ASCOBANS

Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat

Contents

1. Executive Summary

1.1 Background

The harbour porpoise is the most common cetacean in the North Sea, the Baltic and the waters in between and ASCOBANS has so far adopted two plans to ensure the species' conservation: the Recovery Plan for Baltic Harbour Porpoises (the Jastarnia Plan) and the Conservation Plan for Harbour Porpoises in the North Sea. In 2011, it was decided that a third plan should be produced covering the genetically distinct harbour porpoise population in the Kattegat, the Belt Seas, the Sound and the Western Baltic. Two large-scale surveys (in 1994 and 2005) have been conducted to estimate the abundance of porpoises in this area. The point estimates from these surveys indicate a 60% decline, but the difference is not statistically significant, and a new survey will be conducted in 2012 to evaluate the population status. Harbour porpoises may be observed throughout the Plan area, but the highest densities are found in Little Belt, Great Belt, Flensborg Fjord, Fehmarn Belt and the Sound.

In the Western Baltic, the Belt Sea and the Kattegat harbour porpoises face anthropogenic threats such as bycatch, marine constructions, extraction of resources, overfishing, shipping, chemical pollution and increased noise level, all of which may potentially have a negative influence on the porpoise population. The current knowledge is however insufficient to determine the level of impact especially on cumulative effects.

The harbour porpoise is listed in Annex II and IV of the Habitats Directive (92/43/EEC), which obligates all EU Member States to protect porpoises in their entire range as well as to designate protected areas called Special Areas of Conservation (SACs) in areas of high porpoise density. Within the geographical extent of this Plan, Denmark, Germany and Sweden have designated 26 SACs (11, 11 and 4 SACs respectively).

1.2 Management Recommendations

The recommendations of the Plan are articulated around five main objectives: a) involvement of all stakeholders in the implementation of the plan and its evaluation; b) mitigation of bycatch; c) assessment of the bycatch level; d) monitoring the status of the population; and e) insuring a habitat quality favourable to the conservation of the harbour porpoise.

SACs referred to in the recommendations only include those SACs for which the presence of harbour porpoises was a site selection criterion and where national authorities have not categorized the size and density of the population within the SAC to be non-significant (Status D) according to the criteria in the Habitats Directive. These SACs are hereinafter referred to as hpSACs.

The recommendations are as follows:

Objective a. Involvement of all stakeholders in the implementation of the plan and its evaluation

- Recommendation 1: Actively seek to involve fishermen in the implementation of the plan and mitigation measures to ensure reducing bycatch
- Recommendation 2: Cooperate with and inform other relevant bodies about the Conservation Plan

Objective b. Mitigation of bycatch

- Recommendation 3: Protect harbour porpoises in their key habitats by minimizing bycatch as far as possible
- Recommendation 4: Implement pinger use in fisheries causing bycatch
- Recommendation 5: Where possible replace gillnet fisheries known to be associated with high porpoise bycatch with alternative fishing gear known to be less harmful

Objective c. Assessment of the bycatch level

- Recommendation 6: Estimate total annual bycatch

Objective d. Monitoring the status of the population

- Recommendation 7: Estimate trends in abundance of harbour porpoises in the Western Baltic, the Belt Sea and the Kattegat
- Recommendation 8: Monitor population health status, contaminant load and causes of mortality

Objective e. Ensuring habitat quality favourable to the conservation of the harbour porpoise

- Recommendation 9: Ensure a non-detrimental use of pingers by examining habitat exclusion and long-term effects of pingers
- Recommendation 10: Include monitoring and management of important prey species in national harbour porpoise management plans
- Recommendation 11: Restore or maintain habitat quality

2. Introduction

Neither the original Recovery Plan for Baltic Harbour Porpoises (Jastarnia Plan) of 2002 nor the revised and updated version adopted in 2009 contains any definition as to its exact geographical scope. It is, however, generally assumed that the Plan follows the definition used by the ASCOBANS Baltic Discussion Group, according to which the Baltic Sea comprises "the waters in ICES Division IIId (area 24-29) east of the Darss-Limhamn ridges and south of the Åland Islands" ("Baltic Proper", cf. Fig. 1). However, the ASCOBANS Conservation Plan for Harbour Porpoises in the North Sea, adopted in 2009, contains an (implicit) definition of its geographical scope as the waters "northwards of latitude 57°44.8'N from the northernmost point of Denmark to the coast of Sweden" (Fig. 1). Therefore, part of the western Baltic, the Danish Straits and the Kattegat is not covered by either Plan, and as a consequence the geographical extent of the Jastarnia Plan has long been controversial. It has repeatedly been on the agenda of the various ASCOBANS Agreement bodies for several years but the issue has remained unresolved.

In 2011, the 18th meeting of the ASCOBANS Advisory Committee (AC18, Bonn, Germany), following a recommendation by the 7th meeting of the Jastarnia Group (Copenhagen, Denmark, February 2011) decided that a draft paper containing background information and proposed objectives and measures for the 'gap area' currently not covered by the Jastarnia Plan should be commissioned. Moreover, AC 18 stipulated that this paper should be reviewed and refined by the 8th meeting of the Jastarnia Group with a view to enabling formal adoption of such objectives and measures by the 7th Meeting of the Parties, 2012.

This draft plan covers the 'gap area' defined as the waters north and west of the Darss and Limhamn ridges up to the north-western border of the Baltic Sea as defined by HELCOM (i.e. a line from the northern point of Denmark to the coast of Sweden at 57°44.43'N). This area will hereinafter be referred to as the Western Baltic, the Belt Sea and the Kattegat.

The draft paper was reviewed and revised by the 8th Meeting of the Jastarnia Group (Bonn, 31 January – 2 February 2012) and again following the 19th Meeting of the Advisory Committee (AC19), Galway, Ireland (20-22 March 2012).

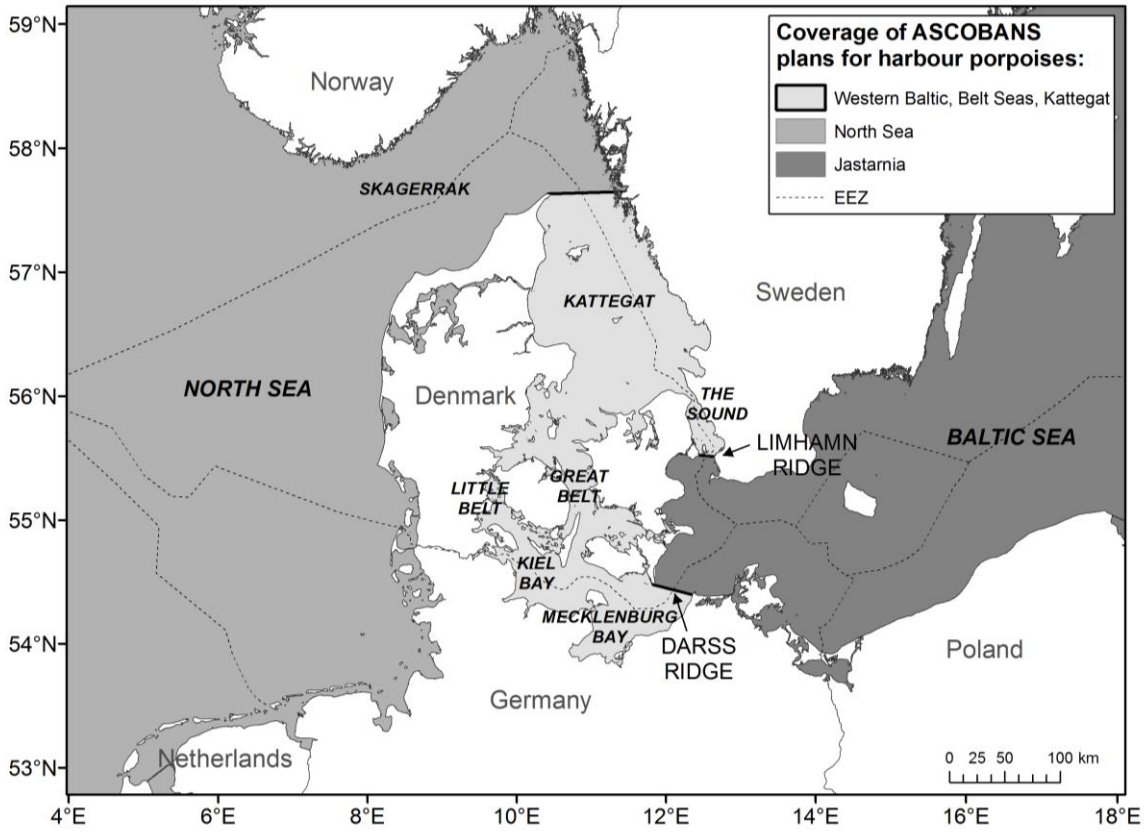

Figure 1 *Map of the North Sea and the Baltic indicating where the geographical area covered by the Plan for the population in the Western Baltic, the Belt Sea and the Kattegat adjoins that of the ASCOBANS North Sea Plan and the ASCOBANS Jastarnia Plan. The dashed line indicates the national borders of the Exclusive Economic Zone (EEZ).*

3. Background Information on Harbour Porpoises

The harbour porpoise is the most common cetacean in the Western Baltic, the Belt Sea and the Kattegat and the only cetacean species known to reproduce here. In the past two decades, our knowledge of harbour porpoise genetics, distribution, abundance, prey preferences, ecology and anthropogenic stressors has improved in this region partly due to the development of novel methods and intensified efforts from researchers, and partly facilitated by an increased management focus from national authorities, international organizations and the EU. Yet, essential information such as sustainability of the population, drivers for distribution, effects of anthropogenic utilization of the sea, e.g. bycatch, underwater noise, pollution and other threats remains unclear. In this section, the current knowledge is described and essential gaps in knowledge are highlighted.

3.1 Population Status

Only two harbour porpoise populations have been evaluated as “endangered” by the International Union for Conservation of Nature (IUCN); the Baltic Sea population (listed as “critically endangered”), and the Black Sea population (listed as “endangered”). The population structure and extent of other harbour porpoise populations are less clear and they are listed as populations of “least concern” based on the fact that the harbour porpoise “is widespread and abundant”, and since conservation measures are being implemented in many areas (Hammond et al. 2008). However, as described below in sections “3.2 Population structure” and “3.3 Population abundance”, the harbour porpoises inhabiting the Western Baltic, the Belt Sea and the Kattegat should be considered as a separate population, and abundance estimates from 1994 and 2005 indicate a possible decline, although the estimates are not significantly different (Teilmann et al. 2011). As a result, the ICES Working Group for Marine Mammal Ecology (WGMME, Berlin 2011, ICES 2011) and the Jastarnia Group (Copenhagen 2011) recommended that a new survey should be carried out in 2012 to determine the abundance and status of the population. The IWC Scientific Committee also expressed its concern over the status of the population, and stressed the importance of such a survey (IWC 2012).

The harbour porpoise is listed on Annex II and IV of the EU Habitats Directive (92/43/EEC) which obliges all EU Member States to protect the species in its entire range as well as to identify protected areas, named Special Areas of Conservation (SAC). However, Article 4, paragraph 1 of the Habitat’s Directive states that: “for aquatic species which range over wide areas, SACs will be proposed only where there is a clearly identifiable area representing the physical and biological factors essential to their life and reproduction”. These factors may be difficult to determine, so it was decided that these areas should be identified on the basis of three criteria: 1) The continuous or regular presence of the species (although subject to seasonal variations), 2) Good population density (in relation to neighbouring areas) and 3) High ratio of young to adults during certain periods of the year (EC (2001) Habitats Committee, Hab. 01/05). The process of identifying SACs is comprehensive, but in short, Member States must first identify sites as Sites of Community Importance (SCI) according to their relative value for the conservation of each species on Annex II, and then designate the area as a SAC. Notwithstanding the present status (SCI or SAC) of identified areas, for reasons of simplicity in this Plan all will be referred to as SACs. Within the Western Baltic, the Belt Sea and the Kattegat, Germany and Denmark have each designated 11 SACs with porpoises listed as part of the designation features (Germany 1,996 km^2, Denmark 2,075 km^2) (Fig. 2). Sweden is considering to designate SACs for harbour porpoises, but has at present identified four SACs within the area of this plan where harbour porpoises occur. In relation to the designation of SACs, each Member State has to conduct a “global assessment” of the value of each site for conservation of harbour porpoises, i.e. evaluate the importance of each area with regard to conservation, population status and degree of isolation by assigning a ranking of A) excellent value, B) good value or C) significant value to each site (Natura2000 standard data form, Explanatory notes). Some SACs are yet to be ‘globally assessed’, but the currently available status for each area is displayed in Fig. 2.

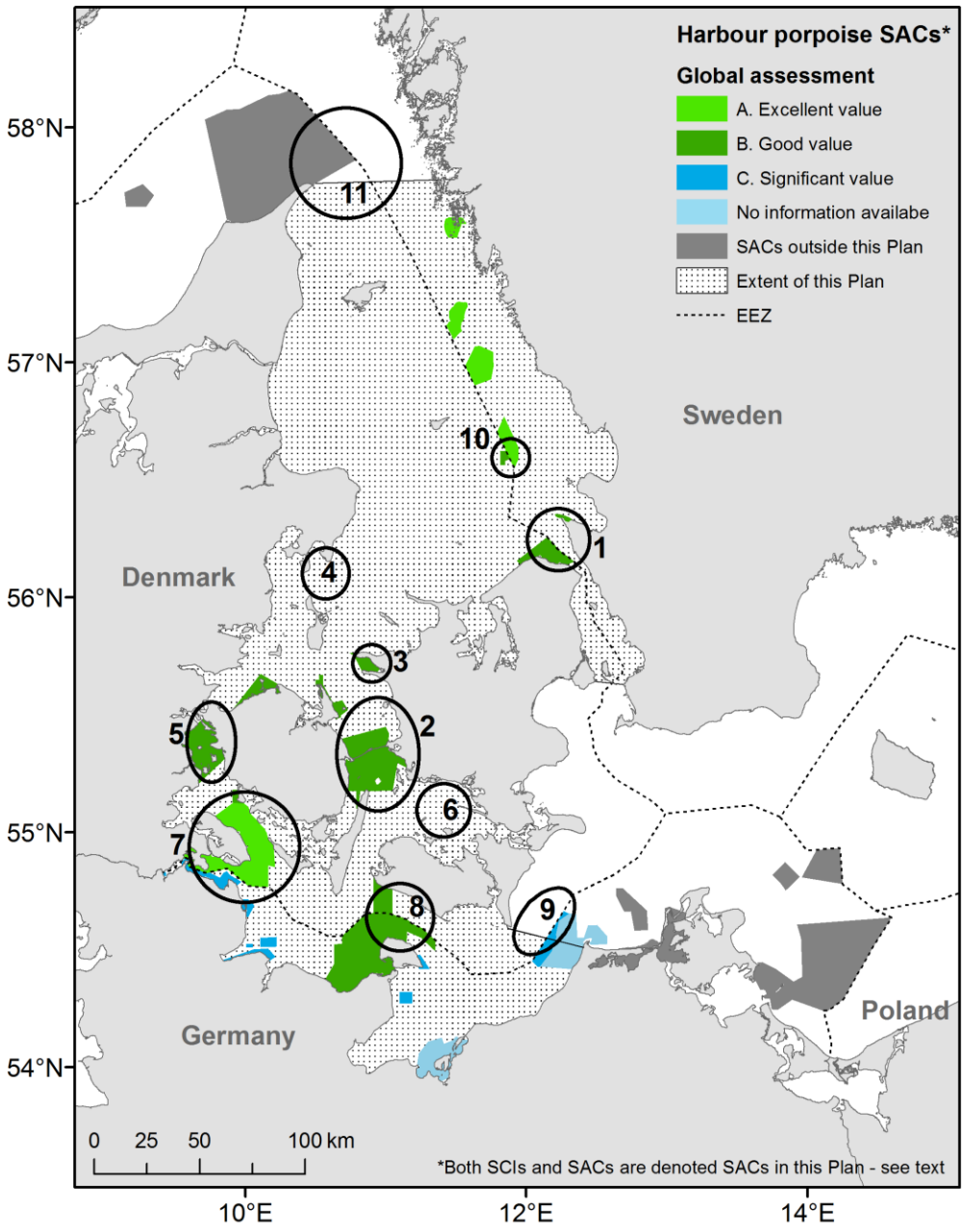

Figure 2 *Special Areas of Conservation (SACs) designated according to the EU Habitats Directive for harbour porpoises (i.e. where harbour porpoises are part of the selection criteria and listed as Population status A, B or C) by Denmark, Germany and Sweden within the Western Baltic, the Belt Sea and the Kattegat. Colours refer to the global assessment of each site to harbour porpoises (from ICES WGMME report 2011 and http://eunis.eea.europa.eu/sites.jsp). Black circles indicate areas of high porpoise density identified by satellite tracking, surveys and passive acoustic monitoring: Northern Sound (1), Great Belt (2), Kalundborg Fjord (3), northern Samsø Belt (4), Little Belt (5), Smålandsfarvandet (6), Flensborg Fjord (7), Fehmarn Belt (8), Kadet Trench (9), Store Middelgrund (10) and Tip of Jutland (11). The order of the numbers is arbitrary.*

3.2 Population Structure

The harbour porpoise is divided into several populations throughout its range (Andersen 2003, Lockyer & Kinze 2003, Evans & Teilmann 2009). In the waters between the North Sea and the Baltic Sea, studies on satellite telemetry, genetics and morphology have identified three populations; one in the eastern North Sea including the Skagerrak and the northern part of the Kattegat, one in the Western Baltic, the Belt Sea and the Kattegat, and a third in the Baltic Proper (Tiedemann et al. 1996, Andersen et al. 1997, Huggenberger et al. 2002, Galatius et al. 2010, Wiemann et al. 2010, Teilmann et al. 2011). No exclusive geographical boundaries have been found between these three populations, and morphological studies and satellite tracking of porpoises show some degree of overlap in distribution in transition areas in the northern Kattegat (between 56°30'N - 57°30'N) and the south-eastern area around Fehmarn Belt, the Darss-Limhamn Ridge to latitude 14°E (Galatius et al. 2010, Teilmann et al. 2011).

3.3 Abundance

The abundance of harbour porpoises in northern European waters has been estimated twice from internationally coordinated large-scale dedicated surveys; SCANS (Small Cetacean Abundance in the North Sea and Adjacent waters) in 1994 (Hammond et al. 2002) and SCANS-II in 2005 (SCANS-II 2008). Abundance for the population inhabiting the Kattegat, Belt Sea, the Sound and Western Baltic was estimated to be 27,767 (CV = 0.45, 95% confidence interval (CI) = 11,946-64,549) in 1994 and 10,865 (CV=0.32, 95% CI = 5,840-20,214) in 2005 (Teilmann et al. 2011). Although this represents a 60% decline in the point estimates, this difference is not statistically significant (due to the large coefficient of variation). There is a need for more data on population size, abundance and trends.

Scheidat et al. (2008) showed that density between areas varied seasonally and spatially in the south-western Baltic; the area around Kiel Bay showing generally the highest density. Total abundance varied between surveys with the lowest value in March 2003 (457 ind.; 95 % CI: 0-1,632) and the highest estimate in May 2005 (4,610 ind.; 95 % CI: 2,259-9,098). The most recent abundance estimates for Kiel Bay (incl. Danish waters up to the island of Funen) in 2010 and 2011 show low densities of less 0.4 ind. km^{-2} (Gilles et al. 2011a).

3.4 Distribution

The harbour porpoises in the Western Baltic, the Belt Sea and the Kattegat have been studied by means of visual surveys from boats and aircrafts (Heide-Jørgensen et al. 1992, Heide-Jørgensen et al. 1993, Hammond et al. 2002, Siebert et al. 2006, Scheidat et al. 2008, Gilles et al. 2011a), detections of incidental sightings and strandings (Kinze et al. 2003, Siebert et al. 2006), passive acoustic monitoring (Verfuss et al. 2007), acoustic surveys (SCANS-II 2008, Sveegaard et al. 2011a) and satellite tracking (Teilmann et al. 2007, Sveegaard et al. 2011b). From these studies, it is clear that the porpoises are not evenly distributed, and the telemetry studies indicate that porpoises concentrate in certain high-density areas. These areas are presumably key habitats, defined as the parts of a species'

range essential for day-to-day survival, as well as for maintaining a healthy population growth rate. Areas that are regularly used for feeding, reproducing, raising calves and migration are all part of key habitats (Hoyt 2005). Within the range of the Western Baltic, the Belt Sea and the Kattegat population, the highest densities are found in the northern Sound, Great Belt, Kalundborg Fjord, northern Samsø Belt, Little Belt, Smålandsfarvandet, Flensborg Fjord, Fehmarn Belt, Kadet Trench and Store Middelgrund (Fig. 2).

The distribution of harbour porpoises and the location of high-density areas may vary seasonally, but current studies are not conclusive: satellite tracking and acoustic surveys of harbour porpoises show that during winter the majority of the population moves south i.e. out of the Kattegat and into the Belt Sea and the Western Baltic resulting in very low winter abundance in some of the summer high density areas, such as the Kattegat and the Sound. A few immature individuals have however instead moved into the North Sea in the winter (Sveegaard et al. 2011a, Sveegaard et al. 2011b). Studies using passive acoustic monitoring show an increase in porpoise click activity in the German Baltic Sea during spring and summer, and a subsequent decrease in the winter as well as a general increase in porpoise density from east to west (Verfuss et al. 2007). This trend is supported by data on strandings and incidental sightings (Hasselmeier et al. 2004, Siebert et al. 2006), whereas studies involving aerial surveys found no obvious seasonal patterns (Scheidat et al. 2008, Gilles et al. 2011a). Conclusively, the current data on seasonal changes in distribution are not sufficiently consistent to be efficiently used in management of porpoises.

Seasonal changes in distribution may be related to reproduction, but so far no specific breeding areas have been identified in the Western Baltic, the Belt Sea and the Kattegat. However, during the first SCANS survey and from opportunistic sightings and strandings, a high ratio of calves to adult porpoises was found in the Belt Sea (Hammond et al. 1995, Kinze 2003). Since the population inhabiting these waters is rather stationary, it is likely that both birth (mainly in June and July) and conception (July-August) also occur in these waters (Sørensen & Kinze 1994). In Danish waters, the pregnancy rate has been found to be between 0.61 and 0.73 calves/adult female per year (Sørensen & Kinze 1994). The calves are nursed for 8-10 months (Lockyer & Kinze 2003). For porpoises from the Kiel Bay the birth period was calculated to take place between July 6 and August 16, with 27 July as the mean date of birth (Hasselmeier et al. 2004). Most female porpoises from western German waters of the Baltic become sexually mature at the age of four years and become pregnant each year thereafter (Benke et al. 1998).

3.5 Habitat Preferences

The harbour porpoise inhabits temperate and cold environments and is a small whale species with a high energy demand but limited capacity for energy storage (Koopman 1998, Lockyer & Kinze 2003, Lockyer 2007). The distribution of harbour porpoises is therefore believed to follow the distribution of its main prey species (Koopman 1998, Santos et al. 2004). In the last few years, the number of studies examining drivers for harbour porpoise habitat selection has increased. Results indicate that porpoise distribution may be influenced by the distribution of main prey species (Sveegaard 2011), prey diversity (Sveegaard et al. 2012), frontal zones (Johnston et al. 2005, Skov & Thomsen 2008, Gilles et al. 2011b) depth

and other environmental variables believed to drive distribution of harbour porpoise prey (Bailey and Thompson 2009, Marubini et al. 2009, Edrén et al. 2010, Embling et al. 2010). The influence of each factor varies between areas, but prey distribution appears to be an important factor in the habitat quality for harbour porpoises (Gilles et al. 2011b). In the waters between the eastern North Sea and the Baltic Sea, the major prey species during the last 25 years were found to be herring (*Clupea harengus*), sprat (*Sprattus sprattus*), cod (*Gadus morhua*), whiting (*Merlangius merlangus*), gobies (Gobiidae) and sand eels (Ammodytidae) (Aarefjord et al. 1995, Benke et al. 1998, Börjesson et al. 2003, Gilles et al. 2009). The relative importance of these prey species varies between regions and seasons (Benke et al. 1998, Santos & Pierce 2003, Gilles et al. 2009).

3.6 Health Status

Pathological investigations have revealed that harbour porpoises in the Western Baltic show a significantly higher rate of diseases and severe bacterial infections compared with harbour porpoises from waters with lower anthropogenic pressure e.g. around Greenland, Iceland and Norway (Wünschmann et al. 2001, Siebert et al. 2001, 2006). The nutritional status was judged on 52 mainly bycaught harbour porpoises from the Baltic Sea collected between 1991 and 1996: 54% were in good, 36% in moderate nutritional status and 10% were emaciated (Siebert et al. 2001). Main pathological findings were parasitic infections of the lungs, bacterial pneumonia and septicemia (Swenshon et al. 1998, Wünschmann et al. 1999, Siebert et al. 2001, Wünschmann et al. 2001, Siebert et al. 2002, Lehnert et al. 2005). A total of seven species of parasites was identified from the investigated organs, mainly originating from the respiratory tract (Lehnert et al. 2005). Generally, harbour porpoises from the German Baltic and North Sea as well as Norwegian waters showed clearly more bacterial growth and more associated pathological lesions when compared to individuals from Icelandic and Greenlandic waters, possibly resulting from the higher stress caused by anthropogenic activities (Siebert et al. 2009).

Blood and tissue samples of lung, brain and lymph nodes from 74 stranded or by-caught harbour porpoises from German waters of the Baltic and North Sea were collected between 1991 and 1997 for investigation into the role of morbillivirus infection in harbour porpoises. The high incidence of PMV-specific antibodies in all age groups indicated a continuous spread of and infection with a morbillivirus among harbour porpoises from the German Baltic and North Sea (Müller et al. 2000).

Investigations of the inner and middle ear of harbour porpoises from the German and Danish Baltic Sea by computer tomography and histology showed more lesions (e.g. bleeding, fractures, inflammatory lesions) than expected resulting in an impaired ability of orientation (Seibel et al. 2010). These lesions indicate that more investigations are needed to elucidate the influence of noise pollution and infectious diseases on the health of harbour porpoises and the probability of being bycaught. Impairment of the immune (e.g. lymphoid depletion in the thymus and spleen) and endocrine system (replacement of thyroid follicles by connective tissue results in severe impairment of thyroid function) was also found in harbour porpoises from the Baltic and North Seas (Beineke et al. 2005, Das et al. 2007). These findings indicate that harbour porpoises in these waters are under continuous pressures by different

anthropogenic activities. Therefore the understanding of cumulative effects on the health status is essential for appropriate management measures.

3.7 Threats

All major known threats to the harbour porpoises in the Western Baltic, the Belt Sea and the Kattegat are human induced and the anthropogenic utilization of marine areas is constantly increasing. If not controlled and mitigated, bycatch, marine constructions, extraction of resources, overfishing, shipping, military, chemical pollution, marine litter and potentially also climate change may have a negative influence on the porpoise population. Moreover, the background noise level in the water is increasing due to anthropogenic use of the sea, and since hearing is essential for harbour porpoises to find prey and potential mates, noise pollution may have negative effects on the population and potentially cause chronic stress. Consequently, it is important that harbour porpoise populations are monitored not only locally, e.g. in relation to new marine constructions or in hpSACs, but also at population level so that cumulative effects of various anthropogenic impacts on the marine environment may be revealed.

Bycatch

Incidental bycatch in gillnet fisheries is considered a significant threat to harbour porpoises (Lowry & Teilmann 1994, Kock & Benke 1996, Carlström et al. 2009, IWC 2012). ASCOBANS has advised that, to be sustainable, the maximum annual anthropogenic induced mortality (incl. bycatch) for harbour porpoises should not exceed 1.7% of the population size (Resolution No. 3, Incidental Take of Small Cetaceans, Bristol 2000) and the International Whaling Commission (IWC) stated that the flag of concern should be raised if the number of small cetaceans captured is greater than 1% of their total population size (Bjørge & Donovan 1995). However, assessing the actual levels of bycatch is difficult due to the limited information on porpoise abundance as well as bycatch rates, particularly on small fishing vessels as EC Regulation 812/2004 requires monitoring bycatch only on boats > 15m. Consequently, levels of bycatch have never been estimated for this area. Bycatch is best studied by direct, onboard monitoring of the net hauls. Nevertheless, a minimum estimate can be obtained from the number of stranded porpoises diagnosed as bycaught through post mortem analysis, and although only a proportion of the bycatches may strand, numbers may provide an indication of the magnitude of the problem.

Germany has a comprehensive stranding network led by the Institute for Terrestrial and Aquatic Wildlife Research (ITAW) of the University of Veterinary Medicine in Hannover and the German Oceanographic Museum, Stralsund, which collects and examines the majority of reported bycatches and stranded porpoise carcasses along the German Baltic coast. The number of strandings in the German Baltic has continuously increased since 2001 (Siebert et al. 2010), which may either reflect 1) an increase in bycatch, 2) a general increase in porpoise abundance in the area, 3) a higher mortality rate or 4) increased awareness leading to higher reporting rates (Siebert et al. 2010). However, while the number of suspected bycatches has continuously increased, the number of bycaught porpoises delivered by

fishermen has continuously decreased, indicating less willingness by the fishermen to report bycatch and leading to probably higher numbers of undetected instances. Of all carcasses in varying states of preservation collected between 2000 and 2007, 17% were considered bycatch or suspected bycatch; among carcasses in a good state of preservation this figure rose to 47% (Herr et al. 2009). In 2008, a maximum was reached among the carcasses in a good state of preservation with 76% bycatch or suspected bycatch (Siebert et al. 2009). By evaluating bycatch questionnaires from part-time fishermen and data on strandings, Rubsch & Kock (2004) estimated that part-time fishermen using gillnets were responsible for 27% of the estimated bycatch in German waters. Scheidat et al. (2008) applied the bycatch estimate by Rubsch and Kock (2004) to abundance estimates for the Western Baltic Sea and showed that the percentage of porpoise bycatch in the south-western Baltic could lie within a range of 1.78% to 17.94% of the local abundance estimates for this area.

In Denmark, basic information on stranded porpoises has systematically been collected since 1991. Information is gathered in a database and once a year the new results are published in a contingency plan. In 2000-2002 fewer than 50 porpoises were registered per year in the entire country, but during 2003-2007 this number increased to an average of 113 harbour porpoises per year with a peak of 224 strandings in 2008 (Thøstesen et al. 2010). However, the cause of this increase cannot be attributed to bycatch as records do not contain the cause of death of the stranded animals. For the period 2009-2011 there seems to be a decline from 137 animals in 2009 to 115 in 2010 and then 91 animals in 2011.

In Sweden, Berggren (1994) used fishermen's reports to estimate the minimum bycatch of harbour porpoises in Swedish waters between 1973 and 1993. The data showed a total of 169 bycaught porpoises in the period 1973-1988 and 297 in 1988-1991. During the period 1989-1991, 70% of the catches occurred in the Kattegat. Lunneryd et al. (2004) reported on the results of a telephone survey among Swedish Kattegat fishermen in 2001. They extrapolated the reported bycatch to an annual total bycatch of 114 porpoises.

Bycatch rates may be assessed by independent on-board observers, observers in a separate boat or video monitoring of net hauling at an appropriate sampling level, to obtain reliable data. Onboard video monitoring has recently shown promising results as a reliable method of estimating bycatch (Kindt-Larsen et al. 2011) and has been shown to be more cost-effective than onboard observers (Tilander & Lunneryd 2009). This method also accounts for porpoises that fall out of the net even before they are hauled onboard, which for any other method will lead to an underestimation of the bycatch (Kindt-Larsen & Dalskov 2010). In 2012, Denmark initiated a bycatch monitoring project aimed specifically at providing an estimate of the porpoise bycatch in the area covered by the plan. The urgent need for effective observer schemes throughout the species' range is also recognized elsewhere; for example the 2011 conservation plan for the Harbour Porpoise in Dutch waters requires an observer scheme on all set net fleets to assess bycatch rates (Camphuysen & Siemensma 2011).

Considerable efforts have been made to prevent incidental bycatch and mitigation methods include acoustic deterrent devices (pingers) as well as replacement of gillnets with alternative fishing gear such as traps or pots (e.g. Hasselmeier et al. 2011).

The most effective method to reduce bycatch is to cease fishing using gear that poses a risk to cetaceans (ICES 2010), i.e. decreasing the effort of gillnets. However the most widely

used method for mitigating bycatch is the use of acoustic deterrent devices (so-called "pingers"). Their use is mandatory under current EU legislation in many areas. However, EC Regulation 812/2004 requires pinger use only on boats >12m. Pingers have proven to be efficient in decreasing bycatch levels (Trippel et al. 1999, Larsen et al. 2002, ICES 2010), but the sounds emitted may deter the porpoises from the area (Carlström et al. 2009) and thus drive them out of a potentially key habitat. According to Article 2 (4) of Council Regulation No. 812/2004 "Member States shall take necessary steps to monitor and assess, by means of scientific studies or pilot projects, the effects of pinger use over time in the fisheries and areas concerned" (EU 2004), but so far, the results have not been conclusive (Dawson et al. 1998, Cox et al. 2001, Larsen et al. 2002, Barlow & Cameron 2003, Palka et al. 2008, Carlström et al. 2009). Additionally, whether porpoises may habituate to pingers and, thus, reduce pinger effectiveness over time, is still unclear (Cox et al. 2001, Jørgensen 2006, Teilmann et al. 2006).

Also compliance of pinger requirements and monitoring the efficiency and practical workability need attention when considering the use of acoustic devices (Camphuysen & Siemensma 2011). Lessons can be learned from other approaches to mitigate bycatch, such as the experiences of the United States National Marine Fisheries Service (NMFS), which, in consultation with the US Harbor Porpoise Take Reduction Team (HPTRT), developed a strategy to establish the compliance with the Harbor Porpoise Take Reduction Plan (HPTRP) pinger requirements (NOAA 2010).

The only method to actually reduce gillnet effort while still maintaining a fishery is replacing gillnets with alternative fishing gear such as traps, pots and long-lines. These gear types do not cause bycatch, but still allow for a viable fishery (Königson et al. 2010). Different types of fishing gear may have multiple impacts on the marine environment but studies have shown that e.g. fish traps not only mitigate bycatch of cetaceans but they are also considered sustainable and have a lower discard rate than gillnets (Ovegård et al. 2011, Shester & Micheli 2011). In many fisheries, alternative fishing gear has been studied, but with the purpose of finding more selective or effective gear, rather than for mitigating bycatch. Therefore there is a need to review and characterize gear alternatives in fisheries where marine mammal bycatch is severe. This implies a need for fisheries scientists and managers to include and focus on bycatch in their work. In addition, an exchange of information about alternative fishing gear and experiences with its use needs to be facilitated.

It is also an overarching recommendation that researchers need to work with and fully understand the fishery being studied, which requires collaboration between scientists, industry, and fishery managers. Factors to be included when developing new fishing gear are behaviour of target species as well as other species, and the fishing gear's practicality and cost effectiveness. Consequently the process is time-consuming and requires long-term commitment to careful experimentation and development as well as persistence on the part of managers and scientists. Finally, the implementation of new fishing gear frequently requires cultural shifts within fisheries. These shifts can be assisted by educational work, incentives (economic, market based, certifications, etc.) and or regulations/enforcement.

In conclusion, the bycatch level of harbour porpoises in the Western Baltic, the Belt Sea and the Kattegat in gillnet fishery is currently of unknown magnitude. The most important obstacles in assessing and resolving the problem of bycatch are: 1) obtaining reliable data

on the extent of the current bycatch, 2) the need for an abundance estimate with a reasonably narrow confidence interval (to be able to determine the status in relation to the 1.7 % maximum mortality limit), 3) finding the best mitigation method for the fishery concerned, and 4) the lack of knowledge on types of gillnet fisheries with bycatch of porpoises. In order to protect the population in the Western Baltic, the Belt Sea and the Kattegat, these points should receive the utmost attention.

Habitat degradation and food depletion

Habitat degradation may occur through noise, trawling, construction, shipping, pollution and extraction of marine resources such as oil, boulders, sand and gravel.

The cumulative effects of several noise sources may, by adding the disturbance effects from each source, exceed the tolerable level for porpoises. However, little is known about the behavioural and physiological effects on harbour porpoises of the major noise sources such as ship and boat traffic, construction work, seismic exploration, commercial sonars, depth finders, fisheries acoustics gear and acoustic deterrent and harassment devices. Only dedicated studies will be able to quantify these effects.

Major constructions can influence the distribution of porpoises. During the construction phase of the Nysted wind farm in the Danish Western Baltic a strong decrease in harbour porpoise presence up to 10 km away from the construction site was found to have occurred (Carstensen et al. 2006). Subsequent monitoring of the operational phase showed that the negative effect persisted even after several years (Teilmann et al. 2009). In the North Sea, studies of porpoise presence in areas where wind farms operate have demonstrated either similar or increased densities inside the wind farm (Tougaard et al. 2006, Scheidat et al. 2011). Pile driving has been found to be the most disturbing activity during wind farm and other construction work, causing a decrease in porpoise density up to 17 km away (Tougaard et al. 2009, Brandt et al. 2011, Siebert et al. 2012). It is uncertain why porpoises react differently in different areas but impact may depend on construction activity, noise attenuation due to seabed features, importance of the area to the porpoises, prey availability, as well as the presence of other disturbance factors apart from noise.

Other important anthropogenic effects on the marine environment are overfishing and destruction of the sea bed (e.g. by bottom trawling or dredging) which could result in decreasing availability of suitable prey for porpoises (Hammond et al. 1995). The distribution of fish stocks and that of porpoises are linked to one another, and conservation of porpoises should include management of fisheries especially in, but not limited to, designated protected areas (SACs). In the Western Baltic, the Belt Sea and the Kattegat, the cod stock in the Kattegat has undergone a substantial reduction over the past 25 years and both stock size and spawning stock biomass have remained at very low levels since the end of the 1990s (Vitale et al. 2008). This is most likely due to the extensive and long term use of towed fishing gears, since the adjacent Sound, where trawling has been banned for 80 years, has not been affected (Svedäng 2010).

Chemical pollution

Despite international efforts to combat POPs with special instruments like the Stockholm Convention on Persistent Organic Pollutants and the POP-Protocol of the UN-ECE Convention on Long-Range Transboundary Air pollution anthropogenic contamination of the marine environment has increased dramatically in the past century (Halpern et al. 2008), and the effects on marine mammals have caused concern (Hammond et al. 1995, O'Shea & Tanabe 2003, Jepson et al 2005, Reijnders et al. 2008). Persistent organic pollutants (POPs) such as polychlorinated biphenyls, DDT, hexachlorbenzene (HCB), chlordanes (CHLs) have been used worldwide and are still found in high concentrations in wildlife long after restrictions on their use have been implemented (Letcher et al. 2010). Other compounds, such as polybrominated diphenyl ethers (PBDEs) and polyfluorinated chemicals (PFCs) were restricted more recently while trends of increasing concentrations are still being detected in the environment (Letcher et al. 2010, Galatius et al. 2011). POPs accumulate in animal tissue and biomagnify through the food chains and therefore pose an obvious threat to the harbour porpoise as a top predator. Potential effects of POPs include reproductive failure, immunosuppression, disruption of endocrine systems, nervous system disorders and cancers.

POPs are suspected to cause reproductive failure and affect the immune system of seals in the Wadden Sea and Baltic Sea (Helle et al. 1976, Reijnders 1992). Since Kleivane et al. (1995) found organochlorine (OC) concentrations in harbour porpoises in Norwegian and Danish waters two to three times higher than corresponding OC levels detected in harbour seals (*Phoca vitulina*) from the same areas, there is reason to be concerned. PCB levels in UK-stranded harbour porpoises frequently exceed all proposed/known thresholds for mammalian toxicity and are strongly associated with both infectious disease mortality and immunosupression (Jepson et al 2005, Hall et al 2006). In addition, PCBs still occur at high tissue concentrations in UK-stranded harbour porpoises and these high levels have remained stable since 1998 (Law et al 2010, Law et al 2012). Murphy et al. (2010) found indications for a link between higher POP concentrations and lower pregnancy rates in harbour porpoises. Weijs et al. (2010) have raised concern regarding the exposure of suckling porpoise calves to high levels of POPs.

Heavy metals are suspected to accumulate through the lifespan of marine mammals. Das et al. (2004) found that increasing zinc levels in harbour porpoises were observed with deteriorating health condition (emaciation and bronchopneumonia), while mercury increases were not correlated with health status. Siebert at al. (1999) found significant associations between mercury levels and severity of lesions with respect to the nutritional state of the cetaceans examined.

Arctic porpoises show lower levels of PBCs and PBDEs compared with animals from the North and Baltic Sea (Bruhn et al. 1999, Thron et al. 2004). Investigations on the immune system showed that lymphoid depletion in the thymus and spleen is associated with elevated PCB and PBDE levels, respectively (Beineke et al. 2005, Yap et al 2012). Blood levels of interleukin-10, an immune-regulatory protein, were correlated with an impaired health status and splenic depletion in porpoises (Beineke et al. 2007). Multivariate analysis showed that the increase of connective tissue in the thyroid was mainly correlated to the higher PCB, PBDE, DDE and DDT concentrations in the blubber. Replacement of thyroid follicles by

connective tissue results in severe impairment of thyroid function. These findings lead to the hypothesis that thyroid fibrosis may be induced by contaminants (Das et al. 2007). Overall further investigations are needed to quantify the impact of chemical pollutants on the population level.

3.8 Legal Status of the Harbour Porpoise in the Western Baltic

The harbour porpoise is listed in Annex II and IV of the Habitats Directive (92/43/EEC), Annex II of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn Convention) and Annex II of the Convention on International Trade in Endangered Species (CITES), and it is covered by the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS), and by the Convention on the Protection of the Marine Environment of the Baltic Sea (HELCOM).

Of the above-listed legal instruments, the Habitats Directive has received the most attention in recent years due to the requirement to designate protected areas, known as Special Areas of Conservation (SACs). The porpoises must be protected within designated areas for which the presence of harbour porpoises is a site selection criterion and management plans must be developed. The management plans should ensure that the abundance of porpoises within each SAC is stable or increasing and further that the total abundance of harbour porpoises within national borders does not decline. Measuring the success of the management plans is essential and it is, thus, important to define clear measurable objectives in both the regional monitoring of SACs and in the monitoring of the entire population. Furthermore, the monitoring methods chosen should be kept consistent to reduce method-related variation and increase power in trend analysis (Berggren et al. 2008). Furthermore, the primary objective of the Habitats Directive is the maintenance or attainment of a favourable conservation status (FCS) for natural habitats and species of wild fauna and flora. All measures taken under the Directive must aim to reach or maintain a favourable conservation status. This requirement is not limited to protected areas.

The main goal of the EU Marine Strategy Framework Directive (MSFD) (2008/56/EC), which was formally adopted by the European Union in July 2008, is to maintain or restore a good environmental status (GES) by 2020 in all waters under EU Member States' jurisdiction. The MSFD sets out a strategy with key milestones which EU Member States must follow to achieve GES in their marine environment by 2020. These steps are:

- assessment of current ecological status and definition of GES and corresponding indicators (by 2012)
- establishment and implementation of monitoring programmes (by 2014)
- development and implementation of corrective measures (by 2016), and
- achievement of GES (by 2020)

To achieve the aims of the Directive, Member States are to use existing regional institutional cooperation structures, including regional seas conventions. Monitoring the abundance and distribution of harbour porpoises has been proposed as a means to determine GES.

In April 2004, in the framework of the Common Fisheries Policy (CFP), the EU adopted Council Regulation No. 812/2004 (EU, 2004). This regulation is aimed at reducing the incidental catch of cetaceans in fisheries in European Union waters. The Regulation includes measures prohibiting Baltic Sea drift net fisheries, providing for mandatory use of acoustic deterrent devices (pingers) in some EU gillnet fisheries for vessels over 12 m in length, and the use of onboard observers on vessels of over 15 m in length. For the Western Baltic, the Belt Sea and the Kattegat, the regulation specifies (article 2.2, Annex 1) that the use of acoustic deterrent devices is mandatory in fisheries in ICES Area IIIa for bottom set gillnets with net length up to 400m (1 Aug-31 Oct) and for bottom-set gillnets with mesh sizes > 220mm (all year). ICES Areas 22 and 23 are not covered by the requirement to use pingers, although these hold the highest densities of porpoises within the area covered by the Plan. Furthermore, since the regulation is only applicable to vessels longer than 12 m, the majority of the current fishing fleet as well as all recreational fisheries are unregulated. The insufficiencies of Regulation 812/2004 were acknowledged and discussed by the Commission in its 2009 report on the implementation of the Regulation (COM (2009) 368 fin.) and again in the 2011 report on the same subject (COM (2011) 578 final). In 2010, ICES, based on a request of the European Commission, evaluated the aspects of EC Regulation 812/2004 (ICES 2010) and found that the measures required under Regulation 812/2004 are being poorly implemented in general.

Information on fishing effort is important in order to identify areas where intense fishing effort coincides with high porpoise density. From 1 January 2012, fishing boats with a length of > 12 m in all EU Member States have been required to install a vessel monitoring system (VMS) which at regular intervals provides data to the fisheries authorities on the position, course and speed of vessels (Council Regulation No. 1224/2009). Prior to January 2012, this Regulation was only valid for vessels >15 m, so perhaps this new provision will provide a better geographical overview of the fishing effort. However, bycatch almost exclusively occurs in gillnets, and the VMS system for this fishery will only show where the boats go but not provide any indication as to about gear type and effort.

Other international bodies that also provide relevant advice for harbour porpoise protection include the International Council for the Exploration of the Sea (ICES), which offers scientific advice relevant to the management of fish stocks and other species (including marine mammals) and the Scientific Committee of the International Whaling Commission (IWC). Although constrained from giving management advice regarding small cetaceans, the IWC has provided a forum for assessing the status of small cetacean species, including harbour porpoises. The 2012 IWC Scientific Committee meeting expressed its concern about the population in the Western Baltic, the Belt Sea and the Kattegat and recommended to (1) assess bycatch levels, (2) monitor abundance on a regular basis, (3) introduce measures to mitigate bycatch and other anthropogenic mortality, (4) monitor the health status of the porpoises, (5) ensure the full reporting of bycaught and stranded animals and their delivery to qualified institutions for necropsy and sampling, and (6) implement this Plan (IWC 2012).

A list of the national authorities responsible for management of harbour porpoises as well as of research institutions and their current relevant research in Denmark, Germany and Sweden will be maintained by the Secretariat.

4. Development of the Conservation Plan

The current conservation status of the harbour porpoise population in the Western Baltic is uncertain but abundance estimates coupled with a lack of knowledge on bycatch rates might give reason for concern. Consequently, the responsible national authorities are requested to consider the recommendations of this Plan.

This Plan seeks to protect the harbour porpoise population in the Western Baltic, the Belt Sea and the Kattegat and to restore and/or maintain the population at a favourable conservation status aiming for a population size at 80% or more of the carrying capacity (Resolution No. 3, Incidental Take of Small Cetaceans, Bristol 2000), whereby:

1. population dynamics data will show that harbour porpoises are maintaining themselves at a level enabling their long-term survival as a viable component of the marine ecosystem

2. the range of harbour porpoises is neither reduced, nor is it likely to be reduced in the foreseeable future

3. habitat of favourable quality is and will be available to maintain harbour porpoises in the long term

The above aim can be achieved by following the recommendations of this Plan and by involving all stakeholders during its implementation.

Concerning the general lack of data in the Plan area for assessing the status of the species and the magnitude of the threats it faces, the recommendations of the Plan are articulated around six main objectives:

a. Involvement of all stakeholders in the implementation of the plan and its evaluation

b. Mitigation of bycatch

c. Assessment of the bycatch level

d. Monitoring the status of the population

e. Ensuring habitat quality favourable to the conservation of the harbour porpoise

5. Recommendations

The following recommendations constitute the ASCOBANS Conservation Plan for Harbour Porpoises in the in the Western Baltic, the Belt Sea and the Kattegat.

Special Areas of Conservation (SACs) referred to in the following section only include those SACs for which harbour porpoises are listed as designated features and where national authorities have not categorized the size and density of the population within the SAC to be non-significant according to the criteria in the Habitats Directive, hereinafter referred to as hpSACs. The hpSACs presently (March 2012) referred to are shown in fig. 2.

The recommendations are not written in any particular order, but each recommendation is given a priority (low-medium-high). They are consistent, where relevant, with existing EU requirements, including EU Reg. 812/2004.

Objective a. Involvement of all stakeholders in the implementation of the plan and its evaluation

Recommendation 1: Actively seek to involve fishermen in the implementation of the plan and mitigation measures to ensure reducing bycatch

Rationale: Reducing bycatch in fisheries must involve fishermen. By developing regulations or creating incentives in cooperation with fishermen, industry, scientists, NGOs and government managers, the rate of success will most likely increase. This would help ensure the success of bycatch mitigation measures. This also adds to objective b: Mitigation of bycatch.

Action required:

- A working group including fishermen, scientists, and representatives of governments and environmental organizations should be established to develop guidelines and methods to reduce and monitor bycatch in relevant fisheries

Actors: National authorities, fisheries and scientists in Denmark, Germany and Sweden and beyond, the Industry, NGOs and RACs

Priority: High

Recommendation 2: Cooperate with and inform other relevant bodies about the Conservation Plan

Rationale: Cooperation between ASCOBANS and other relevant regional and international players will contribute to achieving synergies, avoiding duplication of effort and promoting more efficient and result-oriented use of available resources.

Action required: Dissemination of the Conservation Plan for the Western Baltic, the Belt Sea and the Kattegat to the national governments of Denmark, Germany and Sweden as well as to HELCOM, OSPAR, ICES, European Commission, RACs and other relevant bodies, including NGOs

Actors: ASCOBANS Secretariat

Priority: High

Objective b. Mitigation of bycatch

Recommendation 3: Protect harbour porpoises in their key habitats by minimizing bycatch as far as possible

Rationale: Harbour porpoises are exposed to bycatch in their entire range, but may be especially vulnerable in foraging areas where their attention is directed towards their prey. Key habitats are areas that usually hold a high density of harbour porpoises and should therefore be designated as hpSACs. The same amount of fishing effort will therefore pose a relatively higher risk of bycatch inside hpSACs than outside of hpSACs. Optimal protection should therefore be ensured within these areas. Under the EU Habitat Directive each EU Member State has to develop management plans for the hpSACs. Bycatch should be reduced as far as possible in all waters by appropriate measures, e.g. by promoting low-risk gear types. Future research into resolving potential habitat exclusion and the long-term effectiveness of pingers is needed.

Action required*:*

- Full implementation of the provisions in the Habitats Directive and CFP
- Development of national management plans for hpSACs
- Agreements between the Parties concerned to minimize bycatch rates within hpSACs
- Promoting alternative fishing methods

Actors*:* National authorities controlling fishery management, fisheries, EU, international experts

Priority: High

Recommendation 4: Implement pinger use in fisheries causing bycatch

Rationale: Harbour porpoises must be protected in their entire range in order to fulfil the objectives of this Plan and of the EU Habitats Directive and CFP. The main known threat for harbour porpoises is bycatch and consequently steps should be taken to prevent bycatch throughout their range. Pingers are currently the only applied option for effectively reducing bycatch while maintaining gillnet fisheries and should therefore be implemented as an interim measure until alternatives have been introduced. However, if certain gear types are proven by the fishermen and/or researchers not to induce bycatch, pingers should not be used with these gear types, in order to reduce the possible negative impact on the environment.

Action required:

- Agreement between the Parties to implement immediately the controlled use of pingers in gillnet fishery associated with bycatch irrespective of vessel size or type

Actors: National authorities, fisheries, EU, NGOs

Priority: High

Recommendation 5: Where possible replace gillnet fisheries known to be associated with high porpoise bycatch with alternative fishing gear known to be less harmful

Rationale: The use of fishing gear such as traps, pots, hooks and pound nets as an alternative to gillnets will reduce the gillnet effort, and thereby reduce the bycatch of harbour porpoises. At the same time the fisheries can remain viable, economically profitable and sustainable.

Action required:

- Test and implement alternative fishing gear and/or practices
- Find incentives for the fishery such as eco-labelling to switch to fishing gear without bycatch
- Increase focus and promote the development of alternative fishing gear

Actors: National authorities in Denmark, Germany and Sweden (possibly using the European Maritime and Fisheries Fund), fisheries, scientists, EU, NGOs, eco-labelling companies

Priority: High

Objective c. Assessment of the bycatch level

Recommendation 6: Estimate total annual bycatch

Rationale: No reliable estimate of bycatch exists within the geographical scope of this Plan. In order to estimate the sustainability of the population, the annual bycatch needs to be estimated for all types of gillnet fisheries irrespective of vessel type/size (see Appendix I).

Action required:

- Effective monitoring of all types of gillnet fisheries for estimation of bycatch rate in cooperation with fisheries
- Facilitate landing of bycaught harbour porpoises. Requisite national legislation
- Identify gear types, effort, seasons and geographical bycatch hotspots

Actors: National authorities, fisheries, scientists

Priority: High

Objective d. Monitoring the status of the population

Recommendation 7: Estimate trends in abundance of harbour porpoises in the Western Baltic, the Belt Sea and the Kattegat

Rationale: The status of the population is unclear. To monitor the sustainability and assess trends in the population it is essential to conduct regular abundance surveys.

Action required:

- Conduct synoptic absolute abundance surveys regularly
- Identify a survey interval based on power analysis in relation to effort and statistical uncertainty
- The surveys should be coordinated among Denmark, Germany and Sweden. The method and timing of the surveys should be comparable to previous SCANS surveys

Actors: Scientists, national authorities

Priority: High

Recommendation 8: Monitor population health status, contaminant load and causes of mortality

Rationale: Annual sampling of stranded and bycaught harbour porpoises will help to determine if the population is exposed to pressures from bycatch, diseases, food depletion, parasite load, high level of contaminants and pollution, physical effects of noise, etc. and

whether this pressure changes over time. Although it is difficult to include mitigation of diseases and pollutants on harbour porpoises in management schemes, the regular necropsies of dead porpoises will provide invaluable knowledge on the general health of the population, and how and which contaminants has an effect. Understanding the age structure and the health status of bycaught animals will also enhance the understanding of causes of bycatch risk.

Action required:

- Collection of a sufficient number of stranded and/or bycaught harbour porpoises annually in each country: Denmark, Germany and Sweden
- Conduct necropsies and examine cause of death, diseases, pollutant level and fitness using standard protocols

Actors:

- The authorities in Denmark, Germany and Sweden should allocate funding for annual collection and necropsies of dead harbour porpoises and the information from all three countries should be gathered in a common database
- Research institutions to conduct the necropsies

Priority: High

Objective e. Ensuring habitat quality favourable to the conservation of the harbour porpoise

Recommendation 9: Ensure a non-detrimental use of pingers by examining habitat exclusion and long-term effects of pingers

Rationale: Studies of the long-term deterrence effect and possible habituation to pingers are inconclusive. The long-term effectiveness of pingers to prevent bycatch and the potential habitat exclusion should be investigated. This is particularly important when pingers are used as the long-term solution to bycatch in gillnet fisheries. Furthermore, pingers are already mandatory in some gillnet fisheries operating in the area covered by this Plan without knowledge of the potential detrimental effects (ICES area IIIa).

Action required:

- Examine the habitat exclusion and habituation of harbour porpoises in large-scale gillnet fishery using pingers
- Examine the long-term effectiveness in large-scale use of pingers not only in relation to harbour porpoise bycatch but in relation to other species, like seals

Actors: EU, National authorities, Scientists

Priority: High

Recommendation 10: Include monitoring and management of important prey species in national harbour porpoise management plans

Rationale: Distribution of harbour porpoises and their prey is correlated and consequently important prey species should be considered in the management of harbour porpoises. This is particularly important in hpSACs, many of which are believed to constitute important foraging areas. Distribution and stock sustainability of prey species rely on anthropogenic effects as well as different environmental factors and thus future management plans should be extended to focus on the ecosystem level, e.g. by including prey distribution, abundance and habitat quality.

Action required:

- Data on preferred prey and prey communities should lead to sustainable management of these species to ensure favourable long-term conservation status for both the fish species and of harbour porpoises
- Cooperation between researchers and national authorities
- Agreements between the Parties concerned on management of fisheries on relevant prey species. Requisite national legislation.
- Emphasis should also be given to the investigation of biology and distribution of non-commercial prey-species

Actors: Scientists, National authorities

Priority: Medium

Recommendation 11: Restore or maintain habitat quality

Rationale: Marine areas subjected to intense shipping and exploitation such as the Western Baltic, the Belt Sea and the Kattegat are in danger of habitat degradation through fisheries, noise, construction, shipping, pollution and resource extraction. This may diminish their suitability as habitats for harbour porpoises. It is therefore important to ensure that the quality of the habitat allows a viable harbour porpoise population to be supported.

Action required*:*

- Full implementation of the MSFD and relevant decisions by ASCOBANS, HELCOM, CMS and other relevant international bodies. Requisite national legislation
- Monitoring of the effect on porpoise behaviour and distribution of new projects such as marine constructions, shipping, seismic testing and other noise sources

Actors*:* National authorities

Priority: High

6. Implementation and Re-evaluation of the Conservation Plan

This Conservation Plan is adopted *without prejudice to the exclusive competence of the European Union for the conservation of marine biological resources under the common fisheries policy*.

It is important that the Plan and the recommendations outlined within it to be implemented without delay, and that ASCOBANS undertake a formal re-evaluation and revision of the Plan at least every five years. The next review should occur at the AC Meeting before the next Meeting of Parties after the adoption of the Plan. It is also suggested that the authorities of Denmark, Germany and Sweden are asked to supply ASCOBANS with updated information at the meetings of the Jastarnia Group regarding progress in implementation.

The actual implementation of this Plan falls within the remit of the Parties. The Jastarnia Group will act as a Steering Group for evaluating progress and the implementation, establishing further implementation priorities and making appropriate recommendations, and carrying out the periodic reviews.

7. References

Aarefjord H, Bjørge A, Kinze CC, Lindstedt, I (1995) Diet of the harbour porpoise *Phocoena phocoena* in Scandinavian waters. In: Bjørge, A. & Donovan, G.P. (eds.) Biology of the Phocoenids, Special Issue 16, pp. 211-222. IWC, Cambridge.

Andersen LW (2003) Harbour porpoises (*Phocoena Phocoena*) in the North Atlantic: Distribution and genetic population structure . Pages 11-29 in T. Haug, G. Desportes, G. A. Vikingsson, and L. Witting editors. Harbour porpoises in the North Atlantic. The North Atlantic Marine Mammal Commission.

Andersen LW, Holm LE, Siegismund HR, Clausen B, Kinze CC, Loeschcke V (1997) A combined DNA-microsatellite and isozyme analysis of the population structure of the harbour porpoise in Danish waters and West Greenland. Heredity 78:270-276

Bailey H, Thompson PM (2009) Using marine mammal habitat modelling to identify priority conservation zones within a marine protected area. Mar Ecol Prog Ser 378:279–287Barlow J, Cameron GA (2003) Field experiments show that acoustic pingers reduce marine mammal bycatch in the California drift gill net fishery. Mar Mamm Sci 19:265-283

Beineke A, Siebert U, McLachlan M, Bruhn R, Thron K, Failing K, Müller G, Baumgärtner W (2005) Investigations of the potential influence of environmental contaminants on the thymus and spleen of harbor porpoises *(Phocoena phocoena)*. Environ Sci Technol 39: 3933-3938

Beineke A, Siebert U, Stott J, Müller G, Baumgärtner W (2007) Phenotypical characterization of changes in thymus and spleen associated with lymphoid depletion in free-ranging harbor porpoises (*Phocoena phocoena*). Vet Immunol Immunopath 117:254-265

Benke H, Siebert U, Lick R, Bandomir-Krischak B, Weiss R (1998) The current status of harbour porpoises (*Phocoena phocoena*) in German waters. *Archive of Fisheries and Marine Research* 46 (2), 97-123.

Berggren P (1994) Bycatches of the harbour porpoise (*Phocoena phocoena*) in the Swedish Skagerrak, Kattegat and Baltic Seas; 1973-1993. International Whaling Commission (Special Issue 15).

Bjørge A, Donovan GP (1995) Harbour porpoises in the North Atlantic; edited extract from the Report of the Scientific Committee of the International Whaling Commission, Dublin 1995. In: Bjørge, A., Donovan, G.P. (eds). Biology of the Phocoenids: Report of the International Whaling Commission (Special Issue 16). IWC, Cambridge.

Börjesson P, Berggren P, Ganning B (2003) Diet of harbour porpoises in the Kattegat and Skagerrak Seas: accounting for individual variation and sample size. Mar Mamm Sci 19(1):38-58.

Brandt MJ, Diederichs A, Betke K, Nehls G (2011) Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. Marine Ecology-Progress Series 421:205-216

Bruhn R, Kannan N, Petrick G, Schulz-Bull DE, Duinker JC (1999) Persistant chlorinated organic contaminants in harbour porpoises from the North Sea, the Baltic Sea and Arctic waters. Sci Total Environ 237/238:351-361.

Camphuysen CJ, Siemensma ML (2011). Conservation plan for the Harbour Porpoise Phocoena phocoena in The Netherlands: towards a favourable conservation status. NIOZ Report 2011-07, Royal Netherlands Institute for Sea Re- search, Texel.

Carlström J, Berggren P, Tregenza NJC (2009) Spatial and temporal impact of pingers on porpoises. Can J Fish Aquat Sci 66:72-82

Carstensen J, Henriksen OD, Teilmann J (2006) Impacts of offshore wind farm construction on harbour porpoises: acoustic monitoring of echolocation activity using porpoise detectors (T-PODs). Mar Ecol Prog Ser 321:295-308

Cox TM, Read AJ, Solow A, Tregenza N (2001) Will harbour porpoises (*Phocoena Phocoena*) habituate to pingers? J Cetacean Res Manage 3:81-86

Das K, Siebert U, Fontaine M, Jauniaux T, Holsbeek L, Bouquegneau JM (2004) Ecological and pathological factors related to trace metal concentrations in harbour porpoises Phocoena phocoena from the North Sea and adjacent areas. Marine Ecology-Progress Series 281:283-295

Dawson SM, Read A, Slooten E (1998) Fingers, porpoises and power: Uncertainties with using fingers to reduce by catch of small cetaceans. Biol Conserv 84:141-146

Edrén SMC, Wisz MS, Teilmann J, Dietz R, Söderkvist J (2010) Modelling spatial patterns in harbour porpoise satellite telemetry data using maximum entropy. Ecography 33:698–708

Embling CB, Gillibrand PA, Gordon J, Shrimpton J, Stevick PT, Hammond PS (2010) Using habitat models to identify suitable sites for marine protected areas for harbour porpoises (*Phocoena phocoena*). Biol Conserv 143:267–279

Evans PGH, Teilmann J (2009) ASCOBANS/HELCOM Small Cetacean Population Structure Workshop: Held on 8-10 October 2007 At UN Campus, Hermann-Ehlers-Str. 10, 53113 Bonn, Germany. Bonn: ASCOBANS. 141 p. in http://www.ascobans.org/pdf/Report_PopulationStructureWorkshops2007_small.pdf.

Galatius A, Kinze CC, Teilmann J (2010) Population structure of harbour porpoises in the greater Baltic region: Evidence of separation based on geometric morphometric comparisons. Report to ASCOBANS Jastarnia Group, 17 pp.

Galatius, A., Dietz, R., Rigét, F.F., Sonne, C., Kinze, C.C., Lockyer, C., Bossi, R. (2011) Temporal and life history related trends of perfluorochemicals in harbor porpoises from the Danish North Sea. Marine Pollution Bulletin, 62: 1476-1483.

Gilles A, Adler S, Kaschner K, Scheidat M, Siebert U (2011b) Modelling harbour porpoise seasonal density as a function of the German Bight environment: implications for management. Endangered Species Research 14: 157-169

Gilles A, Andreasen H, Walton M, Siebert U (2009) Feeding ecology of harbour porpoises in German waters. In Gilles, A. (2009): Characterisation of harbour porpoise *(Phocoena phocoena*) habitat in German waters. Dissertation (doctoral thesis). University of Kiel, 151 pp.

Gilles A, Peschko V, Siebert U (2011a) Monitoringbericht 2010-2011. Teilbericht marine Säugetiere – Visuelle Erfassung von Schweinswalen. Endbericht für das Bundesamt für Naturschutz, p 5-73 (plus Appendix). http://www.bfn.de/habitatmare/de/downloads/monitoring/BfN-Meeresmonitoring_marine_Saeugetiere_AWZ_2010-2011.pdf

Hall, A.J., Hugunin, K., Deaville, R., Law, R.J., Allchin, C.R., Jepson, P.D. (2006) The risk of infection from polychlorinated biphenyl exposure in harbour porpoise (*Phocoena phocoena*) – A case-control approach. *Environmental Health Perspectives* **114**, 704-711

Halpern BS, Walbridge S, Selkoe KA, Kappel CV, Micheli F, D'Agrosa C, Bruno JF, Casey KS, Ebert C & Fox HE (2008) A Global Map of Human Impact on Marine Ecosystems. Science, 319: 948.

Hammond PS, Benke H, Berggren P, Borchers P, Buckland ST, Collet A, Heide-Jørgensen MP, Heimlich-Boran S, Hiby AR, Leopold MF, Øien N (1995) Distribution and abundance of the harbour porpoise and other small cetaceans in the North Sea and adjacent waters. Life 92-2/UK/027. 240pp.

Hammond PS, Berggren P, Benke H, Borchers DL, Collet A, Heide-Jorgensen MP, Heimlich S, Hiby AR, Leopold MF, Oien N (2002) Abundance of harbour porpoise and other cetaceans in the North Sea and adjacent waters. J Appl Ecol 39:361-376

Hasselmeier I, Abt KF, Adelung D, Siebert U (2004) Stranding patterns of harbour porpoises (*Phocoena phocoena*) in the German North and Baltic Seas; when does the birth period occur? *The Journal of Cetacean Research and Management* 6 (3), 259-263.

Hasselmeier I, Danehl S, Gilles A, Siebert U (2011) Schweinswale und Seevögel der Ostsee – Vorschläge für die Reduzierung von Beifängen in passiven Fanggeräten und die systematische Erfassung von Beifängen – PILOTSTUDIE. Teilbericht Schweinswale, p 4-43 (submitted BfN)

Heide-Jørgensen MP, Mosbech A, Teilmann J, Benke H, Schultz W (1992) Harbour Porpoise (*Phocoena Phocoena*) Densities Obtained from Aerial Surveys North of Fyn and in the Bay of Kiel. Ophelia 35:133-146

Heide-Jørgensen MP, Teilmann J, Benke H, Wulf J (1993) Abundance and distribution of harbour porpoises, *Phocoena phocoena*, in selected areas of the western Baltic and the North Sea. Helgoländer Meeresuntersuchungen 47:335-346

Helle E, Olsson M, Jensen S (1976) PCB levels correlated with pathological changes in seal uteri. Ambio 5:261-263

Herr H, Siebert U, Benke H (2009) Stranding numbers and bycatch implications of harbour porpoises along the German Baltic Sea coast. Document AC16/Doc.62 (P), 16th ASCOBANS Advisory Committee Meeting, 20-24 April 2009, Brugge, Belgium

Hoyt E (2005) Marine Protected Areas for Whales, Dolphins and Porpoises: A World Handbook for Cetacean Habitat Conservation. Earthscan Publications Ltd, London, UK.Huggenberger, S., Benke, H., Kinze, C.C., (2002) Geographical variations in harbour porpoise (*Phocoena phocoena*) skulls; support for a separate non-migratory population in the Baltic proper. Ophelia 56, 1-12.

ICES (2010) Report of the Workshop to Evaluate Aspects of EC Regulation 812/2004 (WKREV812), 28–30 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57. 67 p.

Jepson, P.D., Bennett, P.M., Deaville, R., Allchin, C.R., Baker J.R. & Law, R.J. (2005) Relationships between PCBs and health status in UK-stranded harbour porpoises (Phocoena phocoena). Environmental Toxicology and Chemistry 24, 238–248

Johnston DW, Westgate AJ, Read A J (2005) Effects of fine-scale oceanographic features on the distribution and movements of harbour porpoises *Phocoena phocoena* in the Bay of Fundy. Marine Ecology Progress Series 295:279-293.

Jørgensen PB (2006) Habituation and habitat exclusion of harbour porpoises (Phocoena phocoena) in response to pingers. Masters thesis, University of Copenhagen (unpublished). 83 pp.

Kindt-Larsen L, Dalskov J (2010) Pilot study of marine mammal bycatch by use of an Electronic Monitoring System. Project report to the Directorate for Food, Fisheries and Agri Business. Danish Ministry of Food, Agriculture and Fisheries.

Kindt-Larsen L, Kirkegaard E, Dalskov J (2011) Fully documented fishery: a tool to support a catch quota management system. ICES Journal of Marine Science 68:1606–1610

Kinze CC, Jensen T, Skov R (2003) Fokus på hvaler i Danmark 2000-2002. Biologiske Skrifter, nr.2, Fiskeri- og Søfartsmuseet, Esbjerg, Denmark.

Kleivane L, Skaare JU, Bjorge A, Deruiter E, Reijnders PJH (1995) Organochlorine Pesticide-Residue and PCBs in Harbour Porpoise (*Phocoena Phocoena*) Incidentally Caught in Scandinavian Waters. Environmental Pollution 89:137-146

Kock KH, Benke H (1996) On the by-catch of harbour porpoise (*Phocoena Phocoena*) in German fisheries in the Baltic and the North Sea. Arch Fish Mar Res 44:95-114

Koopman HN (1998) Topographical distribution of the blubber of harbor porpoises *(Phocoena phocoena)*. J Mammal 79:260 – 270

Kuiken T, Bennett PM, Allchin CR, Kirkwood JK, Baker JR, Lockyer CH, Walton MJ, Sheldrick MC (1994) Pcbs, Cause of Death and Body Condition in Harbour Porpoises (*Phocoena phocoena*) from British Waters. Aquatic Toxicology 28:13-28

Larsen F, Vinther M, Krog C (2002) Use of pingers in the Danish North Sea wreck net fishery. IWC Scientific Committee.

Law, R.J, Barry, J., Barber, J.L., Bersuder, P., Deaville, R., Reid, R.J., Brownlow, A., Penrose, R., Barnett, J., Loveridge, J., Smith, B. and Jepson, P.D. (2012) Contaminants in cetaceans from UK waters: status as assessed within the Cetacean Strandings Investigation Programme from 1990 to 2008. *Marine Pollution Bulletin* **64**: 1485-1494.

Law, R.J., Bersuder, P., Barry, J., Deaville, R., Reid, R.J., Jepson, P.D. (2010) Chlorobiphenyls in the blubber of harbour porpoises (*Phocoena phocoena*) from the UK: levels and trends 1991-2005. *Marine Pollution Bulletin* **60**, 470-473.

Lehnert K, Raga JA, Siebert U (2005) Macroparasites in stranded and bycaught harbour porpoises from German and Norwegian waters. Dis Aqua Org 64, 265-269

Letcher RJ, Bustnes JO, Dietz R, Jenssen BM, Jorgensen EH, Sonne C, Verreault J, Vijayan MM, Gabrielsen GW (2010) Exposure and effects assessment of persistent organohalogen contaminants in arctic wildlife and fish. Science of the Total Environment 408:2995-3043

Lockyer C (2007) All creatures great and smaller: a study in cetacean life history energetics. J Mar Biol Assoc UK 87:1035-1045

Lockyer C, Kinze CC (2003) Status, ecology and life history of harbour porpoises (*Phocoena Phocoena*), in Danish waters. NAMMCO Scientific Publications 5:143-176

Lowry N, Teilmann J (1994) Bycatch and bycatch reduction of the harbour porpoise (*Phocoena Phocoena*) in Danish waters. Pages 203-209 in W. F. Perrin, G. P. Donovan, and J. Barlow editors. Gillnets and Cetaceans. Reports of the International Whaling Commission Special Issue. (special issue 15), Cambridge

Lunneryd SG, Königson S, Sjöberg NB (2004) By-catch of seals, harbour porpoises and birds in Swedish commercial fisheries. Fiskeriværket informarer: 8

Marubini F, Gimona A, Evans PGH, Wright PJ, Pierce GJ (2009) Habitat preferences and interannual variability in occurrence of the harbour porpoise *Phocoena Phocoena* off northwest Scotland. Mar Ecol Prog Ser 381:297–310

Müller G, Siebert U, Wünschmann A, Artelt A, Baumgärtner W (2000) Immunohistological and serological investigation of morbillivirus infection in harbour porpoises (*Phocoena phocoena*) from German Baltic and North Sea. Vet Microbio 75, 17-25

Murphy S, Pierce GJ, Law RJ, Bersuder P, Jepson PD, Learmonth JA, Addink M, Dabin W, Santos MB, Deaville R, Zegers BN, Mets A, Rogan E, Ridoux V, Reid RJ, Smeenk C, Jauniaux T, López A, Alonso Farré JM, González AF, Guerra A, García-Hartmann M, Lockyer C, Boon JP (2010) Assessing the effect of persistent organic pollutants on reproductive activity in common dolphins and harbour porpoises. Journal of Northwest Atlantic Fishery Science 42:153-173

NOAA Fisheries, Protected Species Division (PRD) (2010) Harbour Porpoise Take Reduction Plan Monitoring Strategy, Monitoring the Effectiveness and Regulatory Compliance of the Harbour Porpoise Take Reduction Plan (HPTRP). 18 p. Available from: (http://www.nero.noaa.gov/prot_res/porptrp/doc/HPTRP%20Monitoring%20Summary%2 04-2-2010.pdf)

O'Shea TJ, Tanabe S (2003) Persistent ocean contaminants and marine mammals: a retrospective overview. In: J.G. Vos, G.D. Bossart, M. Fournier, and T.J. O'Shea (eds.). Toxicology of marine mammals. London ; New York: Taylor & Francis Publishers. p 99-134

Ovegård M, Königson S, Persson A, Lunneryd SG (2011) Size selective capture of Atlantic cod (*Gadus morhua*) in floating pots. Fisheries Research 107

Palka DL, Rossman MC, Vanatten AS, Orphanides CD (2008) Effect of pingers on harbour porpoise (*Phocoena phocoena*) bycatch in the US Northeast gillnet fishery. Journal of Cetacean Resource and Management 10:217-226

Reijnders PJH (1992) Harbour porpoises *Phocoena phocoena* in the North Sea: numerical responses to changes in environmental conditions. Netherlands Journal of Aquatic Ecology 26:75-85

Reijnders PJH, Aguilar A, Borrell A (2008) Marine Mammals and Pollution In: Encyclopedia of Marine Mammals / Perrin W, Wursig B, Thewissen J. Academic Press, Amsterdam

Rubsch S, Kock KH (2004) German part-time fishermen in the Baltic Sea and their by-catch of harbour porpoise. ASCOBANS 11th Advisory Committee Meeting Document AC11/Doc. 10(P), Jastrzebia Góra, Poland, 27 - 29 April 2004

Santos MB, Pierce GJ (2003) The diet of harbour porpoise *(Phocoena phocoena)* in the North East Atlantic. Oceanography and Marine Biology: an annual Review 41:355-390

Santos MB, Pierce GJ, Learmonth JA, Reid RJ, Ross HM, Patter- son IAP, Reid DG, Beare D (2004) Variability in the diet of harbor porpoises *(Phocoena phocoena)* in Scottish waters 1992–2003. Marine Mammal Science 20:1–27

SCANS-II (2008) Small Cetaceans in the European Atlantic and North Sea (SCANS-II). Final report to the European Commission under project LIFE04NAT/GB/000245. University of St Andrews, St. Andrews, U.K.

Scheidat M, Gilles A, Kock KH, Siebert U (2008) Harbour porpoise *Phocoena phocoena* abundance in the southwestern Baltic Sea. Endangered Species Research 5:215-223

Scheidat M, Tougaard J, Brasseur S, Carstensen J, Petel TV, Teilmann J, Reijnders P (2011) Harbour porpoises (*Phocoena phocoena*) and wind farms: a case study in the Dutch North Sea. Environmental Research Letters 6:

Seibel H, Prahl S, Kuhn E, Rettmann P, Siebert U (2010) Untersuchungen und Beurteilung evtl. Belastung durch Pinger (akustische Vergrämer) auf Schweinswale in der EU-Fischerei. Final report to the German Federal Ministry of Nutrition, Agriculture and Food Consumption Safety. 121 pp.

Shester GG, Micheli F (2011) Conservation challenges for small-scale fisheries: Bycatch and habitat impacts of traps and gillnets. Biol Conserv 144:1673-1681

Siebert U, Gilles A, Dähne M, Peschko V, Krügel K, Benke H, Lucke K, Müller S, Adler S, Sundermeyer J (2012) Ergänzende Untersuchungen zum Effekt der Bau- und Betriebsphase im Offshore-Testfeld „alpha ventus“ auf marine Säugetiere. In: Blasche, K., Dahlke, C., Boethling, M., Binder, A. (eds). Ökologische Begleitforschung am Offshore-Testfeldvorhaben „alpha ventus“ zur Evaluierung des Standarduntersuchungskonzeptes des BSH – StUKplus. Fortschrittsbericht 2011 (submitted)

Siebert U, Gilles A, Lucke K, Ludwig M, Benke H, Kock KH, Scheidat M (2006) A decade of harbour porpoise occurrence in German waters - Analyses of aerial surveys, incidental sightings and strandings. Journal of Sea Research 56:65-80

Siebert U, Joiris C, Holsbeek L, Benke H, Failing K, Frese K, Petzinger E (1999) Potential relation between mercury concentrations and necropsy findings in cetaceans from German waters of the North and Baltic Seas. Marine Pollution Bulletin 38:285-295

Siebert U, Müller G, Desportes G, Weiss R, Hansen K, Baumgärtner W (2002) Pyogranulomatous myocarditis due to *Staphylococcus aureus* septicemia in two harbour porpoises (*Phocoena phocoena*). Vet Rec 150, 273-277

Siebert U, Seibel H, Lehnert K, Hasselmeier I, Müller S, Schmidt K, Sundermayer J, Redemaker M, Peschko V, Rosenberger T, Wingberg S (2009) Totfundmonitoring von Kleinwalen und Kegelrobben in Schleswig-Holstein 2008. Bericht an das Ministerium für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein. Forschungs- und Technologiezentrum Westküste, Christian-Albrechts-Universität zu Kiel, Büsum, April 2009. 48 pp.

Siebert U, Seibel H, Lehnert K, Hasselmeier I, Müller S, Schmidt K, Sundermayer J, Redemaker M, Peschko V, Rosenberger T, Wingberg S (2010) Totfundmonitoring von Kleinwalen und Kegelrobben in Schleswig-Holstein 2009. Bericht an das Ministerium für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein. Forschungs- und

Technologiezentrum Westküste, Christian-Albrechts-Universität zu Kiel, Büsum, April 2010. 48 pp.

Siebert U, Wünschmann A, Weiss R, Frank H, Benke H, Frese K (2001) Post-mortem findings in harbour porpoises (*Phocoena phocoena*) from the German North and Baltic Seas. Journal of Comparative Pathology 124:102-114

Skov H, Thomsen F (2008) Resolving fine-scale spatio-temporal dynamics in the harbour porpoise *Phocoena phocoena*. Marine Ecology Progress Series 373:173–186

Sørensen TB, Kinze CC (1994) Reproduction and reproductive seasonality in Danish harbour porpoises, *Phocoena phocoena*. Ophelia 39:159-176

Svedäng H (2010) Long-term impact of different fishing methods on the ecosystem in the Kattegat and Öresund. Report for European Parliament's Committee on Fisheries. IP/B/PECH/IC/2010_24. Swedish Institute for the Marine Environment.

Sveegaard S (2011) Spatial and temporal distribution of harbour porpoises in relation to their prey. PhD Thesis. National Environmental Research Institute, Aarhus University, Denmark.

Sveegaard S, Andreasen H, Mouritsen KN, Jeppesen JP, Teilmann J, Kinze CC (2012) Correlation between the seasonal distribution of harbour porpoises and their prey in the Sound, Baltic Sea. Marine Biology 159:1029–1037

Sveegaard S, Teilmann J, Berggren P, Mouritsen KN, Gillespie D, Tougaard J (2011a) Acoustic surveys confirm areas of high harbour porpoise density found by satellite tracking. ICES Journal of Marine Science 68:929-936

Sveegaard S, Teilmann J, Tougaard J, Dietz R, Mouritsen KN, Desportes G, Siebert U (2011b) High density areas for harbour porpoises (*Phocoena phocoena*) identified by satellite tracking. Marine Mammal Science 27: 230–246

Swenshon, M., Lämmler, C. and Siebert, U. (1998). Identification and molecular characterization of beta-hemolytic Streptococci isolated from harbour porpoises (*Phocoena phocoena*) of the North and Baltic Sea. Journal of Clinical Microbiology 36: 1902-1906.

Teilmann J, Larsen F, Desportes G (2007) Time allocation and diving behaviour of harbour porpoises (*Phocoena phocoena*) in Danish and adjacent waters. Journal of Cetacean Management 9:201-210

Teilmann J, Sveegaard S, Dietz R (2011) Status of a harbour population - evidence for population separation and declining abundance. In Sveegaard 2010. Spatial and temporal distribution of harbour porpoises in relation to their prey. PhD Thesis.

Teilmann J, Tougaard J, Carstensen J (2009) Baseline monitoring of harbour porpoises -Rødsand 2 Offshore Wind Farm. NERI Commissioned Report to E.ON Vind Sverige. Roskilde, Denmark. 58 pp.

Teilmann J, Tougaard J, Miller LA, Kirketerp T, Hansen K, Brando S (2006) Reactions of captive harbor porpoises (Phocoena phocoena) to pinger-like sounds. Marine Mammal Science 22:237-506

Thøstesen CB, Baagøe HJ, Jensen LF, Skov R (2010) Strandede havpattedyr i Danmark 2009. Beredskabet vedrørende Havpattedyr og Havfugle. Fiskeri- og Søfartsmuseet, Esbjerg.

Thron KU, Bruhn R, McLachlan MS (2004) The influence of age, sex, body-condition, and region on the levels of PBDEs and toxaphene in harbour porpoises from European waters. Fresenius Environmental Bulletin 13:146-155

Tiedemann R, Harder J, Gmeiner C, Haase E (1996) Mitochondrial DNA sequence patterns of harbour porpoises (Phocoena phocoena) from the North and the Baltic Seas. Z Säugetierkunde 61:104– 111

Tougaard J, Carstensen J, Bech NI, Teilmann J (2006) Final report on the effect of Nysted Offshore Wind Farm on harbour porpoises. Technical report to Energi E2 A/S. 65 pp. Available at: http://www.ens.dk/graphics/Energiforsyning/Vedvarende_energi/Vind/havvindmoeller/vvm%20Horns%20Rev%202/Nysted/Nysted%20marsvin%20final.pdf.

Trippel EA, Strong MB, Terhune JM, Conway JD (1999) Mitigation of harbour porpoise (*Phocoena phocoena*) by-catch in the gillnet fishery in the lower Bay of Fundy. Can J Fish Aquat Sci 56:113-123

Verfuss UK, Honnef CG, Meding A, Dahne M, Mundry R, Benke H (2007) Geographical and seasonal variation of harbour porpoise (*Phocoena phocoena*) presence in the German Baltic Sea revealed by passive acoustic monitoring. J Mar Biol Assoc UK 87:165-176

Vitale F, Borjesson P, Svedang H, Casini A (2008) The spatial distribution of cod (*Gadus morhua* L.) spawning grounds in the Kattegat, eastern North Sea. Fisheries Research 90:36-44

Weijs L, van Elk C, Das K, Blust R, Covaci A (2010) Persistent organic pollutants and methoxylated PBDEs in harbour porpoises from the North Sea from 1990 until 2008. Young wildlife at risk? Science of the Total Environment 409:228-237

Wiemann A, Andersen LW, Berggren P, Siebert U, Benke H, Teilmann J, Lockyer C, Pawliczka I, Skora K, Roos A, Lyrholm T, Paulus KB, Ketmaier V, Tiedemann R (2010) Mitochondrial Control Region and microsatellite analyses on harbour porpoise (*Phocoena phocoena*) unravel population differentiation in the Baltic Sea and adjacent waters. Conserv Genet 11:195-211

Wünschmann A, Siebert U, Frese K, Weiss R, Lockyer C, Heide-Jorgensen MP, Muller G, Baumgartner W (2001) Evidence of infectious diseases in harbour porpoises (*Phocoena phocoena*) hunted in the waters of Greenland and by-caught in the German North Sea and Baltic Sea. Veterinary Record 148:715-720

Wünschmann A, Siebert U, Weiss R (1999) Rhizopusmycosis in a harbour porpoise from the Baltic Sea. J Wildl Dis 35(3):569-573.

Yap, X., Deaville, R., Perkins, M.W., Penrose, R., Law, R.J., and Jepson, P.D. (2012) Investigating links between polychlorinated biphenyl (PCB) exposure and thymic involution and thymic cysts in harbour porpoises (*Phocoena phocoena*). *Marine Pollution Bulletin* **64**: 2168-2176.

APPENDIX I - List of relevant reports (grey literature)

Denmark

Andreasen H (2009) Marsvinets (*Phocoena phocoena*) rolle som prædator i de danske farvande. PhD thesis. University of Copenhagen, 97 pp

Sveegaard S (2011) Spatial and temporal distribution of harbour porpoises in relation to their prey. PhD Thesis. National Environmental Research Institute, Aarhus University, Denmark.

Teilmann, J, Dietz, R, Larsen, F, Desportes, G, Geertsen, BM, Andersen, LW, Aastrup, P, Hansen, JR, Buholzer, L (2004) Satellitsporing af marsvin i danske og tilstødende farvande. Danmarks Miljøundersøgelser. 86 s. – Scientific report from NERI no. 484

Teilmann, J, Sveegaard, S, Dietz, R, Petersen, IK, Berggren, P, Desportes, G (2008) High density areas for harbour porpoises in Danish waters. National Environmental Research Institute, University of Aarhus. 84 pp. – Scientific report from NERI no. 657.

Germany

Danehl, S (2011) Entwicklung von Schweinswal-Strandfunden und Beifängen (*Phocoena phocoena*) an der deutschen Ostseeküste von 1990 bis 2010. Bachelor thesis, University of Kiel, 47 pp.

Gilles, A (2009) Characterisation of harbour porpoise (*Phocoena phocoena*) habitat in German waters. Dissertation (doctoral thesis). Christian-Albrechts-Universitätzu Kiel, 151 pp.

Gilles, A, Andreasen, H, Müller, S, Siebert, U (2008) Nahrungsökologie von marinen Säugetieren und Seevögeln für das Management von NATURA 2000 Gebieten. Teilvorhaben: Marine Säugetiere. Endbericht für das Bundesamt für Naturschutz. F+E Vorhaben FKZ: 805 85 018. 65 pp.

Gilles, A, Peschko, V, Siebert, U (2011) Monitoringbericht 2010-2011. Marine Säugetiere und Seevögel in der deutschen AWZ von Nord- und Ostsee. Teilbericht marine Säugetiere – Visuelle Erfassung von Schweinswalen. Endbericht für das Bundesamt für Naturschutz, p 5-73 (plus appendix). - A yearly report on monitoring of abundance, distribution and habitat use of marine mammals in the German offshore waters under Natura2000. http://www.bfn.de/habitatmare/de/downloads/monitoring/BfN-Meeresmonitoring_marine_Saeugetiere_AWZ_2010-2011.pdf

Gilles, A, Siebert, U (2009) Erprobung eines Bund/Länder-Fachvorschlags für das Deutsche Meeresmonitoring von Seevögeln und Schweinswalen als Grundlage für die Erfüllung der Natura 2000 – Berichtspflichten mit einem Schwerpunkt in der deutschen AWZ von Nord- und Ostsee (FFH-Berichtsperiode 2007-2012) – Teilbericht Schweinswale. Visuelle Erfassung von Schweinswalen. Endbericht für das Bundesamt für Naturschutz, p 5-30; http://www.bfn.de/habitatmare/de/downloads/monitoring/BfN-Monitoring_MarineSaeugetiere_2008-2009.pdf - A yearly report on monitoring of abundance, distribution and habitat use of marine mammals in the German offshore waters under Natura2000.

Hasselmeier, I, Danehl, S, Gilles, A, Siebert, U (2011) Schweinswale und Seevögel der Ostsee – Vorschläge für die Reduzierung von Beifängen in passiven Fanggeräten und die systematische Erfassung von Beifängen – PILOTSTUDIE. Teilbericht Schweinswale, p 4-43 (submitted BfN)

Herr, H (2009) Vorkommen von Schweinswalen (*Phocoena phocoena*) in Nord- und Ostsee – im Konflikt mit Schifffahrt und Fischerei? Dissertation (doctoral thesis). Universität Hamburg, 118 pp

Prahl, S, Kuhn, E, Gaethke, U, Frankenberg, A, Ludwig, M, Siebert, U (2005) Pilotprojekt zur „akustischen Belastung von Schweinswalen". Endbericht an das Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft, 65 pp

Rubsch S, Kock KH (2004) German part-time fishermen in the Baltic Sea and their bycatch of harbour porpoise. ASCOBANS 11th Advisory Meeting, Jastrzebia Góra, 27–29 April, 2004. Doc AC11/Doc10 (P) www.service- board.de/ascobans_neu/files/ac11-10.pdf

Seibel, H, Siebert, U (2010) Untersuchung und Beurteilung evtl. Belastung durch Pinger (akustische Vergrämer) auf das Gehör von Schweinswalen in der EU-Fischerei. Endbericht an das Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft, 122 pp

Siebert, U, Seibel, H, Lehnert, K, Hasselmeier, I, Müller, S, Schmidt, K, Sundermeyer, J, Rademaker, M, Peschko, V, Rosenberger, T, Wingberg, S (2010) Totfundmonitoring von Kleinwalen und Kegelrobben in Schleswig-Holstein 2009. Bericht an das Ministerium für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein. 48 pp. - a yearly report on stranded marine mammals.

Sweden

Carlén I, Isaeus M (2007) Distribution of harbour porpoise prey species in the Baltic Sea. Kolmårdens Djurpark / Naturvårdsverket.

Königson, S (2008) Åtgärdsprogramförtumlare 2008–2013 (*Phocoena phocoena*). Julia Carlström och Christina Rappe, Naturvårdsverket, Fiskeriverket. – *National management program for harbour porpoises.*

Königson, S, Lunneryd SG, Ljunghager, F (2010) Lovande torskfiske med bur. Promising cod fishing with pots. Havsutsikt 3. Report to a journal for The Swedish institute for the marine environment.

Lindahl U, Rappe C (2003) Åtgärdsprogramförtumlare (*Phocoena phocoena*). - Naturvårdsverket, Åtgärdsprogram– *National management program for harbour porpoises.*

Lunneryd SG, Königson S, Sjöberg NB (2004) Bifångstavsäl, tumlareochfåglar i detsvenskayrkesfisket (By-catch of seals, harbour porpoises and birds in Swedish commercial fisheries). In Swedish with an English summary. Fiskeriverket, Göteborg, Sweden.

Österblom H (2002) Bifångster i fiskeredskap av fågel, sälochtumlare iÖstersjön. Naturhistoriskariksmuseet, Stockholm. 25 s. – *Bycatch in fishery of birds, seals and harbour porpoises in the Baltic.*

Tilander, D, Lunneryd SG (2009) Pilot study of Electronic Monitoring (EM) system for fisheries control on smaller vessels. Report to the Swedish Board of Fisheries.

Other

ASCOBANS (2009) ASCOBANS Recovery Plan for Baltic Harbour Porpoises (Jastarnia Plan). http://www.ascobans.org/pdf/ASCOBANS_JastarniaPlan_MOP6.pdf

ASCOBANS (2009) ASCOBANS Conservation Plan for Harbour Porpoises (*Phocoena phocoena* L.) in the North Sea. http://www.ascobans.org/pdf/ASCOBANS_NorthSeaPlan_MOP6.pdf

Hammond PS, Bearzi G, Bjørge A, Forney K, Karczmarski L, Kasuaya T, Perrin WF, Scott MD, Wang JY, Wells RS, Wilson B (2008) *Phocoena phocoena (Baltic Sea subpopulation)*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2.

HELCOM (2010) Hazardous substances in the Baltic Sea. Baltic Sea Environment Proceedings No. 120B, 119 pp.

ICES (2010) Report of the ICES Advisory Committee, 2010., Copenhagen, Denmark. ICES Advice 2010, Books 1-11.

IWC (International Whaling Commission) (2012) Report of the Scientific Committee, 2012. Panama City, Panama.

EU Legislation

EC (2001) Interpretation note: Selection of sites for the species of Annex II *Phocoena Phocoena*. Habitats Committee, Hab. 01/05.

EU (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (The Habitats Directive) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1992:206:0007:0050:EN:PDF

EU (2004) COUNCIL REGULATION (EC) No 812/2004 of 26 April 2004 laying down measures concerning incidental catches of cetaceans in fisheries and amending Regulation (EC) No 88/98. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:150:0012:0031:EN:PDF

EU (2008) DIRECTIVE 2008/56/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)

EU (2009) COUNCIL REGULATION (EC) No 1224/2009of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy