

SECTION 3 - SCIENTIFIC COMMITTEE

3.1	Report of the Twentieth Meeting of the Scientific Committee.....	153
	Executive summary.....	155
	Main Report	165
	Appendix 1 Agenda	206
	Appendix 2 List of Documents	209
	 ANNEX 1 Report of the NAMMCO Scientific Working Group on Harbour Porpoises	 211
	 ANNEX 2 Report of the NAMMCO Scientific Committee Working Group on Walruses	 229

**REPORT OF THE TWENTIETH MEETING OF THE NAMMCO
SCIENTIFIC COMMITTEE**

13 – 16 November 2013, Reykjavik, Iceland,

EXECUTIVE SUMMARY

The 20th meeting of the Scientific Committee (SC) was held in Reykjavik, Iceland, 13 – 16 November 2013. The SC had reports from two NAMMCO SC Working Groups (WG): the NAMMCO Working Group on Harbour Porpoises (Annex 1) and the WG on Walruses (Annex 2); also an Acoustics Report from T-NASS 2007 (SC/20/13) and an analysis of trend in pilot whale abundance from surveys (SC/20/18) contracted by the Secretariat. Additionally there were reports from observers to the IWC, ICES, and ASCOBANS. Other reports and documents were presented and examined under relevant agenda items.

ENVIRONMENTAL ISSUES

Role of Marine Mammals in the Ecosystem

Norway

Norwegian research on the ecology of harp seals in the Barents Sea where they are major top predators was conducted 1996-2006. In terms of biomass, krill was most important (63%) followed by polar cod (16%) and other fish species (10%). Availability of high-energetic food in the northern areas in spring and summer presumably provides the energetic advantage necessary to account for the long migrations of harp seals. Harp seal body condition exhibited a slow increase from 1992 to 2001, where after a significant decrease to a minimum in 2011 occurred. Longer migration routes between the breeding/moulting areas and feeding areas along the ice edge may have contributed to the recently reduced body condition.

In 2012 and 2013, long awaited permission to tag harp seals in the White Sea was given by the Russian Authorities, but now a lack of funding prevented tagging of seals. In 2014 PINRO will give priority to tagging over aerial surveys. Norway will be responsible for the satellite tags. Due to low pregnancy rates and decline in pup production it will be important to focus on harp seal ecology and demographics in the coming years.

Iceland

Changes in diet composition and distribution of common minke whales, the most abundant mammalian top predator in the Icelandic continental shelf ecosystem, are consistent with recent environmental changes, including high sea temperatures and distribution of several prey species including sandeel and capelin.

What was initially a NAMMCO Ecosystem Modelling research programme has developed into a much broader project including more general fisheries management considerations and a socio-economic component, but with modelling at the core. It has now been funded from the EU, and includes 29 institutes from 16 countries. Iceland is still one core area, however multispecies modelling in the Barents Sea has been removed.

SEALS AND WALRUS

Harp Seal

White Sea / Barents Sea

At the recent WGHARP meeting a population model fit estimated a total White Sea/Barents Sea harp seal stock 2013 abundance of 1,419,800 (95% CI 1,266,910–1,572,690). The model predicts an increase in the 1+ population of 13% over the next 10 years. Equilibrium catch level is 17,400 1+ animals or an equivalent number of pups, while a catch level of 26,650 1+ animals will bring the population size down to 70% of Nmax with probability 0.8. The Potential Biological Removals (PBR) were estimated to be

40,430 animals, of which 14% should be pups. This catch option indicates a 16% reduction of the 1+ population in 10 years. WGHARP expressed concerns on the high removals and declining population resulting from the PBR estimations, and concluded that the estimated equilibrium catches were the most preferred option. The current equilibrium option is slightly higher than the previous option, given in 2011. This is possibly a result of no, or very low catches in 2012 and 2013.

Greenland Sea

New aerial surveys to assess harp seal pup production were conducted in the Greenland Sea in 2012 and resulted in an estimate of 89,590 (SE 12,310) pups. This estimate is slightly, but not significantly lower than those from similar surveys in 2002 and 2007.

No data used in modelling are older than 5 years and all model runs indicate a substantial increase in the population abundance from the 1970s with a total 2013 abundance of 627,410 (95% CI 470,540–784,280) seals. With current catch level an increase in the 1+ population of 21% over the next 10 years is predicted. The equilibrium catch level is 14,600 1+ animals or an equivalent number of pups (where one 1+ seal is balanced by 2 pups).

Since Greenland Sea harp seals are classified as data rich, ICES now found the Precautionary Approach framework developed for the management of harp and hooded seals appropriate for the population, given that the reference levels reflect the most recent estimate of total population size which is the largest observed to date. When the population is between N_{70} and N_{max} , harvest levels may be decided to stabilize, reduce or increase the population, as long as it remains above the N_{70} level (i.e. 70% of N_{max}). A preferred option is to design the total allowable catch (TAC) to satisfy a specific risk criterion (e.g., 80% probability of remaining above N_{70} over a 10 year period). Using this approach, a modelled catch level of 21,270 1+ animals, in 2014 and subsequent years, is obtained. Any allowable catch should be contingent on an adequate monitoring scheme, particularly if the TAC is set at a level where a decline is expected.

Northwest Atlantic

Aerial surveys to estimate pup production were flown in 2012, and estimates from the southern Gulf of St Lawrence are almost half of estimates from 2008. Years with poor ice conditions have been increasing in frequency over the past decade. Ice conditions observed during 2012, are among the worst on record. This has serious implications for the persistence of breeding harp seals in the southern Gulf of St Lawrence.

New requests to ICES from individual countries would be needed for a new meeting to finish assessments of Barents Sea and Northwest Atlantic harp seals. Preferably such requests should come from Russia and Greenland, respectively. The SC **advises** the Council that a more formal cooperation between ICES and NAMMCO on harp and hooded seals such as through the ICES WGHARP would be desirable, and that a formal request to ICES for such cooperation could be sent.

Hooded seal

Greenland Sea

During the aerial surveys conducted in the Greenland Sea in 2012, the harp seal was the prime target species but it proved possible to obtain data also on the pup production of hooded seals estimated at 13,655 pups (CV 0.14), slightly lower than from the 2005 and 2007 surveys. Hooded seals have been protected since 2007 due to the low pup production numbers – to assess the effect of protection, more than 5 years are needed due to the 4-5 years age at maturity.

Results from a re-analysis of hooded seal pregnancy rate data (collected from 1958 to 1999) yielded estimates ranging from 0.62 to 0.74 and showed no significant differences between sampling periods. The Greenland hooded seal population is considered to be data poor. The population model is similar to the model assessing the abundance of the Greenland Sea and the Barents Sea / White Sea harp seal population. With estimates of pregnancy rates being fairly constant around $F=0.7$, the model runs indicate a current population size of approximately 83,000 which is well below N_{30} (30% of largest

observed population size). The model predicts a 7% decrease of the 1+ population over the next 10 years. Following the Precautionary harvest strategy previously developed by WGHARP, the implication of this is no current catches from the population.

Grey seal

Norway

An age-structured population dynamics model has been developed to assess the Norwegian grey seal population. Model runs indicated an increase during the last 30 years to 8,740 animals in 2011. A total catch of 707 grey seals would maintain the population size at the 2011 level. Norway has decided not to use the model based TAC, but instead continue to use the more conservative 5% of current abundance until a new pup production estimate becomes available. The most recent pup production estimate of grey seals in Norway is based on data obtained in 2006-2008. The management plan for coastal seals requires that data used in assessments should be updated every 5 years and a boat-based visual survey in Norway started in November 2013, continues in 2014 and 2015, and if possible, a joint survey with Russia of grey seals on the Murman Coast, as these grey seal colonies have not been surveyed since 1991.

Iceland

Grey seals are distributed all around the Icelandic coast. The majority of the population breeds on the west- and northwest shores, with a second high density in the breeding distribution on the southeast coast of Iceland. Seven aerial surveys to estimate pup production in Iceland, have indicated a downward trend in the period 1980 – 2004. In 2005 a new method was applied for the first time counting at least three times on each breeding site. This method has also been applied in 2008 and in 2012. The results indicate a status-quo at the low pup-production reached in year 2002 of about 4,200 animals and just above the minimum population management objective of the Icelandic government, 4,100 1+ animals.

Faroe Islands

Fish farmers kill seals at their farms, in a protective act. Preliminary data for 2012 indicate that the total removal is in excess of one hundred animals.

Satellite tracking has shown that grey seals in the Faroes are very local, although seals migrating from UK waters to the Faroes have been documented. Some of these animals, especially yearlings, could be part of the removals, especially in winter. A genetic study on the population delineation of grey seals in the North Atlantic, which include samples from the Faroes, is still awaited.

The SC **reiterates the recommendation** from SC19 to obtain numbers on total removals (by-catch and catch) for grey seals in Norway, Iceland, and the Faroe Islands.

The SC **recommended** that the WG on Grey and Harbour Seals meet in late winter 2014 or early 2015 to assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway. The meeting should also address by-catch issues (grey seals) in Norway, Iceland, and the Faroe Islands, and a re-evaluation of the Norwegian management plans (which have been already implemented) for grey and harbour seals.

Harbour seal

Aerial surveys in 2011, 2012 and 2013 yielded a new minimum point estimate of 7,081 for the entire Norwegian coast and this is implemented in the 2014 management following the plan reviewed by the SC in 2011.

Aerial surveys of harbour seals in Svalbard in August 2009 and two in 2010 used data from radio-tagged harbour seals together with age distribution data to give corrected total estimates of 1,888 (95% CI 1,660–3,023), 1,742 (1,381–3,549) and 1,812 (1,656–4,418) harbour seals. The low population size, limited spatial distribution and reduced genetic diversity make this population vulnerable to chance events, such as disease epidemics.

Walrus

The three stocks of walrus are: in Baffin Bay estimated 1,238 in 2009 and 1,759 in 2010 (CV 0.19; 0.29), West Greenland / Baffin Island estimated 2,500 (CV 0.17) and East Greenland estimated 1,430 (CV 0.45) in 2009. Walruses tagged in spring 2010–2013 in Smith Sound, Northwest Greenland moved to Canadian waters in July and returned to Greenland in November, where they stay until spring. The tagging provided correction factors for the spring aerial surveys.

Estimates from Aerial winter surveys 2006, 2008 and 2012 in West Greenland were used as a time series of relative abundance in the assessment and an earlier time series (1981 – 1999) of walruses wintering in West Greenland to provide trend information on a longer time scale.

The WG's assessment included a low and a high catch history that includes struck and lost. This results in an average loss rate about 15% for Baffin Bay and West Greenland/Baffin Island, and about 11% for East Greenland. Complete statistics on total removal levels is critical and the SC **strongly recommended** that Greenland obtains reliable reports of all animals struck and lost. Ageing of 376 walruses caught in Qaanaaq between 1987 and 1991 was used.

The fit of the model was characteristic of selection for full-grown animals. An exponential model (Fig. 1, top) was considered to best reflect the production in the Baffin Bay population. The overall decline in the population caused by historical catches is unclear due to incomplete catch reporting prior to 1950s. The estimated decline is 63% from the 1960s to 2007, while decreased catches (~140 to ~70) have subsequently allowed this population to increase. The 2014 abundance estimated by the model was 1,430 (95% CI 999–2,170) with an annual natural growth rate of 7.7% (95% CI 6.4–9.5%) and a replacement yield in 2014 of 120 (95% CI 73–180) walruses.

The historical trajectory for West Greenland/Baffin Island walruses is unclear owing to problems in resolving long term models with current abundance data. The exponential model is unreliable here because it was unable to provide sufficient updated estimates of population growth. A density regulated model (Fig. 1, middle) initiated in 1960, however, solved the problem. It estimated a population that decreased from 4,000 (95% CI 1,210–18,600) walruses in 1960 to 2,360 (95% CI 1,720–3,280) in 2007. Annual catches were then reduced from more than one hundred to around 60, and the population was again increasing with a 2014 model estimate of 2,630 (95% CI 1,640–3,790) walruses and a replacement yield of 120 (95% CI 42–180).

Updated abundance estimates for West Greenland, and modelling with age-structured data from Baffin Bay, have improved these status estimates. The estimated trade-offs between total removals and the probability of population increase is shown in Table 1 for the Baffin Bay and the West Greenland/Baffin Island populations. A target of a 70% probability for increasing populations from 2014 to 2018 results in **recommended** total removals of no more than 93 animals from the Baffin Bay population and no more than 100 animals from the West Greenland/Baffin Island population.

Table 1. The estimated probabilities of increasing populations from 2014 to 2018 for 6 levels of annual removal from the Baffin Bay and West Greenland/Baffin Island stocks. Canadian and Greenlandic catches and struck and lost walruses are assumed to be included in removals. These removals do not assume a specific sex ratio.

Removals	75	80	85	90	95	100
Baffin Bay	0.94	0.86	0.81	0.75	0.67	0.58
West Greenland / Baffin Island	0.87	0.85	0.81	0.78	0.74	0.70

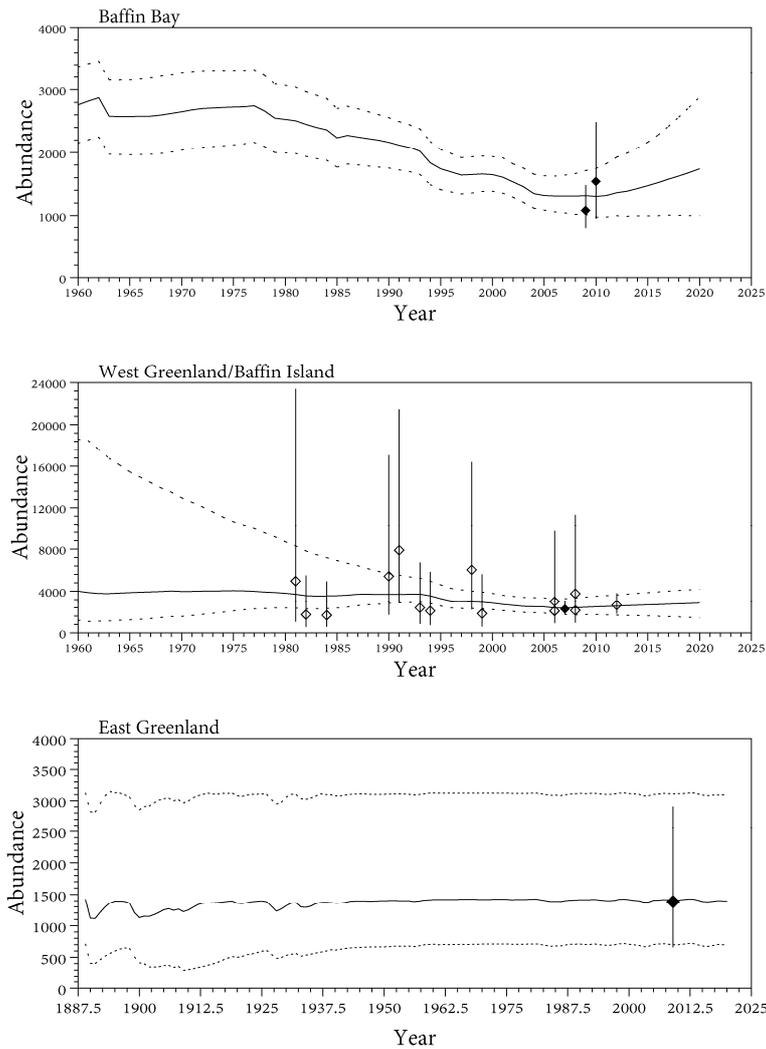


Figure 1. Projections of population models for the three walrus stocks in Greenland, together with absolute (solid diamond) and relative (open diamond) abundance estimates, with 95% confidence intervals. The solid curves are median projections, and the dashed curves span the 95% credibility interval.

East Greenland has apparently recovered relative to 1888, the year prior to first historical catches by European sealers. The trajectory is uncertain. Density regulation estimated a relatively flat trajectory (Fig. 1, bottom), with a maximum depletion in 1890 to 80% of the initial abundance, and a slow continuous increase to almost no current growth, while selection-delayed dynamics gave a historical depletion to 3% in 1957.

There is a high ratio of males, and the overall catch is small. A run of the assessment model with the extra years of catch data shows that this is still sustainable, and the **recommendation** of an annual total removal of no more than 20 individuals from the last assessment is reiterated.

The SC discussed R-2.6.6 and concluded that there is no biological argument against carryover of unused quotas. A problem arises if carryovers accumulate over time and/or across assessments, it was deemed difficult to give more specific advice without a more specific request from the Management Committee.

In a walrus survey of Svalbard completed in 2012 an increase in both total numbers and females with calves compared with the 2006 survey is apparent. The study on disturbance at haulouts using cameras

continues. Funding has been acquired for a 2014 tagging project that aims to investigate how individuals are responding to changes in ice conditions.

CETACEANS

Humpback whale

With reference to the pending request from NAMMCO 15 (**R-3.2.4**) to conduct a formal assessment of humpback whales following the completion of T-NASS 2007, the SC **noted** that the assessment for West Greenlandic waters has been completed, but assessment in other areas not yet initiated. The SC agreed to seek further guidance from the Council on priority of these areas; the SC will then consider this in conjunction with the fin whale meeting.

Minke whale

The commission requested the SC to review the results of the Icelandic research programme on the feeding ecology of common minke whales and multispecies modelling. The programme conducted according to the Special Permit rules of the IWC was in 2013 reviewed at an IWC Expert Panel workshop, and its report, a response paper and updated results, taking into account many of the suggestions of the Panel, were then discussed at the IWC SC meeting. The proponents of the programme considered the review to be positive, fair and constructive. An overview of the IWC review process was presented at the meeting and a short overview of the results of the programme. Future work includes continued development of the multispecies model. The SC **notes** that the quality of the research will be further determined through the peer-review publication process in addition to nine already published articles. The SC draws the attention of the MC to the results from the IWC Expert Panel review process, while **acknowledging** that the IWC review was set according to guidelines set by the IWC, which focused on whether the research can be done using non-lethal means, and the usefulness in IWC assessments. These are not necessarily the same criteria that NAMMCO might use. The SC awaits guidance from the Council concerning potential further review of the results within NAMMCO.

Narwhal and beluga

Relating to **Request 3.4.9** in 2011, the SC proposed a symposium on beluga and narwhals in relation to disturbance and industrial activities. The IWC is holding a workshop about the effects disturbance on cetaceans in general in the Arctic in March 2014. The SC noted that this meeting does not make redundant the originally envisaged NAMMCO SC symposium focusing on narwhals and beluga. The SC **recommends** to the Council that this symposium be held in 2015 and awaits further guidance.

Bottlenose and killer whales

Faroese bottlenose sightings data were analyzed together with CODA and SCANS II data. The preliminary designed based estimate for the Faroese block of T-NASS 2007 was 16,284.

A recent increase in catches of killer whales off Tasiilaq in East Greenland (8 on average per year from 2010 to 2012) was reported and the possibility of a high struck and lost rate in this hunt. The SC **noted** higher levels of annual catches (19 on average per year from 2010 and 2012) in West Greenland. Low levels of bottlenose catches were also noted (20 animals). The SC was informed that the recent catch statistics have not been validated and **recommends** that all catch data be validated.

Pilot whale

The NASS-T-NASS surveys have indicated decreasing abundance of pilot whales subsequent to the 1989 survey. The NAMMCO SC-17 recommended that an index of relative abundance be developed and applied to the area that is common to all surveys with the aim of determining trends in abundance. In 2011 NAMMCO SC-19 recommended to develop this index using only the three largest surveys and including the data from the CODA survey for enlarging the reference area. The reference area still comprises only a small portion of the summer range of the species and changes in distribution may have influenced the results.

Estimation of pilot whale group size had a strong influence on estimated abundance and varied significantly among the surveys. It appears that the definition of a “group” and the estimation of its size

have changed over the course of the surveys. Other potential biases include differences in survey timing and changes in the number of observers on the primary and combined platforms.

The rate of decline in total number was not significantly different from 0 (Fig. 2) and the abundance of groups did not show a unidirectional trend over time. Although it seems unlikely that an annual harvest of around 1,000 whales could have caused the population to decline, the apparent reduction of pilot whale abundance in the reference areas, which include the hunting area around the Faroes, should be of concern for managers.

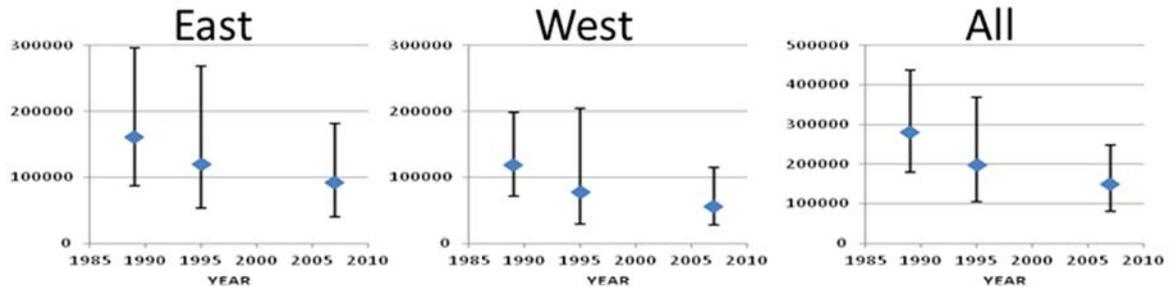


Figure 2. Pilot whale abundance in the three-survey reference area for the Primary platforms and divided into East and West subregions.

The SC was informed about recent progress in pilot whale tagging in the Faroes and notes that these data are highly valuable and is pleased that tagging will continue. It **recommends** more tracking data from offshore areas, with a focus on the period during sightings surveys (July-August).

Harbour porpoise

Greenland

Two harbour porpoises off West Greenland were tracked for more than a year in order to study distribution and site fidelity and spent on average 83% of their time in offshore areas and had maximum dives down to 382 m and 410 m. not previously documented, and exhibited site fidelity to West Greenland. In agreement with earlier genetics studies, the tagged animals did not indicate any overlap with other stocks and it was concluded that West Greenland should be considered a separate stock and management unit.

An aerial survey conducted in West Greenland in August-September 2007 corrected by tracking data gave abundance estimate of 274,883. Another approach based on data on porpoises instrumented with time-depth recorders in Danish waters resulted in a corrected estimate of 50,461.

There were large increases in catches in the past 19 years in the settlements with the largest catches, which may be due to multiple factors, including improvements in technology (introduction of motorized dinghies), increased harbour porpoise population, and the new reporting system. The catches were corrected based on a questionnaire survey among hunters for missing data on harbour porpoise catches by 1.8. The interview also revealed a struck and lost rate of 8%.

The WG used age-structure data from the hunt and combining the two different availability corrections of the abundance estimate, with three different estimates of the historical catches, the model estimated the dynamics of harbour porpoises in West Greenland quite differently, from increase to rapid decline. 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. Nevertheless, the working group noted that the average annual catches since 1993 in West Greenland were 2,126 harbour porpoises and that a large abundance is needed to sustain such catches.

Norway

The two best models to estimate by-catch by coastal monkfish and cod gillnet fisheries gave about 6,900 harbour porpoises taken annually. The mosaic surveys designed for minke whales do not give a reliable abundance estimate for porpoises because they do not cover the coastal habitat of harbour porpoises, and are run in conditions up to (but not including) Beaufort 5. Although no abundance estimate is available for the coastal harbour porpoise population, the annual by-catch is likely not sustainable.

Two options were 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. An experiment is currently running with pingers in Vestfjorden. If the pingers are effective as a deterrent at depths down to 400 m, they will be recommended for use in the large mesh net monkfish fishery. For the cod fishery, further consideration is needed due to the very high fishing effort in the cod spawning area.

Incidental sightings show that the species is commonly observed in near coastal waters, archipelagos and fjord systems along the entire Norwegian coast.

Harbour porpoises have been observed in the southern Barents Sea, including the Pechora Sea (see NPR-R), and a vessel-based survey gave uncorrected estimates of about 3,000 animals. It is known that there is some by-catch in the southern Barents Sea.

Given the recent discovery of large uncertainty in catches, the SC **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. T-NASS 2015 may provide a new abundance estimate and a new assessment should not be considered until the outcome of this survey is known.

The SC **recommends** that Norway expand the information about by-catch giving the next priority to the lumpfish fishery by-catch; that surveys to estimate abundance in Norwegian coastal and fjord waters are carried out with focus in the areas of highest by-catch (Vestfjorden); that both tracking and genetics studies be carried out to clarify stock delineation; that samples be collected from by-catches, to obtain data on sex ratio, reproductive status, age structure, diet, contaminants, *etc.*

The next meeting of the WG on Harbour Porpoises is deferred until new abundance estimates are available.

Bowhead whale

Aerial surveys were completed in West Greenland in 2012 and a comparison with a simultaneous genetic mark recapture study showed the genetics give higher abundance estimates. The reasons for the higher estimates are that the aerial surveys are snapshots of the situation, whereas the genetics represent a whole influx of bowheads.

SURVEY PLANNING

Acoustics

A contracted report on the acoustics data from T-NASS 2007 collected on 4 vessels was reviewed. This was the first broad scale acoustic survey in the North Atlantic. Combined with data from CODA, it represents the largest single dataset collected. There were only 11 detections of sperm whales and it was noted that these are unlikely to result in an accurate estimate to be of value in comparison to an estimate based on 100 sightings. However, it could be interesting to compare acoustic detections with sightings. There was a considerable number of dolphin detections, but further analysis would require additional funding.

Acoustics are not included in the NAMMCO T-NASS 2015 proposal but could be conducted during national survey activities.

T-NASS 2015

Due to national and international requirements, management decisions on cetacean harvests necessitate scientific advice based on updated abundance estimates. Better basis for the management of cetacean species is obtained through effort coordination aiming at a synoptic and contiguous survey across the whole North Atlantic with identified target species, while at the same time allow for modifications necessary to meet national requirements. Such coordinated surveys could also be useful for detecting trends in distribution and abundance of species for ecosystem monitoring. The specific objectives for the planned T-NASS 2015 are to obtain unbiased abundance estimates of:

- 1) Pilot whales around Faroe Islands - useful for assessing the sustainability of the hunt.
- 2) Minke whales in West Greenland, around Iceland, Jan Mayen and Svalbard and the central Norwegian Sea.
- 3) Fin whales southwest of Iceland.

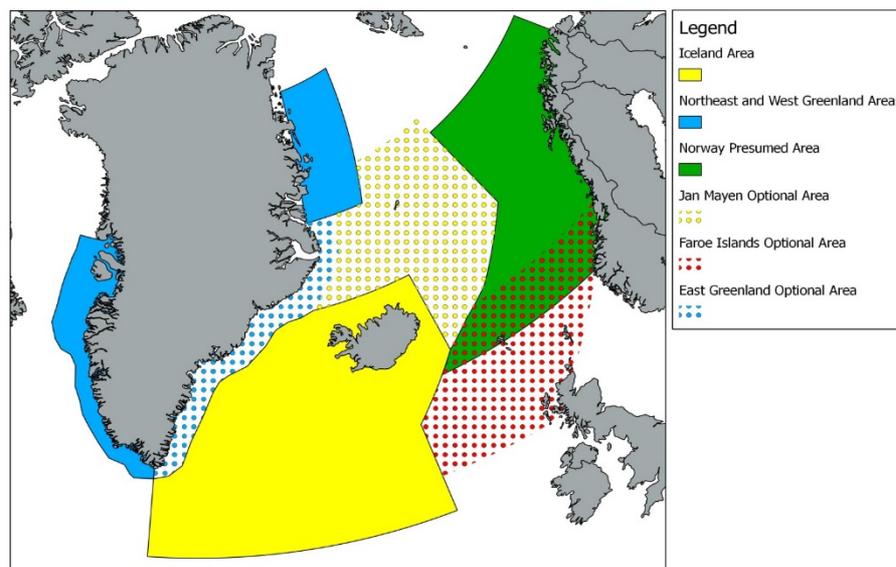


Figure 3. Extension of the proposed T-NASS 2015. The estimated size of the areas is off Northeast Greenland 235,529 km², Jan Mayen 726,044 km², Iceland 2,860,193 km², Norway 934,722 km², Faroe Islands ~768,235 km², East Greenland 233,659 km² and West Greenland 225,285 km².

The plans from individual NAMMCO member countries are to conduct local surveys (see Fig. 3 above) in 2015 generally similar to those of the 2007 T-NASS survey. **Greenland** plans to conduct an aerial survey of West Greenland shelf area from Kap Farvel to Uummannaq in August-September 2015, but no ship surveys are planned. **Norway** conducts a series of mosaic surveys covering different part of the North Atlantic each year and will either cover the central Norwegian Sea or the area around Svalbard. The **Faroe Islands** will provide one survey platform. **Iceland** will provide 2-3 survey platforms that will cover the areas traditionally covered by Iceland. National funding contributions in terms of already planned survey effort, including ship-time, are expected to cover about 45 million NOK.

Aside from already planned national survey activities, there are also plans for surveys of cetaceans funded by oil companies in areas where oil exploration is planned (East Greenland approx 2.5 mill NOK) and there are also expected participations from Russia, Canada and other countries (estimated at ~6 million NOK).

For the target species chosen for T-NASS 2015 however, it is desirable to have larger, more coherent survey coverage and an additional 7 million NOK are needed to ensure coverage in areas adjacent to areas surveyed by NAMMCO member countries. These are:

1. Increased survey coverage of potential pilot whale habitat includes design of survey strata based on information on habitat delineation of whales tracked by satellite to ensure that areas with the highest abundance are well covered. Independent estimation of group sizes will be based on aerial photographic counts of pilot whale groups detected by either the ship survey or aerial platform. The survey is then left with the task of counting groups in passing mode. Group size has been a notorious problem in past surveys. Potential cooperation with SCANS-III is also recommended, with the reservation that these surveys are not planned for the same year.
2. Conduct a ship-based survey coverage of the Jan Mayen area with the methods used in the Norwegian mosaic survey design to ensure that this important area is covered simultaneously with areas in the Norwegian Sea and East Greenland and in particular the Icelandic coastal areas from where minke whales may have shifted to the North in recent years.
3. The East Greenland coastal shelf area from Kap Farvel to about 80°N has not been covered in the past due to sea ice, but the area is known to have conspicuous numbers of baleen whales detected by platforms of opportunity in recent years. It should therefore be covered in T-NASS 2015 with an aerial survey conducted in the same way as the surveys in West Greenland in the same year.

Identified areas of secondary importance (not highlighted in Fig. 3) include the offshore areas between the Labrador coast and the shelf areas of West Greenland not surveyed in the past; areas south of the Irminger Sea and generally south of 55°N with respect to sei and pilot whales; areas north of 70°N in West Greenland where recent catches of minke whales have been taken; areas in the north-east Barents Sea, Pechora Sea where Russian surveys have indicated increased presence of cetaceans.

The T-NASS 2015 will be organized by the Steering Committee appointed by the Council with members from the Scientific Committee. Detailed proposals will be reviewed with the plan to forward them to the Council meeting in February 2014 for a final decision on funding.

MAIN REPORT

1. CHAIRMAN'S WELCOME AND OPENING REMARKS

The Scientific Committee (SC) Chair Gunnlaugsson opened the 20th meeting of the NAMMCO SC. He welcomed the NAMMCO Scientific Committee members, as well as the observers from Japan and the Russian Federation (Address Section 5.4), to the Marine Research Institute (HAFRO).

2. ADOPTION OF AGENDA

The Draft Agenda (Appendix 1) was adopted with minor amendments.

3. APPOINTMENT OF RAPPORTEUR

Prewitt (Scientific Secretary) was appointed Rapporteur with the help of Lockyer (General Secretary), Winsnes (Deputy Secretary), and meeting participants as needed.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

The documents available to the meeting are listed in Appendix 2.

4.1 National Progress Reports

National Progress Reports (NPRs) for 2012 from the Faroe Islands, Greenland, Iceland and Norway were received by the Committee. In addition the SC was pleased to receive progress reports from Canada, the Russian Federation and Japan, and presentations from Japan and Russia at the meeting.

4.2 Working Group Reports

Reports from two NAMMCO Working Group (WG) meetings were available at the meeting:

- WG on Harbour Porpoises (Annex 1)
- WG on Walruses (Annex 2)

4.3 Other reports and documents

Several other reports and documents were presented to the meeting and were examined under the relevant agenda items.

5. COOPERATION WITH OTHER ORGANISATIONS

Observer reports from meetings of other organisations were available for consideration and are summarized below.

5.1 IWC

The 64th meeting of the SC of the International Whaling Commission was held in Panama City, Panama from 11-23 June 2012 and the 65th meeting in Jeju Island, Republic of Korea from 3-15 June 2013. Víkingsson and Gunnlaugsson attended both meetings as observers for the NAMMCO SC.

The 64th meeting of the IWC SC in 2012

Walløe presented a summary of the 18th meeting of the NAMMCO Scientific Committee.

The IWC SC reiterated its interest in monitoring NAMMCO's initiative to implement a series of ecosystem modelling exercises in the Barents Sea and the waters around Iceland.

The IWC SC noted that the NAMMCO Secretariat had indicated interest in organizing and convening a global review of the monodontids jointly with the IWC Scientific Committee and suggested a joint steering committee be established.

The IWC SC recommended that the Implementation Review for North Atlantic fin whales, previously scheduled for 2014, be brought forward to 2013. The Review should start during a pre-meeting immediately before the 2013 annual meeting to ensure that it is completed in one year. An inter-sessional email steering group was established to coordinate the work prior to the 2013 meeting. The committee noted that while the Implementation Review would be focused on providing advice for the Icelandic hunt, the discussions of stock structure would also be valuable in the context of the SWG's work to develop a strike limit algorithm (SLA) for the aboriginal hunt off West Greenland.

The IWC SC agreed in 2011 to conduct an Implementation Review for North Atlantic common minke whales in 2014. Preparations continued at SC/64 and the IWC SC agreed that this will include a full review of stock structure and other issues, recognizing that there had been substantial new information collected over the period since the original hypotheses were developed during the Implementation in 1992.

Preparations for *pre-implementation* of North Atlantic sei whales were initiated at the request of Iceland. An inter-sessional correspondence group was established to oversee this work.

The IWC SC decided that the results from the Icelandic research programme on common minke whales would be subject to final review during the inter-sessional period 2012-2013.

The SC agreed that highest priority within the AWMP working group should be to work towards the development of long-term SLAs for the Greenland hunts:

- (a) Develop trial structures and operating models for the Greenland hunts of bowhead and humpback whales to be presented initially at an inter-sessional Workshop in 2013.
- (b) Develop an AWMP RMP-lite program to assist developers of SLAs for the Greenland hunts of fin and common minke whales; and
- (c) Review a full scientific paper on the work in Greenland related to the collection of information on conversion factors

The 65th meeting of the IWC SC in 2013

Walløe presented a summary of the 19th meeting of the NAMMCO Scientific Committee.

The new large-scale T-NASS survey with the most optimal year for a large scale coordinated survey is 2015 was highlighted and Norway presented its plans to conduct a new series of annual partial surveys over the period 2014 – 2019 (SC/65a/RMP10).

In accordance with new IWC rules concerning special permit programs, an expert panel meeting took place in February 2013 in Reykjavík to review the results from the Icelandic research program on common minke whales. Thirty papers on the results were submitted to the expert panel meeting (<https://events.iwc.int/index.php/workshops/ISPEPR2013/schedConf/presentations>). A response paper (SC/65a/SP1-rev) to the expert panel report (SC/65a/Rep3) was also submitted and some of the papers were revised and resubmitted to the IWC SC annual meeting where several of the papers were presented to the relevant sub-committees and working groups.

Elvarsson presented a preliminary report (SC65a/EM01) from a multispecies modelling effort to study the role of minke whales in the marine ecosystem around Iceland, in the Gadget statistical framework.

A finalised review of MSYR to be used in trials recommended updating the *Requirements and Guidelines for Implementations under the RMP* with the range $MSYR_{1+}$ 1% to 7%. The Norwegian proposal for amending the CLA (SC/59/RMP4) will be a primary document for the next meeting and other modifications will be considered then.

Considerable progress on developing SLAs and providing management advice for Greenlandic hunts was made as a result of an inter-sessional workshop (SC/65a/Rep2). The Committee noted that it may be possible to base the SLA for fin whales off West Greenland on operating models which considered West Greenland only. This will be investigated further including at the inter-sessional RMP workshop on fin whales.

SC/65a/AWMP07 reported on the collection of weights and length measures from fin, humpback and bowhead whales caught in West Greenland. To increase the reporting rate, the Greenland Institute of Natural Resources has now purchased and distributed weighing equipment that can be fitted to cranes in major towns for the hunters to use for weighing when landing a catch.

Using the interim safe approach in providing advice for the Greenland hunts the limits were repeated 2 strikes of bowhead whales off West Greenland and 164 West Greenland minke whales (down from 178) and 12 for East Greenland (repeat from last year). Also repeated was a strike limit of 19 fin whales and 10 Humpback whales off West Greenland.

Bjørge presented published by-catch estimates for harbour porpoises for the Norwegian coastal fleet.

Table 1. Summary of proposed workshops and pre-meeting of special relevance to NAMMCO.

Workshop on developing SLAs for the Greenland hunts	Early January	Copenhagen, Denmark
Workshop on the North Atlantic fin whale Implementation Review	Early January	Copenhagen, Denmark
AWMP/RMP NA minke whale stock structure	April	Copenhagen (or Bergen)
North Atlantic common minke whale Implementation Review	May, Pre-meeting (3 days)	Bled, Slovenia

A completion of the Implementation Review for the North Atlantic fin whales is anticipated at the next annual meeting and then to begin a basin-wide stock structure study for North Atlantic fin whales, to be completed in time to inform the next Implementation Review. A Steering Group under Walløe was set up, to ensure that sufficient progress is made on the Implementation Review of North Atlantic minke whales, starting now under the new guidelines. There will also be a review of the information available for North Atlantic sei whales in the context of a pre-implementation assessment.

The NAMMCO Secretariat, with the IWC Scientific Committee as co-sponsor, indicated it can convene a global review of monodontids workshop back-to-back with the joint meeting of the NAMMCO SC Working Group on Belugas and Narwhals and the JCNB, to be held in Copenhagen in the second half of 2014 (or first half of 2015).

Lars Walløe was again appointed as the IWC representative at the next NAMMCO SC meeting.

The NAMMCO SC **noted** that Walløe has not attended the NAMMCO SC meetings for some years, and appoints Nils Øien as NAMMCO observer to the IWC SC meetings.

5.2 ASCOBANS

Lockyer reported on two meetings of ASCOBANS.

The **7th Meeting of Parties (MOP7)** to the ASCOBANS was held in Brighton, England, 22-24 October 2012 and attended by Lockyer. ASCOBANS holds its MOP only every 3 years, and one of the main matters for consideration and agreement addressed the work plan for the next triennium. Advice had been received from the Advisory Committee (AC) in its report (from its AC19 meeting earlier in March

2012). The implementation of the [Recovery Plan for Baltic Harbour Porpoises \(Jastarnia Plan\)](#) (2002 and updated 2009) and of the [Conservation Plan for Harbour Porpoises in the North Sea](#) are ongoing. The [Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat](#) was the topic for Resolution (7.1). This resolution covered topics from contaminants to by-catch mitigation and disturbance, in effect to improve environmental quality. NAMMCO was specifically mentioned in one of the resolutions (7.2) dealing with the future work plan, where increased cooperation with other IGOs was invited.

The ASCOBANS Secretariat gave a presentation of a new system that would be implemented, based on the UNEP/CMS-system, where member countries could enter information for the national reports online in a specific format.

At the AC19, ASCOBANS had pledged support for the T-NASS 2015. A 2-page information sheet, not presented as an official document to the meeting, was distributed to all delegations, and a short presentation of the planning process and financing through a newly appointed Steering Committee, and also the description of the areas to be covered in cooperation with non-member states (US and Canada, Russia and the EC countries) in comparison with T-NASS 2007 coverage, was provided. Interest and appreciation of this information was expressed by the members present.

The **20th meeting of the ASCOBANS Advisory Committee** was held in Warsaw, Poland, 27–29 August 2013. Lockyer attended as observer from NAMMCO.

The ASCOBANS Advisory Committee (AC) meeting was organized in two sessions: a scientific session and an institutional session.

In the scientific session, a number of reports were presented and discussed that emanated from various working groups appointed under ASCOBANS. Several of these focused on the harbour porpoise, and were from different Action Plan groups: the Recovery Plan for Baltic Harbour Porpoises (Jastarnia Plan), the Conservation Plan for Harbour Porpoises in the North Sea (North Sea Steering Group), and Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat.

The issue of recent large catches of pilot whales and >400 white-sided dolphins in the Faroe Islands was raised. Concern over this was expressed by the AC and the ASCOBANS Secretariat was instructed to write a letter to the Faroes requesting information on these hunts. Lockyer, at this point, fielded off further discussions by informing the AC that NAMMCO was the competent body for providing management advice to the Faroes on such issues regarding sustainability of catches, and that the Faroe Islands would report to NAMMCO on such catches.

Matters concerning the new Agreement extension area and also large cetaceans were discussed following the reports of these two working groups. It was noted that it would be desirable for the Large Cetacean working group to provide information as this could help flag up emerging issues such as ship strikes and entanglement.

The meeting recognized SCANS-III as a priority and the Parties are urged to provide the matching funding needed. Although SCANS-III is not scheduled until 2016, during 2015, a number of trials – mainly experimental survey techniques – will be tested. The project coordinators running SCANS-III were encouraged by the AC to liaise with their counterparts organizing the T-NASS 2015 survey in order to make the results as compatible as possible and exchange expertise.

In the institutional session part of the meeting, of interest to NAMMCO was the introduction and demonstration of an Online Reporting System for ASCOBANS member countries. The topics included in such reporting are comparable to the National Progress Reports in NAMMCO, and as such, the new system may be interesting as a template for NAMMCO when revising its own reporting form format in the future.

The ASCOBANS Coordinator for the [Conservation Plan for Harbour Porpoises in the North Sea](#) (Desportes) was invited to present the Plan and the progress in its implementation at the NAMMCO Working Group on Harbour Porpoises.

5.3 ICES AND NAFO

Haug reviewed the 2012 activities in ICES which have some relevance to the work in NAMMCO SC. This included work in the ICES Working Group on Marine Mammal Ecology (WGMME) and the Working Group on By-catch of Protected Species (WGBYC). The ICES Annual Science Conference (ASC) generally include sessions with marine mammals included as an integral part, occasionally also sessions entirely devoted to marine mammals.

The next ICES Science Conference will be held 15-19 September 2014 in A Coruña, Spain and there are plans to have a session on top predators and climate change that may be of interest to NAMMCO.

Haug will continue as the NAMMCO observer to ICES.

It was noted that the WGHARP no longer includes NAFO and that there are no other NAFO meetings of relevance to NAMMCO. NAFO activities have usually been reported by Canadian observers to the SC meetings; however no Canadian observer was present at this meeting.

5.4 JCNB

A subgroup of the Joint Scientific Working Group of NAMMCO and the JCNB is scheduled to meet in 10–12 March 2014 in Copenhagen to decide on catch allocations of narwhals in Baffin Bay.

6. ENVIRONMENTAL ISSUES

6.1 Sea Ice Conditions

At **NAMMCO/21-2012**, the Management Committee **underlined** the serious situation for ice-breeding seals when the extent and quality of sea ice is rapidly changing under the current climate change.

The SC **noted** that changing sea ice conditions will need to be taken into account, and will add to the uncertainties in regard to ice breeding seal assessments. These issues were further discussed in the species updates for harp, hooded and ringed seals, and were also **noted** for walrus.

6.2 Role of Marine Mammals in the Ecosystem

Norway

Haug reported from recent Norwegian research on the ecology of harp seals in the Barents Sea where they are major top predators (Grahl-Nielsen *et al.* 2011, Lindstrom *et al.* 2013, Øigård *et al.* 2013a). After whelping and moult during spring in the White and southeastern Barents Sea, they disperse to feed, following the receding ice edge and moving northwards in the area. Norwegian studies of their foraging behaviour during this intensive summer feeding period were conducted in the northern Barents Sea in 1996-2006 (Lindstrøm *et al.* 2013). Subadult (<150 cm) and adult seals were observed to feed heavily on pelagic crustaceans (particularly krill) – adult seals also ate fish. In terms of biomass, krill was most important (63%) followed by polar cod (16%) and other fish species (10%). The seals targeted primarily the most lipid-rich prey at this time of the year: krill, followed by other crustaceans and polar cod (see Grahl-Nielsen *et al.* 2011). Other fish species were very lean. Availability of high-energetic food in the northern areas in spring and summer presumably provide the energetic advantage necessary to account for the long migrations of harp seals from their more southerly located winter distributions.

In the Barents Sea the ice coverage is at its minimum in summer and autumn. In recent years, the ice free area of the northern part of the Barents Sea has increased during summer. Additionally, some fish species, such as cod, have extended their range northwards. Could these observed changes in habitat have affected the possibilities for harp seals to restore their blubber reserves during summer feeding? Harp seal body condition, estimated from samples taken during spring in 1992-2011, exhibited a slow

increase from 1992 to 2001, whereafter a significant decrease to a minimum in 2011 occurred (Øigård *et al.* 2013b). Analyses of relevant covariates indicated that high abundance of krill impacted the seal condition positively, emphasizing the ecological significance of krill as key food for harp seals during summer. High abundances of capelin, polar cod and cod had, however, a negative impact on seal condition. A linear correlation between annual pup production and blubber thickness indicated that recently observed declines in pup production may be associated with changes in body condition of the seals. Seemingly, indirect effects such as competition between harp seals and prey for shared resources such as krill, may have resulted in negative effects on condition with subsequent implications for breeding success. Longer migration routes with increased energy expenditure between the breeding/moulting areas and feeding areas along the ice edge may certainly also have contributed to the reduced recent harp seal body condition.

Haug and Zabavnikov reported that a high priority part of the planned Joint Norwegian-Russian Research Program on Harp Seal Ecology is to deploy satellite transmitters on harp seals in the White Sea. In all the years 2007-2011 it was planned to do this in a joint Russian-Norwegian effort just after the moulting period (in late May), or, alternatively, in late March – early April if ice conditions turns out to be unfavourable in early May. Unfortunately, the Federal Technical Committee (FTC) did not permit satellite tagging using non-Russian tags in Russian waters in all years. In 2012 and 2013, however, permission to tag harp seals in the White Sea was given by the Russian Authorities, but now a lack of funding prevented tagging of seals. In 2014 the Russian colleagues in PINRO will again attempt to obtain funding for and carry out both aerial surveys and satellite tagging in the White Sea – if only one of the projects proves feasible, tagging will be given priority over the aerial surveys. During the tagging experiment, PINRO will provide the necessary logistics required for helicopter- or boat-based live catch of seals in April-May 2014. IMR, Norway, will, as before, be responsible for the satellite tags, including providing all necessary technical details, as well as for providing experienced personnel and equipment for anaesthetizing seals and tag deployment. For proper planning and budgeting on both institutes, PINRO scientists must obtain the necessary permissions from Russian authorities before December 2013. The permission from Russian authorities is not dependent on the origin of the transmitters, therefore both US and Russian transmitters can be used. The transmitters cannot collect geographically positioned temperature and salinity data. After the 2014 tagging season future seal tagging will be decided upon following an evaluation of both the tagging methods and the obtained seal movement data set. Due to low pregnancy rates and decline in pup production it will be important to focus on harp seal ecology and demographics in the coming years.

During discussions, Kitakado noted that they are seeing similar declines in blubber thickness in Antarctic minke whales, with differences between sexes. Haug informed the group that they are not seeing differences between the sexes, and are also not seeing decreased body condition in the pups.

Zabavnikov reported that early analysis of data from 2013 ecosystems survey showed that many harp seals were observed in the western part of the Kara Sea, and the final results will be presented later. Little knowledge exists on food conditions for harp seals in the Kara Sea, but the Kara Sea is known to be shallow.

Iceland

Víkingsson summarized the results from a study on diet composition and abundance of common minke whales in Icelandic waters (Víkingsson *et al.* 2014). According to regular aerial surveys conducted since 1986, the common minke whale is the most abundant mammalian top predator in Icelandic continental shelf waters with an estimated total consumption of around 2 million tons in the mid-1990's. Recent surveys have, however, shown an appreciable decrease in abundance of minke whales in this area. It has been hypothesized that these changes represent a shift in distribution triggered by northward shifts in distribution of important prey species. The results show pronounced spatial and temporal variation in the diet. The temporal changes include a decrease in the proportion of sandeel in the diet over the study period and a corresponding increase in herring and gadoids. The diet also differed markedly from the limited previously available data from Icelandic waters from the period 1977-1997. These changes in diet composition are consistent with recent changes in the Icelandic continental shelf ecosystem

including high sea temperatures and changes in distribution of several prey species including sandeel and capelin. Although natural fluctuations cannot be ruled out at this stage, these dietary changes, together with decreased abundance in coastal waters, may reflect the responses of minke whales to a changed environment possibly driven by global warming.

6.3 Other

Vikingsson updated the SC on the Ecosystem Modelling project for which funding was being sought. The initial NAMMCO research program has developed into a much broader project with modelling at the core, including more general fisheries management considerations and a socioeconomic component.

The project has now been funded for 6 million Euros for the next 4 years. The funded project has been adapted for the call for research proposals from the EU, and now includes 29 institutes from 16 countries. It still contains parts of the original marine mammal components. Iceland is still a core area, and the project has been expanded to include many other areas, however multispecies modelling in the Barents Sea has been removed.

The SC **noted** that the original NAMMCO project (coordinated by Lars Walløe) has been changed but the Icelandic component is still included.

7. SEALS AND WALRUS STOCKS - STATUS AND ADVICE TO THE COUNCIL

7.1 Harp Seal

7.1.1 Update

Haug and Zabavnikov reported from the ICES Working Group on Harp and Hooded Seals (WGHARP) which met during 26-30 August 2013 at PINRO in Murmansk, Russia (ICES 2013). WGHARP received presentations related to estimates of catch, mortality, abundance, biological parameters and current research of relevance to White Sea/Barents Sea, Greenland Sea and Northwest Atlantic Ocean harp and hooded seal stocks. The WG was also requested to provide catch options for northeast Atlantic harp and hooded seals in response to a September 2012 request from Norway.

White Sea / Barents Sea

Zabavnikov reported that a pup survey of White Sea/Barents Sea harp seal stock was flown during March 2013, but the results are not yet available. Haug further reported from the recent WGHARP meeting where the population model was fitted to the same pup production surveys and reproductive rate information as used in previous assessments, and with harvest data updated to 2013. The population model estimated a total White Sea/Barents Sea harp seal stock 2013 abundance of 1,419,800 (95% CI 1,266,910 – 1,572,690). At current catch levels, which are essentially 0, the model indicates an increase in the 1+ population of 13% over the next 10 years. Equilibrium catch level is 17,400 1+ animals or an equivalent number of pups (where one 1+ seal is balanced by 2 pups). A catch level of 26,650 1+ animals or an equivalent number of pups will bring the population size down to the N70 level (i.e. 70% of Nmax) with probability 0.8 within 10 years. Since this population is now defined as data poor (reproduction data older than 5 years), also the Potential Biological Removals (PBR) approach was considered. The PBR removals were estimated to be 40 430 animals, of which 14% should be pups. This catch option indicates a 16% reduction of the 1+ population in 10 years. WGHARP expressed concerns on the high removals and declining population resulting from the PBR estimations, and concluded that the estimated equilibrium catches were the most preferred option. The current equilibrium option is slightly higher than the previous option, given in 2011. This is possibly a result of no, or very low catches in 2012 and 2013.

WGHARP has used aerial surveys of pups flown between 1998 and 2010 in the formulation of its advice. Surveys prior to 1998 were surveys to count adults. These surveys were found to have been flown prior to peak pupping, and did not take into account that some females are absent from the ice at different times of the day and under different weather conditions. Therefore unless a correction factor can be developed and applied to the pre-1998 surveys, they are not suitable for providing estimates of abundance of seals in the White Sea.

Greenland Sea

New aerial surveys to assess harp seal pup production were conducted in the Greenland Sea in 2012 (Øigård *et al.* 2013a). Reconnaissance surveys were flown by helicopter (18 March - 1 April) and two fixed-wing aircrafts (22 March – 1 April) in an area along the eastern ice edge between 67°55' and 74°10'N. The reconnaissance surveys detected two patches of harp seal breeding. The general drift of the two patches were in a south westerly direction. Due to more scattered and loose drift ice in the northernmost patch, this patch drifted faster than the more southern patch. Thus, on 28 March the two patches had merged, yielding one large patch which was photographed by the two aircrafts simultaneously in a high-density coverage. A total of 27 photo transects, spacing 3 nautical miles, were flown using both aircrafts in the area between 70°43'N / 18° 31' - 18° 15' W and 72° 01'N / 17° 29' - 17° 29' W. The survey covered the entire area of the merged patches, and all transects were flown with cameras operated to ensure about 80-90 % coverage of the area along each transect line, resulting in a total of 2,792 photos shot. Analyses of the photos resulted in an estimate of 89,590 (SE = 12,310; CV = 13.7%) pups. This estimate is slightly, but not significantly lower, than estimates obtained in similar surveys of the area in 2002 and 2007.

The Greenland Sea harp seal stock is considered to be data rich (no data used in modelling is older than 5 years). Therefore, it is appropriate to use a population model to estimate abundance and evaluate catch options. All model runs seem to indicate a substantial increase in the population abundance from the 1970s to the present. The population model estimates a total 2013 abundance of 627,410 (470,540 – 784,280) seals. Current catch level indicates an increase in the 1+ population of 21% over the next 10 years. The equilibrium catch level is 14,600 1+ animals or an equivalent number of pups (where one 1+ seal is balanced by 2 pups).

Since Greenland Sea harp seals are classified as data rich, ICES now find the Precautionary Approach framework developed for the management of harp and hooded seals appropriate for the population, given that the reference levels reflect the most recent estimate of total population size which is the largest observed to date. ICES suggest that when the population is between N70 and Nmax, harvest levels may be decided that may stabilize, reduce or increase the population, so long as the population remains above the N70 level (*i.e.* 70% of Nmax). A preferred option is to design the TAC to satisfy a specific risk criterion (*e.g.*, 80% probability of remaining above N70 over a 10 year period). Using this approach, a modelled catch level of 21,270 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), in 2014 and subsequent years is obtained. Any allowable catch should be contingent on an adequate monitoring scheme to detect adverse impacts before it is too late for them to be reversed, particularly if the TAC is set at a level where a decline is expected.

Northwest Atlantic

Aerial surveys to estimate pup production in the Northwest Atlantic were flown in 2012, but the results for all regions will not be available until the fall of 2013. Estimates from the southern Gulf of St Lawrence are almost half of estimates from 2008. Years with poor ice conditions have been increasing in frequency over the past decade. Ice conditions observed during 2012, were similar to those observed in 1969, 2010, and 2011 and are among the worst on record. This has serious implications for the persistence of breeding harp seals in the southern Gulf of St Lawrence.

The NAMMCO SC **welcomed** this work, and **agreed** with the advice of the WGHARP.

7.1.2 Future work

Haug reported that the ICES Working Group on Harp and Hooded Seals will meet again in May 2014, presumably in Quebec, Canada, to review the status and assess the catch potential of harp seals in the Barents Sea / White Sea and in the Northwest Atlantic.

There was discussion that new requests to ICES from individual countries would be needed for a new meeting to finish assessments for Barents Sea and Northwest Atlantic harp seals. Preferably such requests should come from Russia and Greenland, respectively.

The SC noted that the previous joint ICES/NAFO WG on harp and hooded seals is now exclusively an ICES WG. Noting the current Letter of Agreement between NAMMCO and ICES on scientific cooperation, the SC advises Council that a more formal cooperation between ICES and NAMMCO on harp and hooded seals such as through the ICES WGHARP would be desirable, and that a formal request to ICES for such cooperation could be sent.

7.2 Hooded seal

7.2.1 Update

When WGHARP met during 26-30 August 2013 in Russia, they also considered recent research and provided catch advice on the Greenland Sea stock of hooded seals in response to the September 2012 request from Norway. Additionally, some new information about the northwest Atlantic hooded seal stock was reviewed.

Greenland Sea

During the aerial surveys conducted in the Greenland Sea in 2012, harp seal was the prime target species for the surveys since this population is still hunted. Hooded seals have been protected since 2007 due to the low pup production numbers – to assess the effect of protection on the pup production, more than 5 years are needed due to the usually 4–5 years age at maturity observed in the species. If possible, however, it was a secondary goal to obtain also a new abundance estimate for hooded seals in the area during the same survey. Evidently, given the available logistical resources and the priority of harp seals, the possibilities to obtain a hooded seal pup production estimate would require that hooded seal breeding occurred within the same main areas as the harp seal breeding. During the course of the survey, it proved possible to obtain data on the pup production of both harp and hooded seals which were both included in the photo transects run on 28 March. The survey suggests that pup production remains low (13,655 pups, CV=13.8%). These estimates were slightly lower, but not significantly different than estimates obtained from the 2005 and 2007 surveys.

Results from a re-analysis of hooded seal pregnancy rate data (collected from 1958 to 1999) yielded estimates ranging from 0.62 to 0.74 and showed no significant differences between sampling periods. The pregnancy rate for the total sample was 0.68 (95% CI=0.06). The Greenland hooded seal population is considered to be data poor. The population model is similar to the model assessing the abundance of the Greenland Sea and the Barents Sea / White Sea harp seal population. With estimates of pregnancy rates being fairly constant around $F = 0.7$, the model runs indicate a current population size of approximately 83,000 which is well below N_{30} (30% of largest observed population size). The model predicts a 7% decrease of the 1+ population over the next 10 years. Following the Precautionary Harvest strategy previously developed by WGHARP, the implication of this is no current catches from the population.

Haug presented a study by Nymo *et al.* (2013) which investigated seroprevalence of *Brucella pinnipedialis* in Greenland Sea hooded seals. Pups (< 1 month) had a substantially lower probability of being seropositive (2.5%, n=159) than yearlings (35.3%, n=17), suggesting that exposure occurs post weaning. For seals older than one year, seroprevalence decreased with age, and there were no seropositives older than five years. No significant relationship was observed between *Brucella*-serostatus and body condition or parity status (based on the presence of corpora albicantia). The authors hypothesise that young hooded seals are likely exposed to *B. pinnipedialis* through prey, with a subsequent clearance of infection.

The NAMMCO SC **welcomed** this work, and **agreed** with the advice of the WGHARP.

7.2.2 Future work

As mentioned under 7.1.2, Haug reported that the ICES Working Group on Harp and Hooded Seals will meet again in May 2014, presumably in Quebec, Canada, to review the status and assess the catch potential of hooded seals in the Northeast Atlantic.

7.3 Ringed seal

7.3.1 Update

Norway

Lydersen informed the SC about ongoing tagging of ringed seals using various combinations of satellite tags and sensors that were deployed on males and females of different age classes. Data collection ended this summer and analysis is underway.

Canada

It was noted that the NPR from Canada contains updates on ringed seal research including research on ringed seal foraging behaviour and the effect of changing ice conditions on breeding behaviour.

Faroe Islands

Mikkelsen informed that 2 yearlings have been seen in the Faroes in the last 5 years.

7.3.2 Future work

R 2.3.1 NAMMCO/5 02-1995 (Standing): To advise on stock identity of ringed seals (*Phoca hispida*) for management purposes and to assess abundance in each stock area, long-term effects on stocks by present removals in each stock area, effects of recent environmental changes (i.e. disturbance, pollution) and changes in the food supply, and interactions with other marine living resources.

R 2.3.2 NAMMCO/7 05-1997 (Standing): The Scientific Committee was requested to advise on what scientific studies need to be completed to evaluate the effects of changed levels of removals of ringed seals in West and East Greenland.

The SC **noted** that there is currently very little information on stock structure and stock size to consider in relation to both requests. Some movement information exists, but these do not give enough information to have understanding of population structure.

The SC **suggested** that a Working Group be considered in the next few years (2015 or later). The WG could look into movements (from the available satellite tagging data) versus where catches are occurring in relation to stock structure. It may also be important to assess this species in light of climate change and changing ice conditions. The SC notes that it is very difficult to obtain the desired information on this species. The Arctic Council recently held a meeting on ringed seals, and it was suggested that the SC considers, at its next meeting, the report from that meeting, and data availability, and considers then the need for a WG.

7.4 Grey seal

7.4.1 Update

R-2.4.2 NAMMCO/11 02-2002: The Management Committee noted that there has been a decline in the numbers of grey seals around Iceland, possibly due to harvesting at rates that are not sustainable. The Scientific Committee had previously provided advice in response to a request to review and assess abundance and stock levels of grey seals in the North Atlantic, with an emphasis on their role in the marine ecosystem in general, and their significance as a source of nematodal infestations in fish in particular (NAMMCO 1995). Given the apparent stock decline in Iceland, an apparent increase in Southwest Norway and in the United Kingdom, and the fact that this species interact with fisheries in three NAMMCO member countries, the Management Committee **recommended** that the Scientific Committee provide a new assessment of grey seal stocks throughout the North Atlantic.

Norway

Haug reported that an age-structured population dynamics model had been developed to assess the Norwegian grey seal population (Øigård *et al.* 2012). The model is of a Bayesian character in the sense that priors for various parameters were used. It includes total pup production, estimated by-catch mortality rates and catch statistics, while age specific pregnancy rates were derived from studies in other areas. Model runs indicated an increase in the abundance of the total Norwegian grey seal population during the last 30 years, suggesting a total of 8,740 (95% CI 7,320-10,170) animals in 2011. A total catch of 707 (95% CI 532-882) grey seals would maintain the population size at the 2011 level.

Pup production estimates used in the model were obtained in three periods: 1996-1999, 2001-2003 and 2006-2008. In management of the species, Norway has decided not to use the model based TAC, but instead continue to use the more conservative 5% of current abundance until a new pup production estimate becomes available.

Iceland

Grey seals are distributed all around the Icelandic coast. The majority of the population breeds on the west- and northwest shores, with a second high density in the breeding distribution on the southeast coast of Iceland. Seven aerial surveys to estimate pup production in Iceland, have indicated a downward trend in the period 1980 – 2004, about 3% ($\pm 1\%$) annually. In the period 1990 – 2002, this downward trend doubled to about 6% annually. In year 2005 a new method was applied for the first time counting at least three times on each breeding site and correcting for double counting with a weaning O-give, and with staging when possible. This method has also been applied in 2008 (and 2009 a re-survey of only a part of the coast due to bad weather the year before) and now in year 2012. The results indicate a status-quo in the low pup-production reached in year 2002. The population size of the Icelandic grey seal is therefore not increasing significantly, but is rather staying at the low levels reached in 2002 (about 4,200 animals) and just above the minimum population management objective of the Icelandic government, 4,100 1⁺ animals.

Greenland

No new information to report.

Faroe Islands

Mikkelsen informed about progress made in the Faroes in response to the standing request listed above (R-2.4.2). No attempt has yet been made to estimate the abundance. Fish farmers that kill seals at their farms, in a protective act, have been asked to deliver removal statistics on an annual basis. However some farmers still have not introduced a sufficient reporting system. Preliminary data for 2012 indicate that the total removal is in excess of one hundred animals, with highest removals during winter.

Satellite tracking has shown that grey seal movements in the Faroes are very local (Fig. 1), however seals migrating from UK waters to the Faroes have been documented. Some of these animals, especially yearlings, could be part of the removals, especially in winter, but this is unknown. The results from a genetic study on the population delineation of grey seals in the North Atlantic, which include samples from the Faroes, are still awaited.

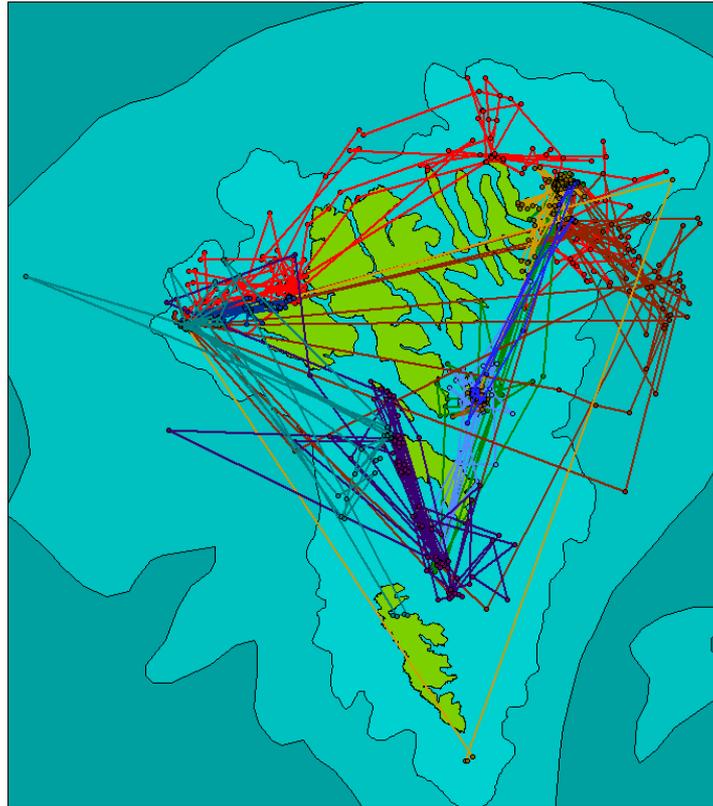


Fig. 1. Satellite tracks from grey seals tagged in the Faroe Islands.

7.4.2 Future work

Norway

The most recent pup production estimate of grey seals in Norway is based on data obtained in 2006-2008. The management plan for coastal seals now implemented in Norway require that data used in assessments should be updated every 5 years. A boat-based visual survey aimed to obtain a new abundance estimate for the species in Norway will therefore start in November 2013 (covering the northernmost parts of Norway), and continue in 2014 and 2015. If possible, Russia and Norway will conduct a joint survey of grey seals on the Murman Coast- these grey seal colonies has not been surveyed since 1991.

All Areas

The SC **reiterates the recommendation** from SC19 to obtain numbers on total removals (by-catch and catch) for grey seals in Norway, Iceland, and the Faroe Islands.

The SC **recommended** that the Grey and Harbour Seals WG meet in late winter 2014 or early 2015 to finalise the **requests 2.4.2 and 2.5.2**. The WG meeting should assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway. The meeting should also address by-catch issues (grey seals) in Norway, Iceland, and the Faroe Islands, and a re-evaluation of the Norwegian management plans (which have been already implemented) for grey and harbour seals. It will also be advisable to include participation from at least Canada, UK, and the Baltic Sea countries.

7.5 Harbour seal

7.5.1 Update

R-2.5.2 NAMMCO/16 02-2007: The commission requested the Scientific Committee to conduct a formal assessment of the status of harbour seals around Iceland and Norway as soon as feasible. The Management Committee agreed to change the geographical focus of this request to entail ALL areas. (NAMMCO 19)

Norway

Haug reported that aerial surveys aimed to obtain a new abundance estimate for harbour seals in Norway were started in 2011 and continued in 2012 and 2013. This has yielded a new minimum point estimate of 7,081 for the species for the entire Norwegian coast. This new estimate is implemented in the 2014 management of the species – this management now follows the management plan reviewed by NAMMCO SC in 2011.

Lydersen reported from an aerial survey of harbour seals in Svalbard (Merkel *et al.* 2013) -

Abstract

This study presents the first abundance estimate for the world's northernmost harbour seal population, which resides in Svalbard, Norway, based on three digital stereoscopic photographic surveys conducted in 2009 and 2010. The counts from these high resolution 3D images were combined with a novel method for estimating correction factors for animals that were in the water at the time of the surveys, in which extensive behavioural data from radio-tagged harbour seals were used together with age distribution data to estimate the proportion of seals of various age and sex classes hauled out at the times of the surveys. To detect possible seasonal shifts in age distribution between surveys, lengths of hauled out seals were measured from the stereoscopic images. No such length differences were detected; but, this may be due to a high degree of sexual dimorphism exhibited in this population. Applying the modelled correction factors, a total of 1,888 (95% CI: 1,660-3,023), 1,742 (1,381-3,549) and 1,812 (1,656-4,418) harbour seals were estimated for the surveys flown on 01 August 2009, 01 August 2010 and 19 August 2010, respectively. The similarity between the three survey estimates (despite significant differences in the number of animals actually counted on the photos from each survey effort) suggests that the variation in numbers of hauled out seals is reasonably accurately adjusted for by the haul-out probability model. The low population size, the limited spatial distribution of the population and its reduced genetic diversity make this population vulnerable to chance events, such as disease epidemics.

Additionally, data from 60 SRDLs from harbour seals in Svalbard are currently being analysed as part of a PhD thesis.

Iceland

The result of the sixth comprehensive seal count in Vatnsnes peninsula on 22nd of July 2012 resulted in a count of 618 harbour seals, considerably fewer than in 2011 when the result was 1033 seals (Granquist and Hauksson 2011).

Greenland

Updates are presented in NPR-G. It was reported that females with pups were observed on a new haulout site south from Nuuk, in the municipality of Sermersooq in 2010, and information about a new one further south was obtained in 2012.

7.5.2 Future work

Norway

Haug reported that biopsy sampling of tissue from pups for genetic studies will continue on the Norwegian coast in 2014. The aim of such sampling is to assess the population structure of the species using DNA analyses.

See Item 7.4.2 for the SC **recommendation** for a Coastal Seals Working Group meeting.

7.6 Bearded seal

7.6.1 Update

Lydersen reported that 7 GPS tags have been deployed, but results are not ready for reporting yet.

Greenland reported that 2 bearded seals have been tagged.

7.6.2 Future work

The tagging projects in Norway and Greenland are ongoing studies.

7.7 Walrus

7.7.1 Update

Walrus Working Group

The SC WG on walrus met 8-10 November 2013 in Copenhagen to update assessments and to provide management advice for the three stocks of walrus that occur in Greenland. The WG also considered a request from Council (**R-2.6.6**) to investigate the possibility to carryover unused quota between years.

Stock Structure

The three stocks of walrus are: 1) Walruses in Baffin Bay, which occur mainly in the North Water area around Qaanaaq, Smith Sound and the fjords on east Ellesmere Island including Jones Sound 2) Walruses in West Greenland / Baffin Island that occur in West Greenland in winter and along the coast of East Baffin Island during summer, and 3) Walruses in East Greenland that occur year-round along the eastern coast of Greenland, mainly north of Scoresby Sound.

A total of 35 walruses during 2010-2013 were instrumented with satellite-linked transmitters in Smith Sound, Northwest Greenland. The tags transmitted from 3 to 125 days and identified movements. Thirty-two of the walruses moved to Canadian waters in July, with 6 entering Jones Sound, and they returned to Greenland in November, where they stay until spring. The tagging provided correction factors for aerial surveys, and it occurred in spring to coincide with aerial surveys.

Catch Statistics

Reported catches since 1993 from three stocks are given in Table 2. The Baffin Bay stock is hunted in the Qaanaaq area and in Grise Fjord, Canada. The West Greenland / Baffin Island stock is hunted in West Greenland and around 4 settlements in Canada (Qikiqtarjuaq, Clyde River, Iqaluit, Pangnirtung). East Greenland walruses are hunted only in East Greenland.

Table 2. Reported catches of walrus. NR= not reported, NA= not available

Year	Qaanaaq Area	Grise Fjord	West Greenland	Qikiqtarjuaq	Clyde River	Iqaluit	Pangnirtung	East Greenland
1993	265	12	241	0	0	29	0	15
1994	156	24	270	5	0	26	40	10
1995	128	5	265	16	0	25	8	11
1996	122	8	176	0	1	9	2	7
1997	74	12	155	3	0	0	16	1
1998	72	11	139	0	1	27	4	7
1999	101	5	184	0	0	15	3	10
2000	126	4	196	0	0	19	15	7
2001	171	2	162	1	1	7	19	10
2002	147	3	150	33	0	1	9	34
2003	160	7	113	1	0	1	15	11
2004	90	5	100	0	2	NR	NR	4
2005	78	2	158	NR	NR	10	NR	16
2006	67	5	73	9	1	9	15	5
2007	80	4	43	6	0	11	NR	10
2008	66	NR	28	NR	NR	NR	10	9
2009	90	7	33	NR	NR	14	NR	4
2010	60	2	40	6	NR	14	NR	7
2011	42	4	50	5	0	14	NR	5
2012	76	NA	34	NA	NA	NA	NA	4
2013	62	NA	NA	NA	NA	NA	NA	NA

Hunters in Greenland are required to fill out a “special form” (*Særmeldingsskema*) which, among other things, requests information on gender.

In Qaanaaq (Baffin Bay stock) there appears to be no bias in the hunter reports on gender, and reports from 2007–2013 were used to derive a weighted average of 39% (SD=8.5) females. The assessment for this stock applied an even sex ratio except for the years since 2007 where the reported sex ratios were used.

Greenlandic regulations forbid hunting of mature females and calves (except the Qaanaaq area). It is likely that the gender reported in the “special forms” in West Greenland is affected by this regulation, with the reported sex being biased towards males. Genetics on samples from 1988 to 2007 estimated a female fraction of 0.59 (Andersen *et al.* 2013), which was applied to catches after 1988 in the assessment for West Greenland/Baffin Island.

All walrus caught in East Greenland from 2011 to 2013 were males, in agreement with an earlier estimate of 10% females (Born *et al.* 1997), as assumed in the assessment for East Greenland.

A review of Canadian catch history was also available (SC/20/WWG/O06), but not discussed in detail.

Each assessment model includes a low and a high catch history. The low catch history does not include struck and lost animals, whereas the high catch history includes struck and lost. This results in an average loss rate about 15% for Baffin Bay and West Greenland/Baffin Island, and about 11% for East Greenland.

The SC recognizes that the loss rates used in the assessment may be lower in some areas and in some types of hunts, but more information is required before the rates can be adjusted. Complete statistics on total removal levels is critical and the SC **strongly recommended** that Greenland obtains reliable reports of all animals struck and lost.

Abundance and Trends

Baffin Bay

Two abundance estimates (1,238 CV=0.19 for 2009 and 1,759 CV= 0.29 for 2010) presented in Heide-Jørgensen *et al.* (2013b) are not statistically different from each other, and it was agreed that the two estimates should be treated separately for the assessment. They were obtained from a multi-species survey. This may affect the perception bias for walrus, but following discussion it was agreed that the method was acceptable given the data available. The applied correction factors were derived from animals tagged in the North Water (SC/20/WWG/04).

West Greenland/Baffin Island

An estimate of absolute abundance of 2,500 (CV=0.17) was obtained from haulout counts from southeast Baffin Island (Stewart *et al.* 2013a).

Three estimates (1,100 CV=0.31 for 2006, 1,140 CV=0.48 for 2008, 1,410 CV=0.22 for 2012) from aerial winter surveys in West Greenland (Heide-Jørgensen *et al.* 2013a) were used as a time series of relative abundance in the assessment. These estimates assume that animals on ice were constantly available, whereas animals in the water have a correction factor for availability. The detection depth for animals in the water was assumed down to 2 m. There are no area-specific correction factors for animals that were submerged, so correction factors from the North Water were used.

The assessment included also an earlier time series (1981 – 1999) of densities of walrus wintering in West Greenland between 66°15 and 68°15 N (SC/17/WWG/04) to provide trend information on a longer time scale.

East Greenland

There was no new information from East Greenland, and the 2009 estimate of 1,430 (CV=0.45) for East Greenland was used in the assessment (SC/17/WWG/07).

Assessment

The historical and current dynamics of the three walrus populations were estimated in SC/20/WWG/05 using age- and sex-structured population models with exponential growth, density-regulated growth and selection-delayed dynamics. These models were integrated with the agreed catch data in a Bayesian framework, where the likelihood of the simulated population trajectories were evaluated from the agreed abundance estimates and 376 aged walrus caught in Qaanaaq between 1987 and 1991.

The fit of the model to the age-structured data from Qaanaaq showed an under-representation of animals younger than ten years in agreement with a hunt that takes mainly adult animals. The estimated selectivity is steep and concave, characteristic of selection for full-grown animals, with selection against animals that are almost but not yet fully grown.

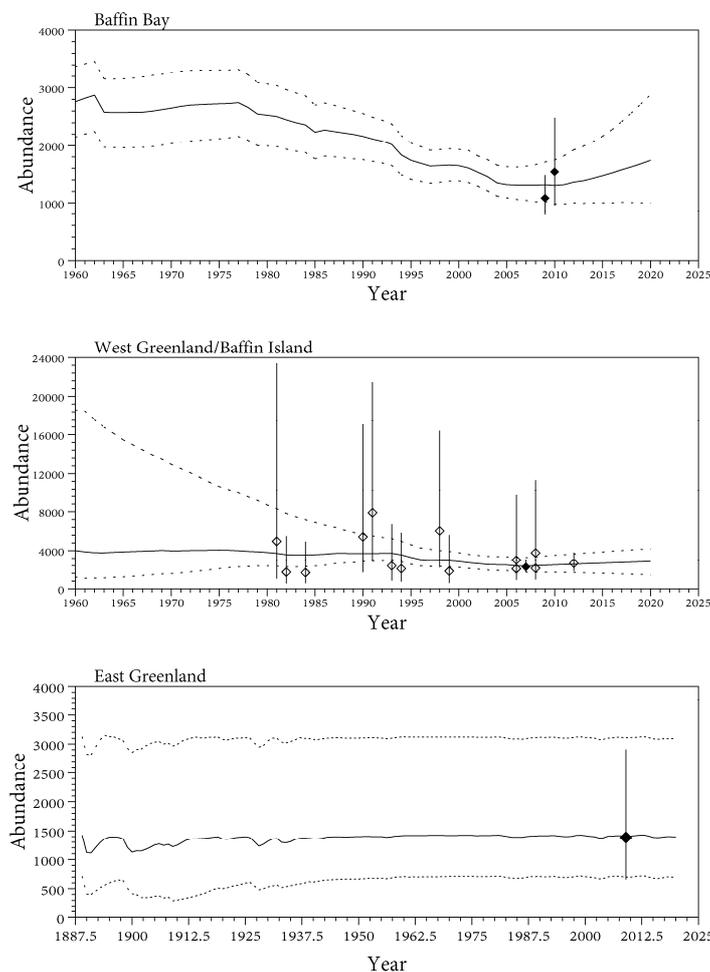


Figure 2. Projections of population models for the three walrus stocks in Greenland, together with absolute (solid diamond) and relative (open diamond) abundance estimates, with 95% confidence intervals. The solid curves are median projections, and the dashed curves span the 95% credibility interval.

The overall decline in the Baffin Bay population caused by historical catches is unclear due to incomplete catch reporting prior to 1950s. An exponential model (Figure 2, top) was considered the best to reflect the production in the population. It estimated that the population declined by 63% from the 1960s to 2007, and decreased catches (~140 to ~70) have subsequently allowed this population to increase. The 2014 abundance estimated by the model was 1,430 (95% CI: 999-2,170) with an annual

natural growth rate of 7.7% (95% CI: 6.4-9.5%) and a replacement yield in 2014 of 120 (95% CI: 73-180) walruses.

The historical trajectory for West Greenland/Baffin Island walruses is unclear owing to problems in resolving long term models with current abundance data. The exponential model is unreliable here because it was unable to provide sufficient updated estimates of population growth. A density regulated model (Figure 2, middle) initiated in 1960, however, solved the problem. It estimated a population that decreased from 4,000 (95% CI: 1,210-18,600) walruses in 1960 to 2,360 (95% CI: 1,720-3,280) in 2007. Annual catches were then reduced from more than hundred to around 60, and the population was again increasing with a 2014 model estimate of 2,630 (95% CI: 1,640-3,790) walruses and a replacement yield of 120 (95% CI: 42-180).

A 2014 estimate of 1,400 (95% CI: 720-3,200) walruses in East Greenland has apparently recovered relative to 1888, the year prior to our first historical catches by European sealers. The historical trajectory is uncertain. Density regulation estimates a relatively flat trajectory (Figure 2, bottom), with a maximum depletion in 1890 to 80% of the initial abundance, and a slow continuous increase to almost no current growth. A recovered population was also estimated by selection-delayed dynamics providing a continued increase and a historical depletion to 3% in 1957.

Updated abundance estimates for West Greenland, and modelling with age-structured data from Baffin Bay, have improved the status estimates for Baffin Bay and West Greenland/Baffin Island.

Sustainable Harvest Levels

The estimated trade-offs between total removals and the probability of population increase is shown in Table 3 for the Baffin Bay and the West Greenland/Baffin Island populations. A target of a 70% probability for increasing populations from 2014 to 2018 results in **recommended** total removals of no more than 93 animals from the Baffin Bay population and no more than 100 animals from the West Greenland/Baffin Island population.

Table 3. The estimated probabilities of increasing populations from 2014 to 2018 for 6 levels of annual removal from the Baffin Bay and West Greenland/Baffin Island stocks. Canadian and Greenlandic catches and struck and lost walruses are assumed to be included in removals. These removals do not assume a specific sex ratio.

Removals	75	80	85	90	95	100
Baffin Bay	0.94	0.86	0.81	0.75	0.67	0.58
West Greenland / Baffin Island	0.87	0.85	0.81	0.78	0.74	0.70

In the East Greenland hunt, there is a high ratio of males, and the overall catch is small. A run of the assessment model with the extra years of catch data shows that this is still sustainable, and the **recommendation** of an annual total removal of no more than 20 individuals from the last assessment is reiterated.

Carryover of unused quotas

R-2.6.6 The Management Committee requested the Scientific Committee to investigate the possibility to include a carryover for quotas in order to include this possibility in the next hearing for the new quota block period.

The SC discussed that the WG was not specific in their advice regarding carryover of quotas. The SC was informed that this issue was discussed at length by the WG, but it was deemed difficult for the group to give more specific advice without a more specific request from the Management Committee.

Recommendations for Research

The SC **recommends**:

- That new estimates of sex and age structure of the catch for West Greenland are obtained. The sex determination that is reported by the hunters should be validated using genetics.
- That the fraction of the catches and abundances in Canada that belong to the West Greenland/Baffin Island population are clarified.
- That complete catch statistics from Canada are collated.
- That reliable reports of struck and lost are obtained for the entire range of the stocks in Greenland and Canada.
- That regular abundance estimates (5-10 years) from Baffin Bay, West Greenland, and the southeast coast of Baffin Island are obtained.

The SC agrees with the **recommendations** of the WG of total removals of no more than 93 animals from the Baffin Bay population, no more than 100 animals from the West Greenland/Baffin Island population, and no more than 20 individuals from the East Greenland population.

The SC **concluded** that there is no biological argument against carryover of unused quotas. A problem arises if carryovers accumulate over time and/or across assessments.

With regards to **R- 2.6.3 NAMMCO/15 03-2006** (regarding the effect of human disturbance on walrus distribution, behaviour, and conservation status), the SC **noted** that there is no new information available to consider this request.

7.7.2 Future work

Greenland plans to conduct an aerial survey of walrus on the ice edge in the North Water in April 2014.

Lydersen informed that a walrus survey of Svalbard was completed in 2012. The results are not yet complete; however an increase in both total numbers and females with calves compared with the 2006 survey is apparent. The study on disturbance at haulouts using cameras continues. There is cooperation with Russian scientists on tagging studies. Funding has been acquired for 2014 for a project that will use tags with GPS positions that will be downloaded to stations on shore. This study aims to investigate how individuals are responding to changes in ice conditions.

Lydersen reported that Russian scientists have collected skin biopsies from animals in the Pechora Sea in order to clarify the relationship of these walrus to those in Svalbard.

Zabavnikov reported that there is a new study of walrus in the Pechora Sea related to oil and gas exploration and extraction.

Iceland and the Faroes both noted that there have been a higher than usual number of visits from walrus in 2013.

8. CETACEANS STOCKS - STATUS AND ADVICE TO THE COUNCIL

8.1 Fin whale

8.1.1 Update

Iceland

Catch limits for fin whales in Icelandic waters are based on management advice provided by the SC of NAMMCO and the work of the SC of IWC using its Revised Management Procedure (RMP). The latest advice was for an annual catch of 154 whales in the West Iceland area and applies for the period 2011-2015. The Marine Research Institute (MRI) has already provided advice for the years 2014 and 2015 in accordance with this advice from NAMMCO. No catches of fin whales were taken in 2011 and 2012

but 134 animals were taken in 2013. The catches taken during 2011-2013 amount to 29% of the TAC set for this period and 17% of the NAMMCO advice for the five year period (2011-2015).

In 2013 the SC of the IWC initiated a RMP implementation review for North Atlantic fin whales. The review could not be completed as planned in 2013 and will be finalized in 2014. The SC agreed changes to the range of MSYR to be applied in the RMP. These changes required time consuming re-programming which is still underway within the IWC. Until these are finalized, there is no point in carrying out re-runs of RMP with 0.6 tuning level recommended by the NAMMCO SC. As the present advice expires in 2015, the NAMMCO SC **recommended** convening a meeting of the working group on large whale assessments in the autumn of 2014 to provide further management advice on fin whales off Iceland.

Greenland

No new information.

8.1.2 Future Work

The Working Group on Large Whale Assessments will meet before the next SC meeting.

8.2 Humpback whale

8.2.1 Update

Norway

Lydersen informed about a Marine Mammal Sighting Database for Svalbard operated by the Norwegian Polar Institute. The purpose is to get tourists, scientists and other people that travel in the area to report sightings of marine mammals including polar bears. This reporting system has been operating for 7 years. Of the many observations, one special case of a completely white humpback whale is reported in Lydersen *et al.* (2013).

This white humpback whale was observed on several occasions off Svalbard, Norway, during August 2012. The animal was completely white, except for a few small dark patches on the ventral side of its fluke. The baleen plates were light-coloured, but the animal's eyes had normal (dark) colouration. This latter characteristic indicates that the animal was not an albino; it is a leucistic individual. The animal was a full-sized adult and engaged in "bubble-feeding" together with 15-20 other humpback whales each time it was seen. Subsequent to these sightings, polling of the marine mammal science community has resulted in the discovery of two other observations of white humpback whales in the Barents Sea area, one in 2004 and another in 2006; in both cases the observed individuals were adult animals. It is likely that all of these sightings are of the same individual, but there is no genetic or photographic evidence, so this suggestion cannot be confirmed. The rarity of observations of such white individuals suggests that they are born at very low frequencies or that the ontogenetic survival rates of the colour morph are low.

Iceland

With reference to the pending request from NAMMCO 15 (**R-3.2.4**) to conduct a formal assessment of humpback whales following the completion of T-NASS 2007, the SC **noted** that it had completed the assessment for West Greenlandic waters. The SC has not yet initiated assessment in other areas and agreed to seek further guidance from the Council regarding that aspect of the request.

8.2.2 Future Work

If the Commission considers request **3.2.4** a priority, the SC will consider this request in conjunction with the fin whale meeting.

8.3 Sei whale

8.3.1 Update

R-3.5.3 amended NAMMCO/19 09-2010: The Scientific Committee is requested to assess the status of sei whales in West Greenland waters and the Central North Atlantic and provide minimum estimates of sustainable yield.

There is no new information available with regards to this request.

8.3.2 Future Work

The SC noted that the SC of the IWC has initiated a review of available data on North Atlantic sei whales with the view conducting an RMP implementation. Given the busy schedule of the IWC RMP sub-committee, such an implementation is not expected to be completed until 2017 or later. To avoid double work, the NAMMCO SC agreed to monitor the outcome of the IWC SC review of available data scheduled in 2014 before proceeding with an assessment.

8.4 Minke whale

8.4.1 Update

Greenland

Greenland reported that 3 minke whales were tagged this summer. This is ongoing research, and results will be presented at a later date. The main purpose of the study is to get surfacing time for correction factors for T-NASS 2015.

Iceland

The tagging program is continuing, but there has been no successful tracking so far this year. Continued collection of samples was conducted from commercially caught animals. It was noted that there have been low densities of minke whales in the Icelandic coastal areas in recent years.

Norway

The mosaic survey for 2008 – 2013 has been completed. Data analysis is underway, and the aim is for the analysis to be completed in time for the IWC implementation review next year.

8.4.2 Request from Council to review Iceland Minke Whale Program

R-1.1.6 The Commission requested the Scientific Committee to review the results of the Icelandic programme on the feeding ecology of minke whales and multi-species modelling as soon as these become available.

The commission had requested the SC to review the results of the Icelandic research program on the feeding ecology of minke whales and multi-species modelling as soon as these become available (NAMMCO 16). Vikingsson presented a short overview of the results from the Icelandic common minke whale research program conducted according to the Special Permit rules of the IWC. These results had been presented and reviewed at an Expert Panel workshop held in Reykjavík during 18-23. At the workshop, 30 scientific papers from the research program were presented to a specialist panel (<https://events.iwc.int/index.php/workshops/ISPEPR2013/schedConf/presentations>).

The papers covered the multiple objectives of the study, including feeding ecology (stomach contents, stable isotope ratios, fatty acid profiles), energetics, multi-species modelling, biological parameters, satellite tagging, distribution and abundance, genetics, pollution, parasites and pathology. The report from the workshop (SC/20/10) and a response paper (SC/20/11) was discussed at IWC 65a in June 2013 and the diverse results from the program were discussed in the relevant sub-committees of the IWC. These reports were briefly summarized at NAMMCO SC/20.

An overview of the IWC review process was presented (SC/20/10). The SC **notes** that this was a useful presentation for knowing more about how the review was conducted and also notes that the quality of the research will be further determined through the peer-review publication process. The SC also **acknowledged** that the IWC review is set according to guidelines set by the IWC for the reviewers — for example, reviewers focused on whether this research can be done using non-lethal means, and how

these data can be used in assessments. These are not necessarily same criteria that NAMMCO might use.

The SC draws the attention of the MC to the results from the IWC Expert Panel review process and the abovementioned papers and reports detailing the results from the program. The SC awaits guidance from the council concerning potential further review of the results within NAMMCO.

8.4.3 Future Work

The review of the Expert Panel constituted the formal conclusion of the research program within the IWC. The proponents of the program considered the review to be positive, fair and constructive. Many of the suggestions of the Panel have already been taken account of in a response paper and revised documents submitted the annual meeting of the IWC SC. Future work will include continuation of the development of multi-species model for Icelandic waters and publication of the results in peer reviewed journals in addition to the nine already published articles.

8.5 Narwhal

8.5.1 Update

Greenland

A variety of studies are ongoing. In East Greenland, multi-year tagging study is underway, however no data is available to present yet. The tagging study will provide background studies for research on the effects of seismic exploration.

8.5.2 Future Work

In Greenland there are plans for continued monitoring of Melville Bay abundance, more direct studies of the effects of seismic exploration, and continued tracking of narwhals in different stocks.

A subgroup of the Joint Scientific Working Group of NAMMCO and the JCNB is scheduled to meet in 10–12 March 2014 in Copenhagen to decide on catch allocations of narwhals in Baffin Bay. The TOR are under Agenda Item 13.3.

Relating to **Request 3.4.9 NAMMCO/14 03-2005**: The Scientific Committee should provide advice on the effects of human disturbance, including noise and shipping activities, on the distribution, behaviour and conservation status of belugas, particularly in West Greenland:

In 2011, the SC proposed a symposium on beluga and narwhals in relation to disturbance and industrial activities. The IWC is holding a workshop about the effects disturbance on cetaceans in general in the Arctic March 2014. The SC **noted** that this meeting is not redundant with respect to the originally envisioned NAMMCO SC symposium focusing on narwhals and beluga. The SC **recommends** this symposium to be held in 2015 to the Council and awaits further guidance from Council before proceeding with the planning.

8.6 Beluga

8.6.1 Update

Norway

Lydersen updated the SC on a new beluga project in Svalbard started in 2013. This study will include satellite tracking and investigations of health status and pollutants.

Greenland

There is currently no dedicated research, but there were a few kills in East Greenland (Scoresby Sound) and samples were collected.

8.6.2 Future Work

Norwegian studies in Svalbard are ongoing.

See Agenda Item 8.5.2 regarding **R-3.4.9** and a proposed symposium on beluga and narwhals in relation to disturbance and industrial activities.

8.7 Bottlenose whale

8.7.1 Update

Norway

Experiments with low frequency sonar are in progress in Norway.

Iceland

Iceland is investigating increases in strandings during seismic experiments close to Iceland.

Faroese

Mikkelsen reported that Faroese sightings data were analysed together with CODA and SCANS II data in a working document presented to IWC (IWC SC/63/SM13). The preliminary designed based estimate for the Faroese block of T-NASS 2007 was 16 284 (CV=0.41)

Greenland

From the catch statistics in the NPR-G appendices, low levels of catches were noted (20 animals). The SC **recommends** that these catch statistics be validated, since to our knowledge there have not been confirmed catches since the 1950s.

8.7.2 Future Work

Faroe Islands and Iceland

Analyses of diet data from the Faroes catches in the period 1987-2009 and Icelandic strandings from 1993-2001 are ongoing.

8.8 Killer whale

8.8.1 Update

Greenland

SC/20/20 reported on a recent increase in catches of killer whales off Tasiilaq in East Greenland (8 on average per year from 2010 to 2012). Samples have been collected, and genetics indicate that these animals are related to Norwegian herring-eating killer whales (Foote *et al.* 2013). However, only marine mammals (including harp seal pups, and bearded seals) have been found in the stomachs of caught whales. The authors also report the possibility of a high struck and lost rate in this hunt.

The SC **noted** higher levels of annual catches (19 on average per year from 2010 and 2012) also in West Greenland. The SC was informed that the recent catch statistics on killer whales in West Greenland have not been validated. As for bottlenose whales, the SC **recommends** that all catch data on killer whales are validated before the next SC meeting, so that it is possible for the SC to monitor the development of the hunt.

Iceland

During the winter of 2012-2013, 60,000 tons of herring died of oxygen shortage inside a small fjord in West Iceland. The reasons for this catastrophic event are under investigation, including possible contributions of killer whales.

8.8.2 Future Work

R-3.7.2 NAMMCO/13 03-2004: The Management Committee requested the Scientific Committee to review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, and to provide advice on research needs to improve this knowledge. Priority should be given to killer whales in the West Greenland – Eastern Canada area.

The SC again **noted** that there is not sufficient new information to answer this request at this time.

8.9 Pilot whale

8.9.1 Update

Faroe Islands

The NASS-T-NASS surveys subsequent to the 1989 survey have indicated decreasing abundance of pilot whales. However, estimates of pilot whale abundance derived using conventional distance sampling (CDS) from the 5 NASS-T-NASS surveys are not directly comparable to one another because of different survey extents and, in the case of the 1989 NASS, different survey timing. Therefore, the NAMMCO SC-17 recommended that an index of relative abundance be developed and applied to the area that is common to all surveys with the aim of determining trends in abundance over the full period of the NASS. In 2011 NAMMCO SC-19 recommended to develop this index only using the three largest surveys and including the data from the CODA survey for enlarging the reference area.

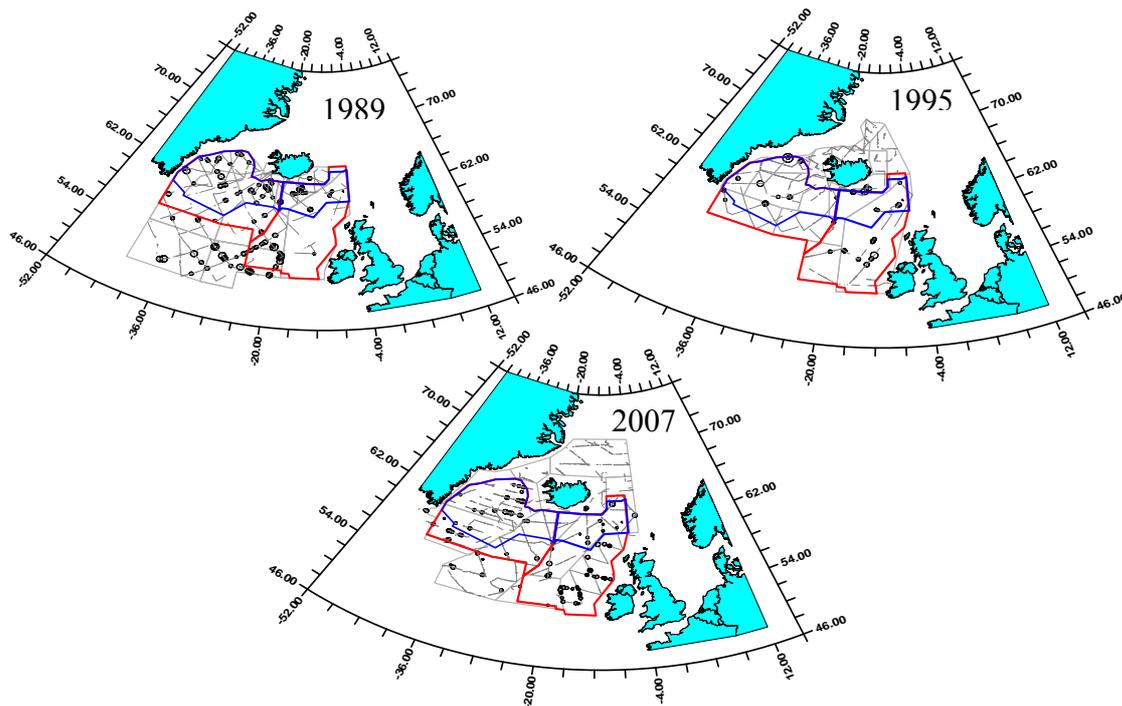


Figure 3. Survey effort and sightings of pilot whales. Symbol size varies with group size from 1 to 500. For 2007 extension effort is shown in blue. Sightings outside of the survey area in 2007 were made by extension vessels. The Index Areas are outlined in blue (5 Survey) and red (3 Survey).

As an answer to these recommendations, Desportes reported NAMMCO SC/20/18. CDS was used to develop indices of relative abundance. The varying spatial coverage of the surveys is accommodated by delineating common areas (Fig. 3) that were covered by: i) all the surveys (red area), and ii) the 3 largest surveys (1989, 1995 and 2007, blue area). These “Index Areas” were divided into East and West sub-regions. Post-stratification was used to obtain abundance estimates for the index areas only. Estimates are provided using the sightings from the combined platforms or the primary platform only for surveys that used double platforms, and including and excluding extension vessel sightings in 2007.

Estimation of pilot whale group size had a strong influence on estimated abundance and varied significantly among the surveys. Mean group size was larger in 1987 than for the other years, especially for the Faroese vessel. It appears that the definition of a “group” and the estimation of its size have changed over the course of the surveys. Other potential biases include differences in survey timing and changes in the number of observers on the primary and combined platforms.

Abundance of individuals declined in both the 5 and 3 Survey Index Regions (Fig. 4), but the rate of decline was not significantly different from 0 in most cases. Sensitivity analyses indicate that annual rates of increase of -4% to -5% and -4% would have been detectable in the 5 and 3 survey analyses

respectively. The abundance of groups did not show a unidirectional trend over time. The index area comprises only a small portion of the summer range of the species and changes in distribution may have influenced the results.

The results are suggestive of a decline in abundance over the past two decades, although no firm conclusions could be reached about the reality or causes of the apparent decline in the relative abundance of pilot whales in the index areas. The role of operational changes in the surveys is equivocal and could have led to either a reduction or exaggeration of the observed trend. If the trend is real, it may have been caused, enhanced or lessened by possible changes in the wider distribution of pilot whales in the area. Although it seems very unlikely that an annual harvest of around 1,000 whales could have caused the population to decline, the apparent reduction of pilot whale abundance in the index areas, which includes the hunting area around the Faroes, should be of concern for managers.

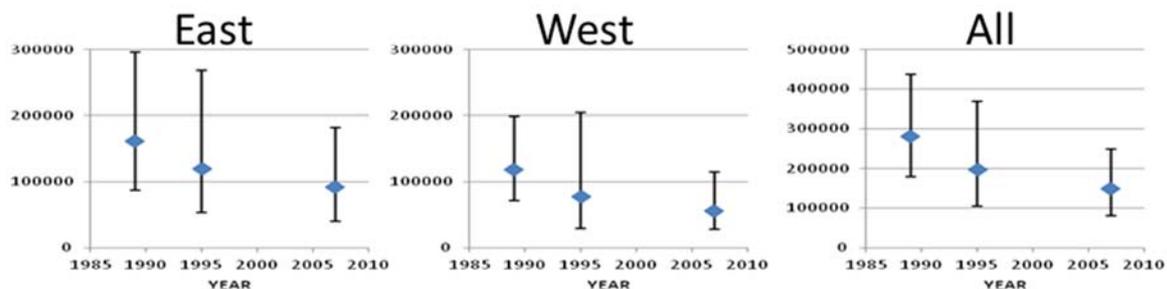


Figure 4. Pilot whale abundance by 3 Survey Index Region (East, West, All) for the Primary platforms.

Pilot whale tagging

Mikkelsen informed about recent progress of pilot whale tagging in the Faroes (Fig. 5).

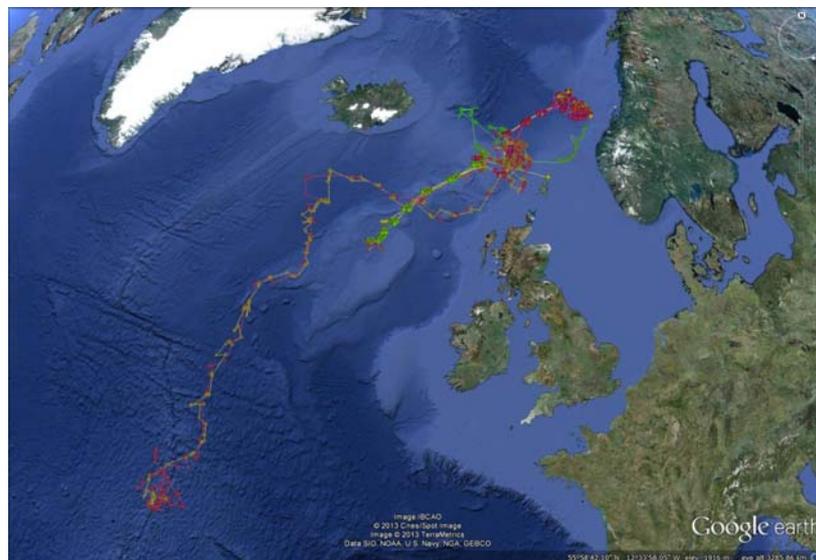


Figure 5. Tracking data from pilot whales tagged in the Faroe Islands.

In 2012 animals from one pod were fitted with satellite transmitters. The longest track was 125 days. This was the fourth successful tagging. During the first five days, the pod stayed at the islands. Then the group moved east, out to the deeper Faroe- Shetland Channel area. After one month, one tagged animal started moving east, toward the Norwegian coast. When reaching the shelf, it turned north, following the shelf slope, and was approaching the Frøya Bank, when contact was lost, after 49 days. After residing for two months in the Faroe- Shetland Channel, the main group started to migrate south. When reaching the Rosemary Bank, the pod swam westward, out into the deeper Iceland Basin. Thereafter the group moved south, to the Edoras Bank, and from there on in a south-west direction until

the pod reached the Mid-Atlantic Ridge. The pod was located on the Mid-Atlantic Ridge when tracking failed. At this stage the group was 1,300 nautical miles away from the tagging location, and the nearest land was the Azores, 350 nautical miles south. The effort to track pilot whale pods off the Faroes will continue.

The SC **noted** that these data are highly valuable and is pleased that tagging will continue.

Iceland

In the last 2 years, there have been 2 mass stranding events, while the last one previous to 2012 was in 1990.

8.9.2 Future work

A new assessment of pilot whales should consider the trend analysis but should await a new abundance estimate from the planned T-NASS 2015 sightings survey.

The Faroese part of T-NASS 2015 will target pilot whales, and it is recommended to use tracking data in the allocation of survey effort. It is also recommended investigate potential cooperation with SCANS-III, with the reservation that these surveys are not planned for the same year.

The satellite tracking programme is ongoing. There have been problems with longevity of the tags (longest track so far 133 days) and to get access to pods for tagging. It is **recommended** that more tracking data are collected, especially from offshore areas, with a focus on the period during sightings surveys (July-August). The SC also **recommended** that the trend data and tracking data should be taken into consideration by the T-NASS 2015 planning group.

8.10 Dolphins

See Agenda Item 9.2 for discussion of acoustic detections of dolphins in the T-NASS 2007 Acoustic report.

In regards to **R-3.9.6 NAMMCO/13 03-2004**: The Management Committee has asked the Scientific Committee to carry out assessments of these species, but to date insufficient information has been available on stock delineation, distribution, abundance and biological parameters to initiate the work. The Committee was pleased to note that considerable progress has been made in the Faroes in describing the ecology and life history of white-sided dolphins and that information on white-beaked dolphins should be available from Iceland and Norway in about 2 years. Abundance estimates are lacking in all areas except Icelandic coastal waters, and no information on stock delineation or pod structure is yet available. The SCANS survey planned for 2005/6 and coastal surveys planned for Norway (see 9.3) should provide information on distribution and abundance in some areas. The Committee endorsed the plan of the Scientific Committee to proceed with the assessments once the above-mentioned studies have been completed, probably by 2007.

The SC noted that there is no new data available to answer this request.

8.10.1 Future work

Mikkelsen informed that the data collected from the drive hunt of white sided dolphins in the Faroes will be published before the next SC meeting.

8.11 Harbour porpoise

8.11.1 Update

Harbour Porpoise Working Group

The NAMMCO Working Group on Harbour Porpoises met in Copenhagen 4-6 November 2013. In attendance were 12 scientists representing Greenland, Norway, Faroe Islands, Denmark, and Scotland, as well as the NAMMCO Secretariat. The SC has been requested to conduct a comprehensive assessment of the harbour porpoise throughout its range. This was the first meeting and terms of

reference was to provide a full assessment for West Greenland, and to initiate the process for Norway, including a review of the method used for obtaining total by-catch estimates.

Greenland

Stock delineation

Harbour porpoises off West Greenland were tracked in order to study distribution and site fidelity. Two animals, tracked for more than a year, 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). The two harbour porpoises displayed 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).

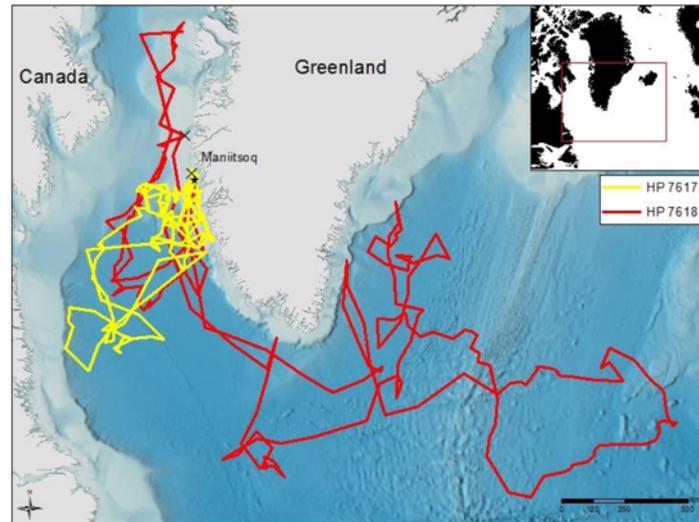


Figure 6. Tracks of two harbour porpoise tagged in West Greenland

No new genetic data was available. 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. 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. The working group concluded that West Greenland should be considered a separate stock, and a separate management unit, based on current evidence.

Life history

For assessment modelling, the following parameters were agreed upon by the working group: age at first reproduction 3-5 years, pregnancy rate 0.85 – 1 and calving interval 1/year (average), no senescence.

Abundance

A aerial survey conducted in West Greenland in August-September 2007 estimated the at-surface abundance of harbour porpoises, corrected for perception bias, to be 10,314 (CV=0.35). Correcting for the proportion of porpoises expected to be outside the survey strata during the survey period (9 tracked porpoises spent 73 % (CV=0.13) of time inside the strata) the at-surface abundance estimate increased to 14,129 (CV=0.37) porpoises. By using satellite transmitter data on the time spent at the surface during daytime in August-September (average percentage of time spent at 0 m depth was 5.14% (CV=0.13)), to correct the at-surface abundance estimate for porpoises detected breaking the surface, a fully corrected abundance estimate provided 274,883 (CV=0.39, 95% CI 130,974-576,909) harbour porpoises in West Greenland in 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. But the working group had considerable discussion of the correction factor used 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) \times 0.0514 (availability bias) = 0.0293 , which was an order of magnitude less than estimates from other aerial surveys for porpoises. 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%), mentioned above. The second was the percentage of time spent at 0-1m, that 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 from 14 porpoises instrumented with time-depth recorders in Danish waters (28%, CV= 0.13). The estimate of abundance by applying the 28% “at surface” correct factors resulted in a corrected estimate 50,461 (CV= 0.39).

Catches

Most catches of harbour porpoises were taken in central West Greenland during summer months; the town of Maniitsoq and its adjacent settlements were responsible for 40% of all catches. 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.

A questionnaire survey among 28 hunters in Maniitsoq in 2013 found that data from 15 hunters in 2012 were not included in the *Piniarneq* statistics, and this non-inclusion corresponds to 45% of the porpoise catches obtained through the interviews. The correction factor for missing data on harbour porpoise catches in Maniitsoq equals 1.8. Despite the uncertainties it was recommended that this correction factor was applied to catch reports from *Piniarneq* (after 1993) in order to derive a realistic time series useful for assessment of harbour porpoises in Greenland. *Piniarneq* does not require reporting of struck and lost. However, the interview revealed a struck and lost rate of 8%.

In the assessment modelling, three options (low, medium, and high catches) were used for handling combined data from the different reporting schemes and their impacts on correction factors for underreporting. Data from 1980-1988 were excluded due to the unrealistically low and declining reported catches.

Population modelling

An age- and sex-structured population models with exponential or density regulated growth, using 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, was designed. Results for six runs combining the two different availability corrections of the abundance estimate, with three different estimates of the historical catches were provided.

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. For the high abundance estimate, the population increased regardless of the catch history. For the low abundance, the population declined, even with the low catch history. 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.

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 was 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 2126 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 T-NASS 2015 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

By-catch

General additive models (GAMs) were used to derive by-catch rates of harbour porpoise, from 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 (Bjørge *et al.* 2013). By-catch rates were then applied to fishery catch data on the target species to estimate the total number of porpoise taken as by-catch 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 6,900 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, the annual by-catch is likely not sustainable.

To reduce harbour porpoise by-catches, it was recommended that large mesh nets associated with the monkfish fishery to be prohibited at depths less than 50m. The group also recommended conducting 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, it was proposed that ADDs should be implemented in the Norwegian coastal gillnet fisheries for monkfish.

Mitigation

Two options were 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. An experiment is currently running 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, further consideration is needed due to the very high fishing effort in the cod spawning area. The group welcomes and encouraged efforts by Norway to investigate by-catch mitigation.

Abundance estimation

The last updated information on distribution and abundance of harbour porpoises in Norwegian waters is from 1995. In the last series of mosaic surveys (2008-2013), 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.

Distributional maps of incidental sightings show that 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 working group strongly recommends that surveys to estimate abundance of harbour porpoise in Norwegian coastal archipelagos and fjord waters are carried out. These surveys may start in the areas of highest by-catch (Vestfjorden). Possible future techniques for surveys to improve detectability in the fjords could include using drones and acoustic monitoring. 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 T-NASS 2015 is recommended.

Stock delineation

The most recent update of information on stock identity of harbour porpoises in Norwegian waters has 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 genetic 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.

Zabavnikov reported that harbour porpoises have been observed in southern Barents Sea, including the Pechora sea (see NPR-R), and a vessel based survey gave uncorrected estimates of about 3000 animals. It is known that there is some by-catch in the southern Barents Sea, but the numbers are unknown at this time.

Taking into consideration the work of the HP WG, the SC **recommends** the following for Greenland:

1. Given the recent discovery of large uncertainty in catches, the SC **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.
2. The SC noted that T-NASS 2015 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.

Taking into consideration the work of the HP WG, the SC **recommends** for Norway:

1. That Norway expand the information about by-catch giving the next priority to the lumpfish fishery by-catch.
2. That surveys to estimate abundance in Norwegian coastal and fjord waters are carried out. These surveys should focus in the areas of highest by-catch (Vestfjorden).
3. That both tracking and genetics studies be carried out 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.
4. That samples be collected from by-catches in Norway, to obtain data on sex ratio, reproductive status, age structure, diet, contaminants, *etc.* Again, the efforts should focus on the Vestfjord area, where most of the by-catches occur.

8.11.2 Future work

Russia plans to collect data on harbour porpoise by-catch in the Kola Peninsula coastal zone. The next meeting of the HP WG is deferred until new abundance estimates are available.

8.12 Sperm whale

8.12.1 Update

The Acoustics Report from T-NASS 2007 has now been completed (SC/20/13): see Agenda Item 9.1.

8.12.2 Future Work

No standing requests or plans for future research.

8.13 Bowhead whale

8.13.1 Update

Norway

Lydersen reported on 2 AURALS (Autonomous Underwater Recorder for Acoustic Listening) deployed in 2012-2013 (Framstredet and north of Svalbard) set to detect bowheads, narwhal and beluga. These were re-deployed in 2013 (for 2013-2014) in addition to 2 more (Kongsfjorden & Rijpfjorden). In

addition to the target species, the AURALS also detect blue and fin whales, bearded seals and a considerable amount of airgun noise from seismic exploration.

Greenland

Studies of whether females or males are vocalizing or singing are ongoing, with deployments of acoustic recorders on bowheads where skin biopsies are simultaneously obtained.

Aerial surveys were completed in West Greenland in 2012 and a comparison with a simultaneous genetic mark recapture study showed the genetics give higher abundance estimates. The reasons for the higher estimates are that the aerial surveys are snapshots of the situation, whereas genetics represent a whole influx of bowheads.

Heide-Jørgensen also noted a new paper on diving behaviour in bowheads (Heide-Jørgensen *et al.* 2013c).

8.13.2 Future work

Acoustics studies both in Greenland and Svalbard are ongoing.

9. SURVEY PLANNING

9.1 Acoustics Report

The report from the acoustics data from T-NASS 2007 was presented. The report was prepared by Rene Swift at St Andrews and analysed the acoustics data from T-NASS 2007 collected on 4 vessels around Greenland, Iceland, and the Faroe Islands. The goal of the analysis was to look for clicks and if possible, identify to species. However, there were problems with deployment of equipment, and how the data were brought together. Therefore, NAMMCO contracted Rene Swift for further analysis to see if gathering click data was useful for including in T-NASS 2015.

Over 100 high frequency acoustic events were detected, from a total distance surveyed of almost 8,000 km. These were assigned to broad categories, *e.g.* delphinids. For medium frequency events, during a surveyed distance of over 18,000 km, 268 events were detected, and assigned to delphinids, 11 events to sperm whale, and a number of unidentified odontocetes.

This was the first broad scale acoustic survey in the North Atlantic. Combined with data from CODA, it represents the largest single dataset collected. The SC **referred** this report to T-NASS 2015 steering group.

In discussion it was noted that there were only 11 detections of sperm whales and these are unlikely to result in an accurate estimate to be of value in comparison to an estimate based on 100 sightings. However, it could be interesting to compare acoustic detections with sightings. There were a considerable number of dolphin detections, but further analysis would require additional funding.

It was noted that in the CODA survey, the abundance from acoustics was slightly higher than visual observations.

In relation to T-NASS 2015, it may be interesting to talk to the SCANS-III coordinators about adding some acoustics to their experimental surveys in 2015. These acoustics are not included in the NAMMCO T-NASS 2015 proposal but could be conducted during national survey activities.

9.2 Update - T-NASS 2015

The NAMMCO T-NASS 2015 Steering Committee (Niels Øien, Geneviève Desportes, Thorvaldur Gunnlaugsson and Mads Peter Heide-Jørgensen, Chairman) met in Copenhagen on 10 December 2012 to prepare a joint proposal for a North Atlantic survey of selected cetaceans to be conducted in 2015 (T-NASS 2015).

Background

Due to national and international requirements, management decisions on cetacean harvests necessitate scientific advice based on updated abundance estimates. It is generally agreed within the NAMMCO SC that a better basis for the management of cetacean species in the area would be obtained through effort coordination aiming at a synoptic and contiguous survey across the whole North Atlantic. In particular it is important that the surveys are coordinated and designed to cover the target species, while at the same time allow for modifications necessary to meet national requirements.

The data gathered in such coordinated surveys could also be useful for detecting trends in distribution and abundance of species for ecosystem monitoring. This also requires a very large survey area and a series of surveys spread over time to be successful.

Objectives of the proposal

To obtain fully corrected abundance estimates for predefined target species and developed for all areas of importance for management.

The specific objectives for the planned T-NASS 2015 are:

To obtain unbiased abundance estimates of

- a) pilot whales around Faroe Islands useful for assessing the sustainability of the hunt
- b) minke whales in West Greenland, around Iceland, Jan Mayen and Svalbard and the central Norwegian sea
- c) fin whales southwest of Iceland.

Approach

1. The survey is focused on abundance estimates from areas and species that are important for providing robust abundance estimates useful for management
2. The following species are identified as primary target species: long-finned pilot whales, minke whales and fin whales. It is, however, assumed that the survey will also provide robust estimates of humpback whales, sei whales and to some extent also smaller cetaceans.
3. It should be attempted to include Canada and Russia and neighbouring countries in surveying parts of the Atlantic to extend the coverage
4. The survey should be planned for 2015 to ensure sufficient time for preparations and because other areas of the Atlantic likely will be covered by surveys conducted by the US and by the EU.

Geographical coverage

The geographical extent of the planned survey is shown in Fig. 7. In addition to areas covered in the past the following new areas were considered of primary importance for a T-NASS 2015 survey:

1. The East Greenland shelf from Kap Farvel to about 80°N where significant numbers of baleen whales have been detected by platforms of opportunity in recent years;
2. The area between Iceland and Jan Mayen is important for minke whales and could be the sink for minke whales not encountered in recent surveys in Iceland. It will not likely be included in the Norwegian mosaic surveys in 2015 and should be surveyed in T-NASS 2015 to ensure a coherent coverage with coastal Icelandic and East Greenland surveys;
3. Intensified survey coverage will be established around the Faroe Islands based on 'home range' information from ongoing satellite tracking experiments of pilot whales instrumented on the Faroe Islands.

Areas of secondary importance that would be important to include if options appear for including survey effort by neighbouring countries (*i.e.* Canada and Russia):

1. The offshore areas between the Labrador coast and the shelf areas of West Greenland that has not been surveyed in the past;
2. Areas south of the Irminger Sea and generally south of 55°N where sei whales and pilot whales occur;

3. Areas north of 70°N in West Greenland where recent catches of minke whales have been taken;
4. Areas between east Iceland and Norway depending on the Norwegian mosaic survey effort;
5. Areas in the northeast Barents Sea, Pechora Sea where Russian surveys have indicated increased presence of cetaceans.

Proper coverage of all areas of primary importance will ensure that unbiased estimates are obtained. The use of double-platforms will further reduce the bias of the estimates. Both approaches are critical for achieving a survey that will be of long-term value for the management of whales in this area. Coverage of areas of secondary importance will, depending on the applied survey methods, provide additional abundance estimates and data on distributional changes. Combined, such a large-scale survey will be able to detect major shifts in abundance caused by ongoing climatic perturbations in the North Atlantic. Finally the survey will provide critically important information on several non-target species and provide abundance estimates for some of those.

An example of how the results of this planned survey will be fundamental to the interpretation of observed changes in abundance is the minke whales around Iceland. A significant decline in abundance in coastal areas of Iceland was detected in the T-NASS-07 survey compared with previous surveys. However, critical areas north of Iceland and along the East Greenland coast were not included in the survey effort in T-NASS-07. It is therefore impossible to say if the decline represents a catastrophic drop in population abundance or if it constitutes a shift in occurrence, perhaps in response to oceanographic changes. In the survey planned for 2015 all areas will be covered and major shifts in abundance should be detectable.

The primary areas of focus for the 2015 survey extend about 1,740,000 nmi² (Fig. 7).

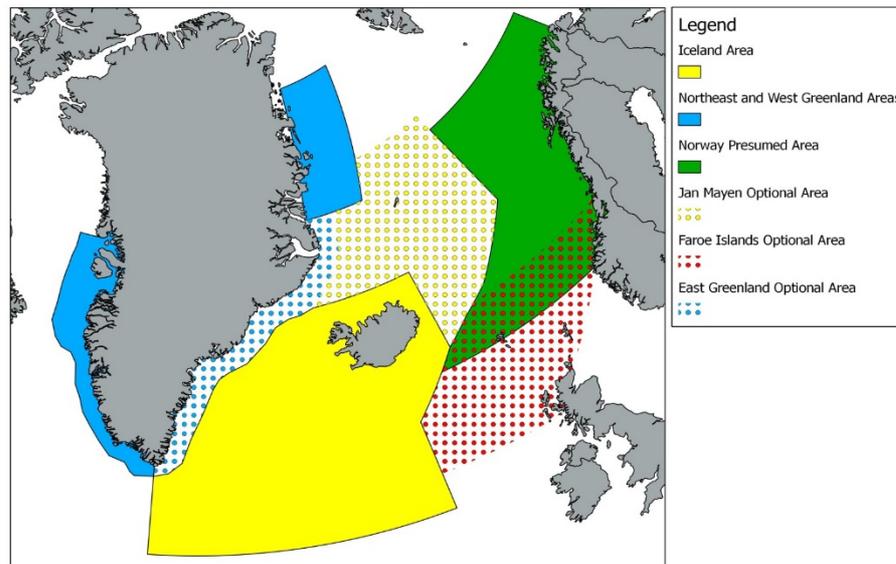


Figure 7. Extension of the proposed T-NASS 2015 and associated surveys. The estimated size of the areas is off Northeast Greenland 235,529 km², Jan Mayen 726,044 km², Iceland 2,860,193 km², Norway 934,722 km², Faroe Islands ~768,235 km², East Greenland 233,659 km² and West Greenland 225,285 km².

Existing survey plans from member countries

Individual NAMMCO member countries plan to conduct local surveys in 2015 and these are generally planned to be similar to those of the 2007 T-NASS survey. Survey expenses are listed in Table 4.

Table 4. Overview of survey expenses in millions NOK covered by National institutions for a T-NASS 2015

Country	Contribution	Costs NOK
Greenland	Survey platform (Twin Otter aircraft with survey crew)	1.5 mill
Greenland	Preparation, analysis and presentation in subsequent years	1.0 mill
Iceland	Survey platform (Two large survey vessel, aircraft and crew)	8 mill
Iceland	Preparation, analysis and presentation in subsequent years	2.0 mill
Norway	Survey platform (One large survey vessel for 6 weeks with crew)	12 mill
Norway	Preparation, analysis and presentation in subsequent years	2.0 mill
Faroe Islands	Survey platform (One large survey vessel for 4 weeks with crew)	1.5 mill
Faroe Islands	Preparation, analysis and presentation in subsequent years	1.0 mill
Total		29 million

Greenland plans to conduct an aerial survey of West Greenland shelf area from Kap Farvel to Uummannaq in August-September 2015. No ship surveys are planned because of lack suitable survey ships and unfavourable weather conditions that require large effort during small windows of good survey conditions. Greenlandic scientists will ensure analysis and presentation of the survey results.

Norway conducts a series of mosaic surveys covering different part of the North Atlantic each year. According to the schedule of the mosaic surveys Norway will either cover the central Norwegian Sea or the area around Svalbard. Analysis and presentation of results are also covered by Norway.

Faroe Islands will provide a survey platform and has tentatively budgeted 1.5 million NOK for this. Participation by Faorese scientists is included in national budgets as well.

Iceland will provide 2-3 survey platforms that will cover the areas traditionally covered by Iceland (see Fig.1) and Icelandic scientists will participate in survey design, survey execution and analysis and presentation of results.

Aside from already planned national survey activities, there are also plans for surveys of cetaceans funded by oil companies in areas where oil exploration is planned (East Greenland approximately 2.5 million NOK) and there are also expected participations from Russia, Canada and other countries (estimated at ~6 million NOK).

For the target species chosen for T-NASS 2015 however, it is desirable to have larger, more coherent survey coverage. The expenses for a large scale survey cannot solely be covered by current national budgets and it is unlikely that funding for such an effort can be secured from scientific funding agencies. Thus the NAMMCO T-NASS 2015 Steering Committee seeks advice from the Council on possible avenues for ensuring proper funding of the survey.

Budget

Based on experience from past surveys the Steering Committee has estimated the costs for a large scale survey to be in the magnitude of ~50million NOK, including Russian and Canadian contributions and national post-survey analysis and presentations of results. In comparison the total cost of the T-NASS-07 survey was 30 million NOK, when corrected for inflation to 2012. National funding contributions in terms of already planned survey effort, incl. ship-time, are expected to cover about 45 million NOK and additional 7 million NOK are needed to ensure coherent survey coverage in areas adjacent to areas surveyed by NAMMCO member countries.

Partial funding of the survey could cause gaps in coverage that will leave areas without data that cannot be included in the abundance estimates and will also reduce the options for detecting shift in abundance between areas. This scenario will eventually hamper the assessment of whale stocks.

Table 5. Overview of budget for the NAMMCO part of T-NASS 2015.

Year	Notes below	Activities within NAMMCO	Costs NOK
2013		Meeting, development & co-ordination	200,000
2014		Meeting, development & co-ordination	200,000
2015		Meeting	20,000
2015	1	Contribution to increased coverage of pilot whale areas	1,000,000
2015	2	Coverage of the Jan Mayen area	5,000,000
2015	3	Coverage of East Greenland areas	800,000
2016		Meetings and publication of results	200,000
Total 2013 - 2016			7,420,000

1. The plan for the increased survey coverage of potential pilot whale habitat has two components:
 - Design of survey strata based on information on habitat delineation of whales tracked by satellite; this will ensure that areas with the highest abundance are covered and that the survey can be intensified in this area;
 - Independent estimation of group sizes based on aerial photographic counts of pilot whales in groups detected at sea by either the ship based survey platform, by satellite tracking or by the aerial platform; this will ensure that group sizes, that has been a notorious problem in past surveys, will be estimated precisely and independent of the survey that is then left with the task of counting groups in passing mode.

This survey design should enable robust estimation of pilot whale abundance from an area where the hunt is recruited and with low variance on the relevant abundance estimates;

2. The plan for the coverage of the Jan Mayen area is to conduct a ship-based survey with the methods used in the Norwegian mosaic survey design to ensure that this important area is covered simultaneously with Icelandic coastal areas and areas in the Norwegian Sea;
3. The East Greenland coastal area has not been covered in the past due to sea ice and the area is known to have conspicuous numbers of baleen whales. It will therefore be covered in T-NASS 2015 with an aerial survey conducted in the same way as the surveys in West Greenland in the same year.

Organisation of the T-NASS 2015

The T-NASS 2015 will be organized by the Steering Committee appointed by the Council with members from the Scientific Committee. The Steering Committee will operate on their funding provided by the Council and this funding will be made available to national research agencies after an application procedure. For smaller amounts of funding for travels, meetings, preparation of proposals and purchase of equipment, a simple request for funding should be submitted to the Steering Committee. For the three large projects in 2015 it is required that each participant submits a detailed project description that can be reviewed internally and externally by the Steering Committee before the funding is provided. The applicants may be required to adjust the proposal based on proposals from the Steering Committee. The agreed project description thereafter also functions as a contract between the Steering Committee and the applicant.

Status for the development of the project

The proposal for T-NASS 2015 was forwarded to the Finance and Administrative Committee in January 2013 and the Steering Committee was informed on a teleconference on 25 October that the FAC agreed

to ask the Steering Committee to move forward with the plans for the T-NASS 2015 as outlined in the proposal.

Shortly after that the members of the T-NASS 2015 Steering Committee were asked by the Chair to prepare the proposals for the surveys. Deadline for the proposals was 27 January 2014 with a subsequent meeting in Copenhagen on 3 February where the detailed proposals will be reviewed with the plan to forward them to the Council meeting in February 2014 for a final decision on funding.

In regards to the funding that was available in 2013 (but awaited decision on T-NASS 2015), the SC **recommends** that these funds are rolled over to 2014. These funds are necessary for planning meetings, the development costs of proposals, testing new technology, and the purchase of equipment that is already known will be needed. Further decisions regarding this will be made at the 3 February 2014 meeting in Copenhagen.

9.3 Other Updates

No further updates.

9.4 Future Work

The T-NASS 2015 Steering Group will meet 3 February 2014 in Copenhagen.

10. NAMMCO SCIENTIFIC PUBLICATIONS

10.1 Online Publication

Prewitt reported that online publication has been established in collaboration with the University of Tromsø's Septentrio Academic Publishing. In order to establish this cooperation with the UiT, it was necessary to formalize our ties with the UiT. To this end, NAMMCO established an Editorial Board consisting of one UiT professor (Lars Folkow), one SC member (Tore Haug), and the Scientific Secretary (Jill Prewitt). The Editorial Board, in conjunction with the NAMMCO Scientific Committee, will provide general oversight of the *NAMMCO Scientific Publications* series, including orderly progress of publication. Additionally, the Editorial Board may be asked to occasionally review manuscripts. Individual volumes will maintain scientific editors who are responsible for the content of those volumes.

The journal website (<http://septentrio.uit.no/index.php/NAMMCOSP/index>) published the first paper on 21 Aug 2013, and as of 12 November 2013, has had 640 visitors (although this is an artificially inflated number because it also includes visits to the site by Prewitt and the University site administrators) from 39 countries.

The current plan is to continue to print hard copies of the volumes, but in smaller numbers.

10.2 Volume 9: Walrus of the North Atlantic

As of the SC meeting, 9 papers from the walrus volume have been published online, with another 5 in various stages of review. Although it would have been optimal to have this volume completed by the end of 2013, in all likelihood, it will be early 2014 before it is completed.

10.3 Volume 10: Age Estimation of Marine Mammals with a Focus on Monodontids

As of the SC meeting, 2 papers have been published online. A few others are closer to publication, but it will likely be well into 2014 before this volume is completed.

The SC welcomes this development that has been long awaited, and compliments the new Scientific Secretary on this valuable contribution to the dissemination of the research results of the SC. Additionally, the SC encourages wider dissemination of information about the online publications, such as postings on MARMAM and other listservs. The SC should keep online publication in mind when looking at the future of the NSP series.

10.4 Other Matters

11. DATABASES ON ABUNDANCE AND CATCHES

11.1 Abundance

The SC recommends that data that have been used to make distribution maps from NASS and T-NASS surveys be stored at the Secretariat. The SC recommends that the Secretariat liaise with Daniel Pike, who holds presently the set of data used to make maps for the Species Status project, and which is the most complete one.

This item should be revisited after completion of the stock status website.

11.2 Catches

Catch statistics (including by-catch) from all countries for all species need validation before they can be included in assessments.

The SC has requested improved by-catch information, however there has apparently been little progress in by-catch reporting.

12. WORK PROCEDURES IN THE SCIENTIFIC COMMITTEE

SC was pleased to see many audiovisual presentations at this meeting, and **reiterates** that participants are encouraged to make audiovisual presentations, for example of WG summaries.

The SC agreed to put future observer reports in the Appendices of the SC report.

Regarding payment of expenses for WG Chairs, in June 2012, document NAMMCO/FAC-June/2012/10 was presented to the FAC for its consideration, and contained the following memo directed to Council:

Memo on the payment of expenses for WG Chairs

The Scientific Committee traditionally appoints working group chairs. It is important that the chair is competent and has the expertise relevant to the working group. For this reason, chairs are sometimes chosen from outside the SC in order to obtain the best person for the role. In such cases, NAMMCO supports the chairs by paying for expenses incurred in taking on the role (sometimes including salary). The **SC recommends that the Council** considers supporting travel and subsistence expenses for all nominated chairs of working groups, even from within the SC, in order to encourage individuals to take on the added responsibility, and ensure that the added expenses do not prevent competent scientists to accept the nomination.

Following enquiries from recent WG chairs, it is apparent that there was no decision regarding this recommendation. The SC therefore again submit this **recommendation** to Council.

13. FUTURE WORK PLANS

13.1 Review of Active Requests

The active requests were examined and reported under the relevant items.

13.2 Scientific Committee

The 21st SC meeting is scheduled to be held in Norway. There was a suggestion for the location to be Longyearbyen, at the Svalbard Science Center. The date will likely be in late October/early November 2014.

13.3 Working groups

The following working groups/meetings were proposed to be held before the next SC meeting:

- 1) **T-NASS Steering Committee:** First meeting 3 February 2014, Copenhagen.
Chair: Mads Peter Heide-Jørgensen

- 2) **Beluga/Narwhal Catch Allocation Meeting:** 10-12 March 2014, Copenhagen.
The SC recommends that a small WG is held in 2013/14, before the next JWG meeting, to provide a framework for the catch allocation within the multi-stock model for Canadian and West Greenland narwhals. The Terms of Reference of this group should be:
- Review information on distribution, movements and harvest locations.
 - Develop an allocation model that will provide a mechanism for assigning harvested animals to all summer stocks based on existing data.
 - Specify and quantify exchange rates between aggregations and stocks.
 - Identify and quantify uncertainty in the allocation model and determine implications for management.
 - Recommend future work to resolve uncertainties within the model structure.

This group should ensure a useful catch allocation model given the current knowledge and data, and it would report back to the JWG at its next meeting. *Convenor: Mads Peter Heide-Jørgensen; NAMMCO Chair: Rod Hobbs.*

- 3) **Large Whale Assessment Working Group:** to be scheduled before the next SC meeting, Reykjavik.
As the present advice expires in 2015, the NAMMCO SC **agreed** to convene a meeting of the working group on large whale assessments in the autumn of 2014 to provide further management advice on fin whales off Iceland. *Convenor: Gísli Víkingsson; Chair: Lars Walløe.*

The following working groups/meetings were proposed to be held after the next SC meeting:

- 1) **Coastal Seals WG:** Late 2014/early 2015
The SC **recommended** that the Grey and Harbour Seals WG meet in late winter 2014 or early 2015 to finalise the **requests 2.4.2 and 2.5.2**. The WG meeting should assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway. The meeting should also address by-catch issues (grey seals) in Norway, Iceland, and the Faroe Islands, and a re-evaluation of the Norwegian management plans (which have been already implemented) for grey and harbour seals. It will also be advisable to include participation from at least Canada, UK, and the Baltic Sea countries. *Chair: Kjell Tormod Nilssen*
- 2) A **Ringed Seals WG** will be considered at the next SC meeting
The SC **suggested** that a Working Group be considered in the next few years (2015 or later). The WG could look into movements (from the available satellite tagging data) versus where catches are occurring in relation to stock structure. It may also be important to assess this species in light of climate change and changing ice conditions. The SC notes that it is very difficult to obtain the desired information on this species. The Arctic Council recently held a meeting on ringed seals, and it was suggested that the SC considers the report from that meeting, and data availability, and consider a WG after the next SC meeting.
- 3) **Scientific symposium on disturbance effects on narwhals and belugas:** Early 2015.
The planning for this symposium will await Council's approval, and the outcome of the IWC meeting scheduled for March 2014 in Anchorage. If approved, the Steering Committee would be tasked with finding outside funding.

To address **R-3.4.9** (see below) the Scientific Committee recommends that an international symposium on the effects of seismic exploration and shipping activity on narwhals and belugas is being organized by NAMMCO in 2014. Among other things, the symposium should relate to the increasing pressure from the oil industry in Greenland, and it could include studies on

other species where information is missing on narwhals and belugas. Funding should be sought from industry and stakeholders.

The *Steering Committee* would include *Mads-Peter Heide-Jørgensen (NAMMCO SC)* and *Randall Reeves (Chair)*. Other relevant scientists for the Steering Committee include Malene Simon, Anders Mosbech, Susanna Blackwell, and Kate Stafford, but the final decision on members is left for Mads-Peter Heide-Jørgensen and the Chair to decide.

R.3.4.9 NAMMCO/15-2005 (ongoing) - NAMMCO asked its Scientific Committee to provide advice on the effects of human disturbance, including noise and shipping activities, on the distribution, behaviour and conservation status of belugas, particularly in West Greenland. In 2009 (NAMMCO/18) it was further specified that there was no need for a broad assessment for all marine mammals, and that focus would be on walrus, narwhal and beluga.

The SC proposes that the Global Review of Monodontids meeting be held in conjunction with the 2016 biennial Holarctic Conference (see 13.4). Future planning will be dependent upon IWC input. The SC awaits further guidance from Council.

13.4 Other matters

There was discussion of SC/20/O02-IWC, a Global Review of Monodontids workshop/meeting. The idea is that this would be a joint NAMMCO-IWC meeting that will include a global review of all stocks of monodontids. This meeting would create the opportunity for experts working on monodontids to exchange information and technology with researchers from within and outside of NAMMCO countries. This global review will not replace the ongoing assessment work in the JCNB.

The SC **noted** that the Marine Mammals of the Holarctic biennial international conference could be alternate venue for exchange of scientific information on belugas with scientists, and this conference would be a useful meeting to have participation from a NAMMCO observer. SC was informed that the next meeting is in Sept 2014 in St. Petersburg, Russia. The SC noted that perhaps a global review of monodontids meeting should be held back to back with the following meeting (2016).

14. BUDGET

14.1 Spending in 2012/13

The SC discussed the 2012/2013 budget.

14.2 Budget for 2014 and T-NASS-15 budget up to 2016

A draft SC budget for 2014 was discussed.

15. ANY OTHER BUSINESS

15.1 NAMMCO Stock Status List update

The Secretariat is investigating an update to the www.nammco.no website and looking into how the stock status list can be incorporated into the website.

The original plan of the Stock Status List was to focus on the most prominent species in NAMMCO (*i.e.*, harvested species, especially large whales) and then continue with other species at a later date. As of now, the first phase has been completed, and the second phase will be completed this coming year. SC members will be asked to check the text and given a deadline, after which the information will be considered as having been validated. This matter should be discussed again at the next SC meeting.

15.2 NPR Format

The Secretariat thanked everyone for submitting NPRs, especially the observers.

During discussion it was also noted that electronic reporting has been implemented in ASCOBANS and the IWC. Kitakado informed the group that more time is needed to assess how this works, and progress will be reported at the next SC meeting.

It was proposed that an online reporting scheme for catch, by-catch, and strandings data could be developed in the future. An update to the NAMMCO website is currently being considered, and an update could possibly include a mechanism for reporting online.

In regards to the NPR format, it was agreed to delete the sections titled “Field Work,” “Laboratory Work,” “Other Studies” and “Research results” (b,c,d,e under Research) and leave “Research by species” for the given year. The section titled “Ongoing Research” will remain.

As for listing publications, it was noted that in the guidelines it requests report preparers to list peer-reviewed publications first and then “grey” literature separately.

16. MEETING CLOSURE

16.1 Acceptance of report

This report was approved in a preliminary form at end of the meeting and was accepted by correspondence on 9 December 2013.

16.2 Closing remarks

The Chair thanked the Participants, the Observers and the Secretariat for an efficient meeting. The participants thanked the Chair for his able chairmanship.

References

- Andersen, L.W., Born, E.W., Stewart, R.E.A., Dietz, R., Doidge, D.W. and Lanthier, C. 2013. A genetic comparison of West Greenland and Baffin Island (Canada) walrus: Management implications. *NAMMCO Scientific Publications*. doi: <http://dx.doi.org/10.7557/3.2610>
- 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>
- Born, E. W., Dietz, R., Heide-Jørgensen, M., and Knutsen, L. 1997. Historical and present status of the Atlantic walrus (*Odobenus rosmarus rosmarus*) in eastern Greenland. *Meddr. Grønland, Biosci.* 46:1–73.
- Footo, A.D., Newton, J., A´vila-Arcos, M.C., Kampmann, M-L., Samaniego, J.A., Post, K., Rosing-Asvid, A., Sinding, M-HS., Gilbert, MTP. 2013. Tracking niche variation over millennial timescales in sympatric killer whale lineages. *Proc R Soc B* 280: 20131481. <http://dx.doi.org/10.1098/rspb.2013.1481>
- Grahl-Nielsen, O., Haug, T., Lindstrøm, U., and Nilssen, K.T. 2011. Fatty acids in harp seal blubber do not necessarily reflect their diet. *Mar Ecol Prog Ser* 426: 263–276. doi: <http://dx.doi.org/10.3354/meps09011>
- Granquist, S. M., Hauksson, E., Árnadóttir, A. B., & Kasper, J. 2011. Landselstalning úr lofti árið 2011. Framvinda og niðurstöður. Hvammstangi: Selasetur Íslands. http://veidimal.is/files/Skra_0059670.pdf
- Heide-Jørgensen, M.P., Laidre, K.L., Fossette, S., Rasmussen, M., Nielsen, N.H. and Hansen, R.G. 2013a. Abundance of walrus in Eastern Baffin Bay and Davis Strait. *NAMMCO Scientific Publications*. doi: <http://dx.doi.org/10.7557.3.2606>
- Heide-Jørgensen, M.P., Hansen, R.G., Nielsen, N.H. and Rasmussen, M. 2013b. The significance of the North Water polynyas to Arctic top predators. *Ambio*. 42(5):596-610. doi: <http://dx.doi.org/10.1007/s13280-012-0357-3>
- Heide-Jørgensen, M.P., Laidre, K.L., Nielsen, N.H., Hansen, R.G. and Røstad, A. 2013c. Winter and spring diving behavior of bowhead whales relative to prey. *Animal Biotelemetry* 1:15 <http://www.animalbiotelemetry.com/content/1/1/15>
- Lindstrøm, U., Nilssen, K.T., Pettersen, L.M.S., and Haug, T. 2013. Harp seal foraging behaviour during summer around Svalbard in the northern Barents Sea: diet composition and the selection of prey. *Polar Biol* 36:305–320. doi: <http://dx.doi.org/10.1007/s00300-012-1260-x>
- Lydersen, C., Øien, N., Mikkelsen, B., Bober, S., Fisher, D., and Kovacs, K.M. 2013. A white humpback whale (*Megaptera novaeangliae*) in the Atlantic Ocean, Svalbard, Norway, August 2012. *Polar Research* 32: 19739 <http://dx.doi.org/10.3402/polar.v32i0.19739>
- Merkel, B., Lydersen, C., Yoccoz, N.G., Kovacs, K.M. 2013. The world’s Northernmost harbour seal population—How many are there? *PLoS ONE* 8(7): e67576. doi: <http://dx.doi.org/10.1371/journal.pone.0067576>
- Nymo, I.H., Tryland, M., Frie, A.K., Haug, T., Foster, G., Rødven, R., and Godfroid, J. 2013. Age-dependent prevalence of anti-*Brucella* antibodies in hooded seals *Cystophora cristata*. *Dis Aquat Org* 106: 187–196 doi: <http://dx.doi.org/10.3354/dao02659>
- Øigård, T.A., Frie, A.K., Nilssen, K.T., and Hammill, M.O. 2012. Modelling the abundance of grey seals (*Halichoerus grypus*) along the Norwegian coast. *ICES Journal of Marine Science* 69: 1436–1447. doi: <http://dx.doi.org/10.1093/icesjms/fss103>
- Øigård, T., Haug, T. and Nilssen, K.T. 2013a. From pup production to quotas: current status of harp seals in the Greenland Sea. *ICES Journal of Marine Science* doi: <http://dx.doi.org/10.1093/icesjms/fst155>
- Øigård, T., Lindstrøm, U., Haug, T., Nilssen, K.T., Smout, S. 2013b. Functional relationship between harp seal body condition and available prey in the Barents Sea. *Mar Ecol Prog Ser* 484: 287–301. doi: <http://dx.doi.org/10.3354/meps10272>
- Stewart REA, Born EW, Dietz R and Ryan AK 2013a. Estimates of Minimum Population Size for Walrus around Southeast Baffin Island, Nunavut. *NAMMCO Sci. Publ.* doi: <http://dx.doi.org/10.7557/3.2615>

Víkingsson, G.A., Elvarsson, B., Ólafsdóttir, D., Sigurjónsson, J., Chosson, V., and Galan, A. 2014. Recent changes in the diet composition of common minke whales (*Balaenoptera acutorostrata*) in Icelandic waters. A consequence of climate change?, *Marine Biology Research* 10:2, 138-152
doi: <http://dx.doi.org/10.1080/17451000.2013.793812>

ADOPTED AGENDA

- 1. CHAIRMAN'S WELCOME AND OPENING REMARKS**
- 2. ADOPTION OF AGENDA**
- 3. APPOINTMENT OF RAPPORTEUR**
- 4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS**
 - 4.1. National Progress Reports
 - 4.2. Working Group Reports
 - 4.3. Other reports and documents
- 5. COOPERATION WITH OTHER ORGANISATIONS**
 - 5.1. IWC
 - 5.2. ASCOBANS
 - 5.3. ICES
 - 5.4. NAFO
 - 5.5. JCNB
 - 5.6. Other
- 6. ENVIRONMENTAL ISSUES**
 - 6.1. Sea-ice conditions
 - 6.2. Role of marine mammals in the ecosystem
 - 6.3. Other
- 7. SEALS AND WALRUS STOCKS - STATUS AND ADVICE TO THE COUNCIL**
 - 7.1. Harp Seal
 - 7.1.1. Update
 - 7.1.1.1. WGHARP
 - 7.1.1.2. Other updates
 - 7.1.2. Future work
 - 7.2. Hooded seal
 - 7.2.1. Update
 - 7.2.1.1. WGHARP
 - 7.2.1.2. Other updates
 - 7.2.2. Future work
 - 7.3. Ringed seal
 - 7.3.1. Update
 - 7.3.2. Future work
 - 7.4. Grey seal
 - 7.4.1. Update
 - 7.4.2. Future work
 - 7.5. Harbour seal
 - 7.5.1. Update
 - 7.5.2. Future work
 - 7.6. Bearded seal
 - 7.6.1. Update
 - 7.6.2. Future work
 - 7.7. Walrus
 - 7.7.1. Update – Report from the WG
 - 7.7.2. Other updates
 - 7.7.3. Future work
- 8. CETACEANS STOCKS - STATUS AND ADVICE TO THE COUNCIL**
 - 8.1. Fin whale

- 8.1.1. Update
- 8.1.2. Future work
- 8.2. Humpback whale
 - 8.2.1. Update
 - 8.2.2. Future work
- 8.3. Sei whale
 - 8.3.1. Update
 - 8.3.2. Future work
- 8.4. Minke whale
 - 8.4.1. Update
 - 8.4.2. Request from Council to review Iceland Minke Whale program
 - 8.4.3. Future work
- 8.5. Beluga
 - 8.5.1. Update
 - 8.5.2. Future work – planning JWG meeting; Global monodontid with IWC
- 8.6. Narwhal
 - 8.6.1. Updates
 - 8.6.2. Future work – planning JWG meeting; Global monodontid with IWC
- 8.7. Bottlenose whale
 - 8.7.1. Update
 - 8.7.2. Future work
- 8.8. Killer whale
 - 8.8.1. Update
 - 8.8.2. Future work
- 8.9. Pilot whale
 - 8.9.1. Update
 - 8.9.2. Future work
- 8.10. Dolphins
 - 8.10.1. Update
 - 8.10.2. Future work
- 8.11. Harbour porpoise
 - 8.11.1. Update – Report from the WG
 - 8.11.2. Other updates
 - 8.11.3. Future work
- 8.12. Sperm whale
 - 8.12.1. Update
 - 8.12.2. Future work
- 8.13. Bowhead whale
 - 8.13.1. Update
 - 8.13.2. Future work

9. SURVEY PLANNING

- 9.1. Acoustic Report
- 9.2. T-NASS 2015 Steering Committee
 - 9.2.1. Update
- 9.3. Other updates
- 9.4. Future work

10. NAMMCO SCIENTIFIC PUBLICATIONS

- 10.1. Online Publication
- 10.2. Walrus volume
- 10.3. Monodontid age estimation volume
- 10.4. Other matters

11. DATABASES ON ABUNDANCE AND CATCHES

11.1. Abundance

11.2. Catches

12. WORK PROCEDURES IN THE SC

13. FUTURE WORK PLANS

13.1. Review of Active Requests

13.2. Scientific Committee

13.3. Working groups

13.4. Other matters

14. BUDGET

14.1. Spending in 2012/13

14.2. Budget for 2013/14

15. ANY OTHER BUSINESS

15.1. NAMMCO Stock Status List Update

15.2. NPR format

16. MEETING CLOSURE

16.1. Acceptance of report

16.2. Closing remarks.

LIST OF DOCUMENTS

Doc.No.	Title
SC/20/01	Draft List of Participants
SC/20/02	Provisional Annotated Agenda
SC/20/03	Draft List of Documents
SC/20/NPR-F	National Progress Report – Faroe Islands
SC/20/NPR-G	National Progress Report – Greenland
SC/20/NPR-I	National Progress Report – Iceland
SC/20/NPR-N	National Progress Report – Norway
SC/20/NPR-C	National Progress Report – Canada
SC/20/NPR-J-1	National Progress Report – Japan – Large cetaceans
SC/20/NPR-J-2	National Progress Report – Japan – Small cetaceans
SC/20/NPR-R	National Progress Report – Russian Federation
SC/20/04	Observer's report on activities in ICES
SC/20/05	Report of the Working Group on Harp and Hooded Seals (WGHARP) – 26–30 August 2013, Murmansk, Russia
SC/20/06	Observer's report: 65 th meeting of the IWC Scientific Committee
SC/20/07	Observer's report: ASCOBANS AC20
SC/20/08	Report of the NAMMCO Working Group on Harbour Porpoises, Copenhagen, November 2013
SC/20/09	Report of the NAMMCO Working Group on Walrus, Copenhagen, November 2013
SC/20/10	Report of the expert workshop to review the Icelandic special permit research program (IWC report)
SC/20/11	Vikingsson <i>et al.</i> (2013) Response to the 'Report of the Expert Workshop to Review the Icelandic Research Program on minke whale
SC/20/12	IWC SC 65 Annex L 23 Update on beluga narwhal meeting
SC/20/13	T-NASS 2007 Final Acoustic Report
SC/20/14	NAMMCO Scientific Committee Expenses 2012/13 and Budget 2013/14 and beyond
SC/20/15	Annex 2 of Annual Report 2012: Summary of requests by NAMMCO Council to the Scientific Committee, and responses by the Scientific Committee
SC/20/16	All Requests- Ongoing/Standing/New
SC/20/17	Revising National Progress Report Guidelines
SC/20/18	Pike <i>et al.</i> Estimates of the relative abundance and trend of pilot whales (<i>Globicephala melas</i>) from North Atlantic Sightings Surveys from 1987 to 2007.
SC/20/19	Observer's report ASCOBANS MOP7
SC/20/20	Ugarte <i>et al.</i> Recent increase of catches of killer whales in Southeast Greenland - Is there a need for NAMMCO advice?
SC/20/21	WWG Summary
SC/20/22	HP WG Summary

BACKGROUND DOCUMENTS

Doc.No.	Title
SC/20/O/01	NAMMCO SC19 Report
SC/20/O/02	IWC: Report of the Scientific Committee Annual Meeting 2013
SC/20/O/03	Grahl-Nielsen <i>et al.</i> (2011) Fatty acids in harp seal blubber do not necessarily reflect their diet. <i>Mar Ecol Prog Ser</i> 426:263–276 http://dx.doi.org/10.3354/meps09011
SC/20/O/04	Lindstrøm <i>et al.</i> (2013) Harp seal foraging behaviour during summer around Svalbard in the northern Barents Sea: diet composition and the selection of prey. <i>Polar Biol.</i> 36:305–320 http://dx.doi.org/10.1007/s00300-012-1260-x

Report of the NAMMCO Scientific Working Group on Harbour Porpoises

SC/20/O/05	Øigård <i>et al.</i> (2013) From pup production to quotas: current status of harp seals in the Greenland Sea. <i>ICES J of Mar Sci.</i> http://dx.doi.org/10.1093/icesjms/fst155
SC/20/O/06	Øigård <i>et al.</i> (2013) Functional relationship between harp seal body condition and available prey in the Barents Sea. <i>Mar Ecol Prog Ser.</i> 484: 287–301 http://dx.doi.org/10.3354/meps10272
SC/20/O/07	Øigård <i>et al.</i> (2012) Modelling the abundance of grey seals (<i>Halichoerus grypus</i>) along the Norwegian coast. <i>ICES J of Mar Sci.</i> 69(8):1436–1447 http://dx.doi.org/10.1093/icesjms/fss103
SC/20/O/08	Merkel <i>et al.</i> (2013) The World’s Northernmost Harbour Seal Population– How Many Are There? <i>PLOS One.</i> (7): e67576. http://dx.doi.org/10.1371/journal.pone.0067576
SC/20/O/09	Footo <i>et al.</i> (2013) Tracking niche variation over millennial timescales in sympatric killer whale lineages. <i>Proc R Soc B.</i> 280: 20131481. http://dx.doi.org/10.1098/rspb.2013.1481
SC/20/O/10	Lydersen <i>et al.</i> (2013) A white humpback whale (<i>Megaptera novaeangliae</i>) in the Atlantic Ocean, Svalbard, Norway, August 2012. <i>Polar Res.</i> http://dx.doi.org/10.3402/polar.v32i0.19739
SC/20/O/11	Bloch <i>et al.</i> (2012) Life History of Risso’s Dolphin (<i>Grampus griseus</i>) (G. Cuvier, 1812) in the Faroe Islands. <i>Aquatic Mammals</i> 38(3): 250-266 http://dx.doi.org/10.1578/AM.38.3.2012.250
SC/20/O/12	T-NASS 2015 Proposal
SC/20/O/13	Nymo <i>et al.</i> 2013. Hooded seals
SC/20/O/14	Gísli A. Víkingsson, Bjarki Þór Elvarsson, Droplaug Ólafsdóttir, Jóhann Sigurjónsson, Valerie Chosson & Anton Galan (2014) Recent changes in the diet composition of common minke whales (<i>Balaenoptera acutorostrata</i>) in Icelandic waters. A consequence of climate change?, <i>Marine Biology Research</i> , 10:2, 138-152, DOI: 10.1080/17451000.2013.793812
SC/20/O/15	Manger (2013) Questioning the interpretations of behavioural observations of cetaceans; Is there really support for a special intellectual status for this mammalian order?
SC/20/O/16	Bjørge <i>et al.</i> (2013) Estimated bycatch of harbour porpoise (<i>Phocoena phocoena</i>) in two coastal gillnet fisheries in Norway, 2006–2008. Mitigation and implications for conservation
SC/20/O/17	Heide-Jørgensen <i>et al.</i> (2013) Winter and spring diving behavior of bowhead whales relative to prey
SC/20/O/18	Link to Marine Mammals of the Holarctic collection of papers

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

REPORT

1. CHAIRMAN'S WELCOME AND OPENING REMARKS

Chair Mikkelsen (Faroe Islands) welcomed the participants (Address Section 5.6) 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 1.

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 2.

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.

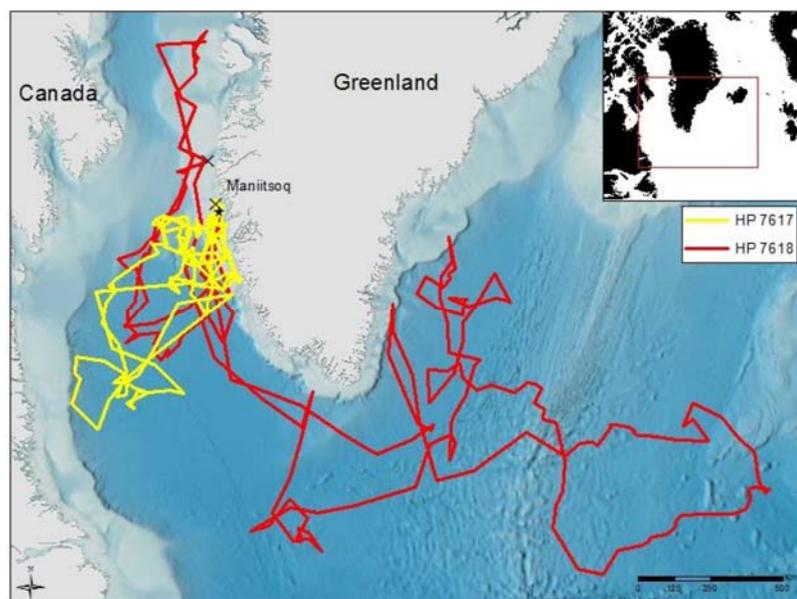


Figure 1. From SC/20/HP/08, Fig. 1. Movements of two harbour porpoises tracked by satellite. The star indicates where the porpoises were tagged on 25 July 2012 and the X's show the ends of the 2 tracks on 30 September 2013 after 431 and 417 days, respectively, with positions.

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.

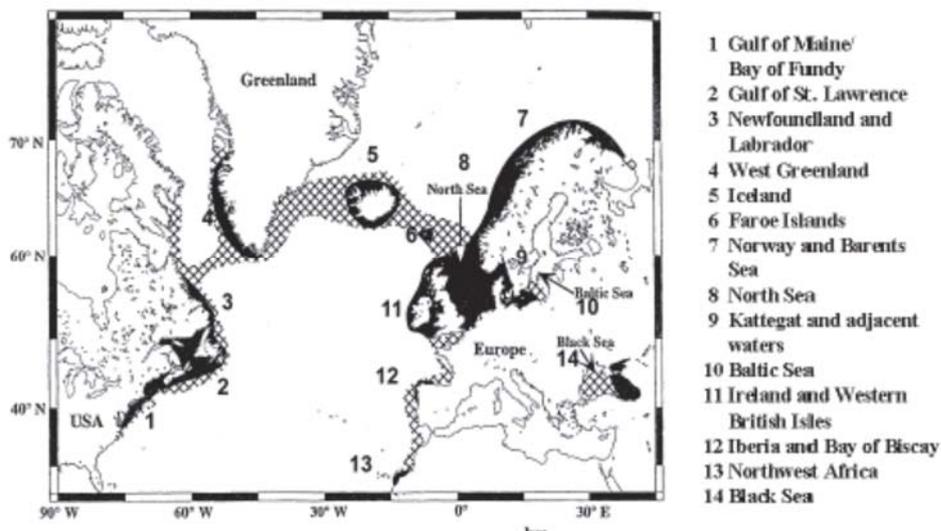


Figure 2. Figure and caption from Andersen (2003) Fig. 1. Map showing the distribution of harbour porpoise populations/sub-populations and possible range in the North Atlantic (After IWC 1996 and Rosel *et al.* 1999). Populations and sub-populations and their possible range are indicated by solid black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

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).

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)

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).

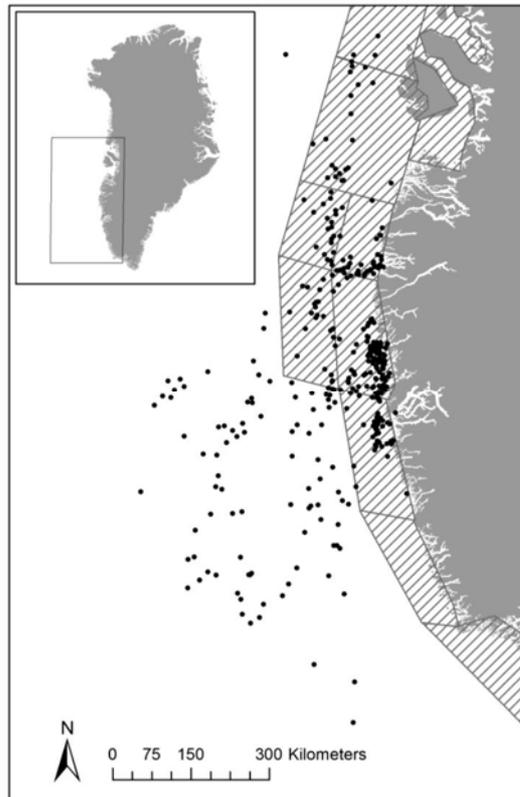


Figure 3. from SC/20/HP/07, Fig. 2. Distribution of daily positions of harbour porpoises relative to survey strata used for the aerial survey in West Greenland 2007.

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.

Time at surface from tag data

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 $\pm 0.5\text{m}$, 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).

Estimates of abundance for use in assessment

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).

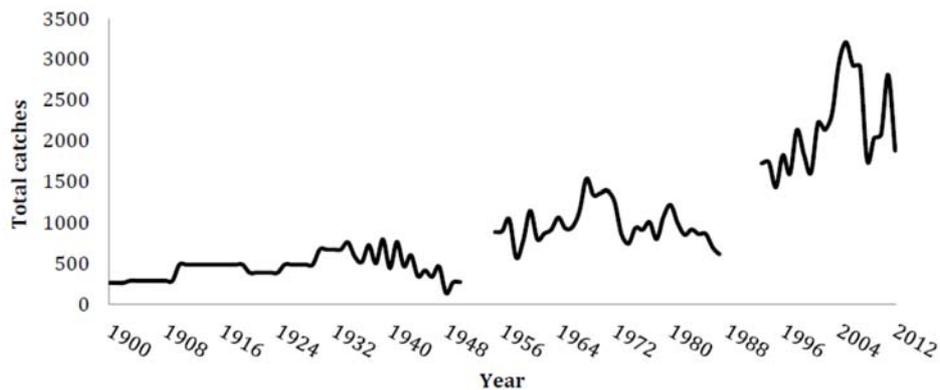


Figure 4. from Fig. 2 of SC/20/HP/06: The total annual catches of harbour porpoises in Greenland 1900 – 2012.

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.

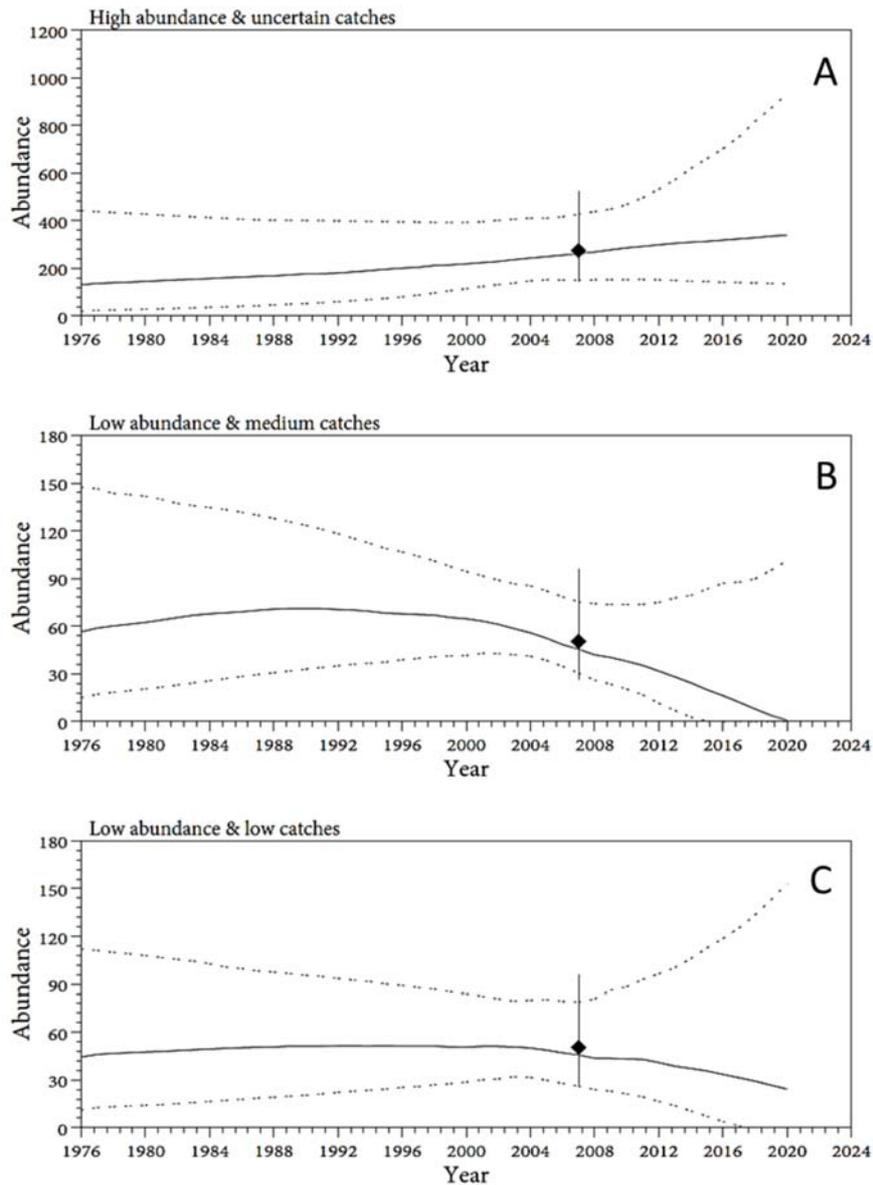


Figure 5: Population trajectories for three scenarios for West Greenland harbour porpoises based on density regulated growth models ‘d’ (SC/20/HP/05). The abundance axes are in units of 1000. Panel A shows the trajectory for the high abundance estimate and uncertain catches that span the range from the 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.

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.

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 to 50 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.

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.

Document List

Document Number	Title
SC/20/HP/00	Practical arrangements
SC/20/HP/01	List of Participants
SC/20/HP/02	Draft Agenda
SC/20/HP/03	List of Documents
SC/20/HP/04	Heide-Jørgensen <i>et al.</i> Life history parameters from the catch of harbour porpoises in West Greenland.
SC/20/HP/05	Witting <i>et al.</i> Assessment runs for harbour porpoise in West Greenland
SC/20/HP/06	Nielsen and Heide-Jørgensen. Catch statistics for harbour porpoises in West Greenland including correction for unreported catches.
SC/20/HP/07	Heide-Jørgensen <i>et al.</i> Revised abundance estimate of 226harbour porpoise in West Greenland.
SC/20/HP/08	Nielsen <i>et al.</i> Extensive offshore movements of harbour porpoises (<i>Phocoena phocoena</i>)
SC/20/HP/09	Øien N, Hartvedt S. Incidental sightings of harbour porpoises in Norwegian waters.
SC/20/HP/10	Øien N. Offshore distributions of harbour porpoises in the northeast Atlantic from Norwegian sightings surveys 1988-2013
SC/20/HP/11	Heide-Jørgensen. Correction of at-surface abundance of harbour porpoises in West Greenland based on detection to 1 m depth.
SC/20/HP/12	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 226harbour porpoises (<i>Phocoena phocoena</i>) in Scottish waters 1992-2003. <i>Marine Mammal Science</i> . 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. <i>J. Mar. Biol. Ass. U.K.</i> 87:213–221
SC/20/HP/O04	Santos MB and Pierce GJ (2003) The diet of harbour porpoise (<i>Phocoena phocoena</i>) in the Northeast Atlantic. <i>Oceanography and Marine Biology: an Annual Review</i> 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. <i>Endangered Species Research</i> . 20: 251–269. doi: http://dx.doi.org/10.3354/esr00499
SC/20/HP/O06	Larsen <i>et al.</i> (2013) Determining optimal pinger spacing for harbour porpoise bycatch mitigation. <i>Endangered Species Research</i> . 20: 147–152. doi: http://dx.doi.org/10.3354/esr00494
SC/20/HP/O07	Bjørge <i>et al.</i> (2013) Estimated bycatch ofharbour porpoise (<i>Phocoena phocoena</i>) in two coastal gillnet fisheries in Norway, 2006–2008. Mitigation and implications for conservation. <i>Biological Conservation</i> . 161: 164–173. http://dx.doi.org/10.1016/j.biocon.2013.03.009

SC/20/HP/O08	Read <i>et al.</i> (2010) Understanding harbour porpoise (<i>Phocoena phocoena</i>) 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 <i>et al.</i> (2012) Application of a novel method for age estimation of a baleen whale and a porpoise. <i>Marine Mammal Science</i> . 29(2): E1–E23
SC/20/HP/O13	Lockyer <i>et al.</i> (2001) Age, length and reproductive parameters of harbour porpoises <i>Phocoena phocoena</i> (L.) from West Greenland. <i>ICES Journal of Marine Science</i> . 58: 154–162
SC/20/HP/O14	Lockyer <i>et al.</i> (2003) Life history and ecology of harbour porpoises (<i>Phocoena phocoena</i>) from West Greenland. <i>NAMMCO Sci. Publ.</i> 5:177-194
SC/20/HP/O15	Heide-Jørgensen <i>et al.</i> (2011) Harbour porpoises respond to climate change. <i>Ecology and Evolution</i> . http://dx.doi.org/10.1002/ece3.51
SC/20/HP/O16	Gilles <i>et al.</i> Harbour porpoise <i>Phocoena phocoena</i> 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. <i>Mar Biol.</i> http://dx.doi.org/10.1007/s00227-013-2283-8
SC/20/HP/O18	Hammond <i>et al.</i> (2013) Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. <i>Biological Conservation</i> . 164:107–122. http://dx.doi.org/10.1016/j.biocon.2013.04.010
SC/20/HP/O19	Teilmann <i>et al.</i> (2013) Geographic, seasonal, and diurnal surface behavior of harbor porpoises. <i>Marine Mammal Science</i> . 29(2): E60–E76
SC/20/HP/O20	Lowry and Teilmann (1994) Bycatch and bycatch reduction of the harbour porpoise in Danish waters. <i>Rep. Int. Whal. Commn.</i> Special Issue 15.
SC/20/HP/O21	Bjørge & Øien (1995) Distribution and abundance of harbour porpoise in Norwegian waters. <i>Rep. Int. Whal. Commn.</i> Special Issue 16.
SC/20/HP/O22	Andersen (2003) Harbour porpoises (<i>Phocoena phocoena</i>) in the North Atlantic: Distribution and genetic population structure. <i>NAMMCO Sci. Publ.</i> 5:11-30.
SC/20/HP/O23	Lockyer, C. 2003. Harbour porpoises (<i>Phocoena phocoena</i>) in the North Atlantic: Biological parameters. <i>NAMMCO Sci. Publ.</i> 5:71-90.
SC/20/HP/O24	Kindt-Larsen L. <i>et al.</i> (2012) Observing incidental harbour porpoise <i>Phocoena phocoena</i> bycatch by remote electronic monitoring. <i>Endangered Species Research</i> . Vol. 19: 75–83. doi: 10.3354/esr00455

**NAMMCO SCIENTIFIC COMMITTEE
WORKING GROUP ON WALRUS -
STOCK STATUS OF WALRUS IN GREENLAND
8-10 November 2013, Greenland Representation, Copenhagen, Denmark**

REPORT

1. OPENING REMARKS

Chair Wiig (Norway) welcomed the participants (Address Section 5.7) to the Walrus Working Group meeting of 2013.

There was a request from Council (**R-2.6.6**) to investigate the possibility for catch quota carryover, which will be discussed at this meeting, however the main topic for the meeting will be the standing request for an assessment.

2. ADOPTION OF AGENDA

The adopted agenda is in Appendix 1.

3. APPOINTMENT OF RAPPORTEURS

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

4. REVIEW OF AVAILABLE DOCUMENTS

The list of available documents (Appendix 2) was reviewed.

5. STOCK STRUCTURE

Heide-Jørgensen presented working document SC/20/WWG/04. In this study, a total of 35 walruses during 2010 – 2013 were instrumented with satellite-linked transmitters in Smith Sound, Northwest Greenland. The tags transmitted from 3 – 125 days and one average daily position of good quality was used to identify the movement of the walruses. Thirty-two walruses moved to Canadian waters after instrumentation and 6 walruses furthermore entered Jones Sound in July or August.

The purpose of the study was to obtain correction factors for aerial surveys. Some tagged animals had dive recordings, and those have been published in Heide-Jørgensen *et al.* (2013a and 2013b). This working paper presented only the movement information.

The last tags were put out in June 2013, and the analyses are still pending. Tagging occurred in spring to coincide with aerial surveys, when the walruses are in Greenland. The walruses moved to Canada in July, and returned to Greenland in November, where they stay until spring. When they are in Canada, they are primarily using the fjords on east Ellesmere Island including Jones Sound, but it is not thought that they are hauling out on land on Ellesmere Island. Some animals (both males and females) move to Jones Sound, where hunting is occurring during the summer and fall. It was reported that the walruses were tagged via harpooning, and it was not always known what the sex is of the animal.

The group was informed that tag failures are usually due to physical damage to the tags, *e.g.*, from animals rolling around on the ice or against each other rather than battery exhaustion. It appears that animals that do not haul out as much get better tag durations, likely because there is not as much physical stress on the tag.

The present information does not change the perception of the stock structure: there is a separate stock in northern Baffin Bay with interchange between Greenland and Canada, *e.g.*, the animals spend the winter/spring in Greenland and summer/fall in Canada.

6. CATCH STATISTICS

6.1 Reported catch

Witting reported that catch histories were used in the assessment (see Fig. 1 from SC/20/WWG/05). These included catches from Greenland, and a few settlements in Canada. SC/20/WWG/05 describes how the catch histories were produced from reported catches (Table 1).

Table 1. Reported catches. NR= not reported, NA= not available

Year	Qaanaaq Area	Grise Fjord	West Greenland	Qikiqtarjuaq	Clyde River	Iqaluit	Pangnirtung	East Greenland
1993	265	12	241	0	0	29	0	15
1994	156	24	270	5	0	26	40	10
1995	128	5	265	16	0	25	8	11
1996	122	8	176	0	1	9	2	7
1997	74	12	155	3	0	0	16	1
1998	72	11	139	0	1	27	4	7
1999	101	5	184	0	0	15	3	10
2000	126	4	196	0	0	19	15	7
2001	171	2	162	1	1	7	19	10
2002	147	3	150	33	0	1	9	34
2003	160	7	113	1	0	1	15	11
2004	90	5	100	0	2	NR	NR	4
2005	78	2	158	NR	NR	10	NR	16
2006	67	5	73	9	1	9	15	5
2007	80	4	43	6	0	11	NR	10
2008	66	NR	28	NR	NR	NR	10	9
2009	90	7	33	NR	NR	14	NR	4
2010	60	2	40	6	NR	14	NR	7
2011	42	4	50	5	0	14	NR	5
2012	76	NA	34	NA	NA	NA	NA	4
2013	62	NA	NA	NA	NA	NA	NA	NA

In Greenland, hunters are required to fill out a “special form” (*Særmeldingsskema*) which, among other things, requests information on the sex of each of the catches of walruses.

Examination of the hunter’s “special form” for East Greenland indicated that all walruses caught were males (between 2011-13). This is in agreement with Born *et al.* (1997), which estimated 10% females in the hunt in East Greenland. This value was used for the assessment.

Greenlandic regulations forbid hunting of mature females and calves (except the Qaanaaq area). It is considered likely that the gender reported in the “special forms” in West Greenland is affected by this regulation and the sex ratio is biased towards males. Instead samples from the walrus hunt during 1988-2007, where the gender was determined genetically, were used to estimate a female fraction of 0.59 (Andersen *et al.* 2013) and in the assessment this estimate was applied to catches after 1988 (Table 2). For the hunt in Qaanaaq (Baffin Bay stock), where it is legal to hunt females, no bias was expected in the “special forms” and reports from 2007-2013 were used to derive a weighted average (weight = number of samples) female fraction of 0.39 (SD=0.085). The assessment used an even sex ratio except for the years since 2007 where the reported sex ratios were applied (Table 2).

It was noted that a comprehensive review of Canadian catch history is now available (SC/20/WWG/O06).

Table 2. Sex ratio of the Greenland walrus hunt. Genetics data are representative samples from the catch; other data given are from hunters' special forms.

Year	Females	Males	Sum	Prop FF	Reference
<u>West Greenland</u>					
1988-2007	75	52	127	0.59	Genetics: Andersen et al. 2013
<u>Baffin Bay/Qaanaaq</u>					
1987-1991	179	197	376	0.47	
1990-91	26	37	63	0.41	Genetics: Andersen et al. 2013
2007	23	40	63	0.37	Hunters' special forms
2008	10	8	18	0.56	Hunters' special forms
2009	38	46	84	0.45	Hunters' special forms
2010	24	37	61	0.39	Hunters' special forms
2011	8	34	42	0.19	Hunters' special forms
2012	31	45	76	0.41	Hunters' special forms
2013	25	39	64	0.39	Hunters' special forms
<u>East Greenland</u>					
2011	0	5	5	0.0	Hunters' special forms
2012	0	4	4	0.0	Hunters' special forms
2013	0	5	5	0.0	Hunters' special forms

6.2 Struck and lost

Witting reported that the information about struck and lost is summarized in the assessment paper SC/20/WWG/05 and was obtained from Born *et al.* (1995, 1997 and references therein). These loss rates were used in earlier assessments.

The models include low and high catch histories. The low catch history does not include the struck and lost animals, where the high catch history includes struck and lost. The average loss rate is about 15% for the North Water area and West Greenland, and about 11% for East Greenland.

There is some effect of method of hunting on struck and lost rates. In Qaanaaq, hunters report that they usually harpoon first, and do not shoot from long distances. The working group recognizes that the loss rates used in the assessment may be lower in some areas and in some types of hunts, but more information is required before the numbers used in the assessment can be adjusted.

The working group identified that complete statistics on total removal levels is critical for the assessment, and therefore the group **strongly recommended** that Greenland obtains reliable reports of all animals struck and lost.

7. ABUNDANCE AND TRENDS

West Greenland-Southeast Baffin Island

In the current assessment, the abundance from Stewart *et al.* (2013a) of 2500 animals was used as an estimate of absolute abundance for West Greenland-Southeast Baffin Island.

Stewart *et al.* (2013a) also provided a series of four estimates from 2005 to 2008 of hauled out walrus from Baffin Island. It was decided not to use these estimates as a series of relative abundance because

the number of walrus on a few haulout grounds fluctuates widely and because no site and year specific correction factors were available.

It was noted that the LGL report (SC/20/WWG/O08) provided estimated numbers of walrus in Hudson Strait of 4675 (95% CI= 1845 – 11842) – 6020 (2485 – 14585). Taking into account that it is uncertain to what extent these animals contribute to the West Greenland-Southeast Baffin Island stock, the group did not use this estimate for the assessment.

Heide-Jørgensen presented Heide-Jørgensen *et al.* (2013a) which uses aerial surveys of walrus on the wintering grounds on the banks of West Greenland. In contrast to previous surveys, this survey assumed that animals on ice were constantly available, whereas animals in the water have a correction factor for availability. The detection depth for animals in the water was assumed down to 2 m. There are no area-specific correction factors for animals that were submerged, so correction factors from the North Water were used.

It was noted that effort did not change depending on sea ice cover, since the survey strata were determined beforehand, and were not changed based on where the ice was located at the time of the survey.

There was not a big difference in effort across years. The discussion continued on whether to weight the model by effort since survey areas changed slightly from year to year. Possibilities included correcting for effort by stratum, and/or including total effort (km) versus only the strata where walrus were sighted. The group concluded that since the same core areas with walrus were surveyed in all years, it was not necessary to correct for effort.

The numbers presented in this paper were used as an index of the abundance in West Greenland-Southeast Baffin Island in the current assessment.

The assessment included also an earlier time series (1981 – 1999) of densities of walrus wintering in West Greenland between 66°15 and 68°15 N (SC/17/WWG/04) to provide trend information on a longer time scale.

Baffin Bay

The estimates in Stewart *et al.* (2013b) are similar to, although slightly lower, than those from the North Water reported in Heide-Jørgensen *et al.* (2013b). Stewart *et al.* (2013b) covered the coastal areas in Canadian waters, however they did not survey some locations in Ellesmere Island, and 2009 was the year with the best coverage. This survey did not include all localities visited by animals tagged in Northwest Greenland (SC/20/WWG/04) and it was therefore decided not to include the 2009 estimate in the assessment.

The abundance estimates presented in Heide-Jørgensen *et al.* (2013b) are not statistically different from each other and can be used as a trend. The group discussed the fact that this was a multi-species survey which may affect the perception bias for walrus. However the group agreed that the approach was acceptable given the data available. The correction factors used in this survey were derived from animals tagged in the North Water (SC/20/WWG/04).

The group concluded that these two estimates (1238 CV=0.19 for 2009 and 1759 CV= 0.29 for 2010) should be treated separately for the assessment.

East Greenland

There was no new information from East Greenland (the previous info from SC/WWG/07 was used in this assessment).

8. ASSESSMENT BY STOCK

8.1 Present status

The historical and current dynamics of the three walrus stocks that occur in Greenland was estimated in SC/20/WWG/05 using age- and sex-structured population models with exponential growth, density-regulated growth and selection-delayed dynamics. These models were integrated with the agreed catch data in a Bayesian framework, where the likelihood of the simulated population trajectories were evaluated from the agreed abundance estimates and the age-structure of a selective hunt in Qaanaaq.

The fit of the model to the age-structured data from Qaanaaq showed an under-representation of animals younger than ten years in agreement with a hunt that takes mainly adult animals. The estimated selectivity is steep and concave, characteristic of selection for full-grown animals, with selection against animals that are almost but not yet fully grown.

The overall decline in the Baffin Bay stock caused by historical catches is unclear due to incomplete catch reporting prior to 1950s. An exponential model (Fig. 1, top) was considered the best to reflect the production in the stock. It estimated that the stock declined by 63% from the 1960s to 2007, and decreased catches (~140 to ~70) have subsequently allowed this stock to increase. The 2014 abundance estimated by the model was 1,430 (95% CI: 999-2,170) with an annual natural growth rate of 7.7% (95% CI: 6.4-9.5%) and a replacement yield in 2014 of 120 (95% CI: 73-180) walrus.

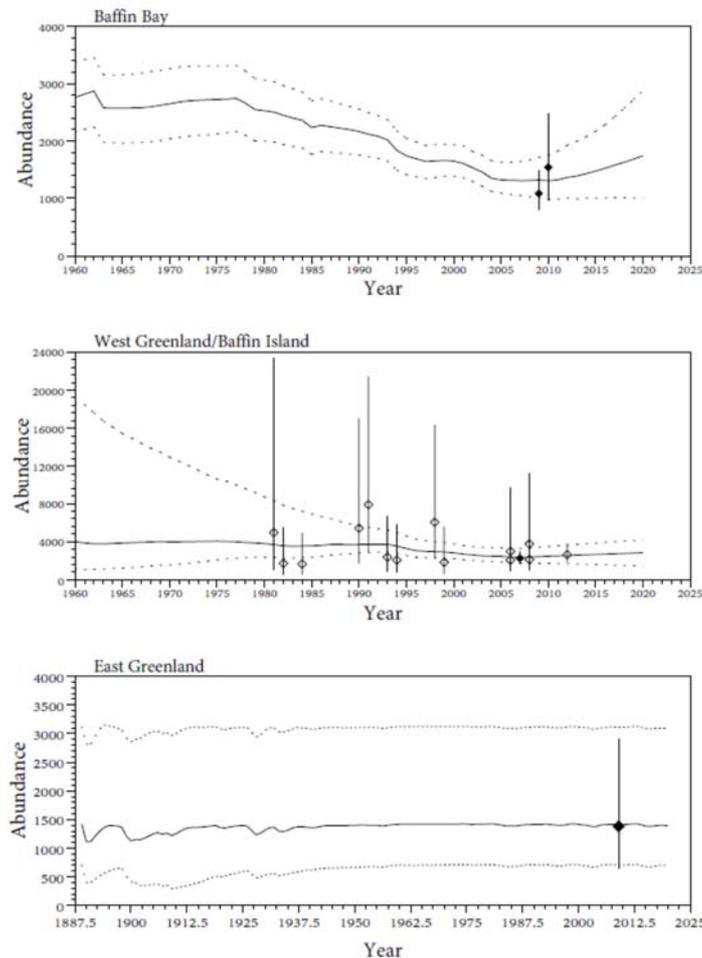


Figure 1. Projections of population models for the three walrus stocks in Greenland, together with absolute (solid diamond) and relative (open diamond) abundance estimates, with 95% confidence intervals. The solid curves are median projections, and the dashed curves span the 95% credibility interval.

The historical trajectory for West Greenland-Southeast Baffin Island walrus is unclear owing to problems in resolving long term models with current abundance data. The exponential model is unreliable here because it was unable to provide sufficient updated estimates of population growth. A density regulated model (Fig.1, middle) initiated in 1960, however, solved the problem. It estimated a stock that decreased from 4,000 (95% CI:1,210-18,600) walrus in 1960 to 2,360 (95% CI:1,720-3,280) in 2007. Annual catches were then reduced from more than hundred to around 60, and the stock was again increasing with a 2014 model estimate of 2,630 (95% CI: 1,640-3,790) walrus and a replacement yield of 120 (95% CI: 42-180).

A 2014 estimate of 1,400 (95% CI: 720-3,200) walrus in East Greenland has apparently recovered relative to 1888, the year prior to our first historical catches by European sealers. The historical trajectory is uncertain. Density regulation estimates a relatively flat trajectory (Fig. 1, bottom), with a maximum depletion in 1890 to 80% of the initial abundance, and a slow continuous increase to almost no current growth. A recovered stock was also estimated by selection-delayed dynamics providing a continued increase and a historical depletion to 3% in 1957.

Updated abundance estimates for West Greenland, and modelling with age-structured data from Baffin Bay, have generally improved the status estimates for Baffin Bay and West Greenland/Baffin Island.

8.2 Management recommendations

8.2.1 Sustainable harvest levels

The estimated trade-offs between total removals and the probability of population size increase is shown in Table 3 for the Baffin Bay and the West Greenland-Southeast Baffin Island stocks. A target of a 70% probability for increasing stock sizes from 2014 to 2018 results in recommended total removals of no more than 93 animals from the Baffin Bay stock and no more than 100 animals from the West Greenland-Southeast Baffin Island stock.

In the East Greenland hunt, there is a high ratio of males, and the overall catch is small. A run of the assessment model with the extra years of catch data shows that this is still sustainable, and the recommendation of an annual total removal of no more than 20 individuals from the last assessment is reiterated.

Table 3. The estimated probabilities of increasing stock sizes from 2014 to 2018 for 6 levels of annual removal from the Baffin Bay and West Greenland-Southeast Baffin Island stocks. Canadian and Greenlandic catches and struck and lost walrus are assumed to be included in removals. These removals do not assume a specific sex ratio.

Removals	75	80	85	90	95	100
Baffin Bay	0.94	0.86	0.81	0.75	0.67	0.58
West Greenland – Southeast Baffin Island	0.87	0.85	0.81	0.78	0.74	0.70

8.2.2 Carryover of quotas

R-2.6.6 The Management Committee requested the Scientific Committee to investigate the possibility to include a carryover for quotas in order to include this possibility in the next hearing for the new quota block period.

The working group discussed the request and **concluded** that there is no biological argument against carryover of quotas. A problem arises if carryovers accumulate over time and/or across assessments.

9. RECOMMENDATIONS FOR RESEARCH

The working group **recommended** that:

- new estimates of sex and age structure of the catch for West Greenland are obtained. The sex determination that is reported by the hunters should be validated using genetics.
- the fraction of the catches and abundances in Canada that belong to the West Greenland-Southeast Baffin Island stock are clarified.
- complete catch statistics from Canada are collated.
- reliable reports of struck and lost are obtained for the entire range of the stocks in Greenland and Canada.
- regular abundance estimates (5-10 years) from Baffin Bay, West Greenland, and the southeast coast of Baffin Island are obtained.

10. OTHER BUSINESS

The completed papers in *NAMMCO Scientific Publications Volume 9: Walrus of the North Atlantic* have been published online and are available at <http://septentrio.uit.no/index.php/NAMMCOASP/index>.

Greenland plans to conduct a survey in the North Water in spring 2014 of marine mammals and birds, and will target walrus along the ice edge.

11. ADOPTION OF REPORT

The report was adopted in a preliminary form at the end of the meeting on 10 November 2013. The final version was adopted by correspondence on 12 November 2013.

References

- Andersen, L.W., Born, E.W., Stewart, R.E.A, Dietz, R., Doidge, D.W. and Lanthier, C. 2013. A genetic comparison of West Greenland and Baffin Island (Canada) walrus: Management implications. *NAMMCO Scientific Publications*. Volume 9. doi: <http://dx.doi.org/10.7557/3.2610>
- Born, E. W., Gjertz, I., and Reeves, R. 1995. Population Assessment of Atlantic Walrus, *Norsk Pol. Medd.* 138:1–100.
- Born, E. W., Dietz, R., Heide-Jørgensen, M., and Knutsen, L. 1997. Historical and present status of the Atlantic walrus (*Odobenus rosmarus rosmarus*) in eastern Greenland. *Meddr. Grønland, Biosci.* 46:1–73.
- Heide-Jørgensen, M.P., Laidre, K.L., Fossette, S., Rasmussen, M., Nielsen, N.H. and Hansen, R.G. 2013a. Abundance of walrus in Eastern Baffin Bay and Davis Strait. *NAMMCO Scientific Publications*. doi: <http://dx.doi.org/10.7557/3.2606>
- Heide-Jørgensen, M.P., Hansen, R.G., Nielsen, N.H. and Rasmussen, M. 2013b. The significance of the North Water polynyas to Arctic top predators. *Ambio.* 42(5):596-610. doi: <http://dx.doi.org/10.1007/s13280-012-0357-3>
- Stewart REA, Born EW, Dietz R and Ryan AK 2013a. Estimates of Minimum Population Size for Walrus around Southeast Baffin Island, Nunavut. *NAMMCO Sci. Publ.* doi: <http://dx.doi.org/10.7557/3.2615>
- Stewart REA, Born EW, Dietz R, Heide-Jørgensen MP, Rigét FF, Laidre K, Villum Jensen M, Knutsen LØ, Fossette S and Dunn JB 2013b. Abundance of Atlantic walrus in western Nares Strait, Baffin Bay stock, during summer. *NAMMCO Sci. Publ.* doi: <http://dx.doi.org/10.7557/3.2611>

AGENDA

1. OPENING REMARKS
2. ADOPTION OF AGENDA
3. APPOINTMENT OF RAPPORTEURS
4. REVIEW OF AVAILABLE DOCUMENTS
5. STOCK STRUCTURE
6. CATCH STATISTICS
 - 6.1.1 Reported catch
 - 6.1.2 Struck and lost
7. ABUNDANCE AND TRENDS
8. ASSESSMENT BY STOCK
 - 8.1.1 Present status
 - 8.1.2 Management recommendations
 - 8.1.2.1 Sustainable harvest levels
 - 8.1.2.2 Carryover of quotas
9. RECOMMENDATIONS FOR RESEARCH
10. OTHER BUSINESS
11. ADOPTION OF REPORT

In a new request (R-2.6.6), 6.2 page 16 of annual report 2012: The Management Committee requested the Scientific Committee to investigate the possibility to include a carryover for quotas in order to include this possibility in the next hearing for the new quota block period.

LIST OF DOCUMENTS

Document Number	Title
SC/20/WWG/00	Practical arrangements
SC/20/WWG/01	List of participants
SC/20/WWG/02	Draft Agenda
SC/20/WWG/03	List of Documents
SC/20/WWG/04	Heide-Jørgensen <i>et al.</i> Satellite tracking of Atlantic walrus from Northwest Greenland
SC/20/WWG/05	Witting. Revised assessment runs of walrus in Greenland

BACKGROUND DOCUMENTS

SC/20/WWG/O01	Witting and Born (2013) Population dynamics of walrus in Greenland. <i>NAMMCO Scientific Publications</i> . Vol 9. http://dx.doi.org/10.7557/3.2612
SC/20/WWG/O02	Stewart and Hamilton (2013) Estimating total allowable removals for walrus (<i>Odobenus rosmarus rosmarus</i>) in Nunavut using the potential biological removal approach. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/031. iv + 13 p.
SC/20/WWG/O03	Stewart, R.E.A., Hamilton, J.W., and Dunn, J.B. 2013. Results of Foxe Basin walrus (<i>Odobenus rosmarus rosmarus</i>) surveys: 2010-2011. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/017. iv + 13* p.
SC/20/WWG/O04	Proceedings of the Pre-COSEWIC Peer Review Meeting for Atlantic walrus (<i>Odobenus rosmarus rosmarus</i>)
SC/20/WWG/O05	Canadian catch data
SC/20/WWG/O06	Stewart DB <i>et al.</i> A catch history for Atlantic walrus (<i>Odobenus rosmarus rosmarus</i>) in the eastern Canadian Arctic. (<i>DRAFT- not for further circulation</i>)
SC/20/WWG/O07	LGL Report- Hudson Strait aerial surveys
SC/20/WWG/O08	Stewart <i>et al.</i> (2013) Estimates of Minimum Population Size for Walrus near Southeast Baffin Island, Nunavut. <i>NAMMCO Scientific Publications</i> . Vol. 9. http://dx.doi.org/10.7557/3.2615
SC/20/WWG/O09	Stewart <i>et al.</i> (2013) Abundance of Atlantic walrus in Western Nares Strait, Baffin Bay Stock, during summer. <i>NAMMCO Scientific Publications</i> . Vol. 9. http://dx.doi.org/10.7557/3.2611
SC/20/WWG/O10	Heide-Jørgensen <i>et al.</i> (2013) The significance of the North Water polynyas to Arctic top predators. <i>Ambio</i> . 42(5):596-610.
SC/20/WWG/O11	Heide Jørgensen <i>et al.</i> (2013) Abundance of walrus in Eastern Baffin Bay and Davis Strait. <i>NAMMCO Sci Publ.</i> doi: http://dx.doi.org/10.7557.3.2606
SC/20/WWG/O12	Report from last WWG meeting
SC/17/WWG/07	Born <i>et al.</i> Abundance of Atlantic walrus (<i>Odobenus rosmarus rosmarus</i>) in East Greenland