of the total population of this subspecies. It has been assumed that this apparently high level of bycatch mortality of the Ladoga seal population has lead to a declining population (Agafonova *et al.*, 2007).

The WG noted that the available data suggests that the conservation situation for the Ladoga seal is serious, and therefore **recommends** that the Russian Federation makes an assessment of the population status, investigate the extent and importance of bycatch and consider ways to minimise bycatch mortality.

4.7 Update on *D. delphis* in the Northeast Atlantic

The following text is a review of work undertaken as part of the EU-funded NECESSITY (*NEphrops* and CEtacean Species Selection Information and TechnologY) project, and a table of all published estimates of bycatch rates for *D. delphis* inhabiting the Northeast Atlantic. The main aims of the EU NECESSITY project were to assess the effect of bycatch mortalities in pelagic trawl fisheries on common dolphins, and to reduce bycatch in those fisheries using various mitigation practices and techniques, such as the use of pingers and alternations in net designs and grids. The project involved eight project partners and three work packages related to cetaceans, the remaining work packages were related to bycatch in *Nephrops* fisheries. The project funded research into on common dolphin population structure (using genetic analysis), population abundance, estimating various life history parameters, determining R_{MAX}, the production of life tables, determining bycatch rates in pelagic trawl fisheries; all of which provided important baseline information for management and conservation in this region.

4.7.1 Population structure in the Northeast Atlantic

As part of NECESSITY, 25 nuclear microsatellite loci and 556 base-pairs (bp) of the mitochondrial DNA control region were analysed for genetic variability, and samples were obtained by Irish stranding and observer bycatch projects (predominately the Irish tuna driftnet fishery), UK observed bycatch program (UK pelagic trawl bass fishery), French stranding and observer bycatch projects (predominately the French tuna driftnet fishery), and the Portuguese's stranding project. 152 individuals from four geographic areas (Ireland, western English Channel, France and Portugal) were genotyped at 20 microsatellite loci and a total of 106 individuals from three geographic areas (Ireland, western English Channel and Portugal) were genotyped at 25 microsatellite loci. Sequences of the mtDNA control region of 13 stranded individuals sampled in Scotland were obtained from a recently published study by Amaral *et al*. (2007) and were also included in the analysis. No significant genetic differentiation was detected when the sexes were analysed separately, suggesting similar patterns of dispersal for male and female common dolphins (Mirimin *et al*., 2007). Genetic differentiation between Scotland and other areas was tested only using mtDNA control region data and a small sample size (n=13), thus nuclear genetic differentiation between these areas needs further investigation.

In conclusion, **results indicate that common dolphins found along the Atlantic coasts of Ireland, France, Portugal and in the western English Channel waters are not divisible into separate genetic stocks using a large number of microsatellite loci and mtDNA sequencing**. This may mean that they are part of the same population, but such a conclusion should be treated with caution (differences may exist elsewhere in the genome and have not been detected with the markers utilised in the study). However, it may certainly be concluded that any genetic differences must be minimal (Mirimin *et al*., 2007).

4.7.2 Abundance estimate for a defined management area for pelagic trawls

Using shipboard and aerial survey data (Table 1), abundance was estimated for a **defined management area** (Figure 1) for pelagic trawl fisheries in the NE Atlantic, which coincided with ICES Areas VI, VII, & VIII. As this area was not covered by a single survey it was necessary to combined data from various surveys. By fitting a model predicting density as a function of environmental covariates to these data, a higher resolution of estimates of density and an abundance estimate were obtained, unconstrained by the original survey regions. Abundance was estimated using density surface models after Hedley *et al*. (1999), Hedley and Buckland (2004) and Burt (2007). For surveys where the probability of detection on the trackline could not be estimated, then the probability of detection was estimated assuming that $g(0)$ equals one. Responsive variables were latitude, longitude, slope, depth & distance from coast.

Abundance was obtained by integrating under the estimated density surfaces in the region of interest. The size of this prediction region was 1 871 600 km^2. The estimated number of common dolphin schools was 28 791 (CV=0.24; 95% CI 15 370–42 210) and the **estimated number of animals was 248 962** (CV=0.18; 95% CI 161 920–336 000) (Burt 2007).

It should be noted though that, the abundance estimate for common dolphins is specific to one area (the management unit), and does not cover the known range of the species; all sightings data used to calculate this abundance estimate were obtained during the summertime, whereas pelagic trawl fisheries operate predominately during the wintertime; the abundance estimate calculated uses data obtained over a long temporal scale (13 years); and while this area is co-incident with the bycatch information the results of these methods should be interpreted with caution, (given the partial abundance estimate and) given the assumption in the analysis that the density and distribution of common dolphins did not change during the 13-year sampling period. Seasonal changes in the densities of common dolphin have been reported in western European waters (see WGMME 2005). Further, Brereton *et al*., (2005) have reported a 10 fold increase in the numbers of common dolphins in the western English Channel during the wintertime.

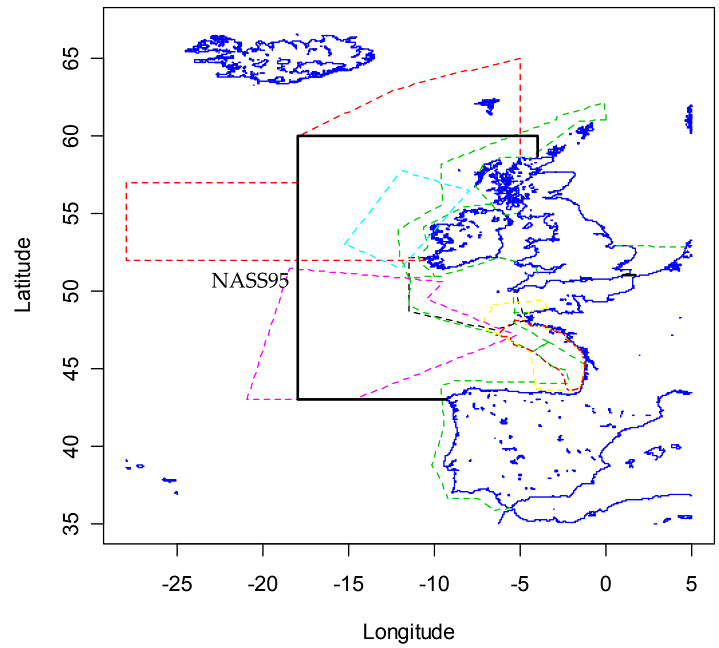

Figure 1 Plot of the region of interest (solid black line) and the regions covered by the surveys (dashed lines). The surveys are MICA (pink), SCANS-94 (black), NASS-95 (red), SIAR (cyan), ATLANCET (yellow), PELGAS (red in Bay of Biscay) and SCANS-II (green).

Cañadas *et al.* (in press) estimated an abundance of **W Block of the NASS-95 Faroese survey** (see Figure 1) of **273 159 (CV = 0.26; 95% CI = 153 392–435 104) common dolphins**. This estimate was corrected for animals missed on the trackline (g(0)) and for responsive movement. However, no genetic samples have been obtained from animals in this area, and therefore it is not known if any genetic variability exists between *D. delphis* from continental shelf waters and animals inhabiting W NASS Block.

Areas to the west of the SCANS 2 area were recently surveyed (July 2007), as part of the CODA and TNASS projects. Results from these surveys will provide up-to-date estimates of abundance for common dolphins, inhabiting offshore waters during the summertime and will become available towards the end of 2008.

Table 1 Summary of survey data. In the columns headed 'Number of sightings', observer 1 and observer 2 refer to the sightings seen by the two teams of observers for surveys using the trial configuration mode. For single platform surveys, sightings are listed under observer 1. The numbers of sightings and search effort have not been truncated by perpendicular distance or Beaufort sea state, respectively.

		Date of survey					Number of sightings		
Survey	Type	Start	End	Block	Size (km^2)	Effort (km)	Obs. 1	Obs. 2	Both
MICA	Ship	03/07/1993	20/08/1993		709 161	6736	55		
SCANS-94	Ship	29/06/1994	24/07/1994	A	201 490	1604	29[1]		
NASS-95	Ship	08/07/1995	06/08/1995	E	774 376	2468	27	28	20
				W	358 402	652	49	41	24
SIAR	Ship	31/07/2000	21/08/2000		120 000	2358	17	19	10
ATLANCET	Aerial	03/08/2002	14/08/2002		140 730	4077	40		
PELGAS	Ship	29/05/2003	24/06/2003		82 660	3550	10		
		28/04/2004	23/05/2004			3186	4		
		05/05/2005	25/05/2005			2843	13		
		02/05/2006	30/05/2006			3642	13		
SCANS-II	Ship	29/06/2005	27/07/2005	Q	149 637	3702	17	8	2
				W	138 639	4238	36	34	18
				P	197 400	3489	66	61	35
	Aerial	28/06/2005	26/07/2005	B	123 825	3674	3		
				N	30 626	730	8		
				O	45 417	2264	5		
				R	38 592	2168	19		
				Z	31 919	1522	4		

[1] Although SCANS-94 was conducted in trial configuration mode, it was analysed using conventional LT methods.

4.7.3 Bycatch limits for the defined management area

Bycatch limits for the defined management area were estimated using: (1) ASCOBANS criteria of 1.7% (maintain population ≥ 80% of K), (2) Bergen declaration precautionary measure of 1%, (3) PBR approach using default values, and (4) a conservative PBR estimate.

Using the best available abundance estimate for the defined management area, a bycatch limit 4232 *D. delphis* was determined using the ASCOBANS 1.7% approach, and 2489 *D. delphis* using the Bergen declaration precautionary measure (1% of best estimate). Using the best available abundance estimate (lower 20%-ile of the best available abundance estimate) for the defined management area, an R_{MAX} of 0.04, and a recovery factor of 0.5 (value used for a stock/population of unknown status, and with a mortality rate CV <0.30 (Wade and Angliss, 1997b)), produced a bycatch limit of 2142. Whereas using a conservative F_R of 0.4 (obtained from Wade, 1998)) in order to maintain/restore the population above 80% of carrying capacity, the potential biological removal (PBR) was estimated to be 1714 animals. Over the last 15 years, minimum estimates of incidental morality rates have, at times, exceeded the PBR estimate (see Table 3).

4.7.4 Estimating life history parameters

Results from analysis of life history data (obtained form Ireland, UK and France, 1990–2006) by the EU-funded NECESSITY project reported an average age attained at sexual maturity of 8.5 years, a pregnancy rate of 26% (n = 248), and a calving interval of approx. 4yrs (1/APR) (Murphy *et al*., 2007). Maximum age reported for the sample was 29 yrs (n = 506 females), but 98% of age sample was less than 20 years of age; all suggesting a life time reproductive output of approximately 4 to 5 calves (Murphy *et al*., 2007). Further analysis of life history parameters however found no evidence of density compensatory responses (i.e. temporal changes in life history parameters), with a low APR reported throughout the sampling period. This suggests the level of anthropogenic mortality during this period did not cause a substantial population level decline. However, the low APR (26%) though could also be a result of high contaminant burdens causing reduced fertility in females (Pierce *et al*., in press). If this is the case, it will complicate future European management plans based on anthropogenic removal.

Table 2 Comparison of results evaluating human-induced mortality thresholds of common dolphins, using the abundance estimate derived for the management area.

METHOD	FORMULA	THRESHOLD
ASCOBANS "unacceptable" Maintain popln. ≥ 80% of K	1.7% of best abundance	4232
Bergen Declaration ASCOBANS "precautionary approach"	1% of best abundance	2489
PBR - Default PBR, R_{MAX} - 0.04, FR–0.5	½ (0.04) x minimum abundance x 0.5	2142
PBR - Conservative PBR, R_{MAX} - 0.04 >80% of K, FR–0.4*	½ (0.04) x minimum abundance x 0.4	<u>1714</u>

4.7.5 Current status of common dolphins in the Northeast Atlantic

Management goals based on detecting trends in abundance are inadequate. As a change in population size does not necessarily signify a change in the optimum sustainable population (OSP) status, due to the fact that the carrying capacity may have changed (Gerrodette and DeMaster, 1990). In order to manage and monitor a population appropriately, both the population condition index and the abundance index need to be assessed in order to detect demographic changes at an early stage (Gerrodette and DeMaster, 1990). Optimum sustainable population (OSP) is the number of animals, which will result in the population being above the maximum net productivity level (MNPL), bearing in the mind the carrying capacity of the habitat and the health of the ecosystem (Wade, 1998). The range of the OSP has been determined to generally lie between the MNPL and carrying capacity (Wade, 1998), however management plans need to determine if the present population is above or below MNPL. In the U.S., one of the main conservation objectives is to maintain populations above maximum net productivity level (MNPL), which is assumed to be between 50 and 70% of carrying capacity (Wade, 1998). Whereas, in European waters, the Agreement on the Conservation of Small Cetacean Conservation in the Baltic and North Seas (ASCOBANS) aims to restore/maintain populations at 80% of carrying capacity (ASCOBANS 2000, 2006).

In general, in marine mammals estimates of carrying capacity are assumed to be equivalent to the historic population size, and can be calculated using back-calculation methods (Smith *et al*., 1983, Gerrodette and DeMaster, 1990). In order to back calculate/estimate the historical population size, at a time prior to the direct (direct fisheries or incidental captures) or indirect (habitat deterioration, or harvest and/or competition for similar prey) impacts by man, information on vital rates, numbers of animals killed by man and a current population abundance estimate are needed, and also a knowledge of where MNPL falls as a fraction of carrying capacity (Gerrodette and DeMaster, 1990). Dynamic response analysis on the other hand avoids estimating carrying capacity and MNPL; however it does require a time series of population size estimates (Goodman, 1988; Gerrodette and DeMaster, 1990).

For common dolphins however, the historical population size for *D. Delphis* in the North-east Atlantic is not known, and due to a lack of data cannot be calculated. Furthermore, a time-series of population size estimates for the whole population, (see Burt, 2007) is not available. We also have no information on whether the population has been over exploited in the past, and no information if habitat degradation or loss may have reduced carrying capacity. Apart from high rates of incidental captures reported in Irish, French and UK tuna-driftnet fisheries during the 1990s (Goujon *et al*., 1993; Goujon, 1996; Harwood *et al*., 1999), where a bycatch estimate of 11 723 common dolphins has been proposed by Rogan and Mackey (2007b) for the period 1990 to 2000, there is a lack of information on bycatch rates in a large number of other fisheries (see Table 3 on minimum annual estimates of bycatch). Furthermore, there is a lack of information on the effect of the direct fisheries operating on the common dolphin in this region. For example, the Portuguese small cetacean fishery operated until a law was passed in Portugal granting full protection to all cetaceans in 1981 (Silva and Sequeira, 2003).

There are a number of problems with producing bycatch limits for this population, based on the available data:

1) Although, a lack of genetic differentiation was detected by the EU NECESSITY project in the Northeast Atlantic using both mtDNA and microsatellites, the samples analysed were only obtained from continental shelf waters, and the adjacent oceanic Bay of Biscay waters. No samples for genetic analysis have been obtained for animal's inhabiting more oceanic waters, such as the W block of the NASS 95 survey area, and therefore it is not known if any genetic differentiation exists between this surveyed region and continental shelf waters.

2) Overall, there is a lack of information on the actual distributional range of the NE Atlantic *D. delphis* population, and as mentioned previously the defined management area in the NECESSSITY project was proposed based on activities of pelagic trawl fisheries (fisheries of interest for this project) and the available sightings data, and may only cover part of the range of the population.

3) Further, in order to correctly use the US PBR approach, it has been stipulated that the abundance data used in this approach should not be older than 8 years (Wade and Angliss, 1997).

In the US it has been shown that projections of current abundance estimates become less dependable with time after a survey has occurred (Wade and Angliss, 1997). Wade and Angliss (1997) stated that unless compelling evidence indicates that a stock has not declined since the last census, the minimum population estimate of the stock should be considered unknown if 8 years have transpired since the last abundance survey of a stock. Eight years was chosen, in part, because a population that declines at 10% per year from carrying capacity would be reduced to less than 50% of its original abundance after 8 years (Wade and Angliss, 1997).

As mentioned previously though, in the EU NECESSITY project, the abundance estimate uses data obtained over a 13 year period and assumes that the density and distribution of common dolphins did not change during the 13-year sampling period. Further, all sightings data were obtained during the summertime, whereas pelagic trawl fisheries (and a large number of other fisheries) operate predominately during the wintertime.

4) Currently, we cannot calculate an annual population incidental mortality rate, as only limited data are available for a few fisheries, and therefore only minimum annual estimates of incidental mortality can be calculated.

However, the CODA (and T-NASS) survey undertaken in 2007 will produce recent abundance estimates for *D. delphis* inhabitating offshore waters. This estimate will be combined with the sightings data on common dolphins obtained by SCANS 2 (2005) for shelf waters, and enable the production of safe bycatch limits for the common dolphin population in the Northeast Atlantic, based on a recent abundance estimate. This task will be undertaken by the CODA project.

The principal objective of the CODA project is to estimate cetacean abundance in offshore European Atlantic waters, apart from providing information that can be used in a management framework to assess the impact of bycatch and recommend safe bycatch limits for the common dolphin. Other objectives are to investigate habitat preferences, and map the summer distribution for common dolphins and other species.

Table 3 Available annual estimates of total bycatch for Common dolphin *D. delphis* in ICES areas VI, VII & VIII.

Fishery	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Irish, UK & French tuna driftnets (Rogan and Mackey, 2007a)	243	390	608	1347	1580	666	546	947	1706	2101	1589	0	0	0	0	0	0
Irish & French tuna & bass pelagic trawls (EU Petracet project- Northridge *et al.*, 2006; ICES, SGBYC 2008)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	620	620	>57
French bass pelagic trawls (Tregenza and Collet, 1998)	-	-	-	-	-	25[+]	-	-	-	-	-	-	-	-	-	-	-
UK bass pelagic trawls -English Channel (Northridge *et al.*, 2007)	-	-	-	-	-	-	-	-	-	-	190*	38*	115*	503*	139*	155	40
French hake pelagic trawls (Tregenza and Collet, 1998)	-	-	-	-	203[+]	203[+]	-	-	-	-	-	-	-	-	-	-	-
Dutch horse-mackerel pelagic trawls (Tregenza and Collet, 1998)	-	-	-	-	101[+]	101[+]	-	-	-	-	-	-	-	-	-	-	-
Irish & UK gillnets -Celtic Sea (Tregenza *et al.*, 1997)	-	-	-	234	-	-	-	-	-	-	-	-	-	-	-	-	-
UK gill, drift & tanglenets - ICES VIIe,f,g,h (Northridge *et al.*, 2007)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	221	544
All other fisheries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total annual minimum estimate	243	390	608	1581	1884	995	546	947	1706	2101	1779	38	115	503	739	996	>641

***not annual data but fishing season**

[+]bycatch data obtained by the EU Bioeco project see Morizur *et al.* (1999) for further information, and extrapolated by Tregenza and Collet (1998)-although these values are only a rough estimate of actual bycatch, due to poor sampling during the project as a result of low observer coverage in France.

4.8 Other reported bycatch

1) Three *D. delphis* in Irish gillnet fisheries (hake, turbot and cod, 2005–2007) (ICES SGBYC 2008).

2) Two *D. delphis* in Dutch, and the data was extrapolated to "some tens of dolphins" (ICES SGBYC 2008).

Common dolphins have been reported incidentally bycaught in a large number of other fisheries such as Portuguese gill, beach seine and trawlnets (Silva and Sequeira, 2003), Spanish trawls, gillnets, long-lines, and seinenets (López *et al*., 2003), analysis of interview data of Spanish fishermen suggested that an annual bycatch of 200 *D. delphis* in inshore waters and 1500 in offshore waters (López *et al*., 2003).

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5 ToR c. Provide an evaluation of the status of grey seals, of harbour seals and of bycatch of harbour porpoise in relation to the following ecological quality objectives being applied by OSPAR in the North Sea

5.1 North Sea seals

5.1.1 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 (Harkonen *et al.*, 2006). In 2002, harbour seal populations on mainland Europe (Netherlands, Belgium, Germany, Denmark and Sweden) were reduced by approx 50% but have since increased, although the rate of increase has been lower than after the 1988 outbreak. 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 (Lonergan *et al.*, 2007). In the summer of 2007 several hundred harbour seals with symptoms similar to those inflicted by PDV were washed ashore in the Kattegat and the Skagerrak. However, all tested samples proved negative for PDV implying that the epidemic was caused by another infective agent. Results from aerial surveys carried out in August 2007 suggest that more than 2000 seals had died, and thus only a small proportion of those that died drifted ashore (Harkonen *et al.*, in press).

From surveys carried out between 2003 and 2007, 41 044 harbour seals were counted around the North Sea. Surveys were carried out during the annual moult and represent between 55%–65% of the total population.

Declines exceeding 10% over a five-year period are evident in subunits Limfjord, Shetland, Orkney, East Scotland, SE England and Norway south of 62°N. A similar decline appears to exist in other areas of the UK bordering the North Sea.

The genetic information indicates that the observed increases and decreases in the different areas are not based on redistribution. In concordance with Goodman (1998). Strong genetic differentiation was observed between haul-out sites in the Skagerrak-Kattegat-western Baltic and the Limfjord-Wadden Sea regions, respectively, indicating distinct historical origins. Structuring within regions was less significant, although present. The overall genetic differentiation between haul-out sites was moderate ($\theta = 0.05$), but there was a significant isolation by distance. At a regional scale, levels of genetic diversity and differentiation could largely be explained by colonization history and geographical distance. The results support the delineation of five management units within the examined area, although their precise boundaries should be allowed some plasticity (Olsen *et al.*, in prep).

Table 5 Recent counts of harbour seals around the North Sea. Changes in absolute numbers counted over a five year period given in the third column.

LOCATION	COUNT	YEAR OF SURVEY	CHANGE OVER PAST 5 YRS
Wadden Sea Germany	10 947	2003–2007	+55%
Wadden Sea Netherlands	4159	2003–2007	+55%
Wadden Sea Denmark	2499	2003–2007	+55%
Lijmfjorden Denmark	879	2003–2007	-23%
Kattegat	6182	2003–2007	+35%
Skagerrak	2689	2003–2007	+20%
ICES Iva (Norway south of 62°N)	685	2003–2006	-40%
ICES IIIa (Norwegian Skagerrak)	291	2006	+20%
UK Shetland	3021	2001–2006	-40%
UK Orkney	4256	2001–2006	-45%
UK Scotland east	1819	1997–2005	-26%
UK England east	3617	2001–2006	-34%
Total	41 044		

5.1.2 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. Total pup production was 25 624 for the area. Although the change in abundance estimates was close to zero at the Orkneys the change was positive (thus greater than -10%) over last monitored five-year periods.

Table 6 Grey seal pup production around the North Sea.

LOCATION	COUNT	YEAR OF SURVEY	CHANGE OVER PAST 5 YRS
Germany (WS)	58	2007	+20%
Netherlands (WS)	200	2002–2006	+50%
ICES IVa (Norway south of 62°N)	35	2003	stable
UK Shetland	677	2006	(stable)
UK Orkney	19 332	2002–2006	+1.5%
UK North Sea colonies	5322	2002–2006	+20%
Total	25 624		

5.2 Atlantic and Baltic seals

5.2.1 Harbour seals

On coasts bordering the east side of the North Atlantic, including Iceland, Svalbard and the Baltic, approximately 35 000 harbour seals were counted during the moulting period. Except for the Baltic, these populations did not appear to have been affected by the PDV outbreak in 2002, although there was some mortality in Northern Ireland, on the Scottish west coast (Firth of Clyde) in 1988.

A decline exceeding 10% over a five-year period was observed in the Outer Hebrides.

Table 5.2 Harbour seal counts from the European Atlantic and the Baltic (*numbers approximate, not based on surveys).

Location	Count	Year of survey	Change over past 5 yrs
Russia (Murman coast)	<500	1998	unknown
Norway N of 62°N			
ICES I (East Finnmark)	207	2003–2005	decreasing
ICES IIa (West-Finnmark to 62°N)	5485	2003–2005	low decrease
Svalbard, Norway	c. 1000*	2006	unknown
Iceland	8023	2006	decreasing
UK Outer Hebrides	1981	2000–2003 (2006)	-13%
UK Scotland west coast	12 507	(96+97) –(2000+2005)	+25%
Ireland north	1248	2002	unknown
Ireland south	2905	2003	unknown
France	239	2005–2006	positive
Southern Baltic	527	2003–2007	+48%
Kalmarsund (Sweden)	637	2003–2007	+35%
Total	c. 34 011		

5.2.2 Grey seal

Estimates of population size are based on pup counts in all areas except for Iceland and the Baltic, where indices of population size are given by numbers hauled out during moult. Trends show considerable variations where the Icelandic population is decreasing, while The Baltic population is increasing by 8.5% per year. Total numbers of counted pups in the area amount to approximately 26 000.

The decrease over the past monitored five-year period at 30% in Iceland substantially exceed the set 10%.

Table 5.2.2 Grey seal pup production in the European Atlantic and the Baltic. *Based on total numbers of hauled out seals during moult divided by 4.5.

East Atlantic	Pups	Year	Change over past 5 yrs
Russia	537	1990–1991	unknown
Norway N of 62°N			
ICES I (East Finnmark)	149	2006	+30%
ICES IIa (West-Finnmark to 62°N)	1100	2001–2003/2006	unknown
Iceland	1100*	2001–2006	-30%
UK Inner Hebrides	3461	2002–2006	+13 %
UK Outer Hebrides	11 612	2002–2006	+1.5 %
S Ireland	c. 1530	2005	unknown
N Ireland	c. 100	2005	unknown
UK south-west	1750	1994,2006	unknown
France	20	2005	stable
Baltic	4900*	2007	+43%
Total	c. 26 259		

5.3 Recommendations

The WGMME **recommends** refining the current geographical subunits for EcoQOs for harbour and grey seals based on the most appropriate available data.

5.4 References

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5.5 Bycatch of harbour porpoise: Annual bycatch levels should be reduced to below 1.7% of the best population estimate

5.5.1 Background

- It was agreed at the fifth North Sea Conference in 2002 (5NSC) that an Ecological Quality Element (3e) relating to harbour porpoise bycatch in the North Sea would be given an Objective: “Annual bycatch levels should be reduced to levels below 1.7% of the best population estimate.” ICES was requested to undertake work in relation to this Element.
- OSPAR 2006 adopted the agreement on the application of the EcoQO system in the North Sea (*OSPAR agreement 2006–4*). This sets out *inter alia* the work to produce evaluations of each EcoQO, which will form the basis of:

    a. in 2008, a first evaluation of the results of the application of the EcoQO system, leading to

    b. in 2009, an improved evaluation of the results of the EcoQO system, as a contribution to the QSR 2010.

- Reporting on certain cetacean bycatches from all EU Member States around the North Sea is required under EC Regulation 812/2004; these reports are relevant but are not fully comprehensive for the North Sea (OSPAR Region II). Those reports that are relevant and publicly available have been used in compiling this evaluation. In addition, evaluation of the scale of bycatch of cetaceans in fisheries is required under the EU Habitats Directive, but precise standards have not been set and there has been little actual evaluation or enforcement of this Directive requirement.

5.5.2 WGMME

The WGMME evaluated the following issues:

a) Status of monitoring and reporting harbour porpoise bycatch in the North Sea;

b) Best estimates of harbour porpoise abundance in the relevant areas;

c) Level of bycatches relative to 1.7% of the best estimate of porpoise abundance;

d) Suitability of present monitoring and reporting;

e) Performance of the EcoQO in terms of the ICES criteria for good EcoQOs and with regard to the Ecosystem Approach to management;

f) Methods for incorporating uncertainties in abundance and bycatch estimation in the evaluation of population level effects of bycatches.

5.5.3 Consideration and evaluation results from monitoring

Results for harbour porpoise bycatch in the North Sea available to the WGMME from a variety of sources are shown in Table 1.

In order to assess any bycatch as a percentage in this EcoQO, a best estimate of harbour porpoise numbers is needed. An international survey of small cetaceans (SCANS II) occurred in northwest EU (and some Norwegian) shelf seas in July 2005, funded by the EU and most relevant Contracting Parties to OSPAR. For the North Sea north of the Straits of Dover, a best estimate of 239 061 harbour porpoises was made, while for the Celtic Shelf (the south west part of OSPAR Area II but the Celtic Shelf also includes much sea area to the west of this) the best estimate was 79 468. The relevant portion of these figures (1.7%) is 4064 and 1351 respectively.

- The WGMME refers to the abundance estimates with associated uncertainties from SCANS II presented under Item 4 (Table 4.1.1), and **recommends** that these figures be used for future considerations of bycatch levels. Further, the WGMME **recommends** further research on population structure in North Sea harbour porpoises with the aim of describing suitable management areas.

As can be seen from Table 1, it is not possible to evaluate whether or not the EcoQO has been met on the basis of reports received. This is due mostly to the lack of a comprehensive requirement for observing bycatch in fisheries that might affect harbour porpoises in the EU. It is regrettable that such a requirement is not in place at least for the most relevant fisheries.

The WGMME notices that most of the EU gillnet fisheries in the North Sea are conducted without bycatch monitoring programmes and that there are no recent estimates of porpoise or other marine mammal bycatch for the North Sea, the most recent dating back to the late 1990s. The Working Group **recommends** to the European Commission that observer monitoring should be extended to the North Sea in order to obtain more recent estimates of bycatch in gillnet fisheries in this region, independent of the requirement of the EU Regulation 812/2004.

Table 5.3.3 Harbour porpoise bycatch by country around the North Sea.

COUNTRY	OBSERVATION	EXTRAPOLATION
Norway (1)	A total of 149 harbour porpoises reported bycaught by 18 coastal gillnet vessels observed between 1 January and 31 December 2006. Data from observed fishing effort in 2007 is currently under validation.	None yet made available. Extrapolation from 2006 and 2007 observations are scheduled to be validated autumn 2008.
Sweden	No report received.	None yet made available.
Denmark	As required for 812/2004, Denmark runs an observer programme related to pelagic trawl fisheries in the North Sea, but this is not expected to provide information on harbour porpoise bycatch.	An extrapolation to Danish North Sea fisheries has been made available based on data of the late 1990s.
Germany	No observer programme in action, nor currently planned. In 2007 one animal from the North Sea was reported bycaught. However, two additional animals from the North Sea (140 total animals necropsied) were diagnosed as possible bycatches during necropsy due to lesions.	None yet made available.
Netherlands	Based on the necropsy of 62 porpoises stranded in 2006 (total of more than 500 stranded animals) and when a cause of death was established, it was estimated that between 57% of porpoises were bycaught. Observer program for 2008 just started.	None yet made available.
Belgium	In 2007, based on the necropsy of 70 porpoises and when the cause of death was established, it was estimated that between 40% and 45% of porpoises were bycaught. There has been a recent increase in strandings (and bycatch) probably due to an increase of numbers of porpoises in Belgian waters.	None yet made available.
France	Report for 812/2004 covered only pelagic fisheries. No harbour porpoises reported caught in these fisheries.	
UK	Report on 2005–06 season was on observations on selected fisheries in the North Sea. In the southwest, areas north and west of the English Channel (i.e. outside the North Sea as defined by OSPAR) were included. No harbour porpoise bycatch was observed in the North Sea and 14 animals observed in the southwest area.	No estimate possible in North Sea, but ca. 350 (2005) and ca. 530 (2006) with wide confidence intervals, in southwest area (but note that this includes waters west of OSPAR Area II.)
Other Parties without a North Sea coast	No reports received.	None yet made available.

(1) Including all Norwegian waters

- In all estimation of biological quantities there are statistical uncertainties inherited from the empirical data used in the estimation procedure. Using the best estimate of abundance and point estimates for bycatches will not take this uncertainty into account when evaluating the EcoQO on harbour porpoise bycatch in the North Sea. Therefore the WGMME **recommends** that an alternative approach should be considered.

The SCANS II project developed a robust framework that uses available information to generate safe bycatch limits for harbour porpoise (*Phocoena phocoena*) and other small cetacean species. The framework involves management procedures that take estimates of population size and bycatch as input, and output bycatch limits that will achieve specific management objectives. The procedures were subjected to a series of performance-testing simulation trials to ensure that they were robust to a wide range of uncertainties and biases. Before a management procedure can be implemented for a particular species in a particular region, several steps need to be taken including decisions by policy makers on the exact conservation/management objective(s) and consideration by scientists of any sub-areas that may be considered to contain sub-populations.

- The WGMME notes that the two approaches (a PBR type procedure and a CLA type procedure) tested in SCANS II explicitly includes uncertainties, and the WGMME agrees with the advice from SCANS II (see Item 8) and **recommends** that ICES consider the CLA approach for future evaluation of bycatch levels and advice on conservation objectives management actions.

6 ToR d. Review progress with the current initiative by the Royal Belgian Institute of Natural Science to create a European Marine Mammal Tissue Bank

The goal of the Marine Mammal Tissue Bank set up by the Royal Belgian Institute of Natural Science (RBINS) is to provide high quality samples of marine mammals (small and large cetaceans as well as pinnipeds) for research purpose, on a strictly non-profit basis. Such samples support a range of essential research, e.g. on life history parameters, prevalence of diseases, and population status, required to underpin European and national level conservation management of cetacean populations and their habitats.

Animals are necropsied, and tissues collected, fixed and stored, following the protocols published by the European Cetacean Society. It is intended to include samples from bycaught animals and biopsy samples. For every sample, there is a complete set of data (animal species, age, sex, date and place of stranding, lesion, cause of death, etc) and it is possible to make the sample selection based on age, sex, origin, lesion, cause of death, etc. Users enter into a collaboration agreement with RBINS. Samples from the tissues bank have so far been used for doctoral and postdoctoral research projects, in Belgium France and the Netherlands.

The tissue bank currently (February 2008) contains more than 9000 individually identified samples from stranded or bycaught marine mammals of Belgium (MUMM, Royal Belgian Institute of Natural Sciences and the Department of Veterinary Pathology, University of Liege), France (Centre de Recherche sur les Mammifères Marins, Université de La Rochelle), Ireland (Department of Zoology, University College Cork) and the Netherlands (Naturalis, Leiden and the Institute for Marine Resources and Ecosystems Studies, Texel).

Formalin-fixed and paraffin-embedded tissues: there are 6634 formalin-fixed (10% neutral buffered formalin) samples (tissues and lesions) of 16 different species: skin, mammary gland, eye, muscle, liver, adrenal, mesenteric lymph node, prescapular lymph node, bronchial lymph node, spleen, gonad (entire ovary or testis or part), reproductive tract (complete or part of uterus, external part of the penis), stomach, intestine, caecum, kidney, urinary bladder, heart, lung, thymus, thyroid, placenta, umbilical cord, central nervous system, pituitary gland.

- Frozen tissues for toxicology: (-20°C): there are 786 samples (liver, muscle, kidney and blubber) of 8 different species stored at -20°C.
- Frozen tissues for microbiology (-20°C): there are 1533 samples for microbiology (spleen, lung, entire blood, lymph nodes and lesions) of 7 different species.
- Ethanol (70%) stored samples for genetics: there are 220 skin samples of 4 different species.
- A range of other samples, including teeth, bones.

Tissues are presently stored at two sites: the Royal Institute of Natural History, Management Unit of the North Sea Department (Belgium) and the Department of Morphology and Pathology, University of Liege (Belgium). The next steps being considered include:

- Provision of on-line access to facilitate the selection of samples following parameters such as species, age, sex, etc;

- To identify and invite participation from other European sample banks that include cetacean material, other European strandings networks and other sources of cetacean sample material;
- Establishment of a Steering Committee which could, for example, evaluate requests to access material and ensure prioritization of high quality science and retention of material for future work;
- Inclusion of other sources and types of samples, for example from biopsies, bycaught animals and samples derived from whaling.

A database is currently established at the Research and Technology Center Westcoast, in Buesum, Germany, which could be linked to the Belgian one. There are numerous samples from different species fixed in formalin, paraffin and alcohol as well as stored in -20°C and -80°C from the German and Danish North and Baltic Seas, Greenland, Iceland, Norway, Poland and Latvia. There are also teeth and some macerated skeleton samples available.

Additional funding for this initiative was requested from the EU as part of the *Cet-Life* proposal (submitted by a consortium of 18 European institutions and voluntary organisations in May 2007), which envisaged gathering key samples of marine mammals from various European areas into a multi-site **European Marine Mammal Tissue Bank (EMMTB)** integrating new and historical samples collected from selected animals (i.e. animals in good condition for which all data are available) covering four bio-geographic regions: the North Sea and adjacent seas (including eastern Channel and Baltic), the Celtic and Irish Seas and adjacent areas (including western Channel and west British Isles), the Bay of Biscay (from southern Brittany to Galicia), Portugal and the Canary Islands. The tissue bank was to be linked to a **common European database** for stranded/bycaught animals, containing post-mortem observations and data on parameters such as age, reproductive status, nutritional condition, cause of mortality, contaminant levels and health status. The aim is to keep samples stored in the different national institutes but to have access to samples and the associated database through a **dedicated web portal** hosted at the Belgian Marine Data Centre (BMDC) of the RBINS (Management Unit of the North Sea Mathematical Models), Brussels (http://www.mumm.ac.be/datacentre/), to create a "meta-tissue bank". RBINS undertook to host and manage this facility in perpetuity. Although this proposal was not funded, the initiative will be carried forward in a new proposal planned for 2008.

WGMME **supports** the establishment of the sample and data bank, recognising its value for facilitating research on marine mammals and helping to generate results that can underpin conservation management. WGMME **encourages** the organisers of the existing Tissue Bank to extend the geographical coverage of participation to the whole of Europe and to take advantage of other possible sources of samples (bycatches, biopsies, etc), and to seek external financial support (e.g. from the EU) for this initiative.

Sample availability could be increased if cetacean bycatches could be landed rather than discarded (currently, for example, such material cannot be landed if caught more than 3 miles offshore due to CITES regulations).

7 ToR e. To review the results of the 2008 'Threats to Marine Mammal Health' Workshop

The workshop on 'Threats to Marine Mammal Health' provisionally planned for January 2008 has not yet taken place. Possible future dates for the proposed workshop will be discussed during the necropsy workshop at the European Cetacean Society conference in March 2008. Aims and structure of the workshop can be found in the 2007 WGMME report.

8 Review conservation objectives and criteria for cetaceans and the SCANS II recommendations on realistic monitoring options

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.

8.1 Introduction

Applying general conservation objectives relating to the long-term viability of cetacean populations and to the maintenance of their natural ranges and habitats is a challenge due to difficulties associated with measuring trends in population size and assessing the natural variability in distribution and habitat-use. For some populations (e.g. the most abundant ones, or those whose individuals can be identified by particular markings) this is possible, but not without a considerable amount of survey effort. Conservation criteria can be applied based on a realistic assessment of the ability to detect a change in population size over a certain period and on the choice of the power to detect that change. For these populations (e.g. harbour porpoise in the North Sea), conservation objectives linked to specific threats can also be formulated and appropriate monitoring put in place. Based on the outputs of the monitoring, management actions can be triggered, if for example, the threat goes beyond a certain critical threshold.

For other species, the survey effort that would be required to monitor population size trends is unrealistically high, and our ability to assess the conservation status or the sustainability of anthropogenic threats is extremely limited. However, is assessing their conservation status as unknown or data deficient the best that can be achieved or could conservation criteria be more realistically designed?

8.2 Review of conservation objectives and criteria used for cetaceans

Conservation objectives are drivers of policy, usually formulated by conservation managers to be the foundation of conservation strategies, in the context of regional, national or international agreements aimed at conserving natural resources. These can address different purposes, including:

1) to define what constitutes favourable status of a species or habitat;

2) to monitor species vulnerability and risk of extinction;

3) to establish levels of an anthropogenic pressure beyond which the species or habitats could be negatively impacted.

There can be a series of criteria associated with these objectives. For example, criteria to categorise the conservation status of a range of species or habitats across taxa helps to prioritise conservation measures. Others are related to specific conservation threats or measures, since such criteria help assessing if particular anthropogenic pressures are to be considered sustainable, or evaluating the impact of conservation measures on the species conservation status. Other criteria can be used to define the ecological quality of a region.

Conservation objectives and criteria used to assess the status of cetaceans include generic ones designed to enable assessment of any taxon, or those designed specifically for cetaceans. Examples of the universal objectives and criteria that are applied to cetaceans include:

- IUCN red list of threatened species
- EC Habitats Directive species favourable conservation status reports.

Examples of the more specific criteria:

- ASCOBANS Resolution on Incidental Take of Small Cetaceans (Bonn 1997)
- IWC resolutions on incidental take of some cetacean species
- The US Marine Mammal Protection Act and
- OSPAR Ecological Quality Objectives for harbour porpoise.

It should be noted that it was not an aim of SCANS II to provide any recommendations on quantitative conservation objectives, since this was not an aim of the project.

8.3 Generic conservation objectives and criteria for population status surveillance

8.3.1 The IUCN red list of threatened species

The objective of the IUCN species assessment process is to monitor species risk of extinction, globally or regionally by providing an explicit, objective framework for the classification of all species. Species are assigned to one of eight categories of threat (Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern or Data Deficient). Species listed as Critically Endangered, Endangered, or Vulnerable are collectively described as 'threatened'. The different criteria used were derived from a wide review aimed at detecting risk factors across the broad range of organisms, the diverse life histories they exhibit and the impact of anthropogenic effects. There are four broad categories of criteria to assess the risk of extinction:

- Reduction in population size over 10 years or three generations, which ever is longer
- Geographic range as either extent of occurrence, area of occupancy or both including quality and degree of fragmentation
- Small population size and subpopulation attributes
- Quantitative analysis showing probability of extinction in wild in next 10 years or three generations which ever is longer

The criteria are set at what are generally judged to be appropriate levels, even if no formal justification for these values exists. The 2007 European Mammal Assessment classified 12 (6 were beaked whales) out of 33 species of cetaceans as data deficient, 1 as critically endangered, 2 endangered, 2 vulnerable, 1 near threatened, 4 least concern, 1 as regionally extinct and the remaining 10 were not considered applicable to Europe based on their marginal distribution.

8.3.2 The EC Habitats Directive and species Favourable Conservation Status (FCS) assessments

One of the objectives of the EC Habitats Directive is to maintain species and habitats in favourable conservation status. Conservation status is defined as "the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations." A species is in favourable conservation status if population dynamics data indicate that the species is maintaining itself on a long-term basis as a viable component of its natural habitats, the natural range of the species is neither being reduced nor is likely to be reduced in the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. Based on these objectives, the EC provided some guidance on the criteria to be used by the Member States to assess the species conservation status (required every six years) (Anon., 2007).

The FCS assessment reports from some Member States have now been submitted to the EU. As an example, the UK assessed 6 out of 11 species of cetaceans as "Unknown". Another 21 species were considered to be uncommon, rare or very rare in occurrence, so it was not possible to ascertain their conservation status. Five species were assessed as favourable, however the reliability of these assessments was moderate to low. This means that a greater understanding of the feature, or the factors affecting it, is required before a confident concluding judgement can be made by experts, and that the current estimate of population and/or trend are based on recent, but incomplete or limited survey data; or based predominately on expert opinion.

A fundamental problem with these assessments for cetaceans is that their biological populations are not limited to the waters of any particular country, with the possible exception of some small coastal populations of bottlenose dolphins. Where species range widely over national boundaries, information collected on a country by country basis will not be informative about population trends or conservation status. As a consequence of this, the UK reported on the FCS for cetaceans using a transboundary approach, i.e. reported at the population level, even if it meant using information on abundance estimates from areas outside UK jurisdiction.

Under the requirements of the Habitats Directive, a surveillance strategy needs to be put in place in order to determine the "conservation status" of each of the species for future reporting. This surveillance is required to be able to detect a decline in range equivalent to loss of more than 1% per annum from the baseline assessment or more than 10% below the favourable reference range. For population changes the surveillance should be able to detect a 1% decline per annum, or that the population is more than 25% below favourable reference population, or alternatively if reproduction, mortality and age-structure strongly deviate from normal. For cetacean species, detecting 1% decline per year in distribution or population size is unrealistic, even for the most well surveyed species. However, the EC gives some flexibility to Member States to set their own conservation criteria/ thresholds as long as they can justify these.

8.3.3 Comparisons between IUCN and FCS

The IUCN Red List Criteria classify species on the basis of their relative extinction risk (IUCN 2001). However, Unfavourable conservation status according to the EU Habitats Directive has a much broader definition. No species meeting the IUCN Red List Criteria at a regional level can be considered to have a Favourable conservation status in the EU. To be classified as Vulnerable (the lowest of the three IUCN threatened categories) a species must undergo a reduction in population size of at least 30% over 10 years or three generations (or have a very small or small and declining population or geographic range; http://www.iucnredlist.org/info/categories_criteria2001). Obviously, it is difficult to claim that a species experiencing a decline of this magnitude is maintaining its population, that its range is stable, and that it remains a viable component of its habitat. Crucially, however, this does not mean that the opposite is true: species that are not threatened as defined by IUCN Red List Criteria do not necessarily have a Favourable conservation status. Recent guidelines issued by the European Commission on the protection of species under the Habitats Directive reinforce this message that "the fact that a habitat or species is not threatened (i.e. not faced by any direct extinction risk) does not necessarily mean that it has a favourable conservation status" (Anon., 2007).

8.3.4 Cetacean specific conservation objectives and criteria for population surveillance

The Marine Mammal Protection Act (MMPA)

In 1994, the MMPA (http://www.nmfs.noaa.gov/pr/laws/mmpa/) was amended to implement a new management approach designed to identify excessive human-caused mortality in US waters with a consequent increase in survey effort. This is further discussed below. With respect to population abundance estimates, there is evidence however, that the adoption of this management approach did not necessarily improve the ability to detect trends in marine mammals stocks. Taylor *et al.* (2007) recently demonstrated that even with this improved surveillance (most stocks surveyed every 4 years), it was still not possible to detect a 50% decrease in abundance over a 15 year period (equivalent to 5% per annum) in 72–90% of the cetacean populations surveyed. This was despite the most recent figures available (2004) indicating that approximately €14M per annum was spent on cetacean surveillance and monitoring in US waters (Weber and Laist, 2007).

Taylor *et al*. (2007) suggested several ways to address this problem. One of these was to change the decision criteria if improved population decline detection is to be achieved (i.e. the statically significance and the power to detect trends; see Section 8.4 on monitoring considerations below).

8.4 Considerations for population monitoring and surveillance

8.4.1 Power of monitoring

There are various forms of surveillance that are relevant to assessing the conservation status of a species, and before conducting any surveillance/monitoring, it is important to clearly define its objectives and relate these to the conservation criteria. The sum of changes in the dynamics of key population parameters (e.g. birth rate and mortality) will be manifested in trends in overall population abundance. Thus regular surveillance of population abundance and distribution are the main requirements to assess conservation status. There is also a need to identify and monitor the factors which may affect population dynamics or distribution including anthropogenic impacts.

Statistical and biological significance are not the same thing (Thomas and Juanes, 1996). Power analysis can be used to determine whether a survey has a good chance of producing a statistically significant result if a biologically significant difference existed in the population. The statistical power of a monitoring program is the probability that the monitoring will detect a trend in the data despite the 'noise' associated with seasonal cycles and other fluctuations (Nichols and Williams, 2006). The power of a monitoring scheme is derived from the Type 2 error, i.e. concluding there is no trend when in fact there is, which is termed β and where power $=1-\beta$.

Estimating statistical power to detect trends depends on a variety of factors including:

- the decision criteria (i.e. desired level of α or statistical significance level)
- the model of population change (e.g. linear or exponential)
- the estimate of variance and
- the number of samples to be collected (e.g. the number of years over which monitoring will be conducted.

Thus, power analyses are sensitive to the nature of existing data and the choice of population model (Hatch, 2003).

8.4.2 SCANS II monitoring recommendations and associated statistical power

One objective of the SCANS-II project was to develop recommendations for the best monitoring method to be used for a particular species of small cetacean in a particular area, focusing on the harbour porpoise (*Phocoena phocoena*), the bottlenose dolphin (*Tursiops truncatus*) and the common dolphin (*Delphinus delphis*) so that trends in abundance in time and space can be determined between major decadal surveys. Monitoring was defined as repeated assessment designed to detect change in relative abundance or distribution of a small cetacean population or within a certain area, and the project focused on population level monitoring where the requirement is to monitor the status of a whole population.

The SCANS-II project evaluate methods for monitoring trends in abundance of small cetacean species, particularly visual shipboard surveys by cetacean or seabird researchers, acoustic surveys using towed-hydrophone arrays, and visual aerial surveys. These methods were evaluated with respect to logistic considerations and their statistical power to detect a trend. Cetacean researchers were considered to be those observers utilising the double platform method to estimate absolute abundance. Seabird researchers were those observers targeting seabirds but collecting cetaceans observations that would provide relative abundance estimates.

There are a number of logistic considerations of using different monitoring methods. Detection methods are affected to varying extent by weather. The SCANS-II project investigated the effect of sea state on the acoustic and visual detection rates of harbour porpoises from the SCANS-II shipboard survey data. It found that visual detection of harbour porpoises can only be maintained in Beaufort sea state ≤2, whereas during acoustic surveys detection of harbour porpoises remains unaffected in Beaufort sea state ≤5. Furthermore, acoustic surveys are independent of light conditions and may be continued 24 hours a day whereas the number of daylight hours available for visual surveys depends on time of the year and latitude. Climatic information on sea state and information on day length were used to explore the likely effects of this in different seasons and locations. In the central North Sea during July the effective survey time for harbour porpoises using visual methods (during daylight hours and in sea state ≤2) would be about 5.5 hours per day, for acoustic methods the effective survey time would be about 22 hours in sea state ≤5. Because survey ships working offshore are hired on a 24h basis, this information is important to consider in cost-benefit analysis when evaluating the results of the power analysis. Another logistic consideration is responsive moments of the animals to the vessel during ship surveys. The response may depend on the characteristics of the vessel itself, on equipment used such as a depth sounder, or of the cetacean species under investigation. Similarly the distance at which the effect occurs may also be vessel or species specific. It is therefore important to investigate what, if any, effect the vessel may have on the behaviour of the species that will be monitored.

Because several of the monitoring methods for harbour porpoises (visual surveys by cetacean and seabird researchers and acoustic surveys) were conducted simultaneously on the shipboard surveys, the SCANS-II project was able to estimate the variation in the detection rates from each method and compare this variation among methods. This information was then used to calculate the statistical power of each method to detect a trend in abundance. There were sufficient data from four vessels to make these comparisons for one species, the harbour porpoise. Variation in detection rate and statistical power were also assessed for the aerial survey in the block located nearest to where the four vessels were surveying. Calculations were based on data collected in Beaufort sea state ≤2 for the visual effort and Beaufort sea state ≤5 for the acoustic surveys. Acoustic detection rates were corrected for vessel noise. The power to detect an annual decline in abundance of 5% per year over a 10 year period with annual surveys was calculated. In general, a higher power is achieved for the same survey effort using the cetacean ship observer and the seabird observers compared to the other two methods. The overall best performing method was the seabird observers. For one ship, *Skagerak*, the power was almost identical for all three vessel methods and almost twice the effort is needed for the aerial observers to obtain a similar power. For the other three vessels the acoustic method needs about twice the effort to achieve a similar power to that of the cetacean ship observer and the visual surveys by seabird observers. The results for these two latter visual methods seem independent of the vessel used. However, the acoustic method performs better on some vessels than others indicating the need to test the performance of acoustic equipment on any specific vessel to estimate the power in each case. A main assumption of the conclusions from this power analysis is that changes in the relative abundance observed during the SCANS-II surveys are indicative of changes in absolute abundance. Other assumptions are that all other (logistical, biological and environmental) factors stay the same between surveys and that there is no additional variance affecting the index from e.g. ship's equipment, observers, weather etc. Unless all these other factors do stay the same between surveys, the calculations and resulting power using this approach will likely overestimate the power to detect trends.

8.4.3 Comparison of power analysis results from Taylor *et al*. (2007) and SCANS II

Taylor *et al*. (2007) reviewed the statistical power of surveys for marine mammals in US waters to detect declines of 5% per year over 15 years with current levels of effort (each species surveyed approximately every 4 years). For harbour porpoises in particular, Taylor *et al*. (2007) reported that power ranged between 14 and 33% with survey intervals of 3 to 7 years and CVs of 0.21 to 0.42. In contrast, SCANS II reported a power of approximately 80% to detect the same annual decline over 10 years, with annual surveys of 2500/4500 km depending on methodology used with CVs of 0.17–0.18. The CVs used for the SCANS II power analysis are lower than for the estimates of abundance because it was assumed that the CVs would reduce with increasing effort and effort was calculated to achieve a CV of 0.17–0.18.

The two main reasons for the generally lower power of the surveys reviewed by Taylor *et al*. (2007) are lower survey frequencies and higher CVs. However, it is not possible to directly compare the CVs presented by Taylor *et al*. (2007) to those from

SCANS II, since no effort data is presented which would enable a comparison of CVs per unit effort.

8.4.4 Cost benefit analysis from SCANS II

The cost of the different methods that can be used for monitoring trends in relative abundance depends on the cost of renting a platform (ship or aircraft), hiring observers, the number of hours available for observations or recordings, the cost of the equipment and the cost of analysis of the data. These costs and the availability of methods may vary from country to country. A comparison of the costs of the different monitoring methods was conducted using average weather conditions from the North Sea in July and fixed prices approximately according to the costs of the SCANS-II survey. Based on SCANS-II analyses, it was assumed that the time needed for analysis for each ship month of data might be two months for a full SCANS-II double platform absolute abundance visual survey, two weeks for a single platform relative abundance visual survey, one month for a towed acoustic survey, and one month for aerial survey.

In Table 1 the costs of using different monitoring methods to detect a 5% trend in abundance over 10 years with annual surveys are compared, using data collected from the vessel *Skagerak* in the SCANS-II survey area S and the aerial survey conducted in area L, as an example. The required effort to achieve the given power assumes that there is no change in logistical, biological and environmental factors between the annual surveys and that there is no additional variance affecting the index from e.g. ship’s equipment, observers, weather etc. Given that these assumptions will not be met over a 10 year monitoring period, the required effort and resulting cost should be regarded as an absolute minimum.

Table 1 Comparison of the cost (in Euro) to detect a 5% per annum trend over 10 years with annual surveys for different monitoring methods using harbour porpoise data from the Skagerak in block S and the aerial survey in block L. Effort costs are based on the costs of vessel charter, observer salaries and hours in a day suitable for surveying. Analysis costs are calculated based on the number of months needed to collect data to achieve the required annual effort, the number of months to analyse one month of data, and salary of 4500 Euro per month. Equipment costs are for a single vessel/aircraft and assumed to last 5 years.

Method	Power	Annual effort required	Annual effort cost	Annual analysis cost	Total equipment cost	Total cost to detect trend over 10 yrs
Absolute abundance – visual ship survey – large ship	78%	2500 km	152 334	15 000	40 000	1 713 000
Relative abundance – visual ship survey – large ship	78%	2500 km	130 221	3750	4000	1 344 000
Relative abundance – visual ship survey – small ship	78%	2500 km	56 511	3750	4000	607 000
Relative abundance – visual ship survey – platform of opportunity	77%	2500 km	3686	3750	4000	78 000
Relative abundance – towed acoustic survey – large ship	78%	2500 km	31 634	1875	20 000	355 000
Relative abundance – towed acoustic survey – small ship	78%	2500 km	13 206	1875	20 000	171 000
Relative abundance – towed acoustic survey – platform of opportunity	78%	2500 km	921	1875	20 000	48 000
Absolute abundance – aerial survey	79%	4500 km	19 946	3845	10 000	248 000

The costs of monitoring to detect the specified trend over 10 years are heavily driven by the costs of the survey platform. Use of a small vessel instead of a large one approximately halves the cost for both visual and towed acoustic methods, and both methods are approximately an order of magnitude cheaper if there are no ship costs compared to the use of a large ship. Caution should be exercised when considering the cheapest options because they are based on platforms of opportunity being available on a regular basis at appropriate times and covering the necessary areas. If this is not the case, as is likely, these cheaper options would not provide the necessary data. Excluding the platform of opportunity cases, visual methods are approximately four times more expensive than towed acoustic methods, primarily because acoustic data can be collected for approximately four times longer at sea and thus ship costs are correspondingly less. However, this balance, in favour of the towed acoustic methods, is offset by the fact that this method is currently only appropriate for harbour porpoise, whereas visual methods are appropriate for all small cetacean species.

The analyses of the SCANS-II project show that three methods are suitable for monitoring trends in harbour porpoises-shipboard and aerial visual surveys and towed acoustic surveys on ships. Other methods may also be appropriate but the statistical power of these was not examined by the project. When making recommendations for best practice for monitoring trends, it is likely that a combination of methods will be optimal and that some methods will be better for some areas than others. The analysis presented here focuses on the harbour porpoise, the only species for which there exists sufficient data for a comparison of methods using power analysis. The issue of how relevant this analysis is to other species is an important one. Visual monitoring methods can be used for all small cetacean species but it is currently not possible reliably to distinguish species of dolphins using acoustic methods.

Based on the analysis of statistical power and cost/benefit the following recommendations apply for monitoring harbour porpoises. Comments are made on the applicability to other species where appropriate. All three methods tested (visual and towed acoustic ship surveys and aerial surveys) can achieve sufficient power to detect trends in abundance with achievable effort and are therefore recommended for long term monitoring. Visual methods are also appropriate for other less abundance species (i.e. most dolphin species), but power to detect trends will be lower and, therefore, the cost to detect an equivalent trend will be higher. For all species, features of the monitoring method should be kept as consistent as possible (vessel, conditions, observers, noise etc.) between surveys to reduce survey-related variation and thus increase power to detect trends. Platforms of opportunity using visual and/or acoustic methods are the cheapest way to monitor harbour porpoises (and other small cetaceans using visual methods). However, the success of using such vessels depends on finding a vessel (or vessels) that can cheaply and effectively accommodate observers and equipment and that cover appropriate areas at suitable speeds. These criteria are seldom fulfilled, especially since long term monitoring ideally requires the conditions to be consistent. Ferries may be suitable in some areas but spatial coverage is likely to be poor because of the fixed routes covered. Research vessels conducting annual monitoring of e.g. oceanography or fish resources (e.g. IBTS) have the potential to be valuable platforms of opportunity for monitoring if they take place at the right time(s) in the right place(s). Aerial surveys are a cost efficient way to conduct a dedicated survey in a specific area at a specific time for all species, in part because they can cover a larger area in a given time than any other method. However, they are limited by the range of the aircraft. For the harbour porpoise, towed acoustic surveys are cheaper than visual surveys because they do not rely on daylight and are less weather dependent and therefore a larger area can be covered in shorter time. However, the acoustic characteristics of a vessel to be used in acoustic surveys should first be tested because some vessels are too noisy for towing hydrophones. Combining visual surveys with towed hydrophones surveys on the same vessel is a cost effective to achieve two independent data sets from the same area.

8.4.5 Under versus over protection

The standard criteria usually used for significance (i.e. the risk of a type 1 error occurring) is α=0.05. Many managers remain unaware that this value is not an objective scientific value but a policy choice based on the most commonly used level of statistical significance (Taylor and Gerrodette, 1993). Put simply, using this criterion means that we are prepared to falsely conclude that a decline is occurring 5% of the time or on 1 in 20 occasions. Taylor *et al*. (2007) referred to this as the overprotection error. If a monitoring scheme only has the statistical power to detect such a decline 10% of the time, then for 90% of the time it would be concluded that there was no decline when one was occurring (an under protection error). This represents an implicit policy choice that we are eighteen times more willing to make an under rather than overprotection error in this case (90/5).

The most common solutions used to increase the ability of monitoring schemes to detect trends are to:

1. increase survey frequency; and/or
2. to alter the decision criteria.

Considerable survey effort is required even for common species to accurately estimate abundance, which is costly. Even where estimates of abundance can be made, these are often associated with relatively large coefficients of variation (CV). It is unlikely to be possible to estimate abundance of the less common species, even with extensive surveys. Thus the power to detect trends through time is likely to remain low.

The precision of known estimates has implications for future monitoring requirements. If the required power of a monitoring programme is 80%, where precision is known to be high (eg CV of approximately 0.15), surveys could be undertaken less frequently if the decision criteria are altered (e.g. α = 0.1 or 0.2). In contrast where the precision is low (eg CV of approximately 0.3), both frequent surveys and lower decision criteria thresholds will be required. Moving from α= 0.05 to 0.1 or 0.2 means that we will be prepared to make an over protection error 1 in 20, 10 or 5 times respectively (i.e. conclude that a particular trend is occurring when in fact it is not).

Ideally, from a conservation perspective the risk of overprotection should be greater than underprotection. However, for most species, the cost of achieving such monitoring with a high level of power and precision is likely to be prohibitive. A possible compromise, from a policy perspective, could be to make the risks of over and underprotection similar. A balance therefore needs to be achieved between the power of the monitoring to detect a change and the level of significance at which the trend is tested (i.e. α and β need to be as close as possible). The monitoring requirements and what can realistically be assessed will therefore vary from species to species depending on current knowledge.

In general, for monitoring studies, power is set at 80% or higher (β of at least 0.2) (for examples see Hatch, 2003; Bart *et al.*, 2004; Taylor *et al.*, 2007). Consequently, if the risk of over and under protection are to be similar, a trade off is required between power (i.e.β) and level of significance (i.e. α) with consideration given to using a value of 0.2.

8.5 Recommendations for quantitative conservation objectives and monitoring for cetaceans

It is recommended that three ToRs are developed for consideration by WGMME in 2009:

1) Similar to that already undertaken for harbour porpoise, provide a power analysis of available data from SCANS II and CODA to ascertain the degree of decline that could be identified over a 10 year period for a realistic level of effort for species where there are sufficient data. These could include, but are not limited to, minke and fin whale, and white beaked, bottlenose and common dolphin.

2) Provide a review of the Habitats Directive FCS reports for marine mammals submitted by Member states, including a summary of any

issues identified and solutions utilised. In light of this review and the work undertaken by WGMME in 2008, identify appropriate conservation status assessment criteria that can be used within the ICES area and quantitative measures against which these assessments can realistically be measured.

3) An international cooperative approach should be established for the long term surveillance and monitoring of cetaceans in the Northeast Atlantic through the auspices of WGMME. Develop a framework for surveillance and monitoring applicable to the ICES area that is realistically achievable by contracting parties.

8.6 Bycatch specific conservation objectives and criteria for cetaceans

8.6.1 ASCOBANS incidental take resolution

The aim of ASCOBANS can be interpreted as "to restore and/or maintain biological or management stocks of small cetaceans at the level they would reach when there is the lowest possible anthropogenic influence"-a suitable short-term practical sub-objective is to restore and/or maintain stocks/populations to 80% or more of the carrying capacity. The ASCOBANS Resolution on Incidental Take of Small Cetaceans (Bonn, 1997) has as its conservation objective to minimise (i.e. to ultimately reduce to zero) anthropogenic removals within some yet-to-be-specified time frame, and that intermediate target levels should be set; and that the longer term approach, which involves *inter alia* taking into account uncertainty in the available data, should be developed by the Advisory Committee.

8.6.2 IWC resolutions on incidental take of some cetacean species

The International Whaling Commission has also endorsed its Scientific Committee's advice that an estimated annual bycatch of 1% of estimated population size indicates that further research should be undertaken immediately to clarify the status of the stocks and that an estimated annual bycatch of 2% may cause the population to decline, and requires immediate action to reduce bycatch.

Based on an IWC/ASCOBANS workshop, the conservation criteria adopted to address ASCOBANS objective (see above) was “to reduce annual bycatch levels of harbour porpoise to levels below 1.7% of the best population estimate”. See ToRc) (iii) and h) and Section below.

8.6.3 OSPAR ecological quality objectives for harbour porpoise bycatch in the North Sea

This EcoQO relates to the ASCOBANS conservation objective. See See ToRc) (iii) and h).

8.6.4 The Marine Mammal Protection Act (MMPA)

In 1994, the MMPA (http://www.nmfs.noaa.gov/pr/laws/mmpa/)was amended to implement a new management approach designed to identify excessive human-caused mortality in US waters. The new management approach was based on estimates of direct, human caused mortality as well as information on stock abundance and structure. The implicit assumption behind the new management approach was that direct mortality, such as bycatch in fisheries, was the main threat to marine mammal populations.

A primary conservation objective of the MMPA is to prevent any marine mammal stock from being reduced below its optimum sustainable population level, and to restore stocks that have been reduced below that level. A stock which has a level of human-caused mortality that is likely to cause the stock to be reduced or kept below its optimum sustainable population (total mortality higher than potential biological removal level, PBR) should be classified as "strategic". The calculation of the PBR provides an example of a conservation criteria model designed for management and decision-making. Wade (1998) defined the potential biological removal level as the product of the following factors: a) the minimum population estimate of the stock; b) one-half the maximum theoretical or estimated net productivity rate; c) a recovery factor of between 0.1 and 1.0.

8.6.5 Management framework to assess the impact of bycatch and recommend safe bycatch limits for harbour porpoise and other small cetaceans

One objective of the SCANS-II project was to develop a robust framework, a fully developed and tested scientific procedure, that uses available information to generate safe bycatch limits for harbour porpoise (*Phocoena phocoena*) and other small cetacean species.

Two candidate management procedures that could be used to achieve this objective were developed. The two management procedures were adaptations of the U.S.A. government's Potential Biological Removal approach and the International Whaling Commission's Catch Limit Algorithm (part of the Revised Management Procedure). In brief, both procedures take information about a small cetacean population as input and then they output a bycatch limit. The PBR procedure takes a single, current estimate of absolute population size as input. The CLA procedure takes time-series of estimates of absolute population size and estimates of absolute bycatch as input. Both procedures explicitly incorporate uncertainty in the estimates of population size and thus also require estimates of the precision of the estimates of population size as input.

A computer-based simulation model was developed for testing and comparing the performance of the two management procedures and for tuning the procedures so that one would expect to meet specific conservation objectives in practice. A series of performance-testing simulation trials were conducted to assess the robustness of the procedures to a wide range of uncertainties and biases including uncertainty in initial population status, maximum population growth rate, shape of density dependence, survey precision and bias, bycatch precision and bias, survey frequency and environmental variability.

A key step in generating safe bycatch limits for cetacean species is the establishment of conservation/management objective(s) in quantitative terms. These are management decisions. European policymakers have not established specific conservation objectives for small cetaceans in the SCANS-II study region, or indeed anywhere. Therefore, for the purposes of this work the interim conservation objective agreed by ASCOBANS was adopted: to allow populations to recover to and/or maintain 80% of carrying capacity in the long term. Carrying capacity was defined as the population size that would theoretically be reached by a population in the absence of bycatch. Note that one does not need to know what this carrying capacity actually is to develop management procedures to set safe bycatch limits. A period of 200 years was chosen to represent 'the long term'.

The simulation model was used to tune the management procedures so that one would expect to achieve the conservation objective in practice. Three different tunings were developed. The first tuning was developed so that the median population status after 200 years was 80%. This tuning is therefore appropriate for a conservation objective of maintaining the population at 80% of carrying capacity in the long term. The second tuning was developed in exactly the same way except that the management procedures were tuned so that there was a 95% probability that population status was ≥80% after 200 years. This tuning is therefore appropriate for a conservation objective of maintaining the population at or above 80% of carrying capacity in the long term. The third tuning was developed considering a "worst-case" scenario with respect to biases in the estimation of abundance and bycatch. The management procedures were tuned so that there was a 95% probability that population status was ≥80% after 200 years (under this worst-case scenario). This tuning is therefore appropriate for a conservation objective of maintaining the population at or above 80% of carrying capacity in the long term under a worst-case scenario.

The management procedures are applied at the spatial resolution of defined management areas. A given procedure is applied separately to each management area resulting in a separate bycatch limit for each area. With respect to population structure, a conservative approach is to create management areas no larger than the size of area within which animals are believed to mix and interbreed freely.

Example bycatch limits for harbour porpoise were calculated using the management procedures applied to example management areas represented by groups of SCANS-II survey blocks: inner Danish waters (Block S), the northern North Sea (J, M, T), the central North Sea (L, V), the southern North Sea (B, H, U, Y), west of Britain and Ireland (N, O, P, Q, R), and the waters around south western France, Portugal and Spain (W). It is important to recognise that these bycatch limits are entirely dependent on the stated conservation objective, on the tunings that were used to achieve it under different interpretations, and on the data that were used to initiate the procedure (i.e. a single abundance estimate and no historical bycatch or abundance estimates). They are therefore indicative and should not be used for management purposes. Before that can happen a series of steps must be taken including:

- Agreement by policy makers on the exact conservation/management objective(s), and species and regions covered;
- Final determination by scientists of how to implement the procedure for each species/area considering the available information, particularly population structure and historical bycatch. The latter may require the generation of appropriate historical bycatch data series based on the best available information;
- Generation by scientists of bycatch limits for a specified period (e.g. 5 years);
- Establishment of a mechanism for feedback of information from bycatch monitoring programmes to inform the next implementation of the procedure when the period for which bycatch limits have been set expires.

8.7 Recommendations for bycatch specific conservation criteria and objectives for cetaceans

Same as those agreed for bycatch ToR.

8.8 References

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9 Design and collate a database of historical and current data on abundance of regional seal populations

9.1 Aim

In order to help ICES meet requirements of many of its member countries and international organisations (e.g. HELCOM, NAMMCO, OSPAR) WGMME recommends that a database be created for harbour and grey seal population indices for the ICES area.

9.2 Objectives

- The database should have relevance to other areas e.g. HELCOM, NAMMCO and OSPAR (for EcoQOs).
- The database must be secure as it is likely to contain unpublished data.
- To be effective, the database must be kept up-to-date.
- The database could be housed and maintained by ICES, possibly by the newly appointed database manager.
- Quality control procedures need to be evaluated.
- Each participating country to designate a contact and/or organisation to be responsible for providing annual updates.
- Database will initially be limited to data on harbour and grey seals but may be extended to include other species.
- Other countries may wish to be included e.g. Canada and USA.

9.3 Database structure

9.3.1 Data to be included

Harbour seals

- Adult moult count (use mean if more than one count)
- Adult breeding season count (use mean if more than one count)
- Estimates of pup production

Note that the harbour seal data do not represent total population size. Moult counts are the MINIMUM population size and are considered to represent between 55% and 70% of total population size. We recommend that the minimum population size is used, rather than the extrapolated total population size.

Grey seals

Pup production estimates

Counts of Grey seals at other times of the year in the UK are not considered.

9.3.2 General points

Please refer to listed contact if more detailed information is required.

Geographic scale should be determined by local representatives and should reflect discrete areas over which seals are regularly surveyed. Ideally, they should include areas that may used for management purposes e.g. areas used by OSPAR for EcoQOs.

Annex 1 lists two draft designs of the database filled with data available at the time from the UK.

9.3.3 Metadata

The metadata provided to the database should include a brief description of survey techniques, including a description of what the data represent e.g. pup production estimates or just counts? Modelled estimates or just counts i.e. minimum population size? Different components of populations may be monitored in different countries. These must also be documented and explained e.g. grey seal pup production may be monitored at different frequencies and using different techniques in different countries.

9.4 Recommendation

WGMME **recommends** that a database be created for harbour and grey seal population indices for the ICES area. WGMME recommends that ICES assesses the available databases and to investigate the options for storing and managing the database at ICES.

10 Review and report on the outputs of the SCANS II project and report on the usefulness of future work for ICES

Section 3.6 of the 2007 WGMME report provides information on use of the SCANS II data. The abundance estimates for harbour porpoises have also been used in development of the OSPAR EcoQO on harbour porpoise bycatch and in the 2008 WGMME report to inform ToR b, ciii, e and f.

In 2007 Cetacean Offshore Distribution and Abundance in the European Atlantic CODA was undertaken. Abundance data for common, bottlenose and striped dolphins, and pilot, fin and sperm whales in offshore waters will become available later in 2008.

11 Future work and recommendations

11.1 Future work of the WGMME

It is likely that the demand for advice from ICES client commissions and others on marine mammal issues will continue and will grow in future years. This WG should continue to be parented by the ICES Advisory Committee.

A list of the following recommendations can also be found at Annex 4 of this document.

11.2 Recommendation I

The WGMME notes that the two approaches (a PBR type procedure and a CLA type procedure) tested in SCANS II explicitly includes uncertainties, and the WGMME agrees with the advice from SCANS II and **recommends** that ICES advisory commission asks the European Commission to consider the CLA approach for future evaluation of bycatch levels and advice on conservation objectives management actions (see Section ToR c iii).

11.3 Recommendation II

The WGMME refers to the abundance estimates with associated uncertainties from the SCANS II survey, and **recommends** that these figures be used for future considerations of bycatch levels. Additionally, the WGMME **recommends** further research on population structure in North Sea harbour porpoises with the aim of describing suitable management areas.

11.4 Recommendation III

WGMME **recommends** that SGBYC compiles the best current estimates for common dolphin and harbour porpoise bycatch in Areas VII and VIII for all fisheries that have been monitored to provide overall bycatch estimates for this region.

11.5 Recommendation IV

The Working Group noted that there are no recent estimates of porpoise or other marine mammal bycatch for the North Sea, the most recent dating back to the late 1990s. The Working Group **recommends** to the European Commission that observer monitoring should be extended to the North Sea in order to obtain more recent estimates of bycatch in this region.

11.6 Recommendation V

The Working Group noted that despite all of the observations made under EC Regulation 812/2004, there is little mention in national reports of any seal bycatch, and **recommends** to the European Commission that bycatches of seals and other protected species should be reported by observer programmes established under the 812/2004 regulation as well as those conducted under Data Collection Regulations for discard sampling.

11.7 Recommendation VI

The WGMME **recommends** refining the current geographical subunits for EcoQOs for harbour and grey seals based on the most appropriate available data.

11.8 Recommendation VII

WGMME asks ICES to **endorse** the establishment of the sample and data bank, recognising its value for facilitating research on marine mammals and helping to generate results that can underpin conservation management. WGMME **encourages** the organisers of the existing Tissue Bank to extend the geographical coverage of participation to the whole of Europe and to take advantage of other possible sources of samples (bycatches, biopsies, etc), and to seek external financial support (e.g. from the EU) for this initiative.

11.9 Recommendation VIII

Given the increasing levels of pup mortality of Saimaa Ringed seals, combined with sustained levels of bycatch mortality, the Working Group **recommends** that Finland makes strenuous efforts to decrease bycatch mortality in this population.

11.10 Recommendation IX

The WG noted that the available data suggests that the conservation situation for the Ladoga seal is serious, and therefore **recommends** that the Russian Federation makes an assessment of the population status, investigate the extent and importance of bycatch and consider ways to minimise bycatch mortality.

11.11 Recommendation X

WGMME **recommends** that a database be created for harbour and grey seal population indices for the ICES area. WGMME **recommends** that ICES assesses the available databases and to investigate the options for storing and managing the database at ICES.

11.12 Recommendation XI

The SharePoint site provided by ICES should facilitate intersessional work for the Working Group. However, access to the site was not always possible and up- and download of documents was sometimes very slow. During the actual meeting not everyone had access to the Internet and thus the use of SharePoint during the meeting was also of limited usefulness.

Although in principle considered a good approach to facilitate intersessional work the WGMME **recommends** that the consistency, accessibility and speed of the SharePoint site be improved.

12 Other business

WGMME **recommends** Sinead Murphy, UK to become the new Chair, following the 2008 ASC. She will replace Meike Scheidat (2006–2008 Chair).

Annex 1: Sample tables for seal database

Grey seal pup production

Country	**UK**						**Ireland**		**Iceland**	**France**
area	Orkney	IoM, Fast Castle	Farne Is	Donna Nook, Blakeney, Horsey	Inner Hebrides	Outer Hebrides	North	Eire		
ICES area	IVa	IVa	IVb	IVb, Vic	VIa	VIa	VIa, VIIa	VIa, VIIb, VIIj2, VIIg, VIIa		IVc, VIId, VIIe, VIIh
OSPAR area	II	II	II	II	III	III	III	III	I	II
EcoQO area	Y	Y	Y	Y N and NE						
any other classification? ??	North Sea	North Sea	North Sea	North Sea	Atlantic	Atlantic	Atlantic	Atlantic	Atlantic	
extend before this?										
1986	5796	891	908	35	1711	8455				
1987	6389	865	930	72	2002	8777				
1988	5948	608	812	54	1960	8689				
1989	6773	936	892	94	1956	9275				
1990	6982	1122	1004	152	2032	9801				
1991	8412	1225	927	223	2411	10617				
1992	9608	1251	985	200	2816	12215				
1993	10790	1454	1051	205	2923	11915				
1994	11593	1325	1025	302	2719	12054				
1995	12412	1353	1070	334	3050	12713				
1996	14273	1567	1061	310	3117	13176				
1997	14051	2032	1284	382	3076	11946				
1998	16367	2241	1309	439	3087	12434				
1999	15462	2034	843	503	2787	11759				
2000	16281	2514	1171	618	3223	13396				
2001	17938	2253	1247	634	3032	12427				
2002	17942	2509	1200	913	3096	11248				
2003	18652	2599	1266	1088	3386	12741				
2004	19123	2612	1133	1354	3385	12319				
2005	17644	2718	1138	1557	3387	12297				
2006	19332	2631	1254	1804	3461	11612				
2007										
2008										

Harbour seal moult counts

Country	**UK**									**Ireland**		**Iceland**	**France**
area	Shetland	Orkney	Moray	Tay	Scotland	England	Hebrides	west	de	North	Eire		
ICES area	IVa	IVa	IVa	IVb	IVa, IVb, VIa	IVvb, Ivc	VIa	VIa	VIa	VIa, VIIa	VIIb, VIIj2, VIIg,		IVc, VIId, VIIe, VIIh
OSPAR area	II	II	II	II	II	II	III	III	III	III	III	I	II
EcoQO area	Y	Y			NE	Y							
any other classification? ??	North Sea	North Sea	North Sea	North Sea	North Sea	North Sea	Atlantic	Atlantic	Atlantic	Atlantic	Atlantic	Atlantic	
extend before this?													
1986													
1987													
1988													
1989		7137											
1990				467									
1991	4797			670				2847					
1992			1077	773			2329						
1993	6227	7873							5341				
1994			1061	575									
1995													
1996							2820		6333				
1997	5991	8523	1141	633	2458			3470					
1998													
1999													
2000			838	700		3943	2413		7909				
2001	4883	7752				4274							
2002			*438	668		3724							
2003			759	461		3159	2098						
2004			760	459		3292							
2005			692	361	1819	3271			4966				
2006	3039	4238	752	342		2784	*1981						
2007													
2008													

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Annex 3: Agenda

WGGME 2008 programme

St. Andrews, Scotland 25–29 February 2008

Monday, 25th February 2008

14:00 start of meeting plenary session: opening of meeting, setting up of internet connection, adoption of agenda

15:30 coffee break

16:00 forming of subgroups and leads, setting up of work plan

18:00 finish official work

19:00 pub dinner (optional) place to be announced

Tuesday, 26th February 2008

09:00 plenary session

10:30 coffee break

11:00 work in sub groups throughout the day

12:30 lunch

13:30 review print outs of first drafts

14:00 plenary session review first drafts

15:30 coffee break and presentation by Arliss Winship "Management procedures for determining appropriate limits to the bycatch of small cetaceans in the European Atlantic and North Sea" and by Phil Hammond on latest SCANS II news

16:15 work in sub groups open end

18:00 finish official work

Wednesday, 27th February 2008

09:00 begin

09:30 plenary session presentation of first drafts ToR c

10:30 coffee break

11:00 work in subgroups

12:00 presentation Phil Hammond on SCANS II

12:30 lunch

13:30 plenary session presentation of first drafts

15:30 coffee break

16:00 presentation by Tiago Marques "Density estimation for cetaceans from passive acoustic fixed sensors" at the observatory, Buchanan Gardens

16:00 work in sub groups open end, hand in all missing draft ToRs

18:00 finish official work

Thursday, 28th February 2008

09:30 plenary session

status of subgroups,

presentation of first drafts.

10:30 coffee break

11:00 work in sub groups

12:30 lunch

13:00 presentation by Gordon Waring at the Sea Mammal Research Unit

15:30 plenary session

Review of ToRs 2009

Review of recommendation

adoption of final draft

Discussion of meeting venue 2009

Recommendation of new Chair for WGMME 2009–2011

19:00 pub dinner (optional) place to be announced

Friday, 29th February 2008

Tours around St. Andrews (optional), departure

Annex 4: WGMME terms of reference for the next meeting

The **Working Group on Marine Mammal Ecology** [WGMME] (Chair: Sinead Murphy, UK) will meet in Vigo, Spain end of from 2nd February to 6th February 2009 to:

a) Examine any further information on population structure of small cetaceans in the ICES areas and provide advice on any consequences for management for these species.

b) WGMME examines the geographical subunits for EcoQOs for ICES areas for harbour and grey seals based on the most appropriate available data (e.g. genetic data) and makes recommendations.

c) Similar to that already undertaken for harbour porpoise, provide a power analysis of available data from SCANS II and CODA to ascertain the degree of decline that could be identified over a 10 year period for a realistic level of effort for species where there is sufficient data. These could include, but are not limited to, minke and fin whale, and white beaked, bottlenose and common dolphin.

d) Provide a review of the Habitats Directive FCS reports for marine mammals submitted by Member states, including a summary of any issues identified and solutions utilised. In light of this review and the work undertaken by WGMME in 2008, identify appropriate conservation assessment criteria that can be used within the ICES area and quantitative measures against which these assessments can realistically be measured.

e) An international cooperative approach should be established for the long term surveillance and monitoring of cetaceans in the Northeast Atlantic through the auspices of WGMME. Develop a framework for surveillance and monitoring applicable to the ICES area that is realistically achievable by contracting parties.

f) Update on development of database for seals, status of intersessional work.

WGMME will report to the attention of the Advisory Committee (ACOM).

Supporting Information

PRIORITY:	
SCIENTIFIC JUSTIFICATION AND RELATION TO ACTION PLAN:	Action Plan No: 1. Term of Reference a) Term of Reference b) Term of Reference c) SCANS II developed and tested potential methods for monitoring harbour porpoises and made a series of recommendations so that trends in abundance in time and space can be better determined between major decadal surveys. This ToR would extend this work to other species where sufficient information is available for such an analysis. Term of Reference d) Recommendations on quantitative monitoring objectives and quantitative assessment approaches will contribute to developing strategies for the long term maintenance of cetacean populations within the ICES area. Term of Reference e) Development of such a framework is essential to the long-term management of cetacean populations within the ICES area.
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 20–25 members and guests.
SECRETARIAT FACILITIES:	None.
FINANCIAL:	No financial implications.
LINKAGES TO ADVISORY COMMITTEES:	The WGMME reports to the ACE (Advisory Committee on Ecosystems).
LINKAGES TO OTHER COMMITTEES OR GROUPS:	
LINKAGES TO OTHER ORGANIZATIONS:	

Annex 5: Recommendations

RECOMMENDATION	FOR FOLLOW UP BY:
1. The WGMME notes that the two approaches (a PBR type procedure and a CLA type procedure) tested in SCANS II explicitly include uncertainties, and the WGMME agrees with the advice from SCANS II and recommends that ICES advisory commission asks the European Commission to consider the CLA approach for future evaluation of bycatch levels and advice on conservation objectives management actions (see Section ToR c iii).	ICES AC
2. The WGMME refers to the abundance estimates with associated uncertainties from the SCANS II survey, and recommends that these figures be used for future considerations of bycatch levels. Additionally, the WGMME recommends further research on population structure in North Sea harbour porpoises with the aim of describing suitable management areas.	ICES
3. WGMME recommends that SGBYC compiles the best current estimates for common dolphin and harbour porpoise bycatch in Areas VII and VIII for all fisheries that have been monitored to provide overall bycatch estimates for this region.	ICES SGBYC
4. The Working Group noted that there are no recent estimates of porpoise or other marine mammal bycatch for the North Sea, the most recent dating back to the late 1990s. The Working Group recommends to the European Commission that observer monitoring should be extended to the North Sea in order to obtain more recent estimates of bycatch in this region.	EC
5. The Working Group noted that despite all of the observations made under EC Regulation 812/2004, there is little mention in national reports of any seal bycatch, and recommends to the European Commission that bycatches of seals and other protected species should be reported by observer programmes established under the 812/2004 regulation as well as those conducted under Data Collection Regulations for discard sampling.	EC
6. The WGMME recommends refining the current geographical subunits for EcoQOs for harbour and grey seals based on the most appropriate available data.	OSPAR
7. WGMME asks ICES to endorse the establishment of the sample and data bank, recognising its value for facilitating research on marine mammals and helping to generate results that can underpin conservation management. WGMME encourages the organisers of the existing Tissue Bank to extend the geographical coverage of participation to the whole of Europe and to take advantage of other possible sources of samples (bycatches, biopsies, etc), and to seek external financial support (e.g. from the EU) for this initiative.	ICES
8. Given the increasing levels of pup mortality of Saimaa Ringed seals, combined with sustained levels of bycatch mortality, the Working Group recommends that Finland makes strenuous efforts to decrease bycatch mortality in this population.	ICES, Finland
9. The WG noted that the available data suggests that the conservation situation for the Ladoga seal is serious, and therefore recommends that the Russian Federation makes an assessment of the population status, investigate the extent and importance of bycatch and consider ways to minimise bycatch mortality.	ICES, Russian Federation
10. WGMME recommends that a database be created for harbour and grey seal population indices for the ICES area. WGMME recommends that ICES assesses the available databases and to investigate the options for storing and managing the database at ICES.	ICES data centre
11. Although in principle considered a good approach to facilitate intersessional work the WGMME recommends to improve the consistency, accessibility and speed of the sharepoint site.	ICES
12. WGMME recommends Sinead Murphy, UK to become the new Chair, following the 2008 ASC. She will replace Meike Scheidat (2006–2008 Chair).	ICES

Annex 6: Technical Minutes: Review Group on Marine Mammals

The review took place by correspondence from 25 March–April 2008.

Participants were:

- Mark Tasker (Chair)
- Santiago Lens
- Olle Karlsson
- Claus Hagebro (ICES Secretariat)

The Chairs of the two relevant Expert Groups, Meike Scheidat (WGMME), Simon Northridge (SGBYC) provided advice and clarification to the review group.

The reviewers had access to the WGMME and SGBYC reports and some Guidelines for review groups at the ICES SharePoint site.

The reviewers provided written comments to the reports (attached as Appendices 1 and 2) which were forwarded to the Advice Drafting Group.

One of the reviewers (Santiago Lens) participated in the Advice Drafting Group which took place at ICES HQ from 10–11 April 2008.

Appendix 1

Review of the Reports of SGBYC and WGMME.

SGBYC

General comments

The report is under all sections technically correct and the scope and depth of the review is appropriate and it answers to the requests, given the specific constraints given by the SG.

Specific comments

Section 3.1.11: I agree in with the recommendation generally; however I am a bit worried that these recommendations from a managing or a political point of view could be used as an excuse for doing nothing. There is always an argument for an additional study, or an extra assessment before putting mitigation measures into practise, especially since doing nothing often is the cheapest solution.

Section 5: Setting quotas or allocating catch limits of protected species seems like a peculiar way of reducing bycatches given the difficulties in both defining such limits, i.e. having a good estimate of population size, but also of monitoring the observance of the regulations.

WGMME ToR b and c

General comments

The report is technically correct and the scope and depth of the review seems appropriate to answer the requests, given the constraints given by the WG.

However I agree with the suggestions made by Santiago Lens that the readability would benefit from a reorganization following his request. A few sections need additional clarification as stated below:

Section 4.2.1. Paragraph 2. This section would benefit from some clarification regarding the methodology or maybe a reference. How is the stranding program organized? Is it voluntary or are the beaches monitored regularly? Has the effort been constant throughout the years?

Section 4.5. Paragraph 2. This section would benefit from some clarification. I assume the author means that due to voluntary restrictions, the percentage of bycaught seals has dropped over time. But with the present sentence there is nothing to explain if total bycatches have decreased over time, or if it is just that less seals are bycaught during April to June. If possible I would prefer that bycatches are expressed in relation to population size or to the number of pups born each year.

Figure 4.5.1. Wouldn't it be more meaningful if the surface area with voluntary restrictions were expressed as a fraction of the total area? Maybe this could give an indication if a mandatory fishing regulations could be feasible if used in the whole area.

Section 4.5. Third paragraph from the end starting "Annual pup production….." There is no explanation of how the figure of 40% of the dead pups found in the monitoring program was derived.

Section 4.6, third paragraph. There is a wide estimate of the size of the Ladoga ringed seal population, but no explanation of how it was derived. Maybe it is in Agafonova *et al.*, 2007 but since it is in Russian an explanation would be appropriate. The data given shows an alarming situation for the ringed seals in Lake Ladoga. Such a high bycatch rate in combination with other mortality (for example lair mortality) means that if the figures given are correct, Ladoga ringed seals will be lost in the near future. Therefore one might consider a stronger statement in the recommendation.

Section 4.7.3, last sentence. The reference to Table 3 is right, even though one might consider putting the Table closer to this Section.

Appendix 2

Review Report of SGBYC and WGMME Reports

Review of the SGBYC Report

- Section 3: Review of methods and technologies that have been used to minimise bycatch.

  This section provides a thorough review of the subject including relevant examples of cases of failure such as the use of acoustic devices ("pingers") into EU fisheries under Regulation No.812/2004 and makes a recommendation to carefully consider a series of factors concerning the introduction of methods to minimise bycatches before implementing the corresponding enforcement legislation. See also the revised text of the SG Report for some minor editorial changes.

  Is the text under this section technically correct? Yes.

  Is the scope and depth of the science appropriate to the request? Yes.

  Does it answer the request? Yes.

  Is the draft advice technically correct? There is no specific advice to be delivered, although this recommendation should be mentioned when dealing with the EU request for advice, ToR d).

- Section 4: Review information on sustainable take limits for species and populations for which relevant data are available.

  The two most well known criteria for defining sustainable take levels are presented. The application of different takes limits to the estimated abundance of several species in European waters is also presented in a tabulated form.

  Is the text under this section technically correct? Yes.

  Is the scope and depth of the science appropriate to the request? Yes.

  Does it answer the request? Yes.

  Is the draft advice technically correct? There is no advice to be delivered.

- Section 5: Consider the advantages and disadvantages of allocating take limits, and if relevant, propose methods.

  This section briefly deals with the question of allocating takes limits among different "metiers" The SG felt that some clarification in the meaning of this ToR is needed.

  Is the text under this section technically correct? Yes.

  Is the scope and depth of the science appropriate to the request? Yes, given the lack of clarification.

  Does it answer the request? Only partially, for the reason mentioned above.

  Is the draft advice technically correct? There is no advice to be delivered.

- Section 6: Co-ordinate monitoring programmes under EU Regulation 812/2004 and the Habitats Directive.

  Under this section the SG Report discussed widely several topics in relation with EU 812/2004 and 2187/2004 Regulations, including the review of the information in the National Reports, a proposal for a standardised reporting format (given as Annex 7) and several aspects of a coordination of the 812/2004 Regulation.

The SG recognises that it could undertake a more thorough review of the National Reports and the requirements for 2009. The establishment of an integrated database with the information provided in the national reports is recommended.

Concerning the Baltic the SG conclude that the 812/2004 Regulation in its present form may not be of service for the conservation of the harbour porpoise. It is also suggested that for an assessment of the current situation both the stakeholder involvement and a detailed analysis of the relevant information concerning the fisheries and by catches are necessary. This should be done in coordination with similar efforts carried out by ASCOBANS.

Is the text under this section technically correct? Yes.

Is the scope and depth of the science appropriate to the request? Yes.

Does it answer the request? Yes, including several aspects related to the 812/2004 Regulation.

Is the draft advice technically correct? There isn't a draft advice formulated as such. (Annex 4 contains a set of recommendations made by the SG).

- Section 7: Review new estimates of bycatch of relevant species.

  A table with data on bycatch available at the meeting is provided in Annex 8.

  Is the text under this section technically correct? Yes.

  Is the scope and depth of the science appropriate to the request? The SG was unable to make a thorough review of this subject.

  Does it answer the request? Only partially.

  Is the draft advice technically correct? There is not draft advice required.

- Section 8: Co-ordinate relevant bycatch mitigation trials.

  Here a good review of experiments and ongoing projects is given.

  Is the text under this section technically correct? Yes.

  Is the scope and depth of the science appropriate to the request? The SG has insufficient time to consider this subject.

  Does it answer the request? Only partially.

  Is the draft advice technically correct? There is not draft advice required.

Review of the WGMME Report

- Executive summary

  The summary should contain a mention of the deliberations of the WG concerning the OSPAR request of advice on the status of seals and harbour porpoises in the North Sea.

- Section 4: Taking account of the results of SGBYC, review and provide draft advice any new information on population sizes, bycatches 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.

  In this Section the WG provide new information on these subjects from SGBYC Report and also some new information on ringed seals and common dolphin.

  Is the text under this section technically correct? Yes. However a reorganization of the subsections following the order of the request (population sizes, bycatches, mitigation, current status) could help to extract the information to formulate the advice. For instance the subsections dealing with ringed seals (4.5 and 4.6) and common dolphin (4.7) could be integrated in the relevant previous subsections (4.1, 4.2, 4.4). Section 4.3 could be part of 4.2 (4.2.3). 4.4 will be 4.3 now. Alternatively the whole section could be organised by species but in my opinion the first option is better. In subsection 4.2, perhaps “New records” (4.2.2) would be better as the first subsection (4.2.1 now), followed by “New estimates” (4.2.1→ 4.2.2). The subsection 4.2.3 “Bycatch impact at the population level” could be moved to a final new subsection on “Current status” summarising what is known about populations and the impact of bycatch at the population level.

  Is the scope and depth of the science appropriate to the request? The relevant sections of SGBYC should be more fully taken into account. In Subsection 4.2.1 “New estimates of bycatch”, as far as I can see, there is a discrepancy between the estimates given in Table 4.1.2 and the corresponding ones in the SBGYC Report (Annex 8). Subsection 4.4 “New information on bycatch” should cite more widely Sections 3 and 8 of the SBGY Report.

  Does it answer the request? Yes, once these comments are taken into account.

  Is the draft advice technically correct? There is not a draft advice formulated as such.

- Section 5: Provide an evaluation of the status of grey seals, of harbour seals and of bycatch of harbour porpoise in relation to the following Ecological Quality Objectives being applied by OSPAR in the North Sea.

  This section provides information to evaluate the relevant Ecological Quality Objectives.

  Is the text under this section technically correct? Yes. The formulation of the Ecological Quality Objective should be copied at the beginning of the corresponding subsections, in both cases: the EcoQO for seals is lacking.

  Is the scope and depth of the science appropriate to the request? Yes. Tables 5, 6, 5.2 and 5.2.2 should include the year and number of individuals found in the last previous annual count to facilitate the comparison with the most recent one. In Subsection 5.3.3 it is not clear how the harbour porpoise estimates of abundance for the North Sea (239.061) and the Celtic Shelf (79,468) are deduced.

Does it answer the request? Yes. It would be useful to make a reference to option adopted for the EcoQO (point annual estimates).

Is the draft advice technically correct? There isn't a draft advice formulated as such.

Annex 7: Review report of Section 3 of Working Group of Marine Mammals Ecology (WGMME) Report

- The review took place during the WGECO meeting (6th May–13th May) 2008.
- Reviewers: Jake Rice (Chair), Catherine L. Scott, Ellen L. Kenchington, Gerjan Piet, Keith Brander, Stuart I. Rogers, Øystein Skagseth, Cristina Morgado (Secretariat)

The reviewers provided written comments to Section 3 of the WGMME report. This section is related to WGMME ToR a).

General comments

In Section 3 of report, WGMME identified Arctic marine mammals as being more likely to be the most severely impacted by changes in climate.

In 2007, WGMME identified that Arctic species (e.g. polar bear, *Ursus maritimus*, harp seals *Pagophilus groenlandica*, hooded seals, *Cystophora cristata*, ringed seals, *Phoca hispida*, bearded seals, *Erignatus barbatus*, walrus, *Odobenus rosmarus rosmarus*, beluga whales, *Delphinapterus leucas*, narwhale, *Monodon monoceros*, and bowhead whale, *Balaena mysticetus*) would be very susceptible to climate change. For those species whose life history is linked to sea-ice structure and formation, a general response to climate change is a move northward following the ice. However, those species which are within landlocked areas (e.g. the Baltic, which is not an OSPAR region) do not have this option.

Arctic marine mammals are not the only species possibly vulnerable/sensitive to climate change; induced changes in abundance, distribution and phenology may affect other species, but they are difficult to predict.

A suite of hydrodynamic indices such as the NAO and sea ice (extent) indices was identified by WGOH, which WGMME considers sufficient to monitor impacts of climate change on the North Atlantic environment. The main problem is that marine mammals' population time series (e.g. change in abundance over time) to assess the impact of climate change and increased variability in populations does not exist. Continuation of dedicated time programmes, such SCANS, to obtain this data is needed.

WGMME identifed the issues with modelling time series data and the problems therein. The group also considers that the hypotheses identified by SGWRECC (2008 report) is difficult to detangle from the effects of other drivers, such as fishing effects.

Thus Section 3 of the WGMME report provides an overview of the possible effects of climate change on the abundance and distribution of marine mammals building from their previous report in 2007 with added contributions, and information from WGOH and SGWRECC. It is emphasised that the population based data sets to fully understand the effects of climate change on marine mammals within the OSPAR region, do not exist.

It is fairly clear that future requests of this kind will require more detailed dialogue between the WG and the group carrying out the overview and analysis in order to ensure that there is a common basis and methodology and that the WG is clear about what information is required. A common source of data and products on changes in ocean climate is an essential part of this.