Agenda Item 7 Cooperation with other Bodies

Cooperation and Joint Initiatives with CMS

Document Inf.7.1.c

Final Report of the NAMMCO Scientific Committee Working Group on Harbour Porpoises

Action Requested

- Take note

Submitted by NAMMCO

NOTE:
DELEGATES ARE KINDLY REMINDED TO BRING THEIR OWN COPIES OF DOCUMENTS TO THE MEETING

Secretariat's Note

The Rules of Procedure adopted at the 19th Meeting of the ASCOBANS Advisory Committee remain in force until and unless an amendment is called for and adopted.

ANNEX 1

**NAMMCO SCIENTIFIC COMMITTEE WORKING GROUP
ON HARBOUR PORPOISES
Copenhagen, Denmark, 4-6 November 2013
Report**

1. CHAIRMAN'S WELCOME AND OPENING REMARKS

Chair Mikkelsen (Faroe Islands) welcomed the participants (Appendix 1) to the meeting of the NAMMCO Working Group on Harbour Porpoises. He gave a brief introduction to NAMMCO, describing that Council will request information from the Scientific Committee (SC), and the SC will, when necessary, establish working groups to gather information around the requests. NAMMCO previously held a harbour porpoise working group in 1999, which gave rise to the NAMMCO Scientific Publications series Volume 5 published in 2003.

The current meeting was organized in response to the following request from NAMMCO Council: R-3.10.1 - NAMMCO/7-1997: to conduct a comprehensive assessment of the harbour porpoise throughout its range. In response to this request, the SC recommended (SC-19-15.3) that assessments of harbour porpoise be attempted for all areas by the working group, which would require at least two meetings. This meeting is the first meeting that will aim to provide a full assessment for West Greenland, and initiate the process for Norway, including a review of the method used for obtaining total by-catch estimates.

The outcome of this meeting will be a report with a list of recommendations.

2. ADOPTION OF AGENDA

The adopted revised agenda is given in Appendix 2.

3. APPOINTMENT OF RAPPORTEURS

Prewitt was appointed as rapporteur, with the help of other participants where needed.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

Documents submitted for use in this meeting are listed in Appendix 3.

5. GREENLAND ASSESSMENT

5.1 Stock delineation

Nielsen presented the first data from satellite tracking of harbour porpoises (*Phocoena phocoena*) from West Greenland (SC/20/HP/08). Two female harbour porpoises (1 adult and 1 sub-adult) were driven into drift nets and equipped with satellite transmitters in July 2012, off West Greenland. The tags provided positions for +431 days (still transmitting) and 417 days, for the adult and sub-adult, respectively, and data on daily depths of dives (± 0.5 m). After leaving the west coast of Greenland, the adult female made extensive movements north to the Disko Bay, south to East Greenland and south east into the central North Atlantic where it wintered (Fig. 1). It moved back to West Greenland the following summer. The other porpoise crossed the southern Davis Strait to Canada twice where it wintered in offshore waters before returning to the tagging site in West Greenland one year later. The porpoises travelled >17,500 km and 10,000 km (adult and sub-adult, respectively), spent on average 83 % (72% for the sub-adult and 94% for the adult) of their time in offshore areas (depths >200 m) and had maximum dives down to 382 m (the sub-adult) and 410 m (the adult). This is the first documentation of the annual movement cycle of an odontocete in the North Atlantic. The two harbour porpoises in this study displayed site fidelity to the summer feeding ground and, despite different movement patterns, both demonstrated that they were capable of inhabiting oceanic parts of the North Atlantic for a major part of the year. This is in contrast to the perception that species is mainly coastal and suggests that the occurrence of the species in offshore areas has been overlooked likely because of their inconspicuous appearance and frequent sightings in coastal waters.

The working group welcomed this new study that provided interesting new information on movements of harbour porpoise in West Greenland, revealing extensive offshore movements that have not been documented in other areas. In addition, record dive depths to 410 m were logged. This new information was made possible by the high longevity of the tags, which lasted for more than one year.

The two animals described in this paper were tagged in July 2012. In addition, Nielsen and Heide-Jørgensen informed the group that additional animals were tagged in 2013, during two tagging periods: 7 were tagged in July and 8 were tagged in Sept/Oct 2013. Most of the 2013 animals were females, but 4 males were also tagged.

Caution is needed in interpretation of these data because they come from only 2 animals. Data from the animals tagged in 2013 (which include some males) will show if the movements and diving behaviour seen thus far are representative of harbour porpoises in West Greenland.

The group discussed factors that may influence this extensive offshore movement (Fig. 1). The animals could be feeding on small mesopelagic fishes and squids, but the working group would require more knowledge of fish and squid resources in the waters off Greenland, or in the Irminger Sea and in the Central North Atlantic to comment more on the possible interactions between harbour porpoises and these fisheries. There is a fishery in the Irminger Sea for redfish and a developing fishery for mackerel, which has the potential to include some by-catch of harbour porpoise. While the redfish fishery usually occurs in May-August outside of the depth range (600-700 m) of harbour porpoises (but see Sigurðsson, Þ. *et al.* 2006), the mackerel fishery may occur with more overlap (higher in the water column). Pierce reported that mackerel were present in harbour porpoise diets (1.5% of weight in stomachs from porpoises off Scotland). Some bias exists in these data because mackerel otoliths are fragile, but the proportion of the diet is still likely very small.

Questions were raised concerning whether there is an influence of ice cover and lack of daylight on the harbour porpoise movements. It is believed that most harbour porpoises move south outside sea ice range, thus avoiding ice entrapment. However, there is little information on the vertical migrations of potential prey items during winter in the Arctic. The dive depths of the 2 tagged animals suggest that the porpoises could feed at or near the bottom when they were near the coast, but not while offshore.

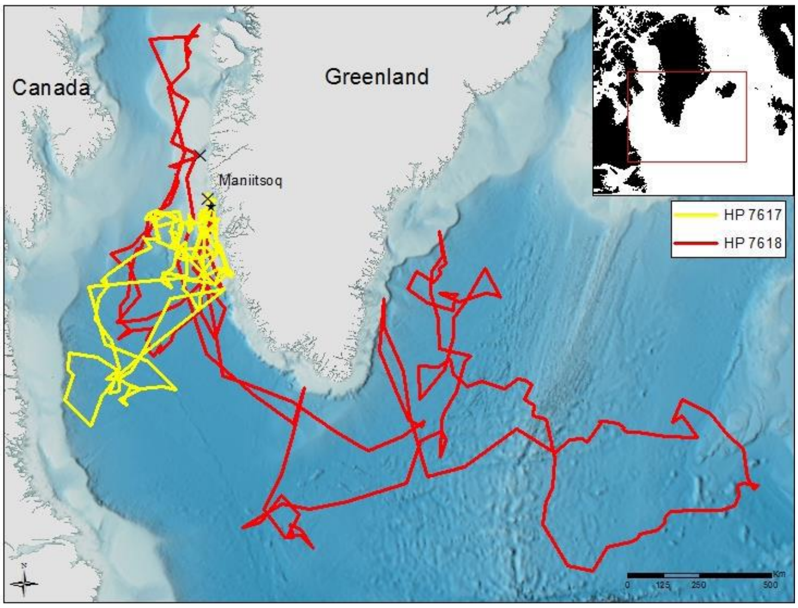

Figure 1. From SC/20/HP/08, Fig. 1. Movements of two harbour porpoises tracked by satellite. The star indicates where the porpoises were tagged on 25 July 2012 and the X's show the ends of the 2 tracks on 30 September 2013 after 431 and 417 days, respectively, with positions.

While they were in coastal areas, tracking showed that they did not use the fjords, which is contrary to behaviour seen in Norway.

The main conclusions of this study were that the harbour porpoises showed deep dive depths not previously documented, spent most of the year in offshore waters, and exhibited site fidelity to West Greenland (returned to tagging location within a couple of weeks of the tagging date the following year).

Previous genetics studies have suggested that porpoises off West Greenland constitute a separate population from animals off Newfoundland, in the Gulf of Maine, and off Iceland (Andersen 2003). With respect to stock delineation, the tagged animals demonstrated that they have the potential to move well offshore, beyond the previously described areas of distribution (Fig. 2). In agreement with the genetics studies, the tagged animals did not indicate any overlap with other stocks to the West, off Canada, and to the East, off Iceland. However, the winter range of these other stocks is unknown.

These genetic data were from 1995 and it was recommended that genetic studies should be updated with more recent samples (*e.g.* from the 2009 set of samples described in Heide-Jørgensen *et al.* 2011), and considered together with movements from tagging studies. Given the new data on offshore movements of porpoises from West Greenland, and increasingly favourable conditions for harbour porpoises in this area (Heide-Jørgensen *et al.* 2011), it is important to know if there is an influx of animals from other stocks that could contribute to the harvest.

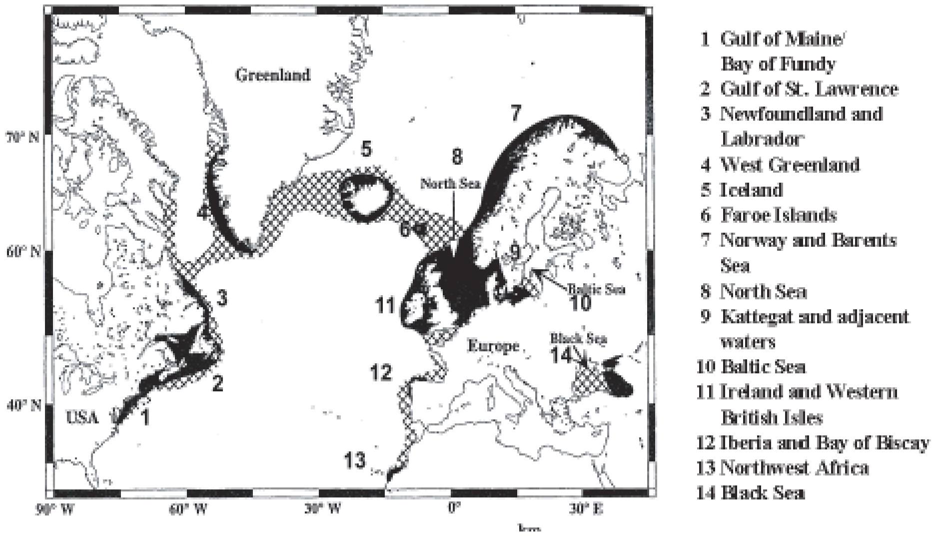

Figure 2. Figure and caption from Andersen (2003) Fig. 1. Map showing the distribution of harbour porpoise populations/sub-populations and possible range in the North Atlantic (After IWC 1996 and Rosel et al. 1999). Populations and sub-populations and their possible range are indicated by solid black areas, while cross-hatched areas are the possible migration routes across the North Atlantic.

In conclusion, the working group **reiterated** that West Greenland should be considered a separate stock, and a separate management unit, based on current evidence.

5.2 Biological parameters

Heide-Jørgensen presented data on life history parameters from the catch of harbour porpoises with comparisons between three time periods (1988-1989, 1995, and 2009) (SC/20/HP/04). The data (Table 1) included age distribution (maximum age recorded was 17 years) and mean age at sexual maturity (as judged by presence of one or more corpora in females and combined testes weight exceeding 200g in males).

Table 1. Mean age at sexual maturity with SE in parentheses.

	Females 1995 n=55	Females 2009 n=60	Males 1995 n=48	Males 2009 n=29
Mean age at sexual maturity	3.7 (0.03)	3.5 (0.03)	2.7 (0.03)	3.1 (0.08)

There were few animals above age 10 years, which is similar to the age distributions seen in other areas (North Sea and Danish waters). However, there were some differences in frequencies of younger animals caught, which may be due to hunter selection and seasonality (*e.g.*, the 1995 catches were earlier in the year).

The age structure of the animals obtained from the hunt is influenced by selectivity, and is not necessarily representative of the population. In particular, the youngest animals are underrepresented in catches.

Discussion focused on the biological parameters to use in assessment modelling. The following parameters were agreed upon:

- Age at first reproduction: 3-5 years (see Table 1 above; figures are similar to those found in studies on porpoises from other areas)
- Pregnancy rate: 0.85 – 1 (unpublished data, Greenland Institute of Natural Resources; again consistent with some other studies, although higher than some estimates from strandings but the latter estimates tend to be downwardly biased due to poor health status of samples mature females)
- Calving interval: 1/year (average) and no evidence of senescence (Lockyer et al. 2001, 2003)

5.3 Abundance estimation

Heide-Jørgensen presented a new abundance estimate from West Greenland (SC/20/HP/07). A large-scale multispecies aerial survey conducted in August-September 2007 and was used to estimate the abundance of harbour porpoises in coastal areas of West Greenland (Hansen and Heide-Jørgensen 2013). The resultant estimate of the at-surface abundance of harbour porpoises inside the surveyed area corrected for perception bias was 10,314 (cv=0.35). Information from satellite tracking of 9 porpoises was used to estimate the proportion of porpoises that can be expected to be outside the survey strata during the survey period. The 9 porpoises spent a total of 73 % (cv=0.13) of their days in August-September 2012 and 2013 inside the strata covered by the aerial survey. Correcting for this increases the at-surface abundance estimate to 14,129 (cv=0.37) porpoises. Two porpoises tracked from July 2012 through October 2013 provided data on the time spent at the surface during daytime in August-September in both years. The average percentage of time spent at 0 m depth was 5.14% (cv=0.13). Correcting the at-surface abundance estimate for porpoises detected breaking the surface provided a fully corrected abundance estimate of 274,883 (cv=0.39, 95% CI 130,974-576,909) harbour porpoises in West Greenland 2007.

The working group accepted the approach of correcting the abundance estimate for the percentage of time (27%) that the two tagged animals had spent outside the survey area in August and September (Figure 3; SC/20/HP/07).

The working group had considerable discussion of the correction factor used in SC/20/HP/07 to account for animals not available at the surface. It was noted that the overall correction factor, $g(0)$, for animals missed on the transect line used to correct the Greenland survey estimate was 0.57 (perception bias; Hansen and Heide- Jørgensen 2013) x 0.0514 (availability bias) = 0.0293, which was an order of magnitude less than estimates from other aerial surveys for porpoises; *e.g.* 0.14-0.37 in the SW Baltic Sea (Scheidat *et al.* 2008), 0.31-0.45 from SCANS-II (Hammond *et al.* 2013).

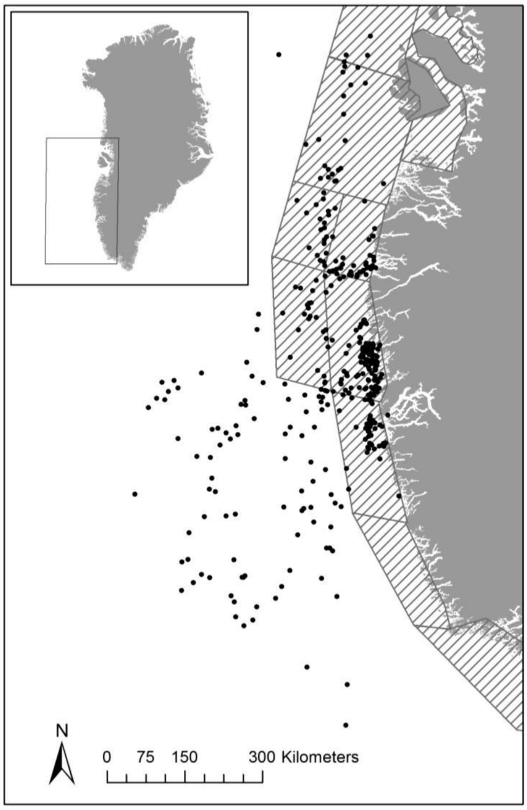

Figure 3. from SC/20/HP/07, Fig. 2. Distribution of daily positions of harbour porpoises relative to survey strata used for the aerial survey in West Greenland 2007.

Appropriate application of this correction factor requires consistency between the data used on (a) the criteria for detection of animals seen at the surface during the survey and (b) the tag data used to estimate the proportion of time that animals are at the surface.

Animals seen at the surface

Fewer than 20% of animals were recorded as being below the surface when detected on the survey (Table 2). All of these eight sub-surface sightings were made by the rear observer and all were duplicates of sightings made by the front observer. These sightings thus contributed to the correction for perception bias but not to the encounter rate and not, therefore, to the uncorrected abundance estimate in Hansen & Heide-Jørgensen (2013).

Table 2. Distribution of harbour porpoise detection cues on categories from the aerial survey in West Greenland in 2007 (Hansen and Heide-Jørgensen 2013).

Cue both observers	n	Percentage
Diving	13	31
Surfacing	21	50
Below surface	8	19
Total	42	

The working group discussed the extent to which animals could be detected below the surface on the survey. Heide-Jørgensen reported that it was difficult to see animals underwater in Greenlandic waters. The animals seen underwater by the rear observer could have been seen because the animals reacted to the aircraft. In surveys of Danish waters, 60% of detections were made at the surface (Heide-Jørgensen *et al.* 1993). However, detection of animals underwater in Danish waters may be easier because they are sometimes seen against a light sandy seabed compared to always being seen against a dark surface off Greenland.

The working group also discussed whether all the sightings recorded as diving and surfacing (Table 2) would have been recorded as being at the surface from tag data because a tag is not above the surface throughout the period when an animal is visible on the surface. However, the relevance of this depends on how time at the surface is estimated from the tag data.

<u>Time at surface from tag data</u>

Heide-Jørgensen explained that the estimate of the proportion of time at the surface is derived from pressure transducer data (time at depth; 1s sampling rate) from the satellite-linked time-depth recorders, not from whether or not the tag is actually above the surface. To avoid problems with drift in the pressure transducer data, the 0m (surface) readings are calibrated from the conductivity sensor that instantly records when the tag breaks the surface. However, data on the length of time that the conductivity sensor is dry (tag is above the surface) are not recorded. In addition, depth data are recorded at a resolution of ± 0.5m, so time at the surface is actually time when the transmitter is between 0m and 0.5m below the surface.

The working group noted that the time at depth data indicated a steep change in the proportion of time spent at 0m (surface) to 0-1m to 0-2m (Table 3). The correction factor used is therefore highly sensitive both to the extent to which animals can be seen below the surface and to the depth range used to calculate the correction factor.

Table 3: from SC/20/HP/11, Table 1. Proportion of time (%) spent at three depths for a porpoise from Denmark, and for two porpoises tracked by satellite in Greenland. * indicates that the value was calculated based on the proportion of time in depth categories for the Danish harbour porpoise. CV indicated in parentheses. Proportions are cumulative.

Depth	Denmark	Greenland
0 m	4.68	5.14 (0.13)
0-1m	36	28 *
0-2 m	54,6	42,4

Because of this, the working group agreed to consider two correction factors in an attempt to put bounds around the problem. One was the percentage of time spent at 0m (5.14%), as presented in SC/20/HP/07. The second was the percentage of time spent at 0-1m presented in SC/20/HP/11. These data were not available for the animals instrumented off West Greenland (only data for 0m and 0-2m were available) so this percentage was calculated by interpolating between 0m and 0-2m based on data on the percentage of time at 0m, 0-1m and 0-2m provided by Teilmann from 14 porpoises instrumented with time-depth recorders in Danish waters during daylight hours in summer. This correction factor was calculated as 28% with CV = 0.13 (Table 3).

<u>Estimates of abundance for use in assessment</u>

The working group agreed to correct the estimate of abundance presented by Hansen & Heide-Jørgensen (2013), by the two "at surface" correct factors, 5.14% and 28%, giving corrected estimates of 274,883 (CV=0.39), as presented in SC/20/HP/07, and 50,461 (CV = 0.39), respectively.

5.4 Catch statistics

Nielsen presented catch statistics for harbour porpoises in West Greenland (SC/20/HP/06). This paper summarizes available catch statistics for harbour porpoises (*Phocoena phocoena*) hunted in Greenland from 1900 to 2012. From 1900 – 1990 the catches were reported by year (Ministry of Greenland); however, catches in some years are missing from the time series. More complete reporting is available from 1993 – September 2012 (Piniarneq, Government of Greenland) when catches were reported by month. Most catches were taken in central West Greenland during summer months; the town of Maniitsoq and its adjacent settlements were responsible for 40% of all catches. To validate the reported catches in 2012 a questionnaire survey of 28 hunters was conducted in Maniitsoq, West Greenland, in 2013. From the interviews it was found that 113 (470-357) animals were not reported in 2012, however, the official catch statistics (Piniarneq) for October – December 2012 are not yet compiled (expected 2014). Adjusting the catches for the missing months revealed that the catches reported in the interviews were in agreement with the expected catches for January – December 2012. The interview study furthermore revealed that the data from 15 hunters in 2012 of catches of harbour porpoises reported in Piniarneq were not included in the statistics, and this non-inclusion corresponds to 45% of the porpoise catches obtained through the interviews. Thus the correction factor for missing data on harbour porpoise catches in Maniitsoq equals 1.8. Despite the uncertainties it is recommended that this correction factor is applied to catch reports from Piniarneq (after 1993) in order to derive a realistic time series useful for assessment of harbour porpoises in Greenland.

SC/20/HP/06 showed increases in catches over three distinct catch periods, 1900-1950, 1955-1990, 1993-2012 (total uncorrected catches = 42,779; Fig. 4).

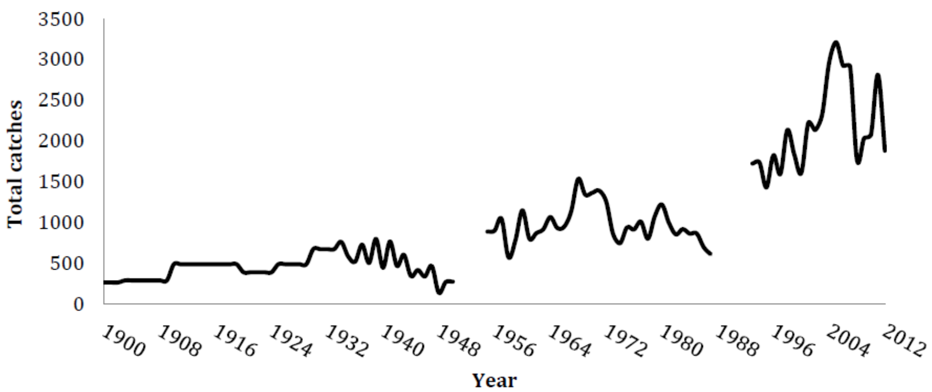

Figure 4. from Fig. 2 of SC/20/HP/06: The total annual catches of harbour porpoises in Greenland 1900 – 2012.

There was a drop in catches in the 1970s which may have been due to the hunters being recruited into fisheries activities rather than hunting.

There were large increases in catches in past 19 years, which may be due to multiple factors, including improvements in technology (introduction of motorized dinghies), increased harbour porpoise population, and the new reporting system. Comparisons of reports from the hunter questionnaire versus the official reporting (Piniarneq) showed that a correction factor for incomplete data must be applied.

Most catches occurred in the area around Maniitsoq and Sisimiut (Midwest Greenland). Although harbour porpoises were hunted year round, catches were mainly from August to October, but mainly July-October in Maniitsoq. Hunters do not specifically target harbour porpoises, but will take them when they encounter them, and are not required to report the location of the catch.

The issue of struck and lost was discussed. Piniarneq does not require reporting of struck and lost. Although not a part of the questionnaire, some hunters noted that they reported the number of porpoises they have seen die, but have not managed to retrieve. Hunters also reported that they do not lose very many animals because they usually float. However whether they float depends on which part of the body they are shot and possibly also depends on seasonal changes in blubber thickness. The struck and lost rate, as included in catch numbers reported in Piniarneq, is 8% (unpublished data, Greenland Institute of Natural Resources).

Catches have been reported since 1900. It has been obligatory to report harbour porpoise catches but there were differences in the reporting in later schemes. The catch reporting system is known to have deteriorated in 1980s - 1992, and this deterioration could have started from the late 1970s.

This may also explain the decrease in reported catches around the late 1970s. In the assessment modelling, data from 1980-1988 were excluded due to the unrealistically low and declining reported catches.

On the issue of including catch history data in the population modelling, the group agreed that there were three options (low, medium, and high catches) for handling combined data from the different reporting schemes and their impacts on correction factors for underreporting. These three options are detailed in the next section.

5.5 Population modelling

Witting presented SC/20/HP/05 which used the abundance estimate from 2007, the historical catches starting from 1975, and age-structure data from the hunt (corrected for hunting selectivity) in three periods, to build age- and sex-structured population models with exponential or density regulated growth. The paper provided results for six runs that combined the two different availability corrections of the abundance estimate, with three different estimates of the historical catches.

A low catch history was derived using the reported catches from 1975 to 1980, together with the reported catches from 1993 to 2012, with the 2011 and 2012 catches corrected for animals not reported in Maniitsoq. The 1975 to 1980 and the 1993 to 2012 series were combined by inserting catches based on a linear increase between a 1981 catch assumed to be equal to the average catch from 1976 to 1981, and a 1992 catch assumed to be equal to the average catch from 1993 to 1997. A high catch history was derived by applying a 1.8 multiplication factor to the reported catches from 1993 to 2012, and scaling all the catches from 1995 to 1980 by a factor obtained by assuming that the average catch from 1976 to 1980 is equal to the average catch from 1993 to 1997. All the catches from 1981 to 1992 were also set to this average. A medium catch history was derived using the reported catches from 1955 to 1980, together with estimated catches from 1993 to 2012, obtained by multiplying the reported catches by 1.8 to correct for unreported animals. Similar to the low catch history, the two series were combined by inserting catches based on a straight line.

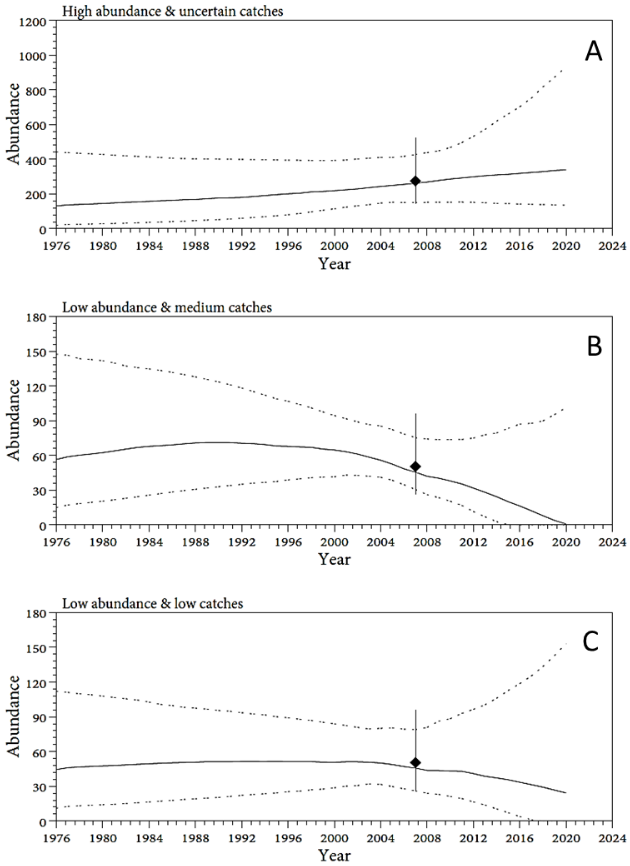

Figure 5: Population trajectories for three scenarios for West Greenland harbour porpoises based on density regulated growth models 'd' (SC/20/HP/05). The abundance axes are in units of 1000. Panel A shows the trajectory for the high abundance estimate and uncertain catches that span the range from the low to the high catch history. Panel B shows the trajectory for the low abundance estimate and the medium catch history, and Panel C shows the trajectory for the low abundance and the low catch history. The solid curves are the median trajectories, the dotted lines show the 95% credibility intervals, the diamonds are the 2007 abundance estimates with 95% confidence intervals. Catches after 2012 are set to catches in 2012.

Dependent upon how the data from the high and the low abundance estimates were combined with the data from the low, medium, and high catch histories, the model estimated the dynamics of harbour porpoises in West Greenland quite differently. This is illustrated in Fig. 5. Panel A shows that for the high abundance estimate, the population increases regardless of the catch history. Panel C indicates that for low abundance, the population declines, even with the low catch history. Panel B shows that for low abundance and the medium catch history, the population declines more rapidly. Hence, to obtain a consistent assessment model that is useful for providing management advice, it is essential that the uncertainties associated with the abundance and catch history estimates are resolved.

5.6 Management Advice

Given the large degree of uncertainty in the abundance estimate and the catch history, and the effect of this on the results of the assessment models, the working group is unable to provide management advice for West Greenland at this time. Nevertheless, the working group noted that the average annual catches since 1993 in West Greenland were 2125.6 harbour porpoises and that a large abundance is needed to sustain such catches. Given the recent discovery of high uncertainty in catches, the working group **strongly recommended** that Greenland provides a complete catch history accounting for all types of underreporting of catches before any future attempts are made to conduct an assessment of harbour porpoises in West Greenland.

The working group noted that TNASS2015 may provide a new abundance estimate for West Greenland and **recommended** that a new assessment not be considered until the outcome of this survey is known.

6. NORWAY ASSESSMENT

6.1 By-catch

6.1.1 Numbers

Bjørge presented information on his paper (SC/20/HP/O07) on by-catch in Norway.

From Bjørge *et al.* 2013: Using data collected during 2006–2008 from a monitored segment (18 vessels) of the Norwegian coastal fleet (vessels<15 m) of gillnetters targeting monkfish and cod, we used general additive models (GAMs) to derive by-catch rates of harbour porpoise. These by-catch rates were then applied to fishery catch data on the target species to estimate the total number of porpoise taken by two coastal gillnet fisheries. The two best models estimated by-catches of 20,719 and 20,989 porpoises during 2006–2008, with CVs 36% and 27%, respectively. Thus, about 6900 harbour porpoises are taken annually in the coastal monkfish and cod gillnet fisheries. Although no abundance estimate is available for the coastal harbour porpoise population, this annual by-catch is likely not sustainable according to the management objectives defined by ASCOBANS. In the cod gillnet fishery, harbour porpoise by-catch rates decreased rapidly with increasing depth to50 m and then levelled off. In the monkfish gillnet fishery, by-catch rates decreased linearly with increasing depth throughout the depth range fished. To reduce harbour porpoise by-catches, we recommend that large mesh nets associated with the monkfish fishery to be prohibited at depths less than 50m.We also recommend to conduct experiments using Acoustic Deterrent Devices (ADDs or ‘pingers’) on nets set deeper than 50 m. If these devices prove successful in reducing porpoise by-catch, we propose that ADDs should be implemented in the Norwegian coastal gillnet fisheries for monkfish.

Bjørge informed the working group that the lumpfish fishery will be monitored next. Fishermen reported that the porpoise by-catch rate may be relatively high. This is a small fishery, with a short season (the target is roe) in winter. The working group considered the importance of including estimates of by-catch from this fishery in the assessment models (that is, whether the by-catch is sufficiently large to make a significant difference). The working group **recommended** that Norway compile as much information as possible about by-catch from other fisheries, and to look into the lumpfish fishery by-catch next.

Bjørge *et al.* (2013) reported high by-catch in shallower waters, but also by-catch in deeper waters (down to 400 m). Fishermen have the opinion that the porpoises are diving deep, and that they are not caught when the net is being deployed or hauled. Effort and depth appear related, so it may be difficult to separate these effects.

A higher coastal by-catch is reported in the monkfish fishery versus the cod fishery. Teilmann pointed out that video camera studies in Danish waters showed that 18% of unreported by-catch were due to the porpoises falling out of the net (Kindt-Larsen *et al.* 2012) before they are brought on board. Thus the cod fishery by-catch rate for Norwegian waters presented here could be underestimated. Cameras could possibly be used in the future to monitor Norwegian fisheries to see if harbour porpoises are falling out of the nets. It is likely that the rate of porpoises falling out of the net is lower in the monkfish fishery due to the larger mesh size.

The group **recommended** that samples be collected from by-catch in Norway, to obtain data on sex ratio, reproductive status, age structure, diet, contaminants, *etc*. It would be challenging to gather carcasses for the whole coast; the group therefore suggested that efforts are focused on the Vestfjord area where most of the by-catch occurs.

It would be informative to have tracking data from porpoises in Norway because the high by-catch in one area (Vestfjorden) could have a large impact on a local population. Harbour porpoises have been tagged in Danish waters, but those animals did not cross the Norwegian trench and did not move into coastal Norwegian waters. These animals do not appear to be part of the population that are subject to by-catch in Norwegian waters.

The working group **recommended** tagging of harbour porpoises in Norway to obtain information about behaviour for use in assessment. Movement data will be important also in light of changing environmental conditions (*e.g.*, food availability).

6.1.2 Mitigation

Bjørge informed the group that he is currently running an experiment with pingers in Vestfjorden. If the pingers are effective as a deterrent at depths down to 400m, they will be recommended for use in the monkfish fishery. For the cod fishery, this needs further consideration due to the very high fishing effort in the cod spawning area.

Two options are being considered for mitigation: the use of pingers on nets as a porpoise deterrent, or changing the fishery by moving the fleet to waters deeper than 50 m.

The group welcomes and encouraged efforts by Norway to investigate by-catch mitigation.

6.2 Abundance Estimation

Øien referred to Bjørge and Øien (1995) as the last updated information on distribution and abundance of harbour porpoises in Norwegian waters.

Øien presented harbour porpoise distributions from recent sighting surveys carried out by Norway (SC/20/HP/10). Shipboard sightings surveys with minke whales as the target species have been conducted in Norwegian and adjacent waters during the summer seasons around July in each of the years 1988, 1989 and 1995. With the survey methodology and procedures established in 1995 (Øien 1995), a series of six-year mosaic surveys was initiated in 1996. The purpose has been to cover the northeast Atlantic over a six-year time frame by surveying about 1/6 of the total area with two vessels annually.

The surveys have experienced methodological developments throughout the years with the specific aim to get a best estimate of minke whale abundance. Other cetacean species have nevertheless also been recorded during these surveys. However, given the focus on minke whales and associated tracking procedures, the collection of data for these other species may have been less than optimal. It is also important to note that the mosaic surveys have been partial in annual coverage which also brings into question additional variance due to possible changes in distributions over the years.

Thus the 1995 survey stands out as the only large-scale synoptic survey which together with the Icelandic and Faroese surveys that year covered a major part of the Northeast Atlantic during NASS-95.

The surveys have been conducted with an intended searching speed of 10 knots. Acceptable conditions for primary searching have been defined as a meteorological sightability of greater than 1 km and sea states of Beaufort 4 or less. Detection probability for harbour porpoises typically decreases markedly in sea states above Beaufort 2. The surveys have been conducted in “passing mode”, such that the vessel did not break the track to approach the sighting, which is a factor which makes validation of species identification and group size more difficult. All vessels were equipped with two platforms usually placed one above the other and operating independently. The distribution plots in SC/20/HP/10 are based on primary sightings made from the primary platform, which is always the upper platform (usually a barrel) on all vessels.

During the period 2008-2013, the last in the series of mosaic surveys, there were fewer sightings of harbour porpoises compared with earlier periods. There may be several reasons for these low numbers, bearing in mind that these surveys were designed for minke whales, and therefore detection probability for harbour porpoises is low.

These surveys do not give a reliable abundance estimate for porpoises because they are designed to estimate minke whale abundance and therefore do not cover the coastal habitat of harbour porpoises, and they are run in conditions up to (but not including) Beaufort 5.

Øien presented SC/20/HP/09 where distributional maps of incidental sightings of harbour porpoises in Norwegian waters were shown. The species is commonly observed in near coastal waters, archipelagos and fjord systems along the entire Norwegian coast. Although sightings have been made throughout the year, most of the observations are recorded during the season April-September (July being highest). The data presented here do not support a change in distribution over the years.

There is a database of sightings from fishing vessels and research vessels which are not focused on marine mammals, but these show the same pattern of distribution as sightings surveys. For reasons that cannot be explained, sightings were higher in the period from 1996-2008 although the distribution was not changing. It appears that the animals are furthest North and offshore in late summer/fall, and follow the continental ridge towards Svalbard.

In order to estimate abundance of harbour porpoises, sightings surveys should include the coastal archipelagos and fjords.

Øien also presented SC/20/HP/12 which shows two years of tagging (total of 4 animals) in Varangerfjord. The animals were caught in traps set for salmon, and tags were deployed in May/June, and lasted 2-5 months. The movements were local, but deployment times considerably less than an annual cycle restrict the ability to make a determination on larger movements.

6.2.1 Survey Design

In the fjords, harbour porpoises appear to be close to the shore, therefore a possible design could be a ship-based strip transect survey near the shore, and then a line transect survey in the middle of the fjord. Possible future techniques for surveys to improve detectability in the fjords could include using drones and acoustic monitoring.

The group did not elaborate further on the survey methods and technology, and this will be addressed in the future survey planning (see Thomas *et al.*2007 and Bjørge *et al.* 2000).

The working group notes the large estimated by-catch of harbour porpoises in two coastal fisheries in Norway. To assess the effects on the population it is important to have estimates of abundance in the areas impacted by the by-catch. The working group therefore **strongly recommends** that surveys to estimate abundance in Norwegian coastal archipelagos and fjord waters are carried out. These surveys may start in the areas of highest by-catch (Vestfjorden).

The group acknowledged that the SCANS-III survey, scheduled for 2016, will conduct a number of experimental surveys and will investigate survey techniques in 2015, and cooperation between coordinators of SCANS-III and TNASS2015 is recommended.

6.3 Stock delineation

The most recent update of information on stock identity of harbour porpoises in Norwegian waters (Andersen 2003) indicated two subpopulations- Barents Sea and northern North Sea.

No new information was available on movements of harbour porpoises in Norwegian waters, although the distribution from incidental sightings along the coast is continuous, which does not support separate populations.

The working group **recommends** both tracking and genetics studies to clarify stock delineation. Reliance on genetics data alone is not enough because movements are needed to inform on mixing and dispersion of the animals on a management time scale.

7. OTHER BUSINESS

Desportes, as coordinator of the Plan, presented the ASCOBANS Conservation Plan (ASCOBANS 2012) for the Harbour Porpoise in the North Sea. The Conservation Plan, adopted in 2009 and covering ICES areas IIIaN, IVabc and VIIed, aims at restoring and/or maintaining North Sea harbour porpoises at a favourable conservation status. The shorter-term pragmatic minimum objective is to at least maintain the present situation and, if possible, improve it. The Plan identifies by-catch as the main threat and is articulated around 12 specific management and /or research actions. Three actions are particularly relevant to the NAMMCO working group on harbour porpoises – by-catch estimation (A3 and A4), population abundance (A7) and population structure (A8) – as there is overlap between the area covered by the Plan and the area relevant to the assessment of harbour porpoises in Norwegian waters. Although, there has been progress in the implementation of the plan, none of the actions are fully implemented yet. The implementation status for the three actions most relevant to the working group was presented. Regarding the regular evaluation of by-catches in all fisheries, methods have been successfully developed for assessing by-catch in the less-than-15m fleet (reference fleet and remote electronic monitoring), but have not been widely implemented. Following EU regulations, monitoring has been implemented in the trawl fishery in the North Sea, revealing no by-catch. However, the gillnet fisheries, which represent the highest risk to harbour porpoise, have been little monitored except in Norway and France, as this was not mandatory under EU regulation. In particular, there are no data since 2001 for the Danish gillnet fleet which had very high by-catch rate in the 80-90s and limited data for the UK gillnet fleet, which in 2009 represented 32% and 17% (respectively) of the reported gillnetter effort (days at sea) in the North Sea. Regarding stock structure, although signals from different lines of evidence, genetics, tagging and ecological tracers, point towards a sub-structuring in the North Sea, no clear divisions have been identified. New abundance data are patchy in space and time and therefore difficult to interpret at the population level. Therefore, the conservation status of the harbour porpoise in the North Sea remains unclear, with very patchy information on by-catch rates and trends in abundance. Efforts are continuing in North Sea states with assessing by-catch in the < 15m fleet, developing alternative mitigation methods - both pingers and modified and alternative fishing gears, looking at habituation and exclusion, and developing frameworks for determining safe by-catch limits.

8. RECOMMENDATIONS

Greenland

- Given the recent discovery of large uncertainty in catches, the working group **strongly recommends** that Greenland provides a complete catch history including all types of underreporting of catches before any future attempts are made to conduct an assessment of harbour porpoises in West Greenland.

- The working group noted that TNASS2015 may provide a new abundance estimate for West Greenland and **recommended** that a new assessment not be considered until the outcome of this survey is known.

Norway

- The working group **recommended** that Norway compile enough information as possible about by-catch from other fisheries, and to look into the lumpfish fishery by-catch next.

- The group **recommended** that samples be collected from by-catch in Norway, to obtain data on sex ratio, reproductive status, age structure, diet, contaminants, *etc.* It would be challenging to gather carcasses for the whole coast; the group therefore suggested that efforts are focused on the Vestfjord area where most of the by-catch occurs.

- The working group **recommended** tagging of harbour porpoises in Norway to obtain information about behaviour for use in assessment. Movement data will be important also in light of changing environmental conditions (*e.g.*, food availability).

- The working group therefore **strongly recommends** that surveys to estimate abundance in Norwegian coastal and fjord waters are carried out. These surveys may start in the areas of highest by-catch (Vestfjorden).

- The working group **recommends** both tracking and genetics studies to clarify stock delineation. Reliance on genetics data alone is not enough because movements are needed to inform on mixing and dispersion of the animals on a management time scale.

General recommendations for all areas

- The group noted that the SCANS-III survey, scheduled for 2016, will conduct an experimental survey to investigate survey techniques in 2015, and cooperation between coordinators of SCANS-III and TNASS2015 is **recommended**.

9. CLOSING REMARKS AND ADOPTION OF REPORT

Given that new information in response to the recommendations of the group will likely not be available until after 2015, a new harbour porpoise assessment meeting to discuss Greenlandic and Norwegian waters will not take place until after this time.

The report was adopted in a preliminary form at the end of the meeting. The final report was adopted by correspondence on 12 November 2013.

References

Andersen, L.W. 2003. Harbour porpoises (*Phocoena phocoena*) in the North Atlantic: Distribution and genetic population structure. *NAMMCO Sci. Publ.* 5:11-30.

ASCOBANS 2012. Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat.

Bjørge, A., Øien, N. and Donovan, G.P. 2000. Surveys to Estimate Abundance of Small Inshore Cetaceans, SEASIC. Document SC/52/O14 to the Scientific Committee of the International Whaling Commission.

Bjørge, A., Skern-Mauritzen, M. and Rossman, M.C. 2013. Estimated bycatch of harbour porpoise (*Phocoena phocoena*) in two coastal gillnet fisheries in Norway, 2006–2008. Mitigation and implications for conservation. *Biological Conservation.* 161: 164–173. http://dx.doi.org/10.1016/j.biocon.2013.03.009

Bjørge, A. and Øien, N. 1995. Distribution and abundance of harbour porpoise in Norwegian waters. *Rep. Int. Whal. Commn.* Special Issue 16.

Hammond, P.S. *et al*. 2013. Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation. 164: 107-122 http://dx.doi.org/10.1016/j.biocon.2013.04.010

Hansen, R. and Heide-Jørgensen, M.P. 2013. Spatial trends in abundance of long-finned pilot whales, white-beaked dolphins and harbour porpoises in West Greenland. *Mar Biol.* http://dx.doi.org/10.1007/s00227-013-2283-8

Heide-Jørgensen, M.P., Teilmann, J., Benke, H. and Wulf, J. 1993. Abundance and distribution of harbour porpoises *Phocoena phocoena* in selected areas of the western Baltic and the North Sea. *Helgoländer Meeresuntersuchungen,* Volume 47, Issue 3, pp 335-346

Heide-Jørgensen, M.P., Iversen, M., Nielsen, N.H., Lockyer, C., Stern, H., and Ribergaard, M.H. 2011. Harbour porpoises respond to climate change. *Ecology and Evolution.* http://dx.doi.org/10.1002/ece3.51

[IWC] International Whaling Commission. 1996. Report of the Sub-Committee on the Small Cetaceans. *Rep. int. Whal. Commn* 46:160-179.

Kindt-Larsen. L., Dalskov, J., Stage, B. and Larsen, F. 2012. Observing incidental harbour porpoise *Phocoena phocoena* bycatch by remote electronic monitoring. *Endangered Species Research.* Vol. 19: 75–83. doi: http://dx.doi.org/10.3354/esr00455

Lockyer, C. 2003. Harbour porpoises (*Phocoena phocoena*) in the North Atlantic: Biological parameters. *NAMMCO Sci. Publ.* 5:71-90.

Lockyer, C., Heide-Jørgensen, M.P., Jensen, J., Kinze, C.C. and Buus Sørensen, T.B. 2001. Age, length and reproductive parameters of harbour porpoises

Phocoena phocoena (L.) from West Greenland. *ICES Journal of Marine Science.* 58: 154–162 doi: http://dx.doi.org/10.1006/jmsc.2000.0998

Rosel , P.E., Tiedemann, R. and Walton, M. 1999. Genetic evidence for restricted trans-Atlantic movements of the harbour porpoise, *Phocoena phocoena. Mar. Biol.* 133:583-91.

Scheidat, M., Gilles, A., Kock, K-H. and Siebert, U. 2008. Harbour porpoise *Phocoena phocoena* abundance in the southwestern Baltic Sea. *Endang Species Res.* Vol. 5: 215–223. doi: http://dx.doi.org/10.3354/esr00161

Thomas, L., Williams, R. and Sandilands, D. 2007).Designing line transect surveys for complex survey regions. *J. Cetacean Res. Manage.* 9(1):1–13

Øien, N. 1995. Norwegian Independent Line transect Survey 1995. Interne notat, nr. 8 – 1995, Institute of Marine Research

Appendix 1

List of Participants

Arne Bjørge (Invited Expert)
Institute of Marine Research
PO Box 1064, Blindern
N-0316 Oslo, Norway
Email: arne.bjoerge@imr.no
Phone: +47 22958751

Geneviève Desportes (Scientific Committee)
GDnatur
Stejlestræde 9, Bregnør
DK-5300 Kerteminde
Denmark
Email: genevieve@gdnatur.dk
Phone: +45 65321767

Phil Hammond (Invited Expert)
Bute Building
University of St Andrews
St Andrews, Fife
KY16 9TS, UK
Email: psh2@st-andrews.ac.uk
Phone: +44 01334 463222

Mads Peter Heide-Jørgensen (Scientific Committee)
Greenland Institute of Natural Resources
Greenland Representation
Strandgade 91, 3
DK-1016 Copenhagen, Denmark
Email: mhj@ghsdk.dk
Phone: +45 32833827

Nynne Hjort-Nielsen (Invited Expert)
Greenland Institute of Natural Resources
Greenland Representation
Strandgade 91, 3
DK-1016 Copenhagen, Denmark
Email: nhn@ghsdk.dk

Christina Lockyer (General Secretary)
NAMMCO
Tromsø Science Park
PO Box 6453
N-9294 Tromsø, Norway
Email: christina@nammco.no
Phone: +47 77687372

Bjarni Mikkelsen (Chair of WG, Scientific Committee)
Faroese Museum of Natural History
Fútalág 40,
FR-100 Tórshavn, Faroe Islands
Email: bjarnim@ngs.fo
Phone: +298 790576

Lars Witting (Scientific Committee)
Boks 570,
DK-3900 Nuuk, Greenland
Email: larsw@natur.gl
Phone: +299 361202

Nils Øien (Scientific Committee)
Institute of Marine Research
PO Box 1870 Nordnes
5817 Bergen, Norway
Email: nils.oien@imr.no
Phone: +47 55238611

Jill Prewitt (Scientific Secretary)
NAMMCO
Tromsø Science Park
PO Box 6453
N-9294 Tromsø, Norway
Email: jill.prewitt@nammco.no
Phone: +47 77687373

Graham Pierce (Invited Expert)
University of Aberdeen
School of Biological Sciences
Tillydrone Avenue
Aberdeen AB24 2TZ
United Kingdom
Tel: 01224 272648
E-mail: g.j.pierce@abdn.ac.uk
Phone: +44 (0)1224 272459

Jonas Teilmann (Invited Expert)

National Environmental Research
Institute
PO Box 358 DK-4000 Roskilde
Denmark
Email: jte@dmu.dk
Phone: +45 46301947

Appendix 2

Agenda

1. CHAIRMAN WELCOME AND OPENING REMARKS
2. ADOPTION OF AGENDA
3. APPOINTMENT OF RAPPORTEURS
4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS
5. Greenland assessment
    - 5.1. Stock delineation
    - 5.2. Biological parameters
    - 5.3. Abundance estimation
    - 5.4. Catch statistics
    - 5.5. Population modelling
    - 5.6. Management advice
6. Norway assessment
    - 6.1. By-catch
        - 6.1.1. By-catch numbers
        - 6.1.2. Mitigation
    - 6.2. Abundance estimation
        - 6.2.1. Survey Design
    - 6.3 Stock delineation
7. OTHER BUSINESS

8. FINALIZE REPORT

TERMS OF REFERENCE

R-3.10.1 - NAMMCO/7-1997: to conduct a comprehensive assessment of the harbour porpoise throughout its range.

Appendix 3

Document List

Document Number	Agenda Item	Title
SC/20/HP/00		Practical arrangements
SC/20/HP/01	1	List of Participants
SC/20/HP/02	2	Draft Agenda
SC/20/HP/03	4	List of Documents
SC/20/HP/04	5.1	Heide-Jørgensen *et al.* Life history parameters from the catch of harbour porpoises in West Greenland.
SC/20/HP/05	5.2	Witting et al. Assessment runs for harbour porpoise in West Greenland
SC/20/HP/06	5	Nielsen and Heide-Jørgensen. Catch statistics for harbour porpoises in West Greenland including correction for unreported catches.
SC/20/HP/07	5.2	Heide-Jørgensen *et al.* Revised abundance estimate of arbour porpoise in West Greenland.
SC/20/HP/08	5	Nielsen *et al.* Extensive offshore movements of harbour porpoises (Phocoena phocoena)
SC/20/HP/09	6	Øien N, Hartvedt S. Incidental sightings of harbour porpoises in Norwegian waters.
SC/20/HP/10	6	Øien N. Offshore distributions of harbour porpoises in the northeast Atlantic from Norwegian sightings surveys 1988-2013
SC/20/HP/11	5	Heide-Jørgensen. Correction of at-surface abundance of harbour porpoises in West Greenland based on detection to 1 m depth.
SC/20/HP/12	6	Øien N. Harbour porpoise tracks North Norway
Background Documents		
SC/20/HP/O01	Santos MB, Pierce GJ, Learmonth JA, Reid RJ, Ross HM, Patterson IAP, Reid DJ, Beare D (2004) Variability in the diet of arbour porpoises (*Phocoena phocoena*) in Scottish waters 1992-2003. *Marine Mammal Science*. 20(1):1–27	
SC/20/HP/O02	ICES. 2013. Report of the Working Group on Marine Mammal Ecology (WGMME), 4–7 February 2013, Paris, France. ICES CM 2013/ACOM:26. 117 pp.	
SC/20/HP/O03	Pierce GJ, Santos MB, Cerviño S (2007) Assessing sources of variation underlying estimates of cetacean diet composition: a simulation study on analysis of harbour porpoise diet in Scottish (UK) waters. *J. Mar. Biol. Ass. U.K.* 87:213–221	
SC/20/HP/O04	Santos MB and Pierce GJ (2003) The diet of harbour porpoise (*Phocoena phocoena*) in the Northeast Atlantic. *Oceanography and Marine Biology: an Annual Review* 41:355–390	

SC/20/HP/O05	Orphanides and Palka (2013) Analysis of harbor porpoise gillnet bycatch, compliance, and enforcement trends in the US northwestern Atlantic, January 1999 to May 2010. *Endangered Species Research.* 20: 251–269. doi: http://dx.doi.org/10.3354/esr00499
SC/20/HP/O06	Larsen *et al.* (2013) Determining optimal pinger spacing for harbour porpoise bycatch mitigation. *Endangered Species Research.* 20: 147–152. doi: http://dx.doi.org/10.3354/esr00494
SC/20/HP/O07	Bjørge *et al.* (2013) Estimated bycatch ofharbour porpoise (*Phocoena phocoena*)in two coastal gillnet fisheries in Norway,2006–2008. Mitigation and implications for conservation. *Biological Conservation.* 161: 164–173. http://dx.doi.org/10.1016/j.biocon.2013.03.009
SC/20/HP/O08	Read *et al.* (2010) Understanding harbour porpoise (*Phocoena phocoena*) and fishery interactions in the north-west Iberian Peninsula. Final report to ASCOBANS (SSFA/ASCOBANS/2010/4).
SC/20/HP/O09	Desportes G. Interim report on the implementation of the ASCOBANS North Sea Conservation Plan for harbour porpoises – 5 with focus on progress in implementation of Actions 1,3,4,7 & 8 and attempt of characterizing recreational fisheries in CPHPNS area (ICES areas IIIaN, IV, VIIed)
SC/20/HP/O10	Desportes G. Interim report on the implementation of the ASCOBANS North Sea Conservation Plan for harbour porpoises – 4 with focus on bycatch situation and population monitoring December 2012
SC/20/HP/O11	Report of the 2nd Meeting of the 'Steering Group for the Conservation Plan for the Harbour Porpoise in the North Sea' (ASCOBANS)
SC/20/HP/O12	Nielsen *et al.* (2012) Application of a novel method for age estimation of a baleen whale and a porpoise. *Marine Mammal Science.* 29(2): E1–E23
SC/20/HP/O13	Lockyer *et al.* (2001) Age, length and reproductive parameters of harbour porpoises *Phocoena phocoena* (L.) from West Greenland. *ICES Journal of Marine Science.* 58: 154–162
SC/20/HP/O14	Lockyer *et al.* (2003) Life history and ecology of harbour porpoises (*Phocoena phocoena*) from West Greenland. *NAMMCO Sci. Publ.* 5:177-194
SC/20/HP/O15	Heide-Jørgensen *et al.* (2011) Harbour porpoises respond to climate change. *Ecology and Evolution.* http://dx.doi.org/10.1002/ece3.51
SC/20/HP/O16	Gilles *et al.* Harbour porpoise *Phocoena phocoena* summer abundance in Icelandic and Faroese waters, based on aerial surveys in 2007 and 2010
SC/20/HP/O17	Hansen & Heide-Jørgensen (2013) Spatial trends in abundance of long-finned pilot whales, white-beaked dolphins and harbour porpoises in West Greenland. *Mar Biol.* http://dx.doi.org/10.1007/s00227-013-2283-8
SC/20/HP/O18	Hammond et al. (2013) Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. *Biological Conservation*. 164:107–122. http://dx.doi.org/10.1016/j.biocon.2013.04.010
SC/20/HP/O19	Teilmann et al. (2013) Geographic, seasonal, and diurnal surface behavior of harbor porpoises. *Marine Mammal Science.* 29(2): E60–E76

SC/20/HP/O20	Lowry and Teilmann (1994) Bycatch and bycatch reduction of the harbour porpoise in Danish waters. *Rep. Int. Whal. Commn.* Special Issue 15.
SC/20/HP/O21	Bjørge & Øien (1995) Distribution and abundance of harbour porpoise in Norwegian waters. *Rep. Int. Whal. Commn.* Special Issue 16.
SC/20/HP/O22	Andersen (2003) Harbour porpoises (*Phocoena phocoena*) in the North Atlantic: Distribution and genetic population structure. *NAMMCO Sci. Publ.* 5:11-30.
SC/20/HP/O23	Lockyer, C. 2003. Harbour porpoises (*Phocoena phocoena*) in the North Atlantic: Biological parameters. *NAMMCO Sci. Publ.* 5:71-90.
SC/20/HP/O24	Kindt-Larsen L. *et al.* (2012) Observing incidental harbour porpoise *Phocoena phocoena* bycatch by remote electronic monitoring. *Endangered Species Research.* Vol. 19: 75–83. doi: 10.3354/esr00455