REPORT OF THE 26TH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE

October 29 – November 1 2019
Tórshavn, Faroe Islands

Tórshavn Marina, location for the 26th meeting of the NAMMCO Scientific Committee

Please cite this report as:

NAMMCO-North Atlantic Marine Mammal Commission (2019). Report of the Scientific Committee 26th Meeting, October 29 – November 1, Tórshavn Faroe Islands

Available at https://nammco.no/topics/scientific-committee-reports/

DISCLAIMER:

The content of this report contains the views of the Scientific Committee and does not necessarily represent the views of the NAMMCO Council.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The 26th meeting of the NAMMCO Scientific Committee took place in Tórshavn, Faroe Islands from October 29th to November 1st 2019 under the chairmanship of Bjarni Mikkelsen (FO).

National progress reports (NPRs) were received from all NAMMCO countries prior to the meeting, as well as written reports from Russia, Canada and Makivik Corporation. Three observers from Japan attended the meeting and gave presentations on their research programs and the new whaling policy.

A list of all documents available to the meeting is provided in appendix 3 of the report. This includes the reports of four working groups (WGs): The Harbour Porpoise Working Group; ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals; *Ad hoc* Working Group on Narwhal in East Greenland; Abundance Estimates Working Group. Each WG report is reviewed below under the relevant species/agenda item.

Work Procedures (Item 5)

Updates from Council: The General Secretary of NAMMCO provided the SC with an update on key decisions from the Council meeting (NAMMCO 27), which was held in Tórshavn, Faroe Islands, in April 2019.

Population estimates: The overview tables used by NAMMCO (both within the Secretariat and on the website) were discussed. The current assessment/conservation status tables were viewed as problematic and it was agreed they be removed from the website and revised versions prepared by the Secretariat. A new overview table describing the management areas/sub-areas of relevance to NAMMCO was agreed (see appendix 4).

Catches: The best methods for collecting reliable information on struck and lost were emphasised as: investments in good time series surveys, independent observer programs in selected hunts, and working with hunters to encourage reliable reporting. The development of a searchable online catch database was welcomed. It was, however, noted that this database currently uses information from the NPRs, which is not always the most up to date. The SC therefore *recommended* that the Secretariat be informed of any and all revisions of catch statistics. Inputs for a common reporting format were provided and following other NAMMCO committees, February 1st was *recommended* as the new deadline for reporting.

***Furthering cooperation in the SC*:** Information was provided that Norway is investigating avenues for funding the 'Supertag' project and all SC members were encouraged to talk to their managers about the possibility to contribute some level of financial support to this common research and development project.

***NAMMCO Scientific Publications*:** A presentation on the Plan S initiative for open access publishing was given and an offer to host an open data archive presented. The SC agreed that working towards being Plan S compliant was important, however, it *recommended* that clarity on the desirability of open data archiving be sought from the NAMMCO management committees (MCs). An update on volume 11 was provided and it was agreed that volume 12 would be pursued through an open call for submissions.

Work flow: A desire to have the SC meet in the spring and Council in the fall was reiterated. An additional option of holding the SC meeting shortly before the Council meeting was also outlined. A workflow for updating scientific information on the NAMMCO website and performing a quality control check was agreed.

Development of management advice

Request R-1.6.6 asked the SC to provide a review of the management procedures used for generating management advice, as well as which procedure is most suitable for each species. The SC answered this request through the provision of a written review. This review describes the difference between stock assessments and management procedures and outlines key methods of each. For stock assessments, this includes a description of HITTER FITTER methods and Bayesian assessment. Under management procedures, a description is provided for: a) the Revised Management Procedure (RMP) for commercial whaling and its catch limit algorithm (CLA), b) the Aboriginal Whaling Management Procedures (AWMP) for subsistence whaling and its strike limit algorithms (SLAs), and c) the approach of Potential Biological Removal (PBR).

The review concludes that there is no biological reason why the advice on a particular species is given through a management procedure or stock assessment calculations. Both approaches can be used for all species and their use within the NAMMCO SC has to a large degree been determined by historical conditions. Management procedures (such as those used by the IWC) are costly to develop (in time and resources) but once available have the advantage of having simple data requirements. Stock assessments models can, however, be tailored

to relevant stocks and species using less time and resources than developing a management procedure requires. Bayesian models are best able to incorporate a range of parameters and their uncertainty, while PBR is only recommended in exceptional cases where there is little data or the models are not fitting the data well.

Management advice provided by the NAMMCO SC is currently based on a suite of management procedures and assessment models developed and tuned to the knowledge available on marine mammal stocks in the North Atlantic. Given the effort required, the SC sees it unlikely that it will develop new management procedures and *recommended* the continued use of stock assessment approaches using population dynamics models as appropriate for generating advice on sustainable harvest levels.

Response to the Performance Review: Following a request from the *ad hoc* performance review working group, all of the recommendations related to the SC were considered and discussed in terms of their relevance, priority and possible pathways for implementation. A full report on the outcomes of this discussion is provided in appendix 5 of the report.

Interactions with Other Organisations (Item 6):

Updates were provided on NAMMCO interactions with the IWC, ASCOBANS, ICES, Joint Commission on Narwhal and Beluga (JCNB), Arctic Council & Subsidiary Bodies, FAO, and OSPAR. The SC *recommended* the Council provide advice on the scope of the collaboration with the IWC (e.g. on small cetaceans) and nominated a representative to participate in all future IWC meetings on abundance estimates. It also *recommended* that a response be sent to OSPAR regarding the proposed NACES marine protected area stating that there was insufficient data to draw a conclusion on the importance of the proposed area for cetaceans.

Environmental/Ecosystem Issues (Item 7)

Marine mammal-fisheries interactions: Updates on recent research on grey and harbour seals in Norway was provided, indicating that consumption by seals is low compared to fishery takes. It was also noted that this topic will be investigated as part of the Joint Norwegian-Russian Research program on Harp Seal Ecology.

By-catch: An update on a workshop held in Ålesund in June 2019 was provided, together with a status report from Norway on by-catch of harbour porpoises, coastal seals, and the mitigation efforts using pingers. The next meeting of the NAMMCO BYCWG was scheduled for spring 2020 to review the new/revised estimates for Norway and Iceland, as well as relevant reports from ICES, OSPAR-HELCOM, and the Norwegian workshop.

Multi-species approaches to management and modelling: NAMMCO participation in the planned ICES WG on Integrated Ecosystem Assessment in the Greenland Sea was encouraged.

Other environmental issues: A recently published review of baleen whale ecology in high-latitude marine ecosystems was presented. An update on the Mary River project was also provided. Concern was reiterated regarding the potential impact of the Mary River project and particularly the impact of disturbance from increased shipping traffic on walrus and narwhal populations. The SC *recommended* that the JCNB propose guidelines for monitoring the response of the narwhal stocks in Eclipse Sound and noted that monitoring of other species wintering in west Greenland would also be important.

Seal and Walrus Stocks – Status & Advice to Council (Item 8)

All of the research updates presented for the different species can be found in the full report.

Harp seal: The results of aerial surveys in the Greenland Sea pack ice (18-31 March 2018) to assess pup production were presented, together with the results of the Joint ICES/NAFO/NAMMCO working group on Harp and Hooded Seals (WGHARP), which met in Tromsø September 2019.

White Sea/Barents Sea: The last pup production estimate is from 2013 (more than 5 years old), making this a data poor population according to ICES rules. The assessment model provided a poor fit to the survey data. A conservative PBR approach was therefore applied and estimated an upper limit for removals of 21,172 seals.

Greenland Sea: This is a data rich population. However, a drop of almost 40% in pup production between 2018 and 2012, combined with a poor fit between the model and the available data, meant that the use of model projections to generate management advice was not recommended. The PBR approach was therefore applied and estimated an upper limit for removals of 11,548 seals.

The SC endorsed the assessments and recommendations from WGHARP, including that NAMMCO and ICES convene a workshop to improve population assessment models for seals. This was scheduled for fall 2020.

Hooded seal: All model runs conducted by WGHARP on hooded seals in the Greenland Sea indicated that the population remains well below N30 (30% of the largest observed population size). The SC *recommended* that there be no commercial catch from this stock but that scientific and subsistence hunting can continue.

Ringed seal: Since there are ongoing studies within Greenland and studies planned within Norway, it was proposed that the ringed seal WG be postponed and a new date set by SC/27 based on an assessment of the sufficiency of the data available at that time.

Grey & Harbour seal: The coastal seals WG will meet in Copenhagen 27-30 April 2020, with aims to: 1) Assess the status of harbour and grey seal populations in NAMMCO and adjacent waters, 2) Assess the status of population modelling for coastal seals, 3) Review by-catch issues in NAMMCO countries, 4) Review new research on ecology and telemetry. This meeting is planned to be held back to back with the by-catch WG.

Bearded seal: It was proposed that the bearded seal WG be delayed (until 2022 at the earliest) to allow for ongoing research to be finalised and additional data to be made available.

Walrus: Concern was expressed that shipping and industrial activity linked to the planned Ilmenite mine in Wolstenholme Fjord, NW Greenland, may impact the small population of walrus using this fjord. The SC *recommended* that the presence of walrus in the area be monitored and catch levels adjusted if needed. The new request from Council (*R.2.6.8 Provide assessments of, and advice on the sustainability of allowing walrus hunt all year round in Greenland, on all stocks*) was noted. The SC did not see any particular problems with allowing a hunt all year round but emphasised the importance of reporting any catch of a female with a calf as two animals (regardless of whether the calf is retrieved or not).

Cetacean Stocks - Status & Advice to Council (Item 9)

All of the research updates presented on the different species can be found in the full report.

AEWG: The AEWG met from 8-10 October in Tromsø under the chairmanship of Daniel Pike. The WG finalised estimates from the last 30 years of Icelandic coastal aerial surveys; Icelandic/Faroese ship surveys from 2007 and 2015; and Norwegian mosaic surveys over the last three survey cycles (spanning 2002-2018). New abundance estimates were made available for fin, humpback, sei, bottlenose, and killer whales, as well as for dolphins and harbour porpoise. An overview of all endorsed abundance estimates is available in appendix 6. The SC *recommended* that the final remaining estimate (killer whales in Iceland/Faroes) also be generated.

Fin whale: Information was given that there were no catches of fin whales in Iceland this year.

Beluga: The previous *recommendation* for seasonal closures in Greenland was reiterated with further explanation given. The next meeting of the NAMMCO-JCNB JWG will be in Winnipeg Canada, May 26-29 2020.

Narwhal: The *Ad hoc* Working Group on Narwhal in East Greenland (NEGWG) met in Copenhagen from 24-27 September 2019. It reviewed data on stock structure, abundance, distribution, impacts from hunting and climate change, and assessed the future sustainability of catches (full details on each item given in the report).

The borders for the three management areas in East Greenland were agreed as: *Area 1* = Ittoqqortormiit/ Scoresby Sound south to 68°30'N; *Area 2* = Kangerlussuaq 68°30'N to 67°N; *Area 3* = Tasiilaq, south of 67°N.

The SC endorsed the assessments performed by the NEGWG and given that catches at the current level for even one year would have a significant negative impact, *recommended* that there be an immediate reduction to 0 catches in East Greenland, at least until a new abundance estimate is generated.

An historical overview of the management of narwhal in East Greenland and the new scientific information that informed the 2019 assessment are provided in Tables 3 & 4 in the narwhal section of the report.

Furthermore, the SC *recommended* NAMMCO develop a principle-based approach to harvest advice for small stocks and hold another meeting of the NEGWG in 2021 to review new data and update the assessment.

Pilot whale: It was proposed that the pilot whale WG be delayed until 2021 to allow time to gather more data.

Harbour porpoise: The report of the Joint IMR/NAMMCO International Workshop (WS) on the Status of Harbour Porpoises in the North Atlantic (held in Tromsø in December 2018) was presented. The SC welcomed the impressive compilation of data and overview of knowledge gaps provided by the WS but agreed that further work was required to generate reliable assessments for the NAMMCO areas.

The report of the Harbour Porpoise Working Group (HPWG), held from 19-22 March 2019 in Copenhagen, was also presented. This WG performed an assessment for West Greenland and the SC endorsed a *recommended*

annual catch (animals reported landed) of no more than 1,869 harbour porpoises. Given the demonstrated importance of reliable and complete reporting of removals, it also *strongly recommended* that Greenland work to eliminate underreporting and validate catch statistics. It also endorsed the recommendation that new surveys for harbour porpoises be carried out in NAMMCO areas, and particularly off Iceland since the last dedicated survey there was 12 years old.

Surveys (Item 10)

The SC established a planning committee for the next NASS, which will meet by correspondence in 2020. The target species for the 2023 NASS will be the same as previous surveys – fin, minke and pilot whales.

Future Work Plans (Item 11)

Greenland will host the 2020 meeting of the SC, with the exact date and location to be decided.

There were some changes to the endorsed work plan and a new plan from SC26 is presented below.

2019 (COMPLETED)	2020	2021	2022
Working Groups: - Harbour porpoise - ICES/NAFO/NAMMCO on Harp and Hooded seals - Narwhal in East Greenland - Abundance Estimates	**Working Groups:** - By-catch - Coastal Seals - NAMMCO/JCNB JWG on Narwhal and Beluga (Planning meeting for next NASS via correspondence) **Workshops:** - Model development for assessment of seals (collaboration with ICES) - North Atlantic humpback whale tagging workshop/collaboration	**Working Groups:** - Pilot Whale - Narwhal in East Greenland (spring) - Abundance Estimates (for killer whales)	**Working Groups:** - Bearded seal - Ringed seal - Harbour porpoise

Expenses and Budget (Item 12)

The previously agreed total budget for 2020 remained applicable. The reallocation of funding required for the new work plan is described in the report.

Any Other Business (Item 13)

It was agreed that next year's SC meeting will separate administrative and scientific components in the agenda and reporting to allow scientific issues to be prioritised and handled first, which is not currently the norm.

Meeting Closure & Acceptance of Report (Items 14 & 15)

The meeting ended at 17:50 on 1 November 2019. A draft version of the report was accepted during the meeting and following a second round of editing and integration of further feedback, the final report was accepted on 15 November 2019.

MAIN REPORT

1. WELCOME FROM THE CHAIR AND OPENING REMARKS

The Chair of the NAMMCO Scientific Committee (SC), Bjarni Mikkelsen welcomed participants to the Faroe Islands for the 26th meeting of the committee and extended a particularly warm welcome to the observers from Japan. It was noted that at last year's meeting, Fernando Ugarte was elected Vice Chair of the SC, however due to personal reasons, he had to step down from this responsibility. This meant that the SC selected a new Vice Chair via correspondence and Mikkelsen took this opportunity to formally congratulate Aqqalu Rosing-Asvid on his election to this position.

Kate Sanderson, the Chair of the NAMMCO Council and Head of European and Ocean Affairs in the Ministry of Foreign Affairs and Culture in the Faroe Islands, also welcomed participants to the meeting and to the Faroe Islands. She highlighted that the Council viewed the work of the SC as the foundation of all the work done within NAMMCO and noted that the Performance Review Panel had also emphasised the value of the work of being done by the SC. Sanderson congratulated the SC on the significant progress that had been made in the analysis of the North Atlantic sighting surveys and highlighted the importance of this milestone for both the NAMMCO SC and the organisation as a whole. She closed by wishing the participants a constructive meeting and an enjoyable stay in the Faroe Islands.

2. ADOPTION OF AGENDA

The draft agenda was delivered to the committee 30 days prior to the meeting, as required under the NAMMCO rules of procedure. The Chair noted that no revisions had been received prior to the meeting but asked the group if any additions or amendments were now required. The General Secretary of NAMMCO noted that under agenda item 6.7, cooperation with other organisations, relations with OSPAR would be presented and particularly the proposal for a new marine protected area (see SC/26/19). A specific point on cooperation with OSPAR was therefore added to the agenda. The agenda was adopted without further amendments. The Chair noted that in recent years the meeting had been extended from 3 to 4 days given the growth in the number of items that now needed to be reviewed.

3. APPOINTMENT OF RAPPORTEURS

The SC agreed that the NAMMCO Scientific Secretary, Fern Wickson, would operate as lead rapporteur for the meeting. The Chair emphasised that to support this work, it was important that all participants who made presentations, long interventions, or highly technical discussion points, provide a written summary to the Scientific Secretary for inclusion in the report. Other members of the NAMMCO Secretariat present at the meeting (Genevieve Desportes and Sabine Hansen) also agreed to assist in the rapporteuring as necessary.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

4.1 NATIONAL PROGRESS REPORTS

The SC welcomed the national progress reports provided by the Faroe Islands, Greenland, Iceland, and Norway, as well as the written reports on activities submitted by Russia, Canada and Makivik Corporation (SC/26/NPR-RU, SC/26/NPR-CA, SC/26/PR-MK).

4.1.1 Updates from Observers – Japan

The observers present from Japan made three presentations to update the SC on their research programs, as well as the new whaling policy that has now been implemented. Summaries of these presentations are provided below.

Presentation on Recent Changes in Whaling Policy in Japan

Pastene presented an overview of recent changes in whaling policy in Japan with particular emphasis on future cetacean research programs under the new policy. He informed that Japan's withdrawal from the International Convention on Regulation of Whaling (ICRW) came into effect on 30 June 2019 and that on the same date, Japan ceased its two whale research programs under special scientific permit, NEWREP-A in the Antarctic and NEWREP-NP in the western North Pacific. From 1 July 2019, Japan started commercial whaling on common minke, Bryde's and sei whales within its territorial sea and Exclusive Economic Zone. A domestic group on calculation of catch limits in line with the RMP was established and the catch limits calculated by this group were reviewed by an international team of specialists in June 2019. Determination of catch quotas for common minke, Bryde's and sei whales by the Government of Japan was based on the results of the review by the international specialists. Pastene identified the following future research activities on cetaceans in Japan: i) non-lethal research programs based on systematic sighting surveys in the North Pacific (national and international programs) and in the Antarctic; ii) update of catch limits calculations for commercial whaling; iii) collection of fisheries-dependent scientific data through commercial whaling; iv) analyses of samples and data from previous whale research programs under special permit; v) DNA registry and market monitoring surveys; and vi) collection and analyses of data and samples from small cetaceans for their conservation and management. He confirmed Japan's interest in scientific and technical research collaboration on cetaceans with NAMMCO Scientific Committee members.

Presentation on Research Activity in North Pacific and Antarctic Waters from 2017-2019

Taguchi presented a summary of the cetacean research activities conducted by Japan in the period 2017-19. She summarized the scientific information on the following research projects/activities: 1) special permit scientific research in the Antarctic Ocean (NEWREP-A) and the western North Pacific Ocean (NEWREP-NP). These programs involved biological sampling of a limited number of whales, sighting surveys, oceanographic and prey species surveys, marine debris survey, and photo-ID, biopsy sampling and satellite tagging for large whale species; 2) international dedicated sighting survey in the North Pacific Ocean organized by the International Whaling Commission Scientific Committee (IWC SC) and Japan (IWC-POWER survey). This program involved sighting surveys, photo-ID and biopsy sampling of large whales, and a marine debris survey; 3) DNA register and market molecular monitoring of large whales; and 4) records and analyses (mainly on population genetic structure) of by-catch and strandings including small and large cetaceans. Several research institutes and universities participated or contributed to the research in each project. The substantial amount of biological samples and data collected using both lethal and non-lethal techniques in the period mentioned above, are being used in analyses relevant to the research objectives of each research project/activity. In 2018, a total of 31 scientific documents were presented to international meetings or published in peer-reviewed journals.

Presentation on Future Research in Antarctic Waters (JASS-A)

Isoda presented the objectives, survey and analytical procedures, and work schedule of a new research program on whales and the ecosystem in the Indo-Pacific region of the Antarctic (JASS-A= Japanese Abundance and Stock structure Surveys in the Antarctic). The main research objectives of JASS-A are: i) the study of the abundance and abundance trends of large whale species, and ii) the study of the distribution, movement and stock structure of large whale species. JASS-A also has several secondary research objectives related to oceanographic factors, marine debris and whale biology. The research program will be based on systematic sighting surveys utilizing the Line Transect Method, to be conducted alternatively in IWC Areas III, IV, V and VI by one or two specialized vessels, during a tentative period of eight austral summer seasons. Analyses related to main and secondary objectives will be conducted based on new as well previous data collected by JARPA/JARPAII and NEWREP-A in the same research area. This means the analyses under each of the objectives will be based on large and consistent data sets. The survey plan for the 2019/20 austral summer season, to be conducted in IWC Area IIIW, was presented. JASS-A is open for international research collaboration following established protocols by the Institute of Cetacean Research.

Presentation on Satellite Tracking Studies at the ICR

Isoda also provided the latest information on satellite tracking studies at the Institute of Cetacean Research. More detailed technical information on the satellite tracking work by Japan had been presented at the 2018 NAMMCO SC meeting. This time he presented information on: i) improvements to the anchor design; ii) results of the satellite tracking in the North Pacific in 2019 (one blue and one fin whale tracked for 8 and 29 days, respectively), and iii) plan for the satellite tracking experiment in the Antarctic in the 2019/20 austral summer season under the JASS-A.

Discussion

It was clarified that the report of the international team of specialists that was assembled to review the calculations of catch limits in Japan was not publicly available at this stage, although it may be available upon request.

Additional information was provided that the catch quotas determined by the government of Japan for sei and Bryde's whales for this year were already taken, and that only some few minke whales from this year's quota remain to be taken. In response to queries, it was clarified that there was no export of whale products out of Japan and that there was a high level of by-catch of minke whales in net-based fisheries in South Korea.

The plan to open the JASS-A research program for international collaboration (both for the fieldwork and the analysis) in the near future was communicated. The SC looked forward to receiving more information about this opportunity for international collaboration in cetacean research.

The SC expressed its appreciation for the updates that were presented on the research and commercial activities taking place in Japan, and particularly the latest work on satellite tagging related to minke whales given the relevance of developments in this field for the NAMMCO countries.

4.2 WORKING GROUP REPORTS

Reports of the four working group meetings that were held in 2019 were presented to the SC as working documents. These included the reports of the:

- Harbour Porpoise Working Group (SC/26/09)
- ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (SC/26/10)
- *Ad hoc* Working Group on Narwhal in East Greenland (SC/26/11)
- Abundance Estimates Working Group (SC/26/12)

4.3 OTHER REPORTS AND DOCUMENTS

Other working documents that were made available to the meeting included:

- List of active council requests (SC/26/04)
- Abundance tables and trends (SC/26/05)
- Development of management advice in NAMMCO (SC/26/06)
- Performance review recommendations for SC (SC/26/07)
- Summary of performance review requests for SC (SC/26/08)
- Report of the harbour porpoise workshop held in Tromsø in 2018 (SC/26/13)
- Overview of populations, stocks and management units (SC/26/14)
- A note on OSPAR, NACES, and MPA (SC/26/19)
- Status management areas (SC/26/20)
- SC accounts and budget (SC/26/21)

The *For Information* documents available to the meeting are described in the document list (see appendix 3 of this report).

5. WORK PROCEDURES IN THE SC

5.1 UPDATES FROM COUNCIL NAMMCO/27

The General Secretary of NAMMCO, Genevieve Desportes, provided an update from the NAMMCO Council meeting (NAMMCO 27), which was held in Tórshavn, Faroe Islands, in April 2019.

5.1.1 General comments

Desportes provided an update on the decisions related to the work of SC that were taken at the 2019 meetings of the Council (CN 27) and the Management Committees (MCs - MC for Seals and Walruses (MCSW) and Cetaceans (MCC), and their Joint Meeting (MCJ)).

Related to the Report of the Performance Review (CN 27: Agenda item 2)

One important issue dealt with by Council was the report of the Performance Review Panel, which started its work in January 2018 and delivered its report in March 2019. The overall conclusions of the Performance Review (PR) were positive. It considered NAMMCO to be a well-functioning organisation, meeting its overall objectives and contributing to the conservation, rational management and study of marine mammals in the North Atlantic. Thanks to the Committees' input and work "*The outputs from the NAMMCO Scientific Committee had been substantial and substantive... NAMMCO has attained a level of credibility among other organizations involved with Arctic issues and marine mammal conservation and that with respect to outputs from the Scientific Committee, the Committee on Hunting Methods and recommended regulatory measures with respect to sustainable management of marine mammals across the North Atlantic its work was valued, relied upon and sought*". The review concluded that NAMMCO was a preeminent and credible forum for discussions on the conservation and management of marine mammals in the Arctic and Northern Atlantic regions. There were, however, areas where NAMMCO could consolidate its work and performance.

As underlined by the Chair of NAMMCO, the PR and the Panel's report provided an excellent opportunity for stepping back, reviewing working processes in NAMMCO, and recommending and implementing changes that could facilitate the workflow and communication between NAMMCO's bodies, as well as the growth of the organisation.

CN 27 established an *ad hoc* Performance Review Working Group (PRWG) to review and follow up on the recommendations presented in the report of the Performance Review Panel. The Scientific Committee (together with all other committees within NAMMCO) was requested to address the relevant recommendations and issues forwarded to them by the PRWG (see agenda item 5.8 of this report, together with appendix 5).

Related to the proposed revision to NPR reporting (CN 27: 4.1)

The Council endorsed the recommendation to extend and standardise the data input to the NPR to meet the data requirements and deadlines of all committees. The new submission deadline should be agreed between the committees (see agenda item 5.3.3 of this report). There was no decision taken on the recommendation to develop a proper database with the Secretariat as depository.

Related to Procedures (CN 27: 9.1)

CN 27 agreed that:

- Requests older than 10 years should be retired and archived after a review process by the management committees, unless they were specifically renewed by the Council;
- The issue of identifying the best reporting method for recording struck and lost should be forwarded to the CHM and advanced as a joint effort together with the SC.

Related to the next NASS survey (CN 27: 10.1 & 13.1)

CN 27 endorsed the recommendations for research forwarded by the MCC, including:

- A workshop on novel abundance survey and estimation methods be held, preferably before the next NASS;
- 2023 was the preferred year for the next NASS survey.

It noted that it expected some input and recommendations from the SC regarding the scope and focus of the next cetacean sightings survey.

Related to humpback whales and large whale assessment in general (MCC 27: 3.2 and CN 27: 10.1)

The MCC endorsed two proposals for conservation and management related to humpback whales that had not been endorsed in previous years due to a request to the SC for further explanation and information. SC/25 informed the MCC that it was possible to use the Strike Limit Algorithms (SLAs) developed by the IWC without the use of 'needs statements', which the SC had done in its previous work to estimate sustainable yields. The MCC therefore agreed to endorse the proposal that:

- SLAs that are developed in the IWC be used for advice for large whales in Greenland.
- Annual strikes of no more than 25 humpback whales off West Greenland from 2019 to 2024

Related to narwhals (MCC 27: 3.5 and CN 27: 10.1)

There were three proposals for conservation and management of narwhals from 2017 that had not previously been endorsed due to a request for further explanation on the advice given by the SC. SC/25 provided further explanation of the reasoning behind its advice on management units, including decreasing abundance and a desire to pursue a precautionary approach. Based on the clarification provided, the three proposals listed below were endorsed by the MCC.

- Recognize the hunting areas in East Greenland around Tasiilaq, Kangerlussuaq and Ittoqqortormiit/Scoresby Sound, as three separate management areas.
- Catch quotas of fewer than 10 narwhals in both Scoresby Sound and Kangerlussuaq.
- No catches south of 68°N (where Tasiilaq is situated).

Related to dolphins (MCC 27: 3.10.2 and CN 27: 10.1)

SC/25 had questioned whether performing an assessment of dolphin species was a priority. The Council agreed that it remained a valid request and had the same level of priority as assessments of other species from which there were removals.

5.1.2 New requests

The NAMMCO Management Committee on Seals and Walrus (MCSW) rephrased two requests and made one new request.

R-2.1.10 was rephrased from "*To provide advice on Total Allowable Catches for the management of harp seals and the establishment of a quota system for the common stocks between Norway and the Russian Federation, leaving full freedom to the Committee to decide on the best methods to determine this parameter based on an ecosystem approach*" to "*To provide advice on the total allowable catches for the management of harp seals*".

R-2.6.3 was rephrased from "*Provide advice on the effects of human disturbance, including fishing and shipping activities, in particular scallop fishing, on the distribution, behaviour and conservation status of walrus in West Greenland*" to "*Provide advice of the effects of human disturbance, including fishing and shipping activities, tourism, hydrocarbon exploration and mineral extractions on the distribution, behaviour and conservation status of walrus in Greenland*".

NEW R-2.6.8: "*Provide assessments of, and advice on the sustainability of allowing walrus hunt all year round in Greenland, on all stocks*".

The SC welcomed the rephrased requests and noted the new request from Council.

5.1.3 Time horizon for requests from Council

At NAMMCO 27, The Joint Management Committee (MCJ) agreed to the SC/25 proposal that requests older than 10 years could be retired. However, they required that the Management Committees (MCs) first be warned when this will occur and given an opportunity to respond. This means that requests will only be retired after review by the MCs, and based on the advice from MCs, Council has the possibility to renew requests if they are considered to still be valid. All retired requests will also be retained in an archive by the Secretariat.

5.1.4 Endorsed SC work plan

The workplan proposed by SC/25 and endorsed by NAMMCO 27 was reviewed. It was noted that the proposed working group with Japan required approval from the Council and could not take place within the timeframe proposed by SC/25. This collaborative working group had therefore been postponed. The pollution review by the Secretariat is underway, however, since it requires additional resources and expertise to be completed, will not be completed in 2019 as indicated in the endorsed workplan. A revised version of the SC work plan for the coming years is presented under agenda item 12.2.

5.2 POPULATION ESTIMATES

5.2.1 Review of NAMMCO abundance and stock status tables

The abundance estimates presented in the NAMMCO overview tables (SC/26/05) (and on the website) will be updated with the work done by the 2019 working groups (WGs) when the reports from these WGs and the estimates provided within them have been approved by the SC. This includes the reports of the abundance estimates working group (AEWG) (SC/26/12), the joint ICES/NAMMCO/NAFO working group on harp and hooded seals (WGHARP) (SC/26/10), the harbour porpoise working group (HPWG) (SC/26/09) and the *ad hoc* working group on narwhal in East Greenland (NEGWG) (SC/26/11).

The NAMMCO Secretariat has been working to develop a table that provides a clear overview of the different management units used within NAMMCO for all species and a draft version of this was presented to the SC (SC/26/14).

Discussion

Some concern was expressed regarding the public presentation of information on trends within NAMMCO and the potential for this information to be misinterpreted. Specifically, the potential for distributional changes to be understood as a declining (population) trend. It was noted that there is a particular danger for misinterpretation when information on trends is presented in a simplified form, such as in the present tables. It was, however, also explained that the work to develop tables with information on abundance, trends and conservation status is in direct response to a request from the Council to the Secretariat and that the SC has responsibility to quality control this information.

It was clarified that document SC/26/14 did not contain a table dealing with trends, but rather more simply a list of the management units used within NAMMCO, which is an important overview for the organisation to have. The process used to develop the overview of these units was discussed and it was proposed that the development of the table presented in SC/26/14 required additional consideration. The table was then projected and reviewed by the whole group in plenary.

The SC agreed that the information in the table explaining the nature of the management areas (e.g. whether they were stocks, populations, pragmatic divisions for management etc) should only be used by the Secretariat and did not need to be part of wider communications. The SC therefore agreed that the table should focus on providing information on the three key factors of: species, region and management unit. Since the title "Management Unit" may not be appropriate in all cases, the SC also agreed that the terminology "Management Areas/Subareas" should be used.

A question was raised regarding the relevance of including information on Canada and the US in this table (beyond the shared stocks that were already indicated). The aim of the document was clarified as being to

provide a clear overview of the current division of management areas for all of the species and regions of relevance to NAMMCO, and that it was an overview primarily intended for use by the Secretariat and the NAMMCO Working Groups. The SC therefore agreed that the focus of the table be restricted to the management areas that are directly and specifically relevant to NAMMCO.

Other issues discussed during the review and finalisation of this table included: how to relate to the area definitions used by the IWC, the relevance of maintaining a division between East Greenland and West Iceland for some species, how to handle situations in which management areas and stocks do not align, and how to treat data deficient species.

The SC agreed that this table should remain a living document that can continue to be revised and updated based on the outcome of future working groups.

5.2.2 Review of the assessment / conservation status tables

SC/25 briefly discussed how the assessment and conservation tables presented on the NAMMCO website for each species may need to be revised and agreed that the colour coding in the tables should be separately applied for removals and assessments and that the information needed to be further broken down into separate stocks for grey and harbour seals. Some further feedback on a draft revision proposed the Secretariat had also been given by correspondence in 2019, particularly regarding the definition of key terms.

During its work to revise the conservation status tables, it became clear to the Secretariat that it was important that there first be an agreement on management areas. This meant that the focus of the Secretariat had shifted to completing that task as a first step (see 5.2.1). A draft list of management areas for each species was prepared by the Secretariat (SC/26/14) and the SC agreed on a final version during the meeting (see appendix 4). With clarity on the management areas established, the SC agreed that a revised version of the conservation status tables could be developed by a selected sub-group and presented during the meeting.

The sub-group concluded that the current tables contained sensitive and problematic elements that meant that they should be removed from the website in their current form and that a new table summarising the information available for NAMMCO sub-areas be prepared. The Secretariat was tasked to prepare such a summary table containing the following information:

- *Size or range size of population*
- *Direct removals (catch and by-catch): presence and sustainability*
- *Abundance estimate: yes/no, how many & period covered, date of the most recent*
- *Assessment: yes/no, full/partial, date of the most recent and by whom*
- *Other key anthropogenic threats, with a guestimate of concern level (high, medium, low).*

A second step, which would need to be discussed further, would be to identify a systematic way of combining this information into a single index, which could be expressed using either a colour or number code to summarise the management progress/concern status for each sub-area considered.

5.3 CATCHES

5.3.1 Struck and lost

The NAMMCO Council has requested (R-1.6.4) that the SC come with a description of the best methods for collecting reliable information on struck and lost. SC/25 agreed that there was a need to prioritise investments in good time series surveys and to work with hunters to encourage reliable reporting. It also recommended that methods for advancing reliable reporting on struck and lost be pursued as a joint effort with the Committee on Hunting Methods (CHM). This recommendation was endorsed by the MCJ. During their October 2019 meeting, the CHM proposed that such a collaborative effort could be advanced through NAMMCO's involvement in a project on integrating local knowledge in international management advice coordinated by NORDECO project.

The SC emphasised that the use of independent observer programs in selected hunts was still a necessary way to validate the reliability of user reporting. The SC were not, however, convinced that there was enough information to support struck and lost being made a focal topic for NAMMCOs involvement in the NORDECO project. If the CHM wished to use this avenue to discuss and advance on the topic though, the SC would be willing to review the outcomes of this work.

5.3.2 Catch database

Catch information from all NAMMCO member countries is now available, searchable, and filterable on the NAMMCO website. The entire database is available under the "About NAMMCO" section and information for each species is available under the "Marine Mammals" section.

The SC welcomed the development of this format for the database and noted that it was already being used. It was, however, highlighted that this database contains information provided in the National Progress Reports (NPRs) and that in some cases, this data was not the latest information now available, (particularly for Greenland).

The SC emphasised the importance of keeping the NAMMCO catch database accurate and up to date, which may include revising the information on historical catch data when this had been amended on the basis of new information. The SC therefore **recommended** that the NAMMCO Secretariat be informed of any and all revisions of catch statistics taking place at a national level.

5.3.3 Common reporting format & timing for all data requirements

The SC was requested to provide input on the format and deadline for a single form for reporting catch, bycatch, entanglements and live strandings (see SC/26/15). This was in response to a request from NAMMCO 27 to extend and standardise the input data for the NPRs to fulfil the requirements and meet the deadlines of all relevant committees. The BYCELS Working Group had identified the data they required and their preferred format for the reporting (SC/26/15). BYCELS, CHM and CIO had also proposed a deadline of February 1st for all reporting all data.

Discussion

The question of why there was a need to provide information on strandings was discussed. It was noted that not all examples of strandings are natural mortality events and having information on all anthropogenic removals was relevant information for NAMMCO to have.

For the content of the reporting, it was proposed that struck and lost be included as a separate column and it was noted that a column for reporting on total numbers may not be needed. It was also suggested as potentially useful to include latitude and longitude for whale catches and not only information on stock and management areas. Data on by-catch of seals was highlighted as necessary information to have but that this is also difficult to obtain. Finally it was suggested that ship strikes be reported according to the ICES area to be consistent with the information required on by-catch.

The SC agreed with the proposal from BYCELS, CHM, CIO and **recommended** that February 1st be given as the new deadline for reporting.

5.3.4 Review and status of active requests (R-1.6.4, R-1.6.5)

R-1.6.4 *[SC and CHM are requested] to provide advice on the best methods for collection of the desired statistics on losses, as SC recommended that catch statistics include correction for struck but lost animals for different seasons, areas, and catch operations.*

The SC reiterated that it views the best methods for collecting statistics on losses as investing in a good time series of surveys and having independent observer programs on selected hunts for different seasons, areas and catch operations. With this answer it considered the request to now be answered.

R-1.6.5 *Struck and loss rates should be subtracted from future advice on sustainable removals in Greenland, with the advice being given as total allowable landings.*

This is now established practice within NAMMCO.

5.4 FURTHERING COORPORATION IN THE SC

5.4.1 Supertag project

The Secretariat provided an update that Norway is currently investigating potential sources of funding to support this project and the initial costs associated with developing the tag. Although it was considered unlikely that a definitive answer will be available before 2020, the indications to date were noted as being positive. It was also communicated that Norway considered it highly desirable for other member states to also make some level of financial contribution to support the project and SC members were encouraged to broach this subject again with their managers.

Since SC/25, Wildlife Computers Inc. had been asked to perform a test on the triple A cells it was hoped the tags could employ. This test remains ongoing and will take one year to complete, with results available next summer. It was noted that there are very few manufacturers making triple A lithium batteries and the early test results indicate it may be relevant to also consider other options for the tags. One other option was to develop a tag suited to minke whales using the current double A battery cell model but with a complete laser cut package. This would result in a tag that was stronger but not much smaller. Pursuing this approach would reduce the developmental costs but not the footprint of the tag on the animals. Another option would be to use the same tags that have been used for humpback whales. However, it was noted that this tag functions well for animals that can be approached but not particularly well for animals that have to be tagged from a distance.

Japan confirmed its interest in this type of technological development and highlighted its ongoing programs on satellite tagging related to minke whales. The SC agreed that this represented a good opportunity for technical collaboration between NAMMCO and Japan.

5.4.2 Presentation from SC member

This is a regular item on the SC agenda and although there were no plans to have a presentation from an SC member at this meeting, it was agreed that the opportunity would remain available in the future.

5.5 NAMMCO SCIENTIFIC PUBLICATIONS

5.5.1 Preparing for Plan S: Database for Open Archiving & Author Contributions

The NAMMCO Scientific Secretary gave a presentation on Plan S (an initiative for open access publishing that will be implemented from 2021) and examples of what *NAMMCO Scientific Publications* would need to do to be compliant with this. The presentation also gave an update on the status of volume 11 and volume 12.

Discussion

The tradition within NAMMCO has been to base volumes of the *Scientific Publications* series around particular meetings that take place. These volumes have typically been species-based, with a particular focus on publishing review papers. It was noted that there was no clear topic of relevance for such a volume in 2020. The SC therefore discussed whether it would be possible to make volume 12 based on an open call for submissions. There was some uncertainty as to whether there were sufficient resources within the organisation to allow for this to become a purely submission based journal, and it was noted that in some years it may also be desirable to retain a theme based approach connected to particular meetings. It was therefore agreed that volume 12 be used to trial an open call approach, without ruling out more focused theme or meeting based volumes in the future. It was suggested that the open call for submissions to the journal could be promoted at the booths that the Secretariat plans to have at the World Marine Mammal

Conference in Barcelona in December 2019 and the IUCN meeting in 2020. The proposed topic for volume 12 was suggested to be a general theme such as "Studies on Marine Mammals in the North Atlantic".

The SC agreed that a relevant niche for the journal is to publish articles that contain useful information for assessment, management and conservation purposes but that may be difficult to get published in other journals. It was seen as particularly important to maintain *NAMMCO Scientific Publications* as a journal where information that is useful for management can be peer reviewed and published in a citable form. Given this orientation, it was highlighted that it may not be necessary that the journal have an aim of achieving a (high) impact factor. However, it was noted as important that the journal be indexed in major databases where possible.

The SC agreed that as an open access journal, it was important that it work towards being Plan S compliant. It suggested that the different routes available for reaching this compliance be further investigated and considered in relation to the resources available within the Secretariat.

On the specific issue of open data archiving, a question was raised regarding how survey data would be handled and on what level such data sharing would be done (e.g. all raw data or some form of agglomeration). It was noted that sharing all the data required to reproduce an abundance estimate may not always be desired by the member states. The data policy of the journal would therefore need to carefully consider the potential sensitivity of this particular form of data and the impact that open archiving might have on this. The SC therefore **recommended** that clarity on the desirability of open data archiving be clarified by the MCs.

There was an additional request that use of the template for submission to *NAMMCO Scientific Publications* only be required when articles are submitted in their revised form following acceptance after a process of peer review. This would allow authors to initially submit their manuscripts in any format (lowering the threshold for submission) and mean that the template would only need to be used once the paper had been accepted for publication. The SC agreed that this approach could be implemented.

5.6 WORK FLOW

5.6.1 Timing of Council & SC meetings

The revision of work flow/meeting times in NAMMCO to help improve efficiency was brought up during SC/25 (under agenda item 5.10.2) and also by the performance review (see agenda item 5.8). A proposal to invert the meeting times so that the SC met in spring and the Council in autumn was presented to NAMMCO 27 where it was determined that this issue should be considered by the FAC. This consideration is scheduled to take place during the FAC meeting in November 2019. Since autumn is already a busy time with several meetings for some Council members, strong arguments from the SC would be required for any such change to be approved. SC/25 had noted that the reasons for proposing such a change included that: WGs had to be squeezed into times outside the field season (June-September) and this meant that data from that year's fieldwork could typically not be included in the WGs or the SC, and that having a Council meeting in spring meant that management recommendations were typically not implemented until the following year.

The SC emphasised that it is important to consider the efficiency of the workflow of NAMMCO as a whole and highlighted the inefficiency of the current model in which there are cases of a 2 year delay from advice being generated within a WG to this advice being implemented. The SC did, however, propose an alternative approach that may also improve efficiency if reversing the meeting order is not desirable to Council. This was the option to hold the SC meeting shortly before the Council meeting. It was noted as also potentially valuable to hold some working groups early in the year before the SC meeting in this approach. To make this possible in practice, it would be relevant to prioritise having those working groups with direct management implications close to the SC meeting, and taking those of less direct relevance in the autumn.

5.6.2 Quality control of scientific information on the NAMMCO website

It is important that the scientific information on the NAMMCO website is accurate and up to date and for there to be a clear process for ensuring quality control of this information. The Secretariat presented a proposal for

a procedure that could be used to formalise a regular review of the scientific information on the website by the SC. This involved assigning each SC member responsibility for the information presented on certain species and allocating time during future SC meetings to review the information on the website and note relevant updates. One of the challenges the SC saw for this approach was that those individuals assigned responsibility for a particular species may not be aware of all the relevant issues and/or information for that species in all the NAMMCO countries.

An alternative proposal presented by the SC was to have a 5-year cycle for the review of each species, with a certain number of species (e.g. 4-5) reviewed each year during the SC meeting. The species selected for review in any given year could be determined by the Secretariat on the basis of the importance of the species for the NAMMCO members and the perceived need for review and updated information. It was suggested that for the sake of time efficiency, the review could be carried out by small groups working in parallel (e.g. one group working on selected whale species and the other on seals). For such a review to take place during the SC meeting, it was noted as potentially desirable to provide the online information in a form that could be printed and read in hard copy in advance. It was also noted that any such review process would need to be combined with the Secretariat regularly updating the website with relevant information arising from a WG. Species that are the subject of a WG that year would not need to be reviewed at the SC meeting. It was also noted that the SC is always welcome to send the Secretariat new publications (authored by its members or others), that are of relevance to NAMMCO. Updates to the website using this information can then be made by the Secretariat on an *ad hoc* basis.

5.7 DEVELOPMENT OF MANAGEMENT ADVICE (R-1.6.6)

To answer request R-1.6.6, SC/25 established an ad hoc working group to describe the management procedures within NAMMCO. A draft document from this WG was provided (SC/26/06), reviewed, revised and finalised at SC/26. The full text of the answer to this request is provided below.

The following represents the SC response to request R-1.6.6 from the NAMMCO Council.

R-1.6.6: *Conduct a review of the management procedures used by the Committee for generating management advice (RMP, AWMP, Bayesian assessment, Hitter Fitter, etc). The Committee should advise on which procedure is the most suitable for each species (or category of species) with the data that is currently available, while also meeting the management principles of NAMMCO. The Committee should further advise where additional data could allow for more suitable management procedure(s) to be implemented.*

The NAMMCO SC provides scientific advice on sustainable removals of marine mammals in line with precautionary principles. This advice is based on either stock assessments (SAs) or management procedures (MPs). Stock assessments are population dynamic models that are fitted to a variety of data (including but not limited to abundance data) with the estimate of sustainable removals being calculated by an advice rule in the model. Management procedures are advice rules that calculate estimates of sustainable removals directly from data. The MPs that have been used by the SC (all described in more detail below) are the RMP Catch Limit Algorithm (CLA), the AWMP Strike Limit Algorithms (SLAs), and Potential Biological Removals (PBR). These MPs need data on abundance, and historical catches for the CLA.

There is generally no biological reason why the advice on a particular species is given by the use of a management procedure or by assessment calculations, and both approaches can be used for all species. The use of these approaches in the advice from the NAMMCO SC is to a large degree determined by the history of the WGs that first developed the advice for the relevant species. Unless there is a specific reason to change the advice method for a given species, the SC finds that it is most efficient to maintain the currently agreed approaches, as these reflect the scientific expertise of the WGs that produce the advice.

The CLA and SLAs were conceived by the IWC as calculation rules that do not require an assessment of the population dynamics. When the IWC developed the CLA and SLAs for large baleen whales, the rationale for the use of MPs was to be able to incorporate the various uncertainties related to the population dynamics and ensure the robustness of the MP. The MPs were designed such that they maximize the catch performance

with or without prior limits, while ensuring that conservation goals were met. In addition, the management procedure approach used by the IWC was appealing due to its simplicity in terms of data requirements.

Once a management procedure is agreed, it is relatively straightforward to provide catch advice. The development of MPs for particular cases is, however, an elaborate process that requires considerable resources. Given the need for advice, it was natural for the NAMMCO SC to focus on assessment models when developing advice for small cetaceans. One benefit of assessment models is that they are tailored to the relevant stocks of a species, requiring less time and resources to develop. This allows the SC to provide advice (and updated advice) with short notice, instead of waiting years for the development of a case specific management procedure.

Today NAMMCO is in the situation in which scientific removal advice can be given for a broad range of marine mammals in the North Atlantic, based on a suite of management procedures and assessment models that were developed and tuned to the specifics of stocks of marine mammals in the North Atlantic. The section below, reviews the current use of the different advice methods in NAMMCO, discussing their potential limitations and improvements.

Stock Assessments

A stock assessment model is a mathematical model of the population dynamics of a particular stock fitted against a range of available data. The data sources can be diverse, and species dependent, and can include time-series of total and/or offspring abundance, size and age composition, mark-recapture, catch history, and calving rates among other things. By fitting the model to the available data, we not only obtain a better understanding of the status of the stock, but can also estimate the level of removal that allows the population to increase in size, remain stable, or approach the maximum sustainable yield level in models with density-regulated growth. Providing catch advice based on the output from the assessment model is commonly based on forward projections under various harvest rate or catch scenarios.

Stock assessments in NAMMCO have taken a variety of forms, from the HITTER-FITTER runs on whales, to the Bayesian assessments of small whales, seals, and walrus. A critical component of the assessment process is the identification of a model that the WG can agree upon and base its advice on. This may be difficult, e.g. if stock structure is uncertain, and it is unclear how to relate the available data to the stock structure of a model. In most NAMMCO cases, however, it has been a relatively straightforward process to define the stocks on which the assessments are based. The joint advice for narwhals in West Greenland and East Canada, where it has been necessary to use an assessment model with eight underlying populations is an example of a complicated assessment.

HITTER FITTER

HITTER FITTER is an assessment framework that runs a density-regulated population model that projects a population from a starting year to the present time and beyond, given assumptions on the maximum sustainable yield rate (MSYR, i.e. the largest catch that can be taken from a species' stock over an indefinite period of time without long-term depletion). There are two settings of the program – HITTER and FITTER. HITTER places a population trajectory through a population estimate in a specified year ('hitting' it). FITTER can use a catch per unit effort (CPUE) series and population estimates over a number of years (with associated variance estimates) to estimate population size and resilience by maximum likelihood.

Some of the early assessments by NAMMCO on large baleen whales, belugas and pilot whales used HITTER FITTER. This continued until NAMMCO agreed to use the RMP CLA for large whales in the Central North Atlantic. The strength of HITTER FITTER is the simplicity that isolates results from the assumed MSYR. However this is also its weakness. The program will not estimate the production of a population, and nor can it integrate current knowledge on the biology of a species with the available data to estimate status and production.

Bayesian Assessment

Bayesian assessment frameworks are more adaptable than HITTER FITTER, and when possible, they are often preferred as they can integrate current knowledge on the biology of a species with the available data and their uncertainty to estimate status, production, and levels of sustainable takes. Another advantage of Bayesian assessments is their ability to translate the uncertainty of the data directly into probabilistic results, where the advice is given as a trade-off between the allowable take and the probability of fulfilling a specified management objective. Precautionary management is then obtained by choosing a removal level that guarantees the conservation objective with a high probability (e.g. the often-used 70% chance of population increase for small cetaceans).

NAMMCO currently uses Bayesian modelling in the assessments of narwhal, beluga, harbour porpoise, walrus, and seals. Just as simplicity is the advantage and weakness of HITTER FITTER, so is the complexity of Bayesian assessments their advantage and weakness. The complexity allows the models to integrate a large amount of data but is constrained by our prior knowledge on the parameters of the model. The available data are usually only able to update the estimates of some of the parameters, and the results are heavily dependent on the assumed priors (i.e. the assumed probability distributions of a variable). This makes it crucial to get the priors right and to double check that the results are not biased because of unrealistic assumptions on one or several of the model parameters.

A successful Bayesian assessment should reflect a population model that integrates as much of the relevant data as possible in a consistent manner and in agreement with our knowledge on the biology of the species (including stock structure and population dynamics). As new data may challenge an old model, and as data may be included or discarded, it is essential that the modelling framework is so flexible that the assessment can be adjusted during assessment meetings. All the assessment models used in NAMMCO for small whales and walrus are run on the same master program that is easily adjusted to: i) a variety of prior assumptions, ii) include or exclude age-structure, iii) include relative and/or absolute abundance estimates as well as age structured catch data, and iv) run with exponential growth, density regulated growth, or selection-delayed dynamics depending upon the timeframe of interest. The modelling is usually for discrete stocks, except in the complex case where eight aggregations of narwhals are exploited by a multitude of hunts in East Canada and West Greenland.

The Bayesian assessment models used for seals run on a different platform than those used for small cetaceans and walrus. Most seal models use data on pup abundance instead of total abundance and have data on pregnancy rates and age of maturity that are usually not available for small cetaceans (at least not to the same extent). The advice rules for the seal assessments are also somewhat different, including a fixed reference point for a recommendation of zero catches. The SC finds that there is no reason to streamline all assessment to have the same advice rules. It is instead important that the advice rules for the different species are in line with concepts that are agreed by the managers, and that the advice rules facilitate a precautionary approach to management.

Given the flexibility of Bayesian assessments, the SC agrees that there is no biological/scientific reason to introduce a management procedure for stocks where there is already a functioning stock assessment-based approach to advice. Bayesian assessments are also the preferred option for stocks where there has been no advice in the past, as they provide a flexible framework to integrate data with softer biological knowledge to estimate the status and production of a stock.

Management Procedures

It may appear at first that management procedures are the ideal method for generating harvest advice, as advice is given by running a small computer program on the agreed data with no need for model interpretation. However, if the advice is to be both safe and allow for a take that is as large as possible, it can be essential that the procedure is developed specifically for the fishery in question and this is no simple task. In fact, NAMMCO has never developed a management procedure. The NAMMCO SC has so far only used management procedures that were developed in other fora.

RMP - Revised Management Procedure for Commercial Whaling

The RMP was developed as a general management procedure for baleen whales by the Scientific Committee of the International Whaling Commission (IWC). It was adopted in 1994 (but never implemented) by IWC to provide advice on safe, risk averse limits for commercial whaling on well-defined stocks. Three objectives were set when developing the procedure – catch limits should be as stable as possible, catches should not be allowed on stocks below 54% of the estimated carrying capacity, and the highest possible continuing catch should be obtained.

The RMP has two elements: The first is the Catch Limit Algorithm (CLA) that calculates the allowed removals from survey data. The second is the Implementation (with regular Implementation Reviews), which is a larger simulation exercise where the CLA is run on a variety of stock assessment models. These models cover an agreed space of stock structure hypothesis, production levels, and other essential components, and they simulate survey estimates with realistic uncertainty so that it is possible to estimate the performance of the stock given the catch levels that are set by the CLA. Whereas the CLA is the same for all species and areas, the Implementations are species and area specific.

The CLA has three official tuning levels (0.60, 0.65 and 0.72), which specify the abundance level (as 60%, 65% or 72% of the carrying capacity) where the stock should stabilize in the long run, given catches set by the CLA. These tuning levels were recommended by the IWC SC as an acceptable precautionary range, with the highest number giving weight to conservation and the lowest number giving weight to utilization. IWC uses the highest tuning in their assessments, while advice from NAMMCO is based on the 0.6 tuning (Norway also uses 0.6 tuning).

The implementation stage of the RMP is a review, where a set of assessment models integrate the available information on the stock structure and production of the relevant species in the area where the RMP is to be implemented. Understanding stock structure is a particularly important part of this process because although the CLA calculates catch limits for a certain geographical area, those limits may have to be divided between different populations. In the implementation stage, computer simulations are used to test the robustness of the CLA against many uncertainties using a wide variety of plausible stock structure and mixing scenarios. Implementation exercises test different theories regarding the numbers of different populations within an area, their distribution and movement and the implications of this for estimates of abundance, catch histories and productivity. Implementations should be reviewed at regular intervals (normally every 6 years) to account for new information and each of these is called an Implementation Review.

Within NAMMCO, the RMP CLA is currently used for the common minke whale and fin whale in the central North Atlantic, building on implementations that were developed by the IWC. The calculations are typically done using different tunings to enable comparative assessments, with the 0.6 tuning being the primary proposal for advice.

The CLA was developed as a general management procedure, and the SC agrees that there is no obvious alternative for baleen whales in the central and eastern North Atlantic (at least not without a substantial amount of additional work). The development of a new management procedure would be a new process for NAMMCO. A pure stock assessment approach could be adapted in principle, but it might not be able to integrate the stock structure uncertainty that is usually considered during CLA implementation. While the RMP CLA might not provide the best balance between conservation and utilization for NAMMCO, it does provide a method that is agreed worldwide for the setting harvest levels on baleen whales.

AWMPs - Aboriginal Whaling Management Procedures for Subsistence Whaling

The AWMPs were developed as case specific management procedures for baleen whales by the IWC SC, with the AWMPs for the North Atlantic region being those for the common minke whale, fin whale, humpback whale and bowhead whale off West Greenland, and common minke whale off East Greenland. IWC adopted the AWMP management scheme in 2018 to provide advice on safe harvest limits to meet the need for whale meat in Greenland.

Like the RMP, an AWMP has two elements: The first is a Strike Limit Algorithm (SLA) that calculates the allowed removals (strikes) from survey data. The second is Implementation (with regular Implementation Reviews), which is a larger simulation exercise where the SLA is run on a variety of stock assessment models. These models cover an agreed space of stock structure hypothesis, production levels, and other essential components, and they simulate survey estimates with realistic uncertainty so that it is possible to estimate the performance of the stock given the catch levels that are set by the SLA.

However, where the RMP CLA is a general procedure, an AWMP is case specific. This means that a SLA for a given hunt is developed to optimize the number of safe strikes given the initial implementation simulations of the hunt. This is done in a competition where several candidate SLAs are run on the implementation simulations, with the best performing SLA being chosen as the final SLA for the hunt. Most SLAs have a tuning parameter like the RMP, but this parameter is set to a fixed value that reflects the case specific optimization of the SLA.

Another difference between the RMP CLA and an AWMP SLA is that the RMP calculates the allowable takes exclusively from survey data, while the AWMP has an extra need envelope that limits the potential strikes. These envelopes limit the number of strikes within the expected future need for whale products. While the need envelopes might set an unnecessary extra limitation on an AWMP relative to the RMP, the envelopes are helpful when it comes to developing an SLA that can ensure stable catch limits within the expected need for whales. By developing the SLA specific to the biology of the species in the hunted area and limits on the number of whales needed, it is more likely to develop an SLA that meets the need for a stable level of allowable strikes. This level might lead to an underutilization of a large stock in a case where few whales are hunted, but it can also be the only way to develop a management procedure that can secure a high level of catches relative to the available survey data.

Fin whales in West Greenland are an example where few whales are taken relative to the production of the stock. With an annual strike limit around 19 over the past ten years, and an average of less than 10 strikes taken, the fin whale SLA was developed to secure a moderate level of strikes. Given a current need of 19, the SLA allows for a current strike limit of 19, which is much less than the 51 that can be calculated by a standard PBR approach.

Being the most hunted baleen whale in Greenland, the common minke whale in West Greenland is an example at the other extreme. By designing an SLA that is limited by a flat need envelope of 164 strikes per year, it was possible to obtain an annual strike limit of 164, and to maintain this catch level with a high probability in the future. This number of strikes is almost twice as large as what can be calculated by a standard PBR approach.

Within NAMMCO, the SLAs have generated management advice for humpback whales in West Greenland. When IWC uses an SLA it requires a need statement to determine the need envelope, while NAMMCO has used SLAs to assess sustainable rates of harvest without needs statements.

With the available AWMP strike limits that have been developed to match the different hunts, the SC agrees that it is difficult to find other methods that provide a better balance between the conservation, utilization, and need for baleen whales in Greenland. The general management procedures like PBR and RMP may allow for higher takes in cases like fin whales, but they cannot be expected to secure the current take of minke whales. A stock assessment approach could, in principle, be adapted for use in these cases, but it might not be able to integrate the stock structure issues that are essential to secure the hunt of minke whales in West Greenland. The available AWMPs are furthermore agreed worldwide for the setting harvest levels on baleen whales in Greenland.

Potential Biological Removal (PBR)

Potential Biological Removals (PBR) refers to a general management procedure approach that was developed to identify the maximum number of individuals that can be removed from a population of marine mammals under the Unites States Marine Mammal Protection Act. Advice based on PBR calculations is developed by the NAMMCO SC only in those few cases where the information available to perform an assessment is limited or the assessment fails to reflect the data. It was, for example, used for harbour porpoises around the Faroe

Islands at the harbour porpoise workshop held in Tromsø in 2018 (due to data poor), and for the 2019 advice on harp seals (due to problems with model fit to data).

PBR calculations attempt to identify the maximum number of individuals (not including natural mortalities), that may be removed annually from a stock while maintaining the stock at the MSYL. PBR is calculated using a mathematical formula involving three quantities: a maximum potential population growth rate (R_{max}, with a default value of 0.04 for cetaceans, and 0.12 for pinnipeds), a minimum estimate of abundance (N_{min}, set to the 20th percentile of a survey estimate), and a recovery factor with a default value of 0.5. The recovery factor buffers against various plausible violations of biases or assumptions and can range from 0.1-1.0.

Being a general approach, it is possible to apply a PBR calculation to any marine mammal stock with at least one abundance estimate. This generality is the strength of PBR, but is also a weakness. Being general, PBR calculations are not optimized and adjusted to the specifics of the relevant stock. Apart from the estimate of potential removal, the PBR calculation provides no insights into the status of the stock. In cases with more data, it is possible to have a separate assessment model that estimates status and parameters, and then replace the PBR parameters by the estimates obtained. In such cases, however, it seems more applicable to provide advice directly from the assessment model, as it will usually allow for a better adjustment of the advice in relation to the status and uncertainty of the data and parameter estimates.

Advice based on PBR is the only form of removal advice in NAMMCO that does not involve the estimation of an assessment model. This is the main reason why the SC **recommend** against using PBR calculations on their own. It is usually possible, even for stocks with only a single abundance estimate, to make a Bayesian assessment model that will use not only the abundance estimate, but also the catch history and prior knowledge on the biological parameters of the species.

Conclusion

The SC **recommends** the use of population dynamics models that incorporate trends in parameters of the stock when generating advice on sustainable harvest levels. In exceptional cases where population models are not properly tracking the data on the stock, it may be advisable to apply the PBR approach. For population models, the HITTER-FITTER model is useful, but outdated compared to Bayesian approaches that are better at including a variety of parameters and their uncertainty. The advantage of Bayesian approaches is also that they improve with additional data, maintaining an incentive to continue monitoring. NAMMCO has primarily used Bayesian models on stocks where the stock structure is somewhat well defined, and there is a need for Bayesian approaches to explore uncertainties in stock structure.

The advice from the SC is based on methods that reflect the current state of knowledge of the species in question. In light of the effort required, it is unlikely that the SC would recommend the development of new management procedures unless specifically requested to do so and provided with the necessary resources. A change in the basis for advice should consider potential limitations with current methods relative to the potential improvements with other methods, and the effort required to change the basis.

With this substantive review of different approaches to generating management advice and their application to different species, together with its conclusions and recommendations regarding suitability, the SC hopes to have answered request R-1.6.6.

5.8 RESPONSE TO THE PERFORMANCE REVIEW

Council 27 established an *ad hoc* Working Group (PRWG) to review and follow up on the recommendations introduced by the NAMMCO Performance Review. As for the other committees, the SC was requested to address the recommendations and issues forwarded to them by the PRWG. Three documents were provided for consideration in advance of SC/26 on this agenda item. These were the full text of the performance review report (SC/26/FI17), the request from the PRWG containing the list and full text of the recommendations relevant to the SC (SC/26/07), and a brief summary containing just the recommendations for the SC synthesised and extracted from detailed context descriptions (SC/26/08).

During the meeting, the Secretariat facilitated a process through which the SC identified possible responses to the recommendations arising from the performance review and prioritised the recommendations of relevance for the SC. A full report on the outcomes of this process is presented in appendix 5 and will be delivered to the PRWG.

6. INTERACTIONS WITH OTHER ORGANISATIONS

6.1 IWC

There is now an agreement that NAMMCO and the IWC will collaborate on abundance estimates (for baleen whales) and work towards the development of a consolidated list agreed by both organisations. In the first instance this collaboration involves the Chairs of each organisation's working group on abundance estimates participating in the meetings of the other group. Unfortunately, this was not possible at this year's NAMMCO AEWG meeting due to illness. However, the IWC did send documents to that meeting that included the draft abundance estimates tables that are currently in development and welcomed input from NAMMCO on these tables and estimates. These tables were provided to the SC as working documents SC/26/15,16,17. The AEWG recommended that the specific form of the future collaboration with the IWC on this issue be discussed at the level of the SC, since it is the SC that officially endorses abundance estimates within both organisations.

The SC noted that collaborating with the IWC on abundance estimates for small cetaceans may be problematic for some NAMMCO member countries and that it may therefore be best to limit the collaboration to estimates for large whales in the North Atlantic. The SC **recommended** that the Council provide advice on the desired scope for the collaboration with the IWC and particularly, the extent to which this collaboration should include small cetaceans.

The SC agreed that it is important that not only the Chair of the AEWG but also someone from the SC participates in the meetings of the IWC sub-committee on abundance, including participation in all inter-sessional work that takes place. This is important because the current Chair of the AEWG is not a member of the NAMMCO SC and this limits the potential for a full exchange of information and therefore productive collaboration. The SC therefore agreed to nominate an SC representative to participate in the meetings of the IWC related to abundance estimates, to specifically follow their process of developing an overview table, and answer questions regarding NAMMCO estimates. It was noted that this person would then be in a good position to report back to the SC and provide further input on the best opportunities to develop the collaboration towards arriving at consolidated abundance estimates. The SC nominated Gísli Víkingsson to serve in this role.

6.2 ASCOBANS

In 2019, there was an exchange of documents between NAMMCO and ASCOBANS on the work done in relation to harbour porpoises.

6.3 ICES

Haug presented a review of the 2019 activities in ICES with some relevance to the work of the NAMMCO SC. This included work in the ICES Working Group on Marine Mammal Ecology (WGMME), in the Working Group on Bycatch of Protected Species (WGBYC) and in the WG on Harp and Hooded Seals (WGHARP, which is now a joint working group with NAMMCO). The ICES Annual Science Conference (ASC) also generally included sessions with marine mammals as an integral part, and occasionally there are also sessions entirely devoted to marine mammals.

It was noted that at the *Ad hoc* Working Group on Narwhal in East Greenland, plans within ICES to develop a working group on Integrated Ecosystem Assessment in the Greenland Sea were presented and it was proposed that NAMMCO follow up on the potential to be involved in this work. The SC **recommended** that the Secretariat send a message to the Chair of this working group (Jesper Boje) and indicate the interest of the

NAMMCO SC in the WG and receiving any further information or updates regarding the development of the work.

6.4 JCNB

There was no joint working group meeting with the JCNB this year but planning has begun for a meeting in Winnipeg, Canada in May 2020. Hansen participating in the JCNB commission meeting in spring and noted that the report from the last meeting is still being finalised and not yet publicly available.

6.5 ARCTIC COUNCIL & SUBSIDIARY BODIES

Wickson participated in the second international science and policy conference on Implementation of Ecosystem Approach to Management in the Arctic organised by PAME, which was held in Bergen 25-27 June 2019. The theme for the conference was "Scale" and Wickson gave a presentation titled "Integrating the Scales of Interest in Different Knowledge Systems for Ecosystem Management". The report and a copy of all presentations is available on the PAME website.

6.6 FAO

Following the FAO *Expert Workshop on Means and Methods for Reducing Marine Mammal Mortality in Fishing and Aquaculture Operations* (held in March 2018), the FAO Committee on Fisheries (COFI) encouraged the FAO to engage with members, relevant experts and organizations such as the IWC and the NAMMCO in developing technical guidelines to support best practices.

In response, the FAO convened the *Expert Meeting to Develop Technical Guidelines to Reduce Bycatch of Marine Mammals in Fisheries* in September 2019. The NAMMCO Secretariat was invited to participate in the meeting and Desportes attended. Guðjón M. Sigurdsson (MFRI) and Arne Bjørge (IMR) also participated as experts from Iceland and Norway respectively. The reports of the NAMMCO By-catch WG were provided as documents to the meeting.

The participants reviewed the draft guidelines circulated ahead of the meeting and provided advice for revising and completing the document. The expert meeting focussed solely on mitigation and did not address how to best assess the rate or risk of by-catch. The final draft of the technical guidelines will be circulated to the FAO parties and discussed at the next COFI meeting in 2020.

6.7 OSPAR

OSPAR asked NAMMCO (together with other organisations) to provide comments on its draft nomination proforma for a "North Atlantic Current and Evlanov Seamount" (NACES) marine protected area (MPA) in the OSPAR Maritime Area (OSPAR 2019, provided as SC/26/FI18). NAMMCO agreed to provide comments, specifically with regard to its implications for the conservation and management of marine mammals and especially cetaceans. The SC was tasked to provide their comments on this specific issue. To inform its response, the Secretariat had prepared working document SC/26/19, which provided an overview of the nomination, collated the information on cetacean distribution that can be extrapolated from the NASS survey series, and reviewed the likely contribution of NACES to the conservation of cetaceans in the North Atlantic.

Discussion

The SC emphasised that there is little information to make an assessment of the importance of the proposed marine protected area for cetaceans, with a particular lack of data for the winter period. There was a suggestion that if the area is deemed to be important for birds, this could indicate a level of productivity that may also make it an important area for cetaceans. However, this was not necessarily the case and the SC was not aware of any evidence to indicate this.

The SC **recommended** that the response to be sent to OSPAR should emphasise the inability to draw any conclusion on the importance of the area for cetaceans due to the lack of data available to make such an assessment.

7. ENVIRONMENTAL/ECOSYSTEM ISSUES

7.1 MARINE MAMMAL / FISHERIES INTERACTIONS

7.1.1 Consumption of resources by marine mammals

Haug and Nilssen reported that a high priority aspect of a 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 2007-2019, 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 were unfavorable in early May. However, formal problems with permissions, lack of funding and/or difficult ice conditions had prevented tagging of seals. In 2020, a new attempt will be made to both obtain funding and carry out satellite tagging in the White Sea. For practical reasons, only beaters (harp seals that have gone through their first moult and are less than one year old) will be tagged. During the tagging experiment, the Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO) will assist with providing the necessary logistics required for helicopter-based live catch of seals in March-April 2020. The institute of marine research in Norway, will, as before, be responsible for the satellite tags, including providing all necessary technical details as well as providing experienced personnel and equipment for anaesthetizing seals and tag deployment. During field work, an experienced scientist from Murmansk Marine Biological Institute (MMBI) in Russia will also participate. For proper planning and budgeting for both institutes, PINRO scientists must obtain the necessary permissions from Russian authorities before December 2019. The transmitters cannot collect geographically positioned temperature and salinity data. After the 2020 tagging season, future seal tagging will be decided upon following an evaluation of both the tagging methods and the seal movement data set that is obtained. 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.

Nilssen provided the following updates on marine mammal-fisheries interactions for grey and harbour seals in Norway.

Grey seals (Norway)

Analysis has been performed on data from 182 grey seal gastrointestinal tracts and 199 faecal samples, collected during 1999-2010 in the Finnmark, Nordland and Rogaland counties. The grey seals fed on a wide variety of mainly benthic fish, where the most important prey were saithe (*Pollachius virens*), cod (*Gadus morhua*) and wolffish (*Anarchichus* s pp), although wolffish was less important in Rogaland. Total annual grey seal consumption of various species was estimated using bio-energetic modelling. The input variables in the model were seal numbers, energy demands, diet composition in terms of biomass and the energy density of prey species throughout the year. Assuming the observed grey seals diet composition in the sampling areas are representative for the diets in the three management regions (Lista - Stad, Stad - Lofoten, Vesterålen – Finnmark), the mean total annual consumption by 3,850 grey seals (95% CI: 3504-4196) was estimated to be 8,084 tons (95% CI: 6166-10191) in Norwegian waters; saithe (3,059 tons), cod (2,598 tons) and wolffish (1,364 tons) were consumed in highest quantities.

The estimated grey seal consumption in Norwegian waters of cod, assumed to include both coastal cod and Northeast Arctic cod, is low compared to fishery takes. Norwegian annual fishery catches of coastal cod and Northeast Arctic cod were 35,000-39,000 tons and 192,000-378,000 tons, respectively, from 2003-2015. The leisure and tourist catch of coastal cod was estimated to be 13,000 tons in 2015.

Harbour seals (Norway)

Using scat sampling and otolith identification, the harbour seal diet was estimated along the western Skagerrak coast of southern Norway. The results showed that seal diet was varied overall and included 20 different species and species groups. The most important prey species were the gadidae Norway pout (*Trisopterus esmarkii*), poorcod (*Trisopterus minutus*), and bib (*Trisopterus luscus*). Also haddock (*Melanogrammus aeglefinus*), pollack (*Pollachius pollachius*), saithe (*Pollachius virens*)], whiting (*Merlangius*

merlangus), herring (*Clupea harengus*) and the flatfishes long rough dab (*Hippoglossoides platessoides*) and witch (*Glyptocephalus cynoglossus*) were eaten. Cod *Gadus morhua* contributed only about 1% to the diet. The diet composition changed between seasons and areas, but only small specimens were eaten, below the smallest allowed catch size. The estimated annual amount of fish consumed by seals was lower than the catch in the local fisheries, suggesting small competition between local fisheries and harbour seals.

The SC welcomed these updates on marine mammal-fisheries interactions.

7.1.2 By-catch

7.1.2.1 Update

Norway held a *Workshop on Marine Mammal Bycatch Monitoring and Mitigation*, 19-20 June 2019 in Ålesund. Desportes participated as an observer for NAMMCO. Participants at the workshop represented a wide range of stakeholders in the by-catch issue, including scientists, statisticians, managers, fishermen and manufacturers of pingers. The workshop reviewed the current monitoring and mitigation efforts in Norway and the Norwegian by-catch estimate for harbour porpoises in the cod and monkfish fisheries, as well as the experience from other areas on by-catch monitoring, estimation and mitigation. It also discussed ways of optimising the Norwegian sampling design. The workshop provided a number of recommendations to Norway on by-catch monitoring, estimation and mitigation. One of these recommendations was to increase the precision and reliability of the by-catch estimation by increasing the size of the reference fleet. The report of the workshop is expected to be available shortly.

7.1.2.2 Status Report from Norway

<u>Harbour porpoises</u>

Since 2017, many important changes have been made to the by-catch estimation method. A traditional ratio-based estimator with catch and days at sea used as two proxies for fishing effort. In the catch-based estimates, the total landed catch of all species is used. To obtain more complete estimates, all gillnet fisheries are included, and trips are classified into one of three fishery groups (cod, monkfish or other) based on catch composition. Data is post stratified according to year, season and region, giving a total of 104 metiers per fishery. The current catch-based annual by-catch estimate is 2571 porpoises (RSE 0.07, 95% CI: 2131– 2831) and the days at sea-based annual by-catch estimate is 2,886 porpoises (RSE 0.05, 22 95% CI: 2576-3142). These estimates represent the incidental mortality imposed on harbour porpoises by the Norwegian *commercial* gillnet fisheries. About 75% of by-caught harbour porpoises were taken in the cod and monkfish fisheries, while the rest were taken in a variety of different gillnet fisheries. In recent years a decreasing trend in harbour porpoise by-catch has been seen, because the fishing effort for monkfish has decreased. However, in 2018, both monkfish fishing effort and estimated harbour porpoise bycatch saw a slight increase. There are no by-catch estimates for recreational fisheries. These new estimates have been submitted to ICES JMS for publication.

<u>Coastal seals</u>

There are currently no new estimates of by-catch for any of the coastal seals. The reason for this is that species identification in the reference fleet data is not reliable. It is also not possible to distinguish harbour seals from grey seals. Work is being done with the administrators of the reference fleet towards a solution. It has been proposed that reference fleet fishermen be asked to take profile pictures of all seals that are by-caught. These pictures could then be used to verify the fishermen's own identifications and to estimate the ratios of by-caught harbour seals to grey seals. It would also then be possible to pool seal by-catch data and use these ratios to again separate estimates into harbour and grey seal components.

The IMR and a commercial partner is exploring the possibility of supplementing the coastal reference observer program with an additional remote electronic monitoring (REM) program. In this REM program, video surveillance equipment would be installed on fishing vessels. Gillnets would then be recorded as they are hauled on board, and the recorded videos automatically analyzed to identify and report marine mammal by-

catch. This would increase the sample size of the gillnet fleet. It would also allow estimation of drop-out rates and the ratio of by-caught harbour seals to grey seals.

Mitigation efforts aimed at reducing harbour porpoise bycatches

The IMR is currently conducting a large-scale multi-year experiment with acoustic alarms (pingers) on cod, monkfish and saithe gillnets. They are using two types of pingers: the Fishtek banana pingers and the Future Oceans egg pingers. Current efforts are focused on fishing vessels that operate in high by-catch areas, mostly in Lofoten, Vesterrålen and Senja. Currently 10 vessels are participating in the study. Preliminary results based on two seasons of data suggest that the pingers are very effective: in this period, 12 harbour porpoises were taken in pinger-free nets and *none* in pingered nets.

The SC acknowledged the work conducted by Norway on by-catch and the value of this work for the upcoming by-catch working group.

7.1.2.3 By-catch Working Group (BYCWG)

The last meeting of the NAMMCO BYCWG was held in October 2019 and its report and recommendations were considered by SC/25. The WG will meet again in Spring 2020 to progress on its terms of reference. The WG will review responses to past recommendations and focus on continuing to 1) identify all fisheries with potential by-catch of marine mammals and, 2) review and evaluate current by-catch estimates for marine mammals in NAMMCO countries.

New or revised by-catch estimates will be available for harbour porpoises in the Norwegian cod and monkfish gillnet coastal fisheries. New information will also be available for the Icelandic lumpsucker gillnet fisheries (including 2018 data) and the cod gillnet fisheries, as well for coastal seals in the Icelandic lumpsucker gillnet fisheries (including 2018 data).

Other relevant documents that will be of interest to the BYCWG and their work to identify all fisheries with potential by-catch of marine mammals, include the reports of the:

- ICES Working Group on Bycatch of Protected Species, 5-8 March 2019, Faro (PT) (SC/26/FI21).

- Norwegian *Workshop on Marine Mammal Bycatch Monitoring and Mitigation*, 19-20 June 2019, Ålesund (NO) (report not available yet),

- OSPAR-HELCOM *Workshop to examine possibilities for developing indicators for incidental by-catch of birds and marine mammals*, 2-3 September 2019, Copenhagen (DK) (SC/26/FI15).

7.1.3 Review and status of active requests (R-1.1.5, R-1.1.8)

R-1.1.5 *To periodically review and update available knowledge related to the understanding of interactions between marine mammals and commercially exploited marine resources.*

New knowledge available on this topic was presented to the SC during the meeting.

R-1.1.8 *In addressing the standing requests on ecosystem modelling and marine mammal fisheries interaction, to extend the focus to include all areas under NAMMCO jurisdiction. In the light of the distributional shifts seen under T-NASS 2007, the SC should investigate dynamic changes in spatial distribution due to ecosystem changes and functional responses. See also 1.1.6 and 1.4.6.*

The SC did not address this request further. This was partly linked to the results of the analysis of the NASS series only being completed recently.

7.2 MULTI-SPECIES APPROACHES TO MANAGEMENT & MODELLING

7.2.1 Review and status of active requests (R-1.2.1, R-1.2.2)

R-1.2.1 *To consider whether multispecies models for management purposes can be established for the North Atlantic ecosystems and whether such models could include the marine mammals compartment. If such models*

and the required data are not available then identify the knowledge lacking for such an enterprise to be beneficial to proper scientific management and suggest scientific projects which would be required for obtaining this knowledge.

No updates were provided on this work at SC/26. However, the SC noted the planned ICES WG on Integrated Ecosystem Assessment of the Greenland Sea and encouraged NAMMCO participation in this work, including supplying relevant data.

R-1.2.2 *In relation to the importance of the further development of multispecies approaches to the management of marine resources, to monitor stock levels and trends in stocks of all marine mammals in the North Atlantic.*

No updates on multi-species approaches were provided at SC/26. However, this is part of the standard work carried out by the SC and member countries. Updates on stock levels and trends of some marine mammals were provided through AEWG 2019, as well as other working groups. The SC **recommended** that responses to standing requests not require annual reporting in the future.

7.3 OTHER ENVIRONMENTAL ISSUES

7.3.1 Updates

Mary River Project

The SC reiterated its concerns that the Mary River project may have unpredictable and irreversible consequences for several stocks and species of marine mammals that are using Baffin Bay for wintering and the Eclipse Sound and adjacent waters for summering. For Greenland, it is of special concern since some of these animal populations are shared with Canada and in some cases are also jointly managed.

The walrus that occur in summer along East Baffin Island are highly dependent on the productive shelf areas in West Greenland for about six months. They feed on bivalves on these banks and rest on drifting sea ice often close to the coastal open water. They abandon West Greenland during summer and fall and follow the recession of sea ice towards Canada. Although there were previously several terrestrial haul-out sites used in West Greenland, all have been abandoned during the 20th century due to increased hunting pressure and human activities.

It is generally accepted that walrus avoid areas with human activities, even if that does not include hunting. There are reports that just the smoke from Loran radio stations has forced walrus away from a terrestrial haul-out site. The offshore shipping in international waters in Baffin Bay is apparently not included in the assessment report. Although shipping along the Baffin Bay pack-ice is not itself a threat to walrus, it is still an operation that has a high risk for disturbing the walrus and making them leave their feeding grounds on the West Greenland shelf. There are few alternative areas in Baffin Bay that can sustain predation by a relatively large population of walrus and the loss of walrus habitat through disturbance is a likely risk when there is shipping through their habitats. The SC also noted that the vessels will follow the edge of the pack ice as it recedes towards Canada, in order to shorten the ferrying distance. However, the edge of the pack ice is at the same time the most likely area where the ships will encounter walrus.

Greenland reported that it had done extensive studies of the reactions of narwhals to disturbance from vessels and seismic operations. These studies indicate that narwhals are clearly not fit for dealing with frequent disturbance situations and both freeze or flee responses have severe physiological and energetic consequences. The flee response (the most commonly seen), elicits an extraordinary stroking activity that provokes both extreme tachycardia and extreme bradycardia, which are unseen under undisturbed conditions. Both acceleration of breathing rates and anomalous heartrates, with increased heartbeats during deep dives simultaneous with elevated stroking activity, are frequently observed responses to approaches by ships. The extreme physiological responses to disturbance have high energetic consequences where the aerobic dive limits are exceeded multi-fold. The flee response will change to a freeze response when the vessels get close to the whales and they are not able to escape the threat. Instead they move towards the coast, where they make shallow dives, stay quiet, and maintain an abnormally high heartbeat with frequent

arrhythmia. Prolonged stress in narwhals will likely lead to myopathy and cardiac arrest due to their special physiological restraints.

Intensive ship traffic within narwhals' migratory corridors and at their summering ground will with very high probability affect the whales and their use of these areas. This also includes a high risk of displacement and a reduced availability of narwhals to the hunting areas. The long-term effects of continued disturbance on narwhal populations is of course unknown as such large-scale industrial activities over extended periods of time have not yet been launched in narwhal habitats.

Belugas and bowhead whales are perhaps more capable of dealing with disturbance situations and will be less exposed to the shipping to and from the Mary River project. Belugas are not as physiologically restrained as narwhals and they have more options for dealing with thermal homeostasis. Bowhead whales are more plastic in their migratory patterns and are generally less responsive to shipping activities.

Several other species of marine mammals (and sea birds) will be affected by the shipping activity, but the SC saw narwhals and walrus as being the most sensitive and of most concern. The SC therefore **recommended** that the JCNB propose guidelines for monitoring the response of the narwhal stocks in Eclipse Sound to the disturbance from the Mary River project. Monitoring of other species wintering in west Greenland would also be important.

Publication on baleen whale ecology in high-latitude marine ecosystems

Haug reported from a recent joint paper (SC/26/FI05) aimed to review baleen whale ecology in high-latitude marine ecosystems of both the north Atlantic and north Pacific (Moore et al. 2019).

Biophysical changes in marine ecosystems of the Arctic and subarctic sectors of the Atlantic and Pacific are now evident, driven primarily by sea ice loss, ocean warming and increases in primary productivity. As upper trophic species, baleen whales can serve as sentinels of ecosystem reorganization in response to these biophysical alterations, via changes in their ecology and physiological condition. Oceanographically the north Atlantic and north Pacific offer four contrasting habitats to baleen whales: (i) a broad-deep-strait and deep-shelf inflow system in the Northeast Atlantic (NEA), (ii) a combination of inflow and outflow systems north of Iceland in the central North Atlantic (CNA), (iii) an outflow shelf and basin in the Northwest Atlantic (NWA), and (iv) a narrow-shallow-strait inflow shelf system in the Pacific sector. Information on baleen whale ecology from visual and passive acoustic surveys, combined with available telemetry and diet studies, show contrasting patterns of baleen whale occurrence among sectors. In brief, arctic and subarctic waters in the Atlantic sector support a far greater number of seasonally migrant baleen whales than the Pacific sector. Thousands of humpback, fin and common minke whales occupy the diverse habitats of the Atlantic sector. These species all exhibit flexible diets, focused primarily on euphausiids (krill) and forage fishes (e.g., capelin, herring, sand lance), which are now responding to ecosystems altered by climate change. Conversely, the Pacific sector supports a far greater number of arctic-endemic bowhead whales than the Atlantic sector, as well as a large population of seasonally migrant gray whales. Currently, differences in migratory timing and, to a lesser extent, foraging behaviors, serves to restrict prey competition between the arctic-endemic bowhead whale and seasonally migrant baleen whale species in both sectors. Regional aspects of changes in prey type and availability will likely impact future migratory timing, habitat selection, body condition and diet of baleen whales. Tracking variability in these attributes can provide valuable input to ecosystem models and thereby contribute the sentinel capability of baleen whales to forecasts of future states of high latitude marine ecosystems.

7.3.2 Review and status of active requests (R-1.5.3, R-1.5.4)

R-1.5.3 *To monitor the development of the Mary River Project and assess qualitatively or if possible quantitatively the likely impact and consequences on marine mammals in the area.*

The SC received an update on the project during this meeting. The SC remains concerned about the development of this project and emphasised the importance of monitoring impacts on marine mammals. The SC **recommended** that plans for monitoring narwhal be developed within the context of the joint working group meeting with the JCNB.

R-1.5.4 *Committed to furthering its ecosystem approach to the management of marine mammals, and recognising the range of anthropogenic pressures facing North Atlantic marine mammals associated with the climate and environmental changes taking place, the Council requests the SC to advise on the best process to investigate the effects of non-hunting related anthropogenic stressors on marine mammal populations, including the cumulative impacts of global warming, by-catch, pollution and disturbance.*

The SC has previously answered this request by implementing a requirement that all WGs include other anthropogenic impacts as an agenda item. How to best address these impacts and further improve the work on this topic within NAMMCO was also addressed in the response to recommendations from the performance review (see agenda item 5.8 and appendix 5).

8. SEALS & WALRUS STOCKS – STATUS AND ADVICE TO THE COUNCIL

8.1 HARP SEALS

8.1.1 Updates

Haug reported on results from aerial surveys conducted in the period 18-31 March 2018 in the Greenland Sea pack-ice (the West Ice) to assess the pup production of the Greenland Sea populations of harp (and hooded) seals. One fixed-wing aircraft, stationed in Akureyri (Iceland) and Contable Pynt (East Greenland), was used for reconnaissance flights and photographic surveys along transects over the whelping areas. A helicopter, operated from the expedition vessel (KV *Svalbard*), also flew reconnaissance flights and was subsequently used for monitoring the distribution of seal patches and age-staging of the pups.

The reconnaissance surveys were flown by the helicopter (18-22 March) and the fixed-wing aircraft (18-31 March) in an area along the eastern ice edge between 68°40'N and 74°47'N. The ice cover was narrow and the edge closer to the Greenland coast in 2018 compared to previous survey years. The reconnaissance surveys were adapted to the actual ice configuration, usually flown at altitudes ranging from 160-300 m, depending on weather conditions. Repeated systematic east-west transects with a 10 nm spacing (sometimes 5 nm) were flown from the eastern ice edge and usually 20-30 nautical miles (sometimes longer) over the drift ice to the west.

On 27 March, two photographic surveys were flown to cover the entire whelping patch area, which was a little more than 60 nm in south-north direction. Due to fog in the northwest areas, these areas had to be re-visited with new transect surveys the following day (28 March). To define the transect lines for this second survey day, data from the ice-deployed GPS beacons were used to account for the ice drift between the two days. In total, 5104 photos were taken during the surveys (3016 photos on 27 March; 2088 photos on 28 March).

Combining data from the two survey days gave an estimated pup production of harp seals of 54,181 (SE=9,236; CV: 17%), which is significantly lower than estimates obtained in similar surveys in 2002, 2007 and 2012. Current status and catch options for the harp seal stock are being assessed by incorporating the pup production estimates into population models.

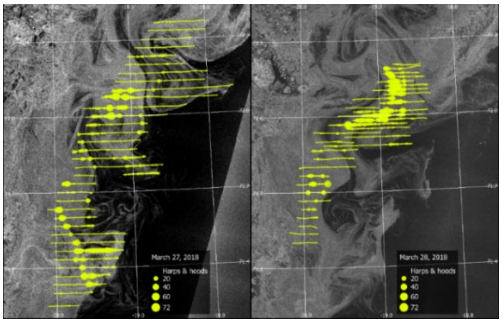

Figure 1. Photo surveys in the West Ice on March 27 and 28 in 2018 overlaid on ice images. Each survey photograph is represented by a yellow filled circle with the radius proportional to the total number of harp and hooded seals counted on each photograph.

8.1.2 Joint ICES/NAFO/NAMMCO WGHARP 2019

Haug reported from the Joint ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHARP) which met during 2-6 September 2019 at the Fram Centre in Tromsø, Norway (ICES 2019). 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 2018 request from Norway.

White Sea/Barents Sea

The population assessment model used for the White Sea/Barents Sea harp seal population provided a poor fit to the pup production survey data. Nevertheless, WGHARP decided to continue to use the model, which estimated a total 2019 abundance of 1,497,190 (95% CI: 1,292,939-1,701,440). The modelled total population indicates that the abundance decreased from its highest level in 1946 to the early 1960s, after which an increase has prevailed. The current level is 74% of the 1946 level.

The last available information about the reproductive potential for the White Sea/Barents Sea harp seal population is new and based on data from 2018. However, the last pup production estimate is from 2013, i.e. more than 5 years old, and therefore according to ICES rules, the population is considered "data poor". In such cases, ICES recommends the use of the Potential Biological Removals (PBR) approach to estimate catch quotas. PBR was developed by the United States for the management of marine mammals, primarily to assess the sustainability of by-catch. Given the uncertainty regarding the current status of this population, WGHARP suggest the application of a conservative PBR approach in which the upper limit for removals was estimated to be 21,172 seals.

Greenland Sea

The 2018 pup production estimate is significantly lower than the previous survey estimates and represents an apparent drop of almost 40% from 2012. Using a combination of Mark-Recapture based (1983-1991) and aerial survey based (2002-2018) pup production estimates, the assessment model suggests a current (2019) abundance of the total Greenland Sea harp seal stock which is 426,808 (95% CI: 313,004-540,613) animals. There is, however, considerable uncertainty in the Mark Recapture (MR)-based pup production estimates used in the model, and WGHARP suggested that the impact of using only the aerial survey estimates (including also a survey estimate from 1991) should be explored. WGHARP also raised concerns regarding the reliability of some of the reproductive parameters that have been measured at sparse intervals throughout the time period from 1946 to the present. To explore the impact of using different reproductive data, the group suggested that the model be run with fecundity fixed at the long-term mean from all sampling, (F=0.84), and with maturity curves being combined to a single curve representing the mean maturity throughout the time period. The final set of models considered was therefore:

1) All pup production estimates included (except the aerial survey estimate from 1991), similar to all past assessments.
2) Pup production estimates from aerial surveys only (including 1991);
3) Same as scenario 2), with constant F=0.84 and a single maturity curve.

The three runs resulted in some differences in estimated population trajectories, but the estimates of the 2019 population size were relatively consistent between runs.

In ICES terminology, this population is data rich. Nevertheless, given the apparent significant drop in pup production between the 2012 and 2018 surveys, the unexplained variability in the Mark Recapture estimates, the poor fit of the model to all historical pup production estimates, and the subsequent uncertainty regarding model-based trajectories and projections, the consensus in WGHARP was that management recommendations for this population should not be based on model projections at this stage. Because the model estimates of current population size were very similar and appeared to be robust to the assumptions of the various runs, WGHARP agreed that catch options should be based on the estimate of current pup and

adult population sizes through the PBR framework. Given the very small difference in estimated current population size irrespective of model run, and similarity between PBR estimates based on these population estimates, WGHARP suggested that the PBR based on the averaged population estimates (and associated averaged CVs), be used when providing catch scenarios. Using the traditional PBR approach in this way, removals were estimated to be 11,548.

Northwest Atlantic

Photographic and visual aerial surveys were conducted off Newfoundland (i.e. the Front) and in the Gulf of St. Lawrence to determine pup production of Northwest Atlantic harp seals in 2017. Ice conditions in the southern Gulf were very poor and the pup production estimate for this area was extremely low (<= 25 000). There was some indication that some Gulf seals may have moved to the Front and pupped there. The number of pups born in the northern Gulf was also lower than in recent surveys. The majority of pups born at the Front were found in one large whelping patch. In addition, a number of small, scattered, groups formed up. Final estimates have not been completed, but preliminary estimates indicate that pup production may have been in the order of 740,000. This is lower than the previous (2012) survey estimate of 790,000 (SE=69 700, CV=8.8%), but whether this represents a significant decline remains unknown until formal analyses are completed.

The SC **endorsed** the conclusions of the WGHARP and the **recommended** upper limits of removals of 21,172 for harp seals in the Barents Sea/White Sea and 11,548 in the Greenland Sea.

The SC also **endorsed** the recommendations of the WGHARP for future work:

- A new aerial survey of harp seal pups in the White Sea be conducted in 2020.
- A new aerial survey of harp and hooded seal pups in the Greenland Sea be conducted in 2022.
- The population model(s) used to describe the dynamics of North Atlantic harp and hooded seals, in particular the Greenland Sea, Barents /White Sea be developed to include uncertainty in fecundity and examine the inclusion of environmental variables into the model structure.
- ICES and/or NAMMCO convene a workshop on population assessment models for seals in the North Atlantic to advance model development in the ways identified as required, before the next WGHARP.
- The Greenland Sea harp seal mark-recapture data in Norway be re-examined and updated with new information if available.
- Efforts continue to obtain reproductive samples, particularly in years when an aerial survey is completed. These are required for use in the population model.

Discussion

The SC questioned whether ICES accepted the use of PBR and was informed that it was accepted for use in the case of data poor populations.

The SC discussed the models used within WGHARP, including the limitations currently being experienced and differences in the input data across the different areas. The use of possible signals and variables from diet and other ecosystem factors to enhance the quality of the model were discussed. The SC agreed with WGHARP that it was important to revise and improve the population assessment model for harp and hooded seals and that NAMMCO should convene a workshop (together with ICES) to improve the model. The SC emphasised that external experts should be invited and could include members of WGHARP with modelling expertise (including Martin Biuw, Gary Stenson, Mike Hammill, Sophie Smout and Hans Skaug) as well as experts from St. Andrews in Scotland and NOAA in the USA. It was also suggested that it could be relevant to invite experts modelling other species and that the workshop work with actual data from the populations to maximize the relevance of the output. Witting noted that he is currently revising his assessment program and the SC agreed that it could be one way to explore alternative models during the workshop.

The SC agreed that the workshop on model development for seals should be developed in collaboration with ICES. It was noted that ICES can cover the costs of the Chair and some invited experts for benchmark meetings.

The SC agreed that this workshop/benchmark meeting could be held in St. Andrews in September 2020 (back to back with the meeting of the UK Special Committee on Seals (SCOS)). The SC also agreed that ICES is well placed to take the lead on coordinating this workshop and the possibility for this should be further investigated with ICES.

8.1.3 Review and status of active requests (R-2.1.4, R-2.1.10)

R-2.1.4 *…to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

R-2.1.10 *To provide advice on the total allowable catches for the management of harp seals*

The work to answer both of these requests is carried out by WGHARP and has therefore been updated in 2019.

8.2 HOODED SEAL

8.2.1 Updates

Haug reported from aerial surveys conducted in the period 18-31 March 2018 in the Greenland Sea pack-ice (the West Ice) to assess the pup production of the Greenland Sea populations of hooded seals (and harp seals, see 8.1.1). The data obtained from the survey gave an estimated pup production of hooded seals of 12,977 (SE=1 823, CV=14%, 95% CI: 9,867-17,067) which is lower than estimates obtained from comparable surveys in 2005 and 2007 but comparable with the estimate from the most recent survey in 2012. Current status and catch options for the hooded seal stock are being assessed by incorporating the pup production estimates into population models.

8.2.2 Joint ICES/NAFO/NAMMCO WGHARP 2019

Due to some uncertainty regarding the historical data on pregnancy rates for the Greenland Sea hooded seals, the population model was run for a range of pregnancy rates (assuming 50%, 70% or 90% of the mature females produced offspring, respectively). All model runs indicated a substantial decrease in the population between the late 1940s and the early 1980s, and the population is currently well below N30 (30% of largest observed population size). Recent analyses have indicated that pregnancy rates have remained rather constant around 70% in the period 1958–1999. Using this scenario, the model estimates a 2019 total population of 76,623 (95% CI: 58,299-94,947).

Following the ICES precautionary harvest strategy and the fact that the population is below N_{lim}, WGHARP suggested that no commercial catches should be taken from this population.

The SC welcomed the WGHARP report and **recommended** that there be no commercial catch of hooded seals in the Greenland Sea, but that current levels of scientific and subsistence hunting from this stock can continue.

8.2.3 Review and status of active requests (R-2.1.4, R-2.1.9)

R-2.1.4 *…to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

This request is answered by WGHARP and was therefore updated in 2019.

R-2.1.9 *To investigate possible reasons for the apparent decline of Greenland Sea stock of hooded seals…*

With the information available to date, neither WGHARP nor the SC is able to answer this question.

8.3 RINGED SEAL

8.3.1 Updates

Two *For Information* documents were provided with recently published research on ringed seals (Hamilton et al. 2019; Hamilton, Kovacs and Lydersen, 2019) (SC/26/FI07 & FI08).

Lydersen presented a unique biotelemetry dataset for ringed seals and white whales from Svalbard spanning two decades (1995–2016), which was used to investigate how these species have responded to reduced sea-ice cover and increased Atlantic water influxes in the area. Tidal glacier fronts were traditionally important foraging areas for both species. Following a period of dramatic environmental change, ringed seals now spend significantly more time near tidal glaciers, where Arctic prey presumably still concentrate. Conversely, white whales spend significantly less time near tidal glacier fronts and display spatial patterns that suggest that they are foraging on Atlantic fishes that are new to the region. Differences in levels of dietary specialization and overall behavioural plasticity are likely reasons for similar environmental pressures affecting these species differently.

Rosing-Asvid provided information that genetic analysis of ringed seals is ongoing and when complete, will help develop a better understanding of stock structure. There is also ongoing work to deliver an abundance estimate of a group of ringed seals that live isolated within Kangia (a large fjord system in West Greenland).

8.3.2 Ringed seal WG (2021)

In the endorsed workplan, SC/25 proposed a ringed seal WG be run back to back with a bearded seal WG in 2021.

The SC noted that reviews of both species had been published within the last 10 years and there was limited new information produced since then. Given the limited information available and the tradition that NAMMCO WGs focus on providing population assessments and management advice, the SC did not feel it was appropriate for NAMMCO to coordinate a pan-arctic review at this stage.

The SC discussed the relevance of holding the WG meeting in 2021 as planned due to the current lack of data and the difficulties associated with producing reliable abundance estimates. It was noted that since this is a hunted species in NAMMCO countries, it was important that an assessment be conducted, even if there was no immediate cause for concern regarding the status of the populations. Since there are ongoing studies within Greenland and planned studies within Norway, it was noted that it may be worthwhile to delay the WG until the information generated from this work is available. On the basis of this discussion, the SC proposed that the ringed seal WG be postponed and that SC/27 set a new date based on an assessment of the sufficiency of the data available at that time.

8.3.3 Review and status of active requests (R-2.3.1, R-2.3.2)

R-2.3.1 *To advise on stock identity of ringed seals 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.*

There is a plan to advance on this request through a dedicated ringed seal working group. However, it is proposed that this be delayed until sufficient information is available.

R-2.3.2 *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.*

SC/25 provided an overview of the important topics for research to evaluate removals of ringed seals and thereby considered this request answered. SC/26 highlighted that there has been significant new work within Greenland on tracking and genetic analysis.

8.4 GREY SEAL

8.4.1 Updates

Nilssen provided an update for Norway. A significant reduction (between 50 and 60%) in grey seal pup production was observed in 2014-2015 in mid Norway in the counties Trøndelag and Nordland. These areas (except for Lofoten) were re-surveyed in autumn 2018. The pup production was still at a very low level. There

are plans to survey Lofoten in 2020. Based on the surveys in 2014-2017, the total Norwegian population was estimated to be 3850 grey seals (95% CI: 3,504–4,196).

The Norwegian evaluation of the management plans for harbour and grey seals recommended that the quota be set to 0 when the population is at 70% of the target level instead of 50%. This was also supported by the NAMMCO coastal seal WG. This was not, however, approved by Norwegian management authorities.

Víkingsson provided an update for Iceland that a grey seal census was conducted by aerial survey during the pupping period of 2017 (Granquist and Hauksson 2019a). Based on the estimated pup production (1,452; 95% CI: 1,385-1,529), the total grey seal population size was estimated to be 6,269 (95% CI= 5,375-7,181) animals. The population was approximately 32% smaller than when the first census was conducted in 1982. The population estimate for 2017 corresponds to an increase of 49% since the last census in 2012.

Mikkelsen informed the SC that survey effort in order to count grey seals along the shoreline of the Faroe Islands was carried out also in summer 2019. This project started in 2018. The survey is a boat census in order to get a total count of grey seals. Drone imaging was used in high density areas for more precise counts. The survey in summer 2019 was able to cover the whole archipelago, partly due to better weather conditions, and the total count increased from 400 animals in 2018 to 550 in 2019, which must be considered a minimum estimate. The plan is to apply a correction factor to the count, from tracking and scouting cameras, to correct for the proportion of animals outside the survey area during the count. In 2020, the plan is to tag up to ten animals with satellite transmitters, and to mount up to eight scouting cameras at main haul-out sites.

The SC welcomed the updates and encouraged the member countries to continue their survey work.

8.4.2 Coastal seals WG (2020)

Nilssen, chairman of the Coastal Seals Working Group (CSWG), informed the SC that the date for the WG will be 27-30 April 2020 and it will be held in Copenhagen. The SC agreed that Mike Hammill and Kimberly Murray were relevant external experts to invite to this meeting, as well as researchers working with coastal seals in the UK, Russia, Sweden and Denmark. The proposed terms of reference for the meeting are:

1) Assess the status of harbour and grey seal populations in NAMMCO and adjacent waters.
2) Assess the status of population modelling for coastal seals.
3) Review by-catch issues in NAMMCO countries
4) Review new research on ecology and telemetry

The SC **recommended** holding a meeting of the BYCWG prior to the CSWG to ensure that the latest data on by-catch of coastal seals is available to inform the meeting. Given that Kimberley Murray is both the Chair of the BYCWG and a proposed external expert for the CSWG, it may be most efficient to hold these meetings back to back in April 2020.

8.4.3 Review and status of active requests (R-2.4.2)

R-2.4.2 *To provide a new assessment of grey seal stocks throughout the North Atlantic.*

This will be done through the CSWG planned for April 2020.

8.5 HARBOUR SEAL

8.5.1 Updates

Víkingssen provided an update from Iceland that an aerial census was conducted with the aim of estimating the population size of Icelandic harbour seals for the 12th time and to examine population trends (Granquist and Hauksson 2019b). In total, 4,168 (CI 95%: 6,149-12,726) seals were observed, which after correction factors had been applied, resulted in an estimated population size of 9,434 (CI 95%: 6,149-12,726) animals. The estimated population size was 72% smaller than when first estimated in 1980, but about 23% larger than in 2016 when the last complete population census was conducted.

Nilssen provided an update from Norway noting that a new counts of harbour seals along the Norwegian coast had begun in 2016 and are expected to be finished in 2021. Results in the southern areas (from the Swedish border to mid Norway) show an increasing trend in abundance in most of these areas. There is also an ongoing genetic study on different breeding areas along the Norwegian coast, which indicates different populations along the study area.

Rosing-Asvid provided an update from Greenland. Since the hunt on harbour seals was banned in 2010, only three small colonies in Greenland have been identified, with the largest colony located on the southern tip of Greenland. It was noted that there may be additional colonies that have not yet been observed.

8.5.2 Coastal seals WG (2020)

An update on this working group is presented under agenda item 8.4.2.

8.5.3 Review and status of active requests (R-2.5.2)

R-2.5.2 *To conduct a formal assessment of the status of harbour seals around Iceland and Norway as soon as feasible.*

This work remains ongoing and will be advanced through the CSWG planned for April 2020.

8.6 BEARDED SEAL

8.6.1 Updates

A number of *For Information* documents with recently published research on bearded seals were available for the meeting (Kovacs et al., 2019; Hamilton et al., 2019; Hamilton et al., 2019b; Hamilton et al., 2018) (SC/26/FI06, FI08, FI09, FI10).

It was noted that the last global review of research on bearded seals was published in 2010.

The SC was informed that there is some ongoing analysis of the multi-species aerial surveys conducted in Greenland and that passive acoustic research in Norway is picking up bearded seals in a wide range of locations.

The SC welcomed the updates, supported the analysis of survey data in Greenland and is looking forward to an update at the next SC meeting.

8.6.2 Bearded seal WG (2021)

To allow for the ongoing research to be finalised and additional data to be made available, the SC proposed that this WG be delayed and take place in 2022 at the earliest.

8.6.3 Review and status of active requests (none)

8.7 WALRUS

8.7.1 Updates

Lydersen presented an update that a survey conducted in 2018 in Svalbard estimated 5,503 (95% CI: 5,031-6,036) walruses, which represents a 48% increase since 2012. It was noted though that the area covered in this (and previous) surveys covers just the Norwegian part of a shared population with Franz Josef Land, Russia and that data to create an overall abundance estimate for the population is not available at this time. Tracking studies conducted in the area suggest that walruses from Svalbard that move into Russian waters in the winter and spring return to Svalbard in in August, which is one of the reasons that the survey was conducted during this month. Since the historical population of walruses in the Svalbard area has been estimated as being approximately 100,000, it is hoped that the high level of increase in this population continues.

Heide-Jørgensen informed the SC that the walrus haul-out site in NW Greenland that, for the first time in ~100 yrs was used in 2018, was according to the available information not used in 2019. He also communicated to the SC that the plans for a land-based Ilmenite mine in Wolstenholme Fjord, NW Greenland, is moving ahead. Concern has been raised in the Environmental Impact Assessment (EIA) that the shipping and industrial activity in the area may impact the relatively small population of walrus that uses Wolstenholme Fjord. The SC noted that Wolstenholme Fjord is one of two feeding grounds in NW Greenland and **recommended** that the presence of walrus in the area be monitored and catch levels adjusted if needed.

8.7.2 Review and status of active requests (R-2.6.3, R-3.4.9, R2.6.8 NEW REQUEST)

R-2.6.3 *Provide advice of the effects of human disturbance, including fishing and shipping activities, tourism, hydrocarbon exploration and mineral extractions on the distribution, behaviour and conservation status of walrus in Greenland*

This request was partly answered by the walrus working group (WWG) in 2018. However, the SC reiterated its concern about mining in the Wolstenholme Fjord and advances in the Mary River project (see 7.3.1 and 8.7.1).

R-3.4.9 *(NAMMCO/22) To continue planning of the disturbance workshop for beluga and narwhal, and also recommends including walrus.*

This workshop carried out in 2015 and the SC therefore considers this request to have been answered.

R.2.6.8 NEW REQUEST *Provide assessments of, and advice on the sustainability of allowing walrus hunt all year round in Greenland, on all stocks*

The SC did not see any particular issues with allowing a hunt all year round but emphasised the importance of any catch of a female with a calf being reported as two animals (independent of whether the calf is retrieved or not).

9. CETACEAN STOCKS – STATUS & ADVICE TO COUNCIL

9.0 AEWG 2019

The AEWG met from 8-10 October in Tromsø under the chairmanship of Daniel Pike. The standing request relevant for the group's work is to develop estimates and trends as soon as possible once a survey has been completed, with the primary target species as priority. For the 2019 AEWG meeting, papers were presented on the Icelandic series of coastal aerial surveys over 30 years; Icelandic/Faroese ship surveys conducted in 2007 and 2015; and Norwegian mosaic surveys over the last three survey cycles. The AEWG first discussed overarching methodological issues concerning these surveys and pointed to where further work was required to address any identified problems; after which the estimates were considered species by species.

Over the period 1986 to 2016, Iceland has conducted 7 aerial surveys in its coastal waters. Over this 30-year period, the minke whale abundance has decreased, with a 75% decrease in 2001 and remaining low after that, while humpback whales and white-beaked dolphins have increased over the same period. Abundance estimates for white-beaked and white-sided dolphins from the 2007 Icelandic/Faroese ship survey were presented, as well as estimates for blue, sei and northern bottlenose whales for their 2015 survey. Abundance estimates for baleen whales (fin, humpback whales) and odontocetes (white-beaked dolphins, harbour porpoise, killer whales) were presented from the Norwegian mosaic surveys 2002-2007, 2008-2013 and 2014-2018. New estimates and their status are given in overview table presented in appendix 6.

A spatial analysis study to improve the understanding of the underlying ecological drivers of any changes in deep-diving (sperm, pilot, northern bottlenose whales) cetacean distributions was presented. Several descriptive covariates had been investigated over the periods 1987-1989 and 1998-2015. As expected, the predicted high-use areas for all three species were mostly deep waters, with some overlap among them in the central Norwegian Sea and the Central North Atlantic, including the Irminger Sea. Differences in distribution likely reflect differences in prey but the mechanisms underlying these relationships are unknown.

Given that the working group considers that it has now responded adequately to its request R-1.7.11, it asked the SC to consider whether a new meeting was required.

The recommendations from the AEWG that were **endorsed** by the SC are given in Table 1 below.

Discussion

The SC welcomed the progress from the AEWG to finalise the analysis. It **recommended** that an estimate for killer whales in Iceland/Faroes (the only estimate lacking that can be generated from the NASS series) be developed and that this be reviewed at a future meeting, which may be virtual or by correspondence.

It noted that the recommendation from the AEWG that a written review on novel methods be contracted and completed in 2020 to inform the development of the next survey in 2023 may be delivered too early to capture any relevant developments that may take place between 2020 and 2023. A counter argument to this was that it would be valuable to have such a review feed into the planning of the next survey and that this planning needed to begin in good time. The SC agreed that an appropriate approach would be to include novel methods as an agenda item for the planning meetings for the next survey and to invite external experts to participate in these meeting. The SC noted that it would not be necessary that such a planning meeting be held back to back with the SC meeting in 2020 as proposed by the AEWG. Hansen was nominated as Chair for the first planning meeting, with Øien, Víkingssen, and Mikkelsen as NAMMCO participants. Relevant external experts to invite were noted as including Phil Hammond, Daniel Pike, Debi Palka and Jack Lawson.

Table 1. The recommendations for research from the AEWG 2019 that were endorsed by the SC

Key: SURVEY: CIC=Corrected Icelandic Coastal, NILS=Northeast Atlantic shipboard Survey, NASS F+I=North Atlantic Sightings Survey (Faroe Islands and Iceland), NASS All=North Atlantic Sightings Survey (All countries); SPECIES: BA=Minke whale, MN=Humpback whale, LL=White-sided and white beaked dolphin, PM=Sperm whale, OO=killer whale, GM=Pilot whale, PP=Harbour porpoise

SURVEY	YEAR	SPECIES	ITEM	RECOMMENDATION
RESEARCH: TECHNICAL				
CIC	ALL	BA, MN, LL	4	Where possible, analyse trends in absolute abundance to enable comparison with trends in relative abundance.
				Include cases with significant effort but no sightings in population growth rate regressions.
				Where appropriate, conduct a power analysis to investigate the magnitude of trend that can be detected
CIC	ALL	BA	5.2	Explore the use of spatial modelling to extrapolate the estimate into the areas that had not been surveyed.
NILS	2002-2015	BP, MN, PM	4	Test the sensitivity of the estimates to a possible over-identification of duplicates from converting unidentified large whale sightings into positive species identifications
NILS	2002-2015	ALL	6.1	Investigate conditional detection functions without perpendicular distance as a covariate and adopt if indicated by AIC
NASS F+I	ALL	OO	9.1	Calculate an abundance estimate for killer whales
NASS ALL	ALL	GM	12	Use the spatial analysis model to perform an assessment of temporal change in pilot whale distribution and abundance in the NASS survey area and time period before the next NAMMCO assessment of pilot whales (currently planned for 2020)
RESEARCH: REQUIRING ACTION FROM MANAGERS				
CIC		PP	8.6	Carry out a new survey with harbour porpoise as a target species and collect dive data to facilitate the development of a correction factor for this species

9.0.1 Review and status of active requests (R-1.7.11)

R-1.7.11 *To develop estimates of abundance and trends as soon as possible once the survey has been completed, with the primary target species (fin, minke and pilot whales) as a first priority, and secondary target species as a second priority.*

With the exception of killer whales in Iceland/Faroes, this work has now been completed for the 2015 NASS survey.

9.1 FIN WHALE

9.1.1 AEWG 2019

The SC endorsed the abundance estimates on fin whales from the AEWG 2019.
Norway 2002-2007 cycle: 10,004 (CV=0.18, 95% CI: 6,937 – 14,426)
Norway 2008-2013 cycle: 10,861 (CV=0.26, 95% CI: 6,433 – 18,339)
Norway 2015: 3,729 (CV=0.44, 95% CI: 1,531 – 9,081)
Norway 2014-2018 cycle: 11,387 (CV=0.17, 95% CI: 8,072 – 16,063)

9.1.2 Updates

The SC was informed that there were no catches of fin whales in Iceland this year.

Lydersen gave a presentation of tagging work carried out on fin whales around Svalbard in September 2019. The boat used as the base for this work was the Polarsyssel, which was rented from the Governor of Svalbard. 25 tags were deployed in less than 3 hours of helicopter flying, with 20 of these tags reporting and 9 sending reports for longer than one month. The tracks from these tags showed animals travelling in various directions, with some staying around Svalbard, some moving north and others heading south. There was one tagged animal that moved through the Denmark strait, which had not previously been seen for fin whales.

9.1.3 Review and status of active requests (R-1.7.11, R-1.7.12)

R-1.7.11 *To develop estimates of abundance and trends as soon as possible once the survey has been completed, with the primary target species (fin, minke and pilot whales) as a first priority, and secondary target species as a second priority.*

This work was carried out by the AEWG and has now been finalised for fin whales.

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).*

No work has been done within NAMMCO to answer this request for fin whales.

9.2 HUMPBACK WHALE

9.2.1 AEWG 2019

The SC **endorsed** the abundance estimates on humpback whales from the AEWG 2019.
Norway 2002-2007 cycle: 10,669 (CV=0.31, 95% CI: 5,695 – 19,998)
Norway 2008-2013 cycle: 12,958 (CV=0.31, 95% CI: 7,033 – 23,873)
Norway 2015: 1,711 (CV=0.41, 95% CI=604 – 3,631)
Norway 2014-2018 cycle: 11,662 (CV=0.40, 95% CI: 5,225 – 26,027)
Iceland 2009: 2,261 (CV=0.35, 95% CI: 1,142-4,477)

9.2.2 Updates

There has been tagging of humpback whales in Norway, Greenland, Iceland, Canada, USA, and the Caribbean and the SC believed that it would be relevant to present the results from these studies in a joint paper in order to get an overview of humpback migrations and movements in the North Atlantic.

At NAMMCO 27, the MCC endorsed the SC/25 recommendation to develop a common workshop on humpback tagging projects in the Atlantic (earliest 2020). Heide-Jørgensen informed the SC that researchers tagging humpback whales in the North Atlantic plan to have a meeting at the World Marine Mammal Conference in the Barcelona in December 2019 to discuss the possibility to share data and make a joint publication. Heide-Jørgensen will therefore raise with this group the potential to arrange a workshop on the topic with support from NAMMCO to help advance the work on a joint publication.

Øien provided an update that the IWC had raised the possibility of having an assessment of North Atlantic humpback whales in the near future.

9.2.3 Review and status of active requests (R-1.7.12, R-3.2.4)

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters.*

This information has previously been provided for humpback whales, as well as additional information explaining why it was justifiable to use SLA to provide advice. The SC therefore now considers this request to be answered.

R-3.2.4 *To conduct a formal assessment following the completion of the T-NASS and investigate the relationship between the humpback whales summering in West Greenland and other areas and to incorporate this knowledge into estimates of sustainable yields of West Greenland humpback whales…amended (NAMMCO/24) to state that MCC 26 noted that the SC had used SLA to come with its management advice in relation to this request and emphasised that the use of 'needs statements' in this approach meant it was inappropriate for NAMMCO*

The SC noted that on the basis of the response to this issue provided by SC/25, at the NAMMCO 27 meeting in 2019, the MCC agreed that further work to address this amended request was no longer an urgent priority.

9.3 COMMON MINKE WHALE

9.3.1 AEWG 2019

The SC **endorsed** the abundance estimate on minke whales from the AEWG 2019.
Iceland coastal 2016 (partial): 13,497 (CV=0.50, 95% CI: 5,377-33,882)

9.3.2 Updates

No updates on minke whales were provided.

9.3.3 Review and status of active requests (R-1.7.11, R-1.7.12)

R-1.7.11 *To develop estimates of abundance and trends as soon as possible once the survey has been completed, with the primary target species (fin, minke and pilot whales) as a first priority, and secondary target species as a second priority.*

This has now been finalised by the AEWG 2019.

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).*

No work has been done within NAMMCO to answer this request for minke whales.

9.4 BELUGA

9.4.1 Updates

The publication of a series of 9 papers, including the entire GROM review, is now in press with *Marine Fisheries Review*. This includes the following papers:

- Global Review of the Conservation Status of Monodontid Stocks, by Hobbs et al.
- Reconstructing Catch Statistics for Narwhals in Greenland 1862 to 2017, by Garde et al.
- Structure and Assessment of the Beluga Whale (*Delphinapterus leucas*) Populations in the Russian Far East, by Shpak et al.
- Meta-population modelling of narwhals in East Canada and West Greenland, by Witting et al.
- Circumpolar mtDNA population structure and variation in belugas: a review, by Skovrind et al.
- A Review of the Current State of Knowledge on the Beluga Whale (Delphinapterus leucas) in the Russian Arctic Seas, by Glazov et al.
- Hunt allocation modelling for migrating marine mammals, by Watt et al.
- Distribution, Abundance, Harvest, and Status of Western Alaska Beluga Whale Stocks. Lowry et al.
- Aerial surveys of Bristol Bay beluga whales in 2016, by Citta et al.

The SC was informed that at NAMMCO 27, the MCC noted that although Greenland has implemented the recommended quotas, the recommendation to have a seasonal closure for beluga has not been put in place. The MCC commented that in the proposed area for this seasonal closure, there is disturbance from non-hunting related activities (e.g. shipping, fisheries) and it was believed that all of these activities would have to be stopped to re-establish the population in this area. It was also noted that changes in the distribution of Greenland halibut in the Nuuk area could be impacting the population.

The SC agreed that there is insufficient evidence to conclude that disturbance from non-hunting activities would need to be stopped to enable the population to re-establish in this area, nor that changes in the distribution of Greenland halibut should impact the population since Greenland halibut is not a primary prey of beluga. The SC emphasised that its primary concern was hunting and noted that several stocks of beluga were found in areas where there are extensive shipping and fishing activities and no hunting (e.g. St. Lawrence, Gulf of Anadyr and Adventfjorden in Svalbard). The SC therefore reiterated its concerns and its previous **recommendation** for seasonal closures.

9.4.2 Review and status of active requests (R-3.4.9, R-3.4.11)

R-3.4.9 *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.*

This request was answered through the disturbance workshop organised by NAMMCO in 2015. No new information was available to this meeting in regard to this request.

R-3.4.11 *To update the assessment of both narwhal and beluga, noting that new data warrant such an exercise.*

This work is done within the context of the joint working group with the JCNB.

9.5 NARWHAL

9.5.1 Updates

The SC was given an update on the information relating to narwhals presented at the MCC during NAMMCO 27.

Lydersen presented an update on work done in the Fram Strait (Ahonen et al., 2019) (SC/26/FI11). This work indicates that narwhals are present in the area and also deep into the ice all year round. Biopsies were obtained from six whales with crossbows from a helicopter. There is an intention to try to tag some of the narwhals next year from the air. Passive acoustic monitoring of narwhals and other vocal marine mammals is ongoing in the Fram Strait and around Svalbard.

9.5.1 JCNB

Information on the upcoming joint NAMMCO-JCNB working group is available under agenda item 6.4. The SC agreed that Rod Hobbs be invited to continue in his role as NAMMCO chair for the joint working group. The

SC proposed that relevant external experts to invite to the upcoming meeting would include the geneticists working on beluga and narwhal in Denmark, Marie Louis and Mikkel Skovrind, as well as Jesper Boje as an expert in the distribution of Greenland Halibut.

The SC received an update that the Mary River mining project in Baffin Bay is going ahead (see 7.3.1). The SC reiterated its concerns regarding this project and emphasised the importance of this being addressed in detail at the next JCNB meeting.

9.5.2 Ad hoc working group on narwhal in East Greenland

The NAMMCO Scientific Committee has previously expressed concern over the status of narwhal stocks in East Greenland due to high catches continuing on a declining population. In 2018 it was decided to convene an *Ad hoc* Working Group on Narwhal in East Greenland (NEGWG). The NEGWG met in Copenhagen from 24-27 September 2019. The tasks for the WG involved reviewing data on stock structure, abundance and distribution; examining impacts from hunting, climate change and other anthropogenic stressors; and assessing the future sustainability of catches.

The SC welcomed the report of the NEGWG and agreed to the proposed borders for the previously agreed upon three management areas (based on the known high degree of site fidelity, the observed distribution during summer, and a desire to facilitate a precautionary approach to management). The management areas are: *Area 1* = Ittoqqortormiit, Scoresby Sound and Blosseville Coast south to 68°30'N; *Area 2* = Kangerlussuaq 68°30'N to 67°N; *Area 3* = Tasiilaq, south of 67°N (see figure 2 below).

Distribution & Stock Structure: Genetic analysis shows that East Greenland narwhals are genetically and ecologically distinct from animals in West Greenland and genetically distinct from those in Svalbard. The analysis is, however, not yet powerful enough to distinguish different stocks in East Greenland and requires additional samples to cover all management areas.

The SC noticed that there is specific uncertainty regarding stock structure in management area 1 (Ittoqqortoormiit /Scoresby Sound). Specifically, whether this area is inhabited by two populations at different times of the year. This possibility is indicated by a bimodal distribution of catches and tracking data that shows all animals tagged in Hjørnedal moving out of the fjord system and staying in offshore areas south of Scoresby Sound between April and June, while catches are reported in Scoresby Sound during this time. Although there could be migration down from a population in the north (e.g. Dove Bay), there is currently no evidence to support this. The SC **recommended** further work to resolve stock structure in management area 1 (Ittoqqortoormiit /Scoresby Sound).

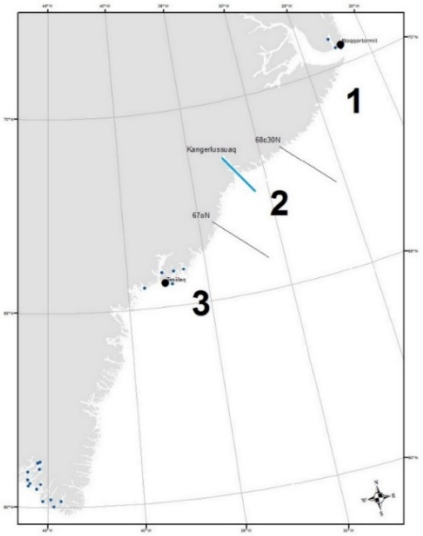

Figure 2: Suggestion for three management areas for narwhals in East Greenland. Ittoqqortoormiit & Scoresby Sound (area 1), Kangerlussuaq (area 2) and Tasiilaq (area 3). Blue line indicates the previous segregation of two management areas. Blue dots represent settlements, with Tasiilaq and Ittoqqortoormiit superimposed

***Abundance**:* Estimates from recent aerial surveys (2016 & 2017) and mark-recapture data were reviewed. Newly calculated correction factors had also been applied to older surveys of Scoresby Sound in 1983 and 1984. The recent surveys found small numbers of narwhals in the three management areas, yet a larger aggregation of narwhals was found further to the North in Dove Bay and Greenland Sea. The SC noted that the identification of a large narwhal aggregation to the north by the same surveys, confirmed the conclusion that there is only a small number of narwhals in the three management areas. Abundance estimates for each management area are reported in table 2.

Table 2: Abundance estimates with cv in parenthesis (given in %). I_a is relative estimates covering only Scoresby Sound. N_b is an absolute estimate for Scoresby Sound and the Bosseville Coast. N_c is absolute estimates for Kangerlussuaq. N_d is absolute estimate for Tasiilaq. Data from Hansen and Heide-Jørgensen (2017), Hansen et al. (2019), Hansen and Heide-Jørgensen (2019), and Heide-Jørgensen (2019).

Year	I_a	N_b	N_c	N_d
1983	1180 (34)	–	–	–
1984	401 (58)	–	–	–
2008	–	1940 (57)	613 (71)	206 (55)
2016	–	433 (49)	269 (37)	–
2017	246 (43)	–	–	–

The SC welcomed the abundance estimates presented in the NEGWG report and agreed that these were sufficiently robust to inform the assessment and advice. However, given the sensitivity of the issue, the SC also **recommended** that the estimate be reviewed by the JCNB. The SC also highlighted that it could be relevant to conduct new surveys in the late spring/early summer to provide information that can help provide clarity on spring abundance.

Non-lethal Impacts: Experiments were conducted exposing narwhals (fitted with satellite tags and acoustic-behavioral recorders) to noise from airguns. Impacts observed included movement towards the surface and a decrease in vocalisations related to foraging, despite the airguns being less powerful than those used in commercial activities and the level being within the range of background noise. Noise disturbance (from shipping and seismic exploration) has a clear potential to impact narwhals although the significance of this for small populations in decline requires further investigation. The SC welcomed the new research that was being carried out on non-lethal impacts and praised the novelty of the experimental approach to investigating noise disturbance. It highlighted that this information was of relevance for narwhal across the North Atlantic. It particularly highlighted the value of this work and its inclusion in the WG deliberations as a response to request R-1.5.4.

Life History: Although not statistically significant, both the fraction of females and their pregnancy rate was observed to be declining in both hunter reports and biological sampling from Scoresby Sound. This trend has further support from very few calves being seen in recent aerial surveys and the lack of young animals in recent live captures. Although the body condition of the whales appears to be good, the pregnancy rate is decreasing. The SC expressed concern over the observed decline in fertility and agreed that this is likely having significant implications for the Scoresby Sound population. It **recommended** that standardisation of the reporting on calves in aerial surveys would be one way forward to generate more information on this issue.

Habitat Changes & Population Responses: Two major oceanographic changes have recently been observed in coastal areas of Southeast Greenland - a lack of pack ice in summer and increasing sea temperatures. This has had cascading effects on the marine ecosystem, as observed through changed fish fauna and the presence of a large number of boreal cetaceans either new to the area or now occurring in surprisingly large numbers

(e.g. humpback, fin, killer, and pilot whales as well as white-beaked dolphins). Narwhals are endemic to the Arctic and depend on cold water. Their habitat range is therefore being restricted by the warming oceans. Since they primarily get rid of heat through the dorsal ridge and tail fluke, their ability to adapt to these warming temperatures is also limited. While there have recently been several sightings of narwhals in areas north of their traditional range (e.g. Dove Bay), evidence suggests that a combination of hunting and climate change is negatively impacting the long-term viability of populations in Southeast Greenland. The SC noted that the reported observations of oceanographic changes align with observations from elsewhere on a shifting distribution of prey species and changing ice conditions. The SC emphasised that since these are the most southerly populations of narwhals, they were likely to be those most exposed to negative effects from climate change. The SC noted that pilot whales moving into the area could also be creating increased competition for resources.

Stock Assessments: The SC agreed on the premises and priors used and **endorsed** the assessments.

Ittoqqortoormiit/Scoresby Sound (management area 1): Applying a fixed a birth rate 0.31, the model estimates a small and depleted aggregation. With a historical population estimate of 2,290 (90% CI:1,750–2,840), and a current depletion to only 18% (90% CI:6–40%) of this, the model estimates a 2019 abundance of 410 (90% CI: 120–990) animals. With an annual growth rate estimate close to zero, it is unlikely that the aggregation can sustain any current removals. The estimated probability of increase is only 57% should a single individual be removed annually.

Kangerlussuaq (management area 2): Using no age structured data and a birth rate fixed at 0.33 for a three year birth interval. The model estimates a small depleted aggregation. With an historical population estimate of 1,050 (90% CI: 720–1,540), and a current depletion to 27% (90% CI: 12–59%) of this, the model estimates a 2019 abundance of 290 (90% CI: 140–560) animals. This aggregation is so small that it is unlikely that it can sustain any current removals. The estimated probability of increase is 72% should 4 individuals be removed annually. This estimate is, however, considered to be too optimistic because demographic variation, allee effects (i.e. positive correlation between population density and individual fitness), and other factors that negatively affect small populations were not included in the model.

Tasiilaq (management area 3): Using no age structured data and a birth rate fixed at 0.33 for a three year birth interval. The model estimates a small depleted aggregation. With a historical population estimate of 820 (90% CI: 580– 1,210), and a current depletion to 25% (90% CI: 4–74%) of this, the model estimates a 2019 abundance of 210 (90% CI: 30–670) animals. This aggregation is so small that it is unlikely that it can sustain any current removals. The estimated probability of increase is 76% should two individuals be removed annually. This estimate is, however, considered too optimistic, partly because of a statistical bias (model abundance being slightly larger than the survey estimate), and partly due to factors negatively affecting small populations as outlined for Kangerlussuaq above.

Management Advice: On the basis of the information given, the SC **recommended** 0 catches in all areas.

The SC noted that ICES operates with harvest control rules for providing management advice on small stocks and recommends zero catch when a population drops below 30% of its historical maximum. It was noted that Norway also operates with similar rules for coastal management. The SC highlighted that applying the ICES rule would also lead to a recommendation of 0 catches in these areas. The SC also agreed with the WG **recommendation** that it would be valuable to develop guidance within NAMMCO on a standard or principle-based approach for how to manage small stocks and harvest advice.

On the basis of their review of the report, and emphasising that catches at the current level for even one year would have a significant negative impact on the populations, the SC **recommended** that there be an immediate reduction to 0 catches in East Greenland, at least until a new abundance estimate is generated.

To help provide relevant contextual and background information for the SC advice in this case, tables 3 & 4 provide an overview of the changes in the management advice for narwhals in East Greenland since 2009, listing the changes in management units over time and the changes in available information between 2017-2019.

Table 3. Historical overview of the management of narwhal in East Greenland from 2009-2019

Meeting	Advice on management unit	New science implemented in assessment model	Advice on removals (70% prob. of increase)	Endorsed by SC	SC REPORT #
2009 JCNB JWG	1	First abundance estimate obtained	85	2009	16
2012 JCNB JWG	2	Satellite tagging from Scoresby Sound	ITT: 70 TAS: 18	2012	19
2017 JCNB JWG	3	New aerial survey and a major revision of the 2008-survey	ITT: 10 KANG: 10 TAS: 0	2017	24
2019 AD HOC NEGWG	3	(see table 4)	ITT: 0 KANG: 0 TAS: 0	2019	26

Table 4. New data incorporated in the assessment of narwhals in East Greenland in 2019

Catch statistics	Update on catches through 2019
Struck and lost	Corrections split on catch methods based on direct observations
Details on catches	Sex, age and reproductive information from the 'Special reports'
Catches by season and areas	Bimodal distribution of seasons in Ittoqqortoormiit and latitude trends in Tasiilaq and Kangerlussuaq
Management areas	Specification of borders by latitudes and splitting of catches and abundance estimates based on 3 areas
Aerial surveys	Aerial survey in 2017 and surveys in NE Greenland
Correction factor for aerial surveys	The 2016 and 2017 aerial surveys were revised with a new 80ds long time series of dive data from one whale
Inclusion of old surveys	Surveys from 1983 and 1984 were included as relative abundance estimates and were updated with correction factors from later surveys
Genetic results	Split between whales in Svalbard and East Greenland
Life history parameters	Data on body condition and pregnancy rate
Feeding habits	Data on feeding on squid, polar cod and capelin
Thermal tolerance – small scale	Data on depth (3-400 m) and temperature preferences during feeding (1-1.5^{o}C)
Thermal tolerance – large scale	Abundance negatively correlated to sea temperatures
Migrations	Spring occurrence in Ittoqqortoormiit perhaps not part of summer occurrence
Human disturbance	Distance to ships and airguns where the response of the whales may have energetic costs

Recommendations from the NEGWG

The SC agreed with the NEGWG and expressed significant concern that removals continue to take place in these small populations observed to be in decline and considers the urgency of the situation to require immediate action.

Although the SC **endorsed** the recommendations of the working group, it saw the list of recommendations made for "conservation and management" as having the potential to dilute the primary management advice, which was the **recommendation** that there be 0 catches in East Greenland. It therefore suggested that the other recommendations made by the WG were more appropriately classed as recommendations for research. Within this list though, the SC particularly emphasised the value of having NAMMCO further investigate the use of a principle-based approach to providing harvest and management advice for small stocks, to provide clear guidelines for difficult cases such as this.

Noting that there were a range of recommendations for research and the issue is a particularly complex and sensitive one, the SC **recommended** that a new meeting of the working group be scheduled for 2021. The aim of this meeting would be to review the latest data (e.g. on catch data and genetic research) and update the assessment using both this new data and the revisions currently underway on the model to allow for time variation in some of the parameters. Work that should be done prior to this new meeting would include the review of the abundance estimate by the JCNB, reconsideration of the mark-recapture data, and an investigation of the potential correlation between ice coverage and narwhal presence in Scoresby Sound.

Given the importance of this topic for NAMMCO, the SC **recommended** that the Chair of the NEGWG be invited to present the work at the Council meeting.

9.5.3 Review and status of active requests (R-3.4.9, R-3.4.11)

R-3.4.9 *To continue planning of the disturbance workshop for beluga and narwhal, and also recommends including walrus.*

This workshop was carried out in 2015 and therefore the SC considered this request to have now been answered.

R-3.4.11 *To update the assessment of both narwhal and beluga, noting that new data warrant such an exercise.*

The assessment of narwhal has been updated in 2019 and there is an intention to hold a new meeting of the ad hoc working group of narwhal in East Greenland in 2021.

9.5.4 Future work

9.6 SEI WHALE

9.6.1 AEWG 2019

The SC **endorsed** the new abundance estimates from AEWG 2019.
Iceland/Faroes 2007: 9,737 (CV=0.38, 95% CI: 4,189-19,665)
Iceland/Faroes 2015: 3,767 (CV=0.54, 95% CI: 1,156-12,270)

9.6.2 Updates

No updates were provided at this meeting.

9.6.3 Review and status of active requests (R-3.5.3 amended, R-1.7.12)

R-3.5.3 *(amended) To assess the status of sei whales in West Greenland waters and the Central North Atlantic and provide minimum estimates of sustainable yield.*

R-1.7.12 *To give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).*

There is still insufficient data to answer these requests.

9.7 BOTTLENOSE WHALE

9.7.1 AEWG 2019

The SC **endorsed** the new abundance estimate from AEWG 2019.
Iceland/Faroes 2015: 18,375 (CV=0.59, 95% CI: 5,128-65,834)

9.7.2 Updates

No updates were given at this meeting.

9.7.3 Review and status of active requests (none)

9.8 KILLER WHALE

9.8.1 AEWG 2019

The SC **endorsed** the abundance estimates from the AEWG 2019.
Norway 2002-2007 cycle: 18,213 (CV=0.21, 95% CI: 11,486 - 29,992)
Norway 2008-2013 cycle: 8,984 (CV=0.36, 95% CI: 4,397 – 13,023)
Norway 2014-2018 cycle: 13,909 (CV=0.30, 95% CI: 7,733-25,018)

The SC agreed with the recommendation from the AEWG that an abundance estimate should be calculated for killer whales using the data from the Iceland/Faroes component of the 2015 TNASS. This would allow the analysis to be completed for all species on the basis of the 2015 data and since killer whales can drive a significant amount of mortality of other marine mammals in the North Atlantic, it is valuable to have clear abundance estimates (as well as further information on predation).

9.8.2 Updates

Two *For Information* papers were made available to the meeting on killer whales (Desforges et al. 2019; Witting 2019) (SC/26/FI13 & FI14). These were published responses to the article by Desforges et al. 2018 on the global collapse of killer whale populations, which was discussed extensively during SC/25. At that meeting, Witting was encouraged to publish the working paper he presented outlining his criticisms of the study by Desforges et al. and the SC was pleased to see that this had been achieved.

9.8.3 Review and status of active requests (none)

9.9 PILOT WHALE

9.9.1 AEWG 2019

No additional information was available for pilot whales from AEWG 2019.

9.9.2 Updates

Mikkelsen informed that five animals in a group of 16 pilot whales had been tagged with satellite transmitters in July 2019, in a continuous effort to determine the distribution and recruitment area for the hunt of pilot whales around the Faroe Islands. Also, that samples had been collected from the catches for biological studies.

Iceland has seen a 136 pilot whales stranded in 14 events in 2019. Parts of these groups were refloated though so some strandings may be of the same animals. It was noted that this is a much higher level of strandings than has previously been seen. The reason for the elevated level of strandings was unknown.

9.9.3 Pilot whale working group

A working group on pilot whales to carry out an assessment had originally been scheduled for 2020. However, given the high number of WGs now planned for 2020 and the value of more time to gather additional data, the SC proposed that this WG be delayed until 2021.

9.9.4 Review and status of active requests (R-1.7.11, R-3.8.6)

R-1.7.11 *To develop estimates of abundance and trends as soon as possible once the survey has been completed, with the primary target species (fin, minke and pilot whales) as a first priority, and secondary target species as a second priority.*

This has been done by the AEWG.

R-3.8.6 *To continue work to complete a full assessment of pilot whales in the North Atlantic and provide advice on the sustainability of catches, as soon as necessary further information becomes available, with particular emphasis on the Faroese area and East and West Greenland. In the short term, the SC was requested to provide a general indication of the level of abundance of pilot whales required to sustain an annual catch equivalent to the annual average of the Faroese catch in the years since 1997.*

Life history data is being collected in the Faroes and abundance estimates have been generated.

9.10 DOLPHINS

9.10.1 AEWG 2019

The AEWG 2019 delivered several new abundance estimates for dolphin species. These were welcomed and **endorsed** by the SC.

Lagenorhynchus spp.
Norway 2002-2007 cycle: 218,640 (CV=0.18, 95% CI: 150,330 – 318,000)
Norway 2008-2013 cycle: 163,688 (CV=0.18, 95% CI: 112,673 – 237,800)
Norway 2014-2018 cycle: 187,482 (CV=0.24, 95% CI: 112,434 - 312,624)

White-sided dolphin
Iceland/Faroes 2007: 81,008 (CV=0.54, 95% CI: 27,993-234,429)

White-beaked dolphin
Iceland/Faroes 2007: 91,277 (CV=0.53, 95% CI: 32,351-157,537)
Iceland 2007: 46,683 (CV=0.37, 95% CI: 22,409-97,251)
Iceland 2009: 75,959 (CV=0.56, 95% CI: 26,366-218,834)
Iceland coastal 2016 (partial): 59,966 (CV=0.44, 95% CI: 24,907-144,377)

It was noted that in Greenlandic, both white-sided and white-beaked dolphins have the same name and therefore it can be difficult to distinguish between them in reporting. The SC **recommended** that a way to distinguish these species in reporting be developed.

9.10.2 Updates

No updates were presented.

9.10.3 Review and status of active requests (R-3.9.6)

R-3.9.6 *The SC was asked 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 endorsed the plan of the SC to proceed with the assessments once the above mentioned studies have been completed.*

The SC was informed that at NAMMCO 27, the MCC confirmed that R-3.9.6 was still valid and prioritised at the same level.

A series of abundance estimates are now available for these species and there will soon be data available on by-catch. Life history data is also available (although not yet published). The SC **recommended** that member countries collate all the data available for these species for consideration at SC/27, after which plans to answer R-3.9.6 and carry out an assessment will be discussed.

9.11 HARBOUR PORPOISE

9.11.1 AEWG 2019

The SC **endorsed** the abundance estimates for harbour porpoises delivered by the AEWG in 2019.
Norway 2002-2007 cycle: 189,604 (CV=0.19, 95% CI: 129,437 – 277,238)
Norway 2008-2013 cycle: 30,556 (CV=0.57, 95% CI: 10,502 – 88,907)
Norway 2014-2018 cycle: 255,929 (CV=0.20, 95% CI: 172,742-379,175)
Iceland coastal 2016 (partial): 22,806 (CV=0.59, 95% CI: 9,166-56,746)

A question was asked as to why there was a substantially lower abundance estimate in the 2008-2013 Norwegian cycle. Øien explained that that series had a much lower effort in the North Sea than usual and that this could in part explain the lower abundance estimate, which would more reflect the abundance in the Southern Barents Sea. For unknown, non-methodological reasons, all the surveys in this cycle generated a lower number of sightings for harbour porpoise than other survey cycles, which might reflect a change in distribution.

The abundance generated by the SCANS surveys and the Norwegian surveys for the 2002-2007 and 2014-2018 series were comparable for the North Sea. The high harbour porpoise abundance in the third series is partly driven by a very high abundance in the Barents Sea.

9.11.2 Updates

Iceland informed that further modelling work related to assessment of potential effects of by-catch on harbour porpoises (and coastal seals) around Iceland is being undertaken by an international expert group in relation to implementation of the US Marine Mammal Protection Act import provisions.

9.11.3 Harbour Porpoise Workshop

Mikkelsen reported from the Joint IMR/NAMMCO International Workshop on the Status of Harbour Porpoises in the North Atlantic, which was held in Tromsø in December 2018, under the Chairmanship of Ulf Lindstrøm from IMR. A total of 34 scientists from NAMMCO, Nordic and European countries, as well as the US and Canada participated. All the harbour porpoise putative assessment areas of the North Atlantic and adjacent waters were represented as information had also been received from scientists working with the Southernmost population of North West Africa.

With an overarching aim to improve the knowledge base for ecosystem-based management, the central objectives of the workshop were to:

a) assemble current information on the biology, abundance and by-catch of harbour porpoises,
b) perform assessments of the status of harbour porpoises in different areas of the North Atlantic, and
c) identify the gaps in existing knowledge that need to be addressed to understand the status and ecological role of harbour porpoises in these waters.

The first session on stock identity and structure focused on better understanding the spatial distribution of populations and their level of interaction to develop agreement on how to reasonably delineate assessment units. Presentations were given on genetic analyses of harbour porpoise populations, as well as research on movement and stock identity in specific areas of the North Atlantic. The outcome from this session was an agreed delineation of management units (see figure 3 below).

Following a first session on stock identity and assessment areas, presentations were given on different human generated threats and pressures faced by harbour porpoises, including by-catch, disturbance, noise and chemical pollution. The focus then turned to questions of general biology, with presentations on feeding

ecology, life history and health. This was followed by presentations and discussions on different models available for performing assessments. Each presentation also highlighted some take home messages and identified knowledge gaps.

The second part of the workshop used population dynamic models to assess the status of harbour porpoises in each of the agreed areas, based on the information collated by expert participants prior to the workshop. Tentative assessments were generated, presented and discussed for each area. Data limitations and their consequences for the reliability of the assessment results were identified. The final day focused on drawing out general conclusions and recommendations concerning the available knowledge and the knowledge required to allow proper assessments to be performed for the different areas, as well as the most efficient ways of generating the missing information.

The workshop provided the opportunity to meet, exchange information, collate knowledge, and perform preliminary status assessments. The workshop report, with the assembled background information, provided a useful preliminary overview of the concern level for the different harbour porpoise populations in the North Atlantic and adjacent waters. The important knowledge gaps and areas requiring further research were identified during the workshop and new collaborative initiatives begun in particular to better address the stock identity issue. Recognising an ongoing and urgent need for clear assessment units, complete datasets of removals, reliable abundance estimates and rigorous assessments, the participants saw the workshop and its outcomes not as definitive, but rather as an informative step in an ongoing process towards developing a comprehensive understanding and sound management of harbour porpoise populations in a changing North Atlantic.

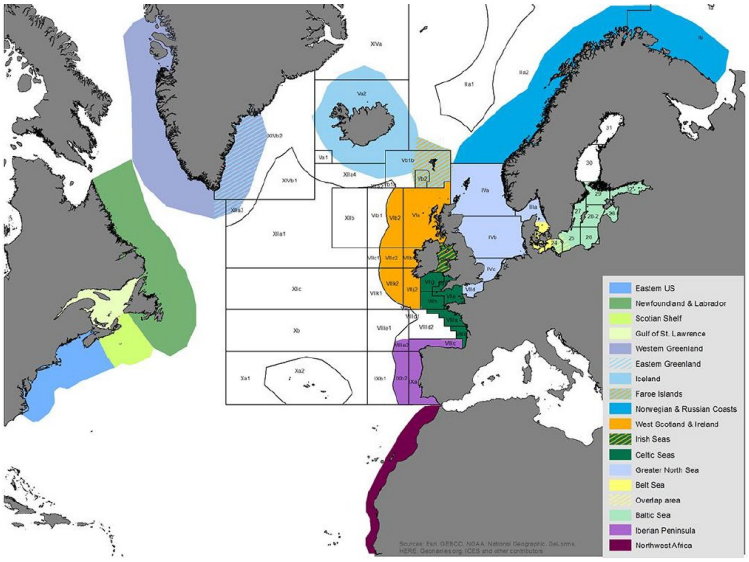

Figure 3. Map of revised assessment areas for harbour porpoise in the North Atlantic as proposed by the 2018 Tromsø Workshop.

Area Assessments for NAMMCO Countries

NORWAY

Genetic studies have corroborated the existence of one panmictic population of harbour porpoises in Norwegian waters. Data gathering on biological parameters remains ongoing, with samples collected from by-caught animals. Progress has been made towards reliable by-catch data and estimates but work remains ongoing, with extrapolation from the reference fleet still being addressed. Experiments in by-catch mitigation through acoustic deterrents (pingers) was described. An update on the 2018 Norwegian fjords survey and progress in estimating abundance from older survey cycles was given, with final estimates expected by the end of 2019. The assessment performed at the Tromsø WS indicated a slow decline in harbour porpoises in the area.

The SC concluded that the lack of information on by-catch before 2005 and the availability of only one abundance estimate meant that this assessment did not allow for reliable conclusions to be drawn.

ICELAND

Although there are indications that the Icelandic population is part of a larger North Atlantic one, for pragmatic reasons a separate assessment for the Iceland area was carried out by the workshop.

There was a significant effort in the 1990s to collect samples for analysis of biological parameters and payments are still being offered to fishermen for genetic samples from by-caught animals. Analysis of all sampling efforts is planned to be finalised at the end of 2019. One absolute abundance estimate from a harbour porpoise survey in 2007 is available (although it should be treated with caution since the aerial survey was primarily designed for common minke whales and covered an unknown fraction of the area of distribution). Two relative abundance estimates from genetic close-kin analysis were also used in the assessment.

The SC agreed that there was a need for further evaluation of the use of close-kin genetic analysis for estimating abundance. Direct hunting of harbour porpoises is not widespread in Iceland but there is significant by-catch, particularly in cod gillnet and lumpfish fisheries. Efforts to reliably estimate the extent of this by-catch are ongoing and the SC emphasized the importance of this work.

The SC noted that the assessments made during the workshop for Icelandic harbour porpoises revealed some problems with the priors that produced a positively biased estimate of abundance and status relative to the absolute abundance estimate. A rerun of the population model (done during the HPWG, see 6.2.5) indicated that there is no specific cause for concern for harbour porpoises in Iceland. However, the SC emphasized that a new assessment is needed to provide management advice on sustainable removals. In this respect, Iceland noted the ongoing work mentioned above (9.11.2).

FAROE ISLANDS

Due to a lack of recent data, stock identity remained unclear. One genetic study indicated no separation from the larger North Atlantic population, but the workshop decided that the Faroes should be assessed as a separate area until more information is available. Biological parameters were presented. A dedicated harbour porpoise aerial abundance survey from 2010 was available but should be considered a minimum because it only covered the area inside the 300 meters depth contour, one strata was excluded due to poor coverage, and an unknown proportion was expected to be outside the survey area. Harbour porpoises are not protected in the Faroes but there is also no tradition to hunt them so the level of removals is likely low. By-catch is likely a rare event due to the absence of gillnet fisheries in shallow waters. There was not enough data available to perform population modeling at this time.

Discussion

The SC welcomed the organisation of this workshop (WS), which followed up on the NAMMCO initiative to organize the first international workshop on harbor porpoise in 1999. The WS was seen to have generated an impressive and comprehensive compilation of data. It was also recognised as providing a) a much sought after opportunity for harbour porpoise experts to meet, b) agreement on a revised delineation of management units based on current knowledge, and c) an overview of the state of the knowledge available for allowing robust assessments of the conservation status of harbour porpoise populations in the North Atlantic and adjacent waters. It also usefully highlighted knowledge gaps that needed to be addressed and provided an overview of the level of concerns for each management unit and therefore the level of urgency for filling the data gaps.

The SC strongly concurred with the WS participants that the WS did not generate a reliable assessment of harbor porpoise in the North Atlantic due to weak datasets. The SC also noted that there were technical problems with the assessment method used by the WS. The SC will continue using its own assessment

procedures for generating management advice for NAMMCO and has now completed the assessment of West Greenland (see below).

9.11.4 Harbour porpoise working group

The Chair of the Harbour Porpoise Working Group (HPWG), Mikkelsen reported from the meeting held on 19-22 March in Copenhagen. This meeting had the following Terms of Reference, to:

- conduct an assessment for West Greenland;
- review assessments for other areas performed during the 2018 Tromsø HP workshop;
- identify knowledge gaps and further research;
- assess impacts from non-hunting related anthropogenic stresses (pollution, climate change, noise etc).

The WG reviewed the information available on stock identity, biological parameters, abundance, and catch for harbour porpoises in West Greenland before performing an assessment and providing management advice. The WG also received information on the impacts of noise disturbance of harbour porpoises and concluded by making a range of recommendations for NAMMCO countries. The central information from the WG on each of these topics, together with the SC comments and conclusions, are presented below.

West Greenland Assessment

Stock identity

The SC noted with interest that the analysis based on genomic divergence and behavioural adaptation found a clear isolation of West Greenland porpoises from those in Iceland and Canada and that there was no evidence to indicate two distinct populations in East and West Greenland, or that the East Greenland population is linked to Iceland or Norway. The SC supported the WG recommendation that the genetically differentiated porpoises with site fidelity to West Greenland be recognised as a *sub-population*, and this be advanced within the IUCN.

Biological parameters

Life history parameters of harbour porpoises sampled from the hunt in West Greenland over two decades showed seasonal increase in mass, length, age, and proportion of mature animals for both males and females, suggesting that young females are the first to arrive in coastal areas of West Greenland in June-July, with mature animals around July–August. The reported age at sexual maturity appeared lower and pregnancy rates higher in West Greenland than other European areas. The SC agreed that this may be explained by the North Sea population being close to carrying capacity and that fluctuations in sea temperature may be linked to the observation that mature female porpoises from 2009 had an increased body condition compared to 1995 and 2014. The SC noted that harbour porpoises in West Greenland may be particularly sensitive to ecosystem level changes because the number of prey species may be limited and subject to more extreme fluctuations in productivity.

Abundance estimation

Abundance estimates were generated from two aerial surveys conducted by the Greenland Institute of Natural Resources in 2007 (West Greenland only) and 2015 (West and East Greenland). These estimates did not, however, include the porpoises not present in the strata at the time of the survey. Information from satellite tracking of 26 harbour porpoises in Greenland was therefore used to correct the estimate with the proportion of porpoises expected to be outside the survey strata. This gave fully corrected abundance estimates of 69,595 porpoises (cv=0.37; 95% CI: 34,689-139,624) for 2007 and 106,822 (cv=0.35, 95% CI: 55,149-206,909) for 2015. The SC **endorsed** these corrected estimates.

Catch numbers

The catch statistics in Greenland highlighted a discrepancy between catches reported in the official Piniarneq system and those reported by hunters during interviews, revealing both under- and non-reporting and a tendency for hunters to report less in Piniarneq. The SC agreed with the WG that it was therefore important to apply correction factors to the official reports and supported the way this had been done by the WG. This included the decision to divide the interview data into categories of under-reporting and non-reporting (with

an exclusion of anomalous hunters as outliers) and to include hunters reporting catches during interviews but 0 in the Piniarneq system in the non-reporting category. The SC also supported the approach of basing the correction factor on the proportion of catch numbers rather than the number of hunters and the correction of reported catches from 1993 onwards. Furthermore, the SC supported the decision to multiply the complete time series of landed catches by 1.103 to account for struck and lost and to add by-catch from 1965 to 1982 to obtain a time series of best estimates of total removals for use in the assessment. It also agreed that it was appropriate to handle West Greenland as a whole and not create correction factors particular to certain areas. On this basis, the SC deemed the total correction factor of 1.552 as appropriate.

Impacts from anthropogenic stressors

The SC noted that specific monitoring of the range of anthropogenic stressors is not currently being performed and that further research on life history parameters and dietary shifts from existing samples may be a relevant way to investigate these impacts further. However, it also agreed with the WG that although such stressors may be having an impact on an individual level, there was no indication of population level impacts. The SC agreed that the impact of the hunt in Greenland is stronger than any potential impacts from non-lethal stressors at current levels.

Population modelling & assessment

The assessment used two area corrected abundance estimates, a corrected estimate of catch history, and age structure data from four periods. The modelling showed a relatively stable population (see figure 3). The SC agreed with the WG that although some of the biological factors indicated by the model were surprising, there was no clear bias in the input data. There therefore agreed to accept the results of the assessment.

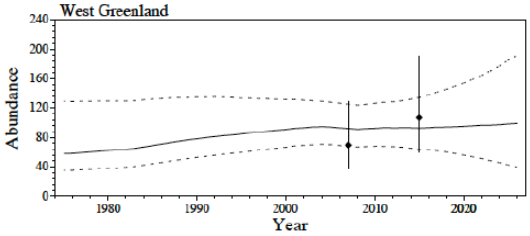

Fig. 3. The projection of West Greenland harbour porpoises from the agreed assessment. The solid curve is the median, the dotted lines the 90% credibility intervals, and the dots with bars the agreed abundance estimates (1000's) and their 90 % confidence interval.

Management advice and recommendations

The estimated annual total removal allowing for a 70% chance of population increase is 2,900 (see Table 5). After correction for struck and lost, this corresponds to a total landed catch of 2,629. With correction for underreporting, catch of only 1,869 harbour porpoises is expected to be reported from a total removal of 2,900 animals.

Table 5. Total removals vs probability of population increase

TR	2100	2200	2300	2400	2500	2600	2700	2800	2900
P	0.83	0.81	0.80	0.78	0.77	0.75	0.74	0.72	0.70

The SC agreed with the premises and priors used for the assessment and **endorsed** the **recommended** annual catch of no more than 2,629 harbour porpoises (corresponding to an expected reported catch of 1,869 animals).

Given that this assessment represents the first time the SC has generated management advice for harbour porpoises in West Greenland, the SC praised the work conducted to make the completion of the assessment possible and commended its timely performance.

The SC noted that the result of the West Greenland assessment again pointed out the importance of having reliable catch statistics and complete reporting of removals and therefore **strongly recommended** Greenland

work to eliminate underreporting and validate the catch statistics. The SC also drew attention to the fact that the average removal over the last 5 years is approximately 30% larger than the recommended maximum catch.

Recommendations from the HPWG endorsed by the SC

The SC **endorsed** the recommendations proposed by the HPWG (see box 1 below), with some modifications.

The SC supported the recommendation that surveys for harbour porpoises should be conducted in the different areas, but the SC did not see the need for coordinated sightings surveys for harbour porpoises. The SC particularly **recommended** that a survey be conducted off Iceland since the last survey (2007) is now 12 years old. Furthermore, the SC emphasised the importance of conducting an assessment for Norway and Iceland when the requested data becomes available and that the effort for obtaining these data be increased.

Iceland informed the SC that 2022 seemed to be a realistic year for conducting an assessment, as an accepted by-catch rate should be available by this time, as well as results from the current work on genetic analysis. Norway informed the SC that 2022 would also be a suitable year for performing an assessment, as an accepted by-catch estimate and abundance estimates for the larger fjord systems should be available. A new meeting of the harbour porpoise working group was therefore scheduled in the proposed work plan for 2022. The SC also noted that next NASS survey is planned for 2023, which will generate an abundance estimate of harbour porpoises in West Greenland, thus providing the opportunity to conduct a new harbour porpoise assessment and a new management advice for West Greenland within the time frame recommended by the HPWG.

Box 1: Recommendations from the HPWG endorsed by the SC

Research

- Each assessment area should provide samples to support the development of a multi-dimensional investigation into population structure and stock identity and allow for all existing datasets to be merged into a common analysis.

FAROE ISLANDS

- To allow an assessment to be conducted, work should be done to: a) obtain reliable removals data, b) update the abundance survey, and c) tag animals to gain a better idea of movements and seasonal occurrence.

GREENLAND

- The research necessary to identify a potential sub-species in West Greenland should be carried out. This may require as a minimum a combination of genetic analysis, morphometrics, and tracking data.
- A follow up study should be conducted to investigate how widespread the underreporting of catches in the official Piniarneq system in Greenland is.
- Hunters in East Greenland should be asked to provide samples to scientists when harbour porpoises are caught.

ICELAND

- By-catch estimates should be finalised and endorsed.
- Information on life history and various biological parameters should be updated.
- Tagging studies should be conducted to assist in the definition of stock identity

NORWAY

- By-catch estimates should be finalised and endorsed and this should include efforts to investigate the potential to extrapolate by-catch further back in time.
- The ongoing work to establish another abundance estimate that includes the fjord systems should be continued.
- Further information on harbour porpoise movements is required and therefore tagging and tracking studies should be conducted along the coastline to help answer questions about stock identity and consider if smaller management units are necessary.

Conservation & Management

GREENLAND

- A West Greenland sub-population should be recognised and this taken forward within the IUCN system.
- The assessment should be updated as soon as a new abundance estimate is available and no later than 2029.
- Catch statistics (in both East and West Greenland) should be validated.

ICELAND

- A formal assessment should be conducted following a full review of the available data, including the approach of using close-kinship genetic analysis to arrive at abundance estimates.

NORWAY

- A formal assessment with updated by-catch estimates should be conducted when new abundances estimates become available.
- The reference fleet should be expanded as part of an effort to obtain reliable by-catch estimates.

9.11.1 Review and status of active requests (R-3.10.1)

R-3.10.1 *(Renewed) The Council noted that the harbour porpoise is common to all NAMMCO member countries, and that the extent of current research activities and expertise in member countries and elsewhere across the North Atlantic would provide an excellent basis for undertaking a comprehensive assessment of the species throughout its range. The Council therefore requested the SC to perform such an assessment, which might include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals.*

The SC is progressing with this task and has now completed the assessment for West Greenland. It has also provided recommendations for the other areas regarding the data needed to conduct such assessments and given advice on how to obtain reliable information. Harbour porpoise assessments for Norway and Iceland are now tentatively scheduled for 2022, with final confirmation pending the availability of the necessary data.

R-3.10.1 *(Renewed) The Management Committee recommends that total removal estimates are made for all areas, and that abundance estimates from the 2007 survey in Iceland and the 2010 survey in the Faroe Islands are available before a WG meeting. (NAMMCO 19).*

The SC is progressing in assessing removals. The BYCWG will meet in spring with a particular focus on reviewing new/revised by-catch estimates of harbour porpoise from Iceland and Norway. The SC has also **recommended** that better reporting of harbour porpoise catch be implemented in Greenland, with effort dedicated to eliminating underreporting.

9.12 SPERM WHALE

9.12.1 AEWG 2019

The SC **endorsed** the abundance estimates produced by AEWG 2019.
Norway 2002-2007 cycle: 8,134 (CV=0.18, 95% CI: 5,695-11,617)
Norway 2008-2013 cycle: 3,962 (CV=0.29, 95% CI: 2,218 – 7,079)
Norway 2015: 3,828 (CV=0.33, 95% CI: 1,994-7,595)
Norway 2014-2018 cycle: 5,522 (CV=0.25, 95% CI: 3,325-9,170)

9.12.2 Updates

No updates were provided

9.12.3 Review and status of active requests (none)

9.13 BOWHEAD WHALE

9.13.1 AEWG 2019

There were no new estimates were produced by AEWG 2019.

9.13.2 Updates

No updates were presented during the meeting.

9.13.3 Review and status of active requests (none)

9.14 BLUE WHALE

9.14.1 AEWG 2019

The SC welcomed and **endorsed** the new abundance estimate from AEWG 2019.

Iceland/Faroes 2015: 3,000 (CV=0.4, 95% CI: 1,377-6,534)

9.14.2 Updates

No new updates were presented.

9.14.3 Review and status of active requests (none)

10. SURVEYS

10.1 NEXT NASS PLANNING

At NAMMCO 27, Council noted that it expected the SC to provide input and recommendations regarding the scope and focus for the next cetacean sightings survey

The SC agreed that the target species for this survey would be the same as in previous surveys – i.e. fin, minke and pilot whales.

Iceland noted that there needs to be a request for funding for such a survey three years in advance of when the survey will be carried out. This may not require a particularly detailed description, but an overview would be required. The SC agreed to advance with the planning of the next NASS via correspondence between those nominated to the planning group, with a virtual meeting held if necessary.

11. FUTURE WORK PLANS

11.1 SCIENTIFIC COMMITTEE 2020 MEETING

The SC has had a tradition in recent years to meet in the last week of October/first week of November. However, given the discussion on workflow (see agenda item 5.6), it was noted that it was also a possibility to hold the next meeting in the spring. The SC agreed to hold the 2020 meeting in the autumn until a decision on the timing has been made by Council. According to the established rotation, it is Greenland's turn to host the 27th meeting. The exact location and timing for the meeting will therefore be decided by Greenland.

11.2 PROPOSED WORK PLAN

2019 (COMPLETED)	2020	2021	2022
Working Groups: - Harbour porpoise - ICES/NAFO/NAMMCO on Harp and Hooded Seals - Narwhal in East Greenland - Abundance Estimates	**Working Groups:** - By-catch - Coastal Seals - NAMMCO/JCNB JWG on Narwhal and Beluga (Planning meeting for next NASS via correspondence) **Workshops:** - Model development for assessment of seals (collaboration with ICES) - North Atlantic humpback whale tagging workshop/collaboration	**Working Groups:** - Pilot Whale - Narwhal in East Greenland (spring) - Abundance Estimates (for killer whales)	**Working Groups:** - Bearded Seal - Ringed Seal - Harbour Porpoise

12. EXPENSES 2019 & BUDGET 2020-21

The SC agreed that the total budget proposed for 2020 by SC/25 remained applicable.

However, there would need to be some reallocations of funding to reflect the revised work plan. This included funding being allocated to the planned workshop on model development for seal assessments, which is

possible given that the planned workshop on climate impacts is now proposed to be addressed as an agenda item within the NAMMCO-JCNB JWG meeting. A reallocation of some funding from the pilot whale working group (now scheduled for 2021) for the JCNB-NAMMCO JWG was requested to ensure that a sufficient range of external expertise can be invited to this meeting (including to review the abundance estimate for narwhal in East Greenland). The coastal seal working group also requested additional funding from the reallocation to allow an invitation to be extended to an expert working on population modelling from St. Andrews. The final reallocation of funding was to support the travel of the NEGWG Chair to attend the Council meeting to present the report.

13. ANY OTHER BUSINESS

Witting noted that there were a range of items (e.g. under agenda point 5) that involve issues involving communications between the SC and the Secretariat and do not necessarily need to be communicated to the Council. There was therefore a proposal that the agenda for and report of future meetings could be split into an administrative component and a scientific component. This would also help prioritise the handling and reporting of these two different types of information within the meeting schedule. The SC particularly agreed that agenda items 5 & 6 should be taken later in the agenda/meeting than is currently the norm. The SC agreed that this approach should be implemented for SC/27 in 2020.

14. MEETING CLOSURE

The SC expressed its appreciation for the hard work of the rapporteur, as well as the general support provided by the Secretariat. It also thanked the Chairman for the excellent arrangements for the meeting and steering the group through a long and complicated agenda. The meeting was closed at 17:50 on Friday November 1st 2019.

15. ACCEPTANCE OF REPORT

A draft of the report was accepted at the close of the meeting on November 1st 2019. A new version was circulated to the SC following a period of editing and formatting by the Scientific Secretary and following the integration of feedback on this version, the final report was accepted on Friday 15th 2019.

REFERENCES

Ahonen, H., Stafford, K. M., Lydersen, C., de Steur, L., & Kovacs, K. M. (2019). A multi-year study of narwhal occurrence in the western Fram Strait—detected via passive acoustic monitoring. *Polar Research 38*: 3468. doi:10.33265/polar.v38.3468

Desforges, JP., Hall, A., McConnell, B., Asvid, A. R., Barber, J. L., Brownlow, A., Guise, S. D., Eulaers, I., Jepson, P. D., Letcher, R. J., Levin, M., Ross, P. S., Sonne, C., & Dietz, R. (2019). Response to L. Witting: PCBs still a major risk for global killer whale population. *Marine Mammal Science, 35,* 1201-1206. doi:10.1111/mms.12615

Granquist, S. & Hauksson, E. (2019a): Aerial census of the Icelandic grey seal (Halichoerus grypus) population in 2017: Pup production, population estimate, trends and current status HV 2019-08 https://www.hafogvatn.is/static/research/files/1549015805-hv2019-02.pdf

Granquist, S. & Hauksson, E. (2019b). Population estimate, trends and current status of the Icelandic harbour seal (Phoca vitulina) population in 2018 / Landselstalning 2018: Stofnstærðarmat, sveiflur og ástand stofns https://www.hafogvatn.is/static/files/hv2019-36.pdf

Hamilton, C. D., Kovacs, K. M., & Lydersen, C. (2019). Sympatric seals use different habitats in an Arctic glacial fjord. *Marine Ecology Progress Series*, *615*, 205-220. doi:10.3354/meps12917

Hamilton, C. D., Lydersen, C., Fedak, M. A., Freitas, C., Hindell, M. A., & Kovacs, K. M. (2019b). Behavioural ontogeny of bearded seals Erignathus barbatus through the first year of life. *Marine Ecology Progress Series*, *627*, 179-194. doi:10.3354/meps13072

Hamilton C.D., Vacquie´-Garcia J., Kovacs, K.M., Ims R.A., Kohler J., Lydersen C. (2019). Contrasting changes in space use induced by climate change in two Arctic marine mammal species. *Biology Letters. 15*: 20180834. doi.org/10.1098/rsbl.2018.0834

Hamilton, C. D., Kovacs, K. M., & Lydersen, C. (2018). Individual variability in diving, movement and activity patterns of adult bearded seals in Svalbard, Norway. *Scientific reports*, *8(1)*, 16988. doi:10.1038/s41598-018-35306-6

Hansen, R.G., & Heide-Jørgensen, M.P. (2017). Abundance of narwhals at the hunting areas in East Greenland in 2008 and 2016. *Working Paper NAMMCO-JCNB/SWG/2017-JWG/18.*

Hansen, R.G., Borchers, D.L. & Heide-Jørgensen, M.P. (2019). Abundance of narwhals summering in East Greenland and narwhals wintering in the North Water and Northeast Water polynas. *Working Paper NAMMCO/SC/26/NEGWG/05*.

Hansen, R.G., & Heide-Jørgensen, M.P. (2019). Re-calculations of abundance of narwhals to three management units in east Greenland. *Working Paper NAMMCO/SC/26/NEGWG/20*

Heide-Jørgensen, M.P. (2019). Abundance of narwhals in Scoresby Sound in 1983 and 1984. *Working Paper NAMMCO/SC/26/NEGWG/06*.

ICES 2019. ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHAP). ICES Scientific Reports. 1:ISS NO. 72.

https://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/Fisheries%20Resources%20Steering%20Group/2019/WGHARP/WGHARP%202019.pdf

Jourdain, E., Ugarte, F., Víkingsson, G. A., Samarra, F. I., Ferguson, S. H., Lawson, J., Vongraven, D., & Desportes, G. (2019). North Atlantic killer whale Orcinus orca populations: a review of current knowledge and threats to conservation. *Mammal Review*. doi:10.1111/mam.12168.

Kovacs, K.M., Krafft, B.A., Lydersen, C. (2019). Bearded seal (*Erignathus* barbatus) birth mass and pup growth in periods with contrasting ice conditions in Svalbard, Norway. *Marine Mammal Science. 1-9*. doi:10.1111/mms.12647.

Moore, S.E., Haug, T., Vikingsson, G.A. and Stenson, G.B. (2019). Baleen whale ecology in arctic and subarctic seas in an era of rapid habitat alteration. *Progress in Oceanography 176*: 102118. 15 pp. doi:10.1016/j.pocean.2019.05.010.

OSPAR. (2019). Draft nomination proforma for a "North Atlantic Current and Evlanov Seamount" MPA in the OSPAR Maritime Area.

https://www.ospar.org/site/assets/files/38964/ospar_naces_mpa_nomination_proforma_with_annexes_version_for_views.pdf

Witting, L. (2019). Rebuttal against Desforges et al. (2018): No evidence for a global killer whale population collapse. *Marine Mammal Science, 35(3)*, 1197-1200. doi:10.1111/mms.12599.

26TH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE

October 29 – November 1 2019, Tórshavn Faroe Islands

AGENDA

1. **Welcome from the Chair and Opening Remarks**
2. **Adoption of Agenda**
3. **Appointment of Rapporteurs**
4. **Review of Available Documents and Reports**
   - 4.1. National progress reports
     - 4.1.1. Updates from observers - Japan
   - 4.2. Working Group (WG) reports
   - 4.3. Other reports and documents
     - 4.3.1. List of active council requests
5. **Work Procedures in the SC**
   - 5.1. Updates from Council NAMMCO/27
     - 5.1.1. General comments
     - 5.1.2. New requests
     - 5.1.3. Time horizon for requests from Council
     - 5.1.4. Endorsed SC Work Plan
   - 5.2. Population Estimates
     - 5.2.1. Review of NAMMCO abundance and stock status tables
     - 5.2.2. Review of the assessment / conservation status tables
   - 5.3. Catches
     - 5.3.1. Struck and lost
     - 5.3.2. Catch database
     - 5.3.3. Removals and strandings database
     - 5.3.4. Review and status of active requests (R-1.6.4, R-1.6.5)
   - 5.4. Furthering cooperation in the SC
     - 5.4.1. Supertag project
     - 5.4.2. Presentation from SC member
   - 5.5. NAMMCO scientific publications
     - 5.5.1. Plan S & Database for open research
     - 5.5.2. Statement on author contributions
   - 5.6. Workflow
   - 5.7. Development of management advice (R-1.6.6)
   - 5.8. Response to performance review
6. **Interactions with other organisations**
   - 6.1. IWC
   - 6.2. ASCOBANS
   - 6.3. ICES
   - 6.4. JCNB
   - 6.5. Arctic Council & Subsidiary bodies
   - 6.6. FAO
   - 6.7. other
7. **Environmental/Ecosystem issues**
   - 7.1. Marine mammal / fisheries interactions
     - 7.1.1. Consumption of resources by marine mammals
     - 7.1.2. By-catch
     - 7.1.3. Review and status of active requests (R-1.1.5, R-1.1.8)
   - 7.2. Multi-species approaches to management & modelling
     - 7.2.1. Review and status of active requests (R-1.2.1, R-1.2.2)
   - 7.3. Other environmental issues
     - 7.3.1. Review and status of active requests (R-1.5.3, R-1.5.4)

8. Seals & walrus stocks – status and advice to the council

- 8.1. Harp seal
  - 8.1.1. Updates
  - 8.1.2. Joint ICES/NAFO/NAMMCO WGHARP 2019
  - 8.1.3. Review and status of active requests (R-2.1.4, R-2.1.10rev)
- 8.2. Hooded seal
  - 8.2.1. Updates
  - 8.2.2. Joint ICES/NAFO/NAMMCO WGHARP 2019
  - 8.2.3. Review and status of active requests (R-2.1.4, R-2.1.9)
- 8.3. Ringed seal
  - 8.3.1. Updates
  - 8.3.2. Ringed seal WG (2021)
  - 8.3.3. Review and status of active requests (R-2.3.1, R-2.3.2)
- 8.4. Grey seal
  - 8.4.1. Updates
  - 8.4.2. Coastal Seals WG (2020)
  - 8.4.3. Review and status of active requests (R-2.4.2)
- 8.5. Harbour seal
  - 8.5.1. Updates
  - 8.5.2. Coastal Seals WG (2020)
  - 8.5.3. Review and status of active requests (R-2.5.2)
- 8.6. Bearded seal
  - 8.6.1. Updates
  - 8.6.2. Bearded Seal WG (2021)
  - 8.6.3. Review and status of active requests (none)
- 8.7. Walrus
  - 8.7.1. Updates
  - 8.7.2. Review and status of active requests (R-2.6.3rev, R2.6.8 NEW REQUEST, R-3.4.9)

9. Cetacean stocks – status & advice to council

- 9.0. AEWG 2019
  - 9.0.1. Status of analysis
  - 9.0.2. Status of joint analysis
  - 9.0.3. Review and status of active requests (R-1.7.11)
- 9.1. Fin whale
  - 9.1.1. AEWG 2019
  - 9.1.2. Updates
  - 9.1.3. Review and status of active requests (R-1.7.11, R-1.7.12)
  - 9.1.4. Future work
- 9.2. Humpback whale
  - 9.2.1. AEWG 2019
  - 9.2.2. Updates
  - 9.2.3. Review and status of active requests (R-1.7.12, R-3.2.4)
  - 9.2.4. Future work
- 9.3. Common minke whale
  - 9.3.1. AEWG 2019
  - 9.3.2. Updates
  - 9.3.3. Review and status of active requests (R-1.7.11, R-1.7.12)
  - 9.3.4. Future work
- 9.4. Beluga
  - 9.4.1. Updates
  - 9.4.2. Review and status of active requests (R-3.4.9, R-3.4.11)
  - 9.4.3. Future work
- 9.5. Narwhal
  - 9.5.1. Updates
  - 9.5.2. Ad hoc Working Group on Narwhal in East Greenland
  - 9.5.3. Review and status of active requests (R-3.4.9, R3.4.11)
  - 9.5.4. Future work

- 9.6. Sei whale
  - 9.6.1. AEWG 2019
  - 9.6.2. Updates
  - 9.6.3. Review and status of active requests (R-3.5.3 amended, R-1.7.12)
  - 9.6.4. Future work
- 9.7. Bottlenose whale
  - 9.7.1. AEWG 2019
  - 9.7.2. Updates
  - 9.7.3. Review and status of active requests (None)
  - 9.7.4. Future work
- 9.8. Killer whale
  - 9.8.1. AEWG 2019
  - 9.8.2. Updates
  - 9.8.3. Review and status of active requests (none)
  - 9.8.4. Future work
- 9.9. Pilot whale
  - 9.9.1. AEWG 2019
  - 9.9.2. Updates
  - 9.9.3. Review and status of active requests (R-1.7.11, R-3.8.6)
  - 9.9.4. Future work
- 9.10. Dolphins
  - 9.10.1. AEWG 2019
  - 9.10.2. Updates
  - 9.10.3. Review and status of active requests (R-3.9.6)
  - 9.10.4. Future work
- 9.11. Harbour porpoise
  - 9.11.1. AEWG 2019
  - 9.11.2. Updates
  - 9.11.3. Harbour Porpoise Workshop
  - 9.11.4. Harbour Porpoise Working Group
  - 9.11.5. Review and status of active requests (R-3.10.1)
  - 9.11.6. Future work
- 9.12. Sperm whale
  - 9.12.1. AEWG 2019
  - 9.12.2. Updates
  - 9.12.3. Review and status of active requests (None)
  - 9.12.4. Future work
- 9.13. Bowhead whale
  - 9.13.1. Updates
  - 9.13.2. Review and status of active requests (None)
  - 9.13.3. Future work
- 9.14. Blue whale
  - 9.14.1. AEWG 2019
  - 9.14.2. Updates
  - 9.14.3. Review and status of active requests (R-1.7.12)
  - 9.14.4. Future work

10. Surveys

- 10.1. Next NASS planning

11. NAMMCO scientific publications

- 11.1. Volume 11 update
- 11.2. Volume 12

12. Future work plans

- 12.1. Scientific committee 2020 meeting
- 12.2. Proposed work plan

13. Expenses 2019 & budget 2020-21

14. Any other business

26TH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE

October 29 – November 1 2019, Tórshavn Faroe Islands

LIST OF PARTICIPANTS

Geneviève Desportes (NAMMCO Secretariat)
General Secretary
PO Box 6453
9294 Tromsø, Norway
genevieve@nammco.no

Þorvaldur Gunnlaugsson (IS)
Marine and Freshwater Research Institute
PO Box 1390,
IS-121 Reykjavík, Iceland
thg@havogvatn.is

Sabine Hansen (NAMMCO Secretariat)
Intern
PO Box 6453
9294 Tromsø, Norway
intern@nammco.no

Tore Haug (NO)
Institute of Marine Research
Fram Centre
PO Box 6606
9296 Tromsø, Norway
tore.haug@hi.no

Mads Peter Heide-Jørgensen (GL)
Greenland Institute of Natural Resources
c/o Greenland Representation
Strandgade 91, 2
DK-1401 Copenhagen K, Denmark
mhj@ghsdk.dk

Tatsuya Isoda (JP)
Institute of Cetacean Research
Toyomi-cho 4-5, Chuo-ku,
Tokyo 104-0055, Japan
isoda@cetacean.jp

Christian Lydersen (NO)
Norwegian Polar Institute
Fram Centre, P.O. Box 6606
9296 Tromsø, Norway
christian.lydersen@npolar.no

Bjarni Mikkelsen (Chair of SC, FO)
Natural History Museum
V. U. Hammersheimbsgøta 20
FO-100 Tórshavn, Faroe Islands
bjarnim@savn.fo

Kjell Tormod Nilssen (NO)
Institute of Marine Research
PO Box 6404
N-9294 Tromsø, Norway
kjell.tormod.nilssen@hi.no

Luis Pastene (JP)
Institute of Cetacean Research
Toyomi-cho 4-5, Chuo-ku,
Tokyo 104-0055, Japan
pastene@cetacean.jp

Aqqalu Rosing-Asvid (Vice Chair of SC GL)
Greenland Institute of Natural Resources
PO Box 570,
DK-3900 Nuuk, Greenland
aqro@natur.gl

Mioko Taguchi (JP)
Institute of Cetacean Research
Toyomi-cho 4-5, Chuo-ku,
Tokyo 104-0055, Japan
taguchi@cetacean.jp

Gísli Víkingsson (IS)
Marine and Freshwater Research Institute
PO Box 1390
IS-121 Reykjavik, Iceland
gisli.vikingsson@hafogvatn.is

Fern Wickson (NAMMCO Secretariat)
Scientific Secretary
PO Box 6453
9294 Tromsø, Norway
fern@nammco.org

Lars Witting (GL)
Greenland Institute of Natural Resources
PO Box 570,
DK-3900 Nuuk, Greenland
larsw@natur.gl

Nils Øien (NO)
Institute of Marine Research
PO Box 1870
Nordnes
5817 Bergen, Norway
nils.oien@hi.no

Rikke Guldborg Hansen (GL)
Greenland Institute of Natural Resources
c/o Greenland Representation
Strandgade 91, 2,
DK-1401 København K, Denmark
rikkeguldborg@gmail.com

26TH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE

October 29 – November 1 2019, Tórshavn Faroe Islands, Location

LIST OF DOCUMENTS

Working Documents

Doc. No.	Title	Agenda item
SC/26/01a	Draft Agenda	2
SC/26/01b	Draft Agenda Annotated	2
SC/26/02	Draft List of Participants	1
SC/26/03	Draft List of Documents	4
SC/26/NPR-FO	National Progress Report 2018 – Faroe Islands	4.1
SC/26/NPR-GL	National Progress Report 2018 – Greenland	4.1
SC/26/NPR-IS	National Progress Report 2018 – Iceland	4.1
SC/26/NPR-NO	National Progress Report 2018 – Norway	4.1
SC/26/NPR-JP	National Progress Report 2018 – Japan *a. Small Cetaceans* *b. Large Cetaceans* *c. Outline of a research program to investigate the abundance, abundance trends and stock structure of large whales in the Indo-Pacific region of the Antarctic, including a survey plan for the 2019/20 austral summer season*	4.1
SC/26/NPR-RU	National Progress Report 2018 – Russian Federation	4.1
SC/26/NPR-CA	National Progress Report 2018 - Canada	4.1
SC/26/PR-MK	National Progress Report 2018 - Makivik	4.1.3
SC/26/04	Active Requests to SC from Council	Several
SC/26/05	Table Abundance & Trends	5.2
SC/26/06	Development of management advice in NAMMCO	5.7
SC/26/07	Performance Review Recommendations for SC	5.8
SC/26/08	Summary of Performance Review Requests for SC	5.8
SC/26/09	Report of the Harbour Porpoise Working Group	4.2, 9.11.4
SC/26/10	Report of the Joint ICES/NAFO/NAMMCO Working Group on Harp & Hooded Seals	4.2, 8.1.2, 8.2.2
SC/26/11	Report of the Adhoc Working Group on Narwhal in East Greenland	4.2, 9.5.2
SC/26/12	Report of the Abundance Estimates Working Group	4.2, 9.0
SC/26/13	Report of the Harbour Porpoise Workshop	9.11.3
SC/26/14	Populations, Stocks, and Management Units	5.2
SC/26/15	IWC: Small Cetaceans Abundance Estimates Tables	6.1
SC/26/16	IWC: North Atlantic Abundance Estimates Table	6.1
SC/26/17	IWC: Notes on Abundance Estimates Table	6.1
SC/26/18	FAO Expert Meeting to Develop Technical Guidelines to Reduce Bycatch	6.6, 7.1.2
SC/26/19	Note on OSPAR, NACES, and MPA	5.8
SC/26/20	Status Management Areas	5.2.2
SC/26/21	Scientific Committee accounts and budget for Scientific Committee meeting	13

For Information Documents

Doc. No.	Title	Agenda item
SC/26/FI01	Report of SC 25 (2018)	Several
SC/26/FI02	Annual Report 2018	Several
SC/26/FI03	NAMMCO 27 Report of Council	Several
SC/26/FI04	NAMMCO 27 Report of Management Committees (MCJ + MCC + MCSW)	Several
SC/26/FI05	Moore, S.E., Haug, T. Vikingsson, G.A. and Stenson, G.B. (2019). Baleen whale ecology in arctic and subarctic seas in an era of rapid habitat alteration. *Progress in Oceanography 176:* 102118	7.3
SC/26/FI06	Kovacs, K.M., Krafft, B.A., Lydersen, C. (2019) Bearded seal (*Erignathus* barbatus) birth mass and pup growth in periods with contrasting ice conditions in Svalbard, Norway. *Marine Mammal Science.* 1-9	8.6
SC/26/FI07	Hamilton C.D., Vacquie´-Garcia J., Kovacs, K.M., Ims R.A., Kohler J., Lydersen C. (2019). Contrasting changes in space use induced by climate change in two Arctic marine mammal species. *Biology Letters.* 15: 20180834.	8.3, 9.4
SC/26/FI08	Hamilton, C. D., Kovacs, K. M., & Lydersen, C. (2019). Sympatric seals use different habitats in an Arctic glacial fjord. *Marine Ecology Progress Series*, *615*, 205-220.	8.3, 8.6
SC/26/FI09	Hamilton, C. D., Lydersen, C., Fedak, M. A., Freitas, C., Hindell, M. A., & Kovacs, K. M. (2019). Behavioural ontogeny of bearded seals Erignathus barbatus through the first year of life. *Marine Ecology Progress Series*, *627*, 179-194.	8.6
SC/26/FI10	Hamilton, C. D., Kovacs, K. M., & Lydersen, C. (2018). Individual variability in diving, movement and activity patterns of adult bearded seals in Svalbard, Norway. *Scientific reports*, *8*(1), 16988.	8.6
SC/26/FI11	Ahonen, H., Stafford, K. M., Lydersen, C., de Steur, L., & Kovacs, K. M. (2019). A multi-year study of narwhal occurrence in the western Fram Strait—detected via passive acoustic monitoring. *Polar Research 38*: 3468	9.5
SC/26/FI12	Jourdain, E., Ugarte, F., Víkingsson, G. A., Samarra, F. I., Ferguson, S. H., Lawson, J., ... & Desportes, G. (2019). North Atlantic killer whale Orcinus orca populations: a review of current knowledge and threats to conservation. *Mammal Review*.	9.8
SC/26/FI13	Desforges, JP., Hall, A., McConnell, B., Asvid, A. R., Barber, J. L., Brownlow, A., … & Dietz, R. (2019). Response to L. Witting: PCBs still a major risk for global killer whale population. *Marine Mammal Science, 35,* 1201-1206	9.8.2
SC/26/FI14	Witting, L. (2019). Rebuttal against Desforges et al. (2018): No evidence for a global killer whale population collapse. *Marine Mammal Science, 35*(3), 1197-1200.	9.8.2
SC/26/FI15	Outcome of the OSPAR-HELCOM workshop to examine possibilities for developing indicators for incidental by-catch of birds and marine mammals.	7.1.2
SC/26/FI16	Status Update Scientific Publications Vol.11	5.5
SC/26/FI17	Report from Performance Review Panel	5.8
SC/26/FI18	Draft OSPAR, NACES, and MPA Nomination Proforma Post	6.8
SC/26/FI19	Review Group Report on WGHARP	8.1.2, 8.2.2
SC/26/FI20	Tracking Recommendations and Implementation within NAMMCO	5.8

Management Areas / Sub-Areas of Direct Relevance to NAMMCO

Species	Regions	Management areas / sub-areas of direct relevance to NAMMCO (Blue = Unit shared between NAMMCO and non-NAMMCO countries)
Common minke whale	Western Atlantic (W)	West Greenland (WG)
	Central Atlantic (C)	East Greenland (CG)
		Iceland Pelagic (CIP)
		Icelandic Coastal (CIC)
		Western (CM)
	North East Atlantic (E)	Svalbard-Bear Island West (ES)
		Eastern Barents Sea (EB)
		Eastern Norwegian Sea (EW)
		North Sea (EN)
Fin whale	West	West Greenland (WG)
	Central	East Greenland Coastal (EGC)
		East Greenland Offshore - West Iceland (EGO + WI)
		East Iceland & Faroes (EI+F)
	East	Norwegian and Barents Seas (N+W)
Humpback whale	North Atlantic	West Greenland
		East Greenland coastal
		Iceland/Faroes
		Norwegian and Barents Seas
Sei whale	North Atlantic	West Greenland
		Iceland-Denmark Strait
		Eastern Atlantic
Blue whale	North Atlantic	Western North Atlantic
		Eastern North Atlantic
Bowhead whale	Arctic	Baffin Bay - Davis Strait
		Spitsbergen

Management Areas / Sub-Areas of Direct Relevance to NAMMCO (continued)

Species	Regions	Management areas / sub-areas of direct relevance to NAMMCO (Blue = Unit shared between NAMMCO and non-NAMMCO countries)
Sperm whale	North Atlantic	North Atlantic
Long-finned pilot whale	North Atlantic	West Greenland
		East Greenland
		Iceland - Faroe Islands
		Norway
Bottlenose whale	North Atlantic	North East Atlantic
Killer whale	North Atlantic	West Greenland
		Central and North East Atlantic (possibly 2 units: East Greeenland - Iceland - Faroe Islands - Scotland & Norway)
Narwhal	Baffin Bay	Smith Sound
		Jones Sound
		Inglefield Bredning
		Melville Bay
		East Baffin Island
		Eclipse Sound
		Admiralty Inlet
		Somerset Island
	East Greenland	Northeast Greenland
		Scoresby Sund
		Kangerlussuaq
		Tasiilaq
	Svalbard	Svalbard

Management Areas / Sub-Areas of Direct Relevance to NAMMCO (continued)

Species	Regions	Management areas / sub-areas of direct relevance to NAMMCO (Blue = Unit shared between NAMMCO and non-NAMMCO countries)
Beluga	Eastern High Arctic - Baffin Bay	North water + West Greenland
	Svalbard	Svalbard
Harbour porpoise	North East Atlantic	Greenland
		Iceland
		Faroes
		Barents Sea-Lofoten
		Coastal Lofoten-62N
		North Sea
White sided dolphin	North Atlantic	Greenland
		Iceland - Faroe Islands
		Norway
White beaked dolphin	North Atlantic	Greenland
		Iceland - Faroe Islands
		Norway
Bottlenose dolphin	North East Atlantic	Faroes

Management Areas / Sub-Areas of Direct Relevance to NAMMCO (continued)

Species	Regions	Management areas / sub-areas of direct relevance to NAMMCO (Blue = Unit shared between NAMMCO and non-NAMMCO countries)
Atlantic walrus	Arctic	Baffin Bay (BB)
		West Greenland-Southeast Baffin Bay (WGSBI)
		East Greenland
		Svalbard - Franz Josef Land
Harbour seals	North Atlantic coastal	GL / South-Southeast
		GL / Sioraq (Frederikshåb Isblink)
		GL / Kangerlussuaq
		GL / Probably more
		Iceland
		NO / Finnmark
		NO / Troms
		NO / Nordland
		NO / Nord Trondelag
		NO / Sør Trondelag
		NO / Møre og Romsdal
		NO / Sogn og Fjordane
		NO / Hordaland & Rogaland
		NO / Vestfold & Telemark
		NO / Østfold
		Svalbard
Grey seals	North East Atlantic coastal	Greenland (visited by strays)
		Iceland
		Faroe Islands
		NO / Finnmark – Lofoten
		NO / Lofoten – Stad
		NO / Stad – Rogaland
Harp seals	North Atlantic	Northwest Atlantic
		Greenland Sea
		White Sea/Barents Sea

Management Areas / Sub-Areas of Direct Relevance to NAMMCO (continued)

Species	Regions	Management areas / sub-areas of direct relevance to NAMMCO (Blue = Unit shared between NAMMCO and non-NAMMCO countries)
Hooded seals	North Atlantic	Northwest Atlantic
		Greenland Sea
Ringed seals	Arctic	Labrador - Baffin Bay - West Greenland
		East and South west Greenland
		Svalbard
		Barents and Kara Sea from East Svalbard
Bearded seals	Arctic	West Greenland (Northwater, Baffin Bay, Davis Strait) (probably more than one population).
		East and South Greenland
		Svalbard & Barents Sea

RESPONSE OF THE NAMMCO SCIENTIFIC COMMITTEE TO THE PERFORMANCE REVIEW

BACKGROUND

At their 27th meeting, the NAMMCO Council established an *ad hoc* Working Group to review and follow up on the recommendations introduced by the Performance Review (PRWG). The PRWG requested that all NAMMCO committees consider the recommendations and issues forwarded to them by the PRWG and provide a written response. The PRWG requested that the committees specifically:

a) Consider the relevance of the recommendations.
b) Identify any other related matters for which they may have suggestions for improvements to their work and working procedures,
c) Propose ways for implementing the recommendations and improving processes, where relevant.

The PRWG noted that the considerations and recommendations of the committees should be clearly and thoroughly substantiated and consider five general priorities:

1) High data quality and reliability
2) Follow up process on the advice provided by the committees
3) Transparency
4) Precautionary approach
5) Communication

Three documents were provided in advance of the 26th meeting of the Scientific Committee (SC/26) to inform the development of the committee's response to the performance review and the request from the PRWG. These were the full text of the performance review report (SC/26/FI17), the request from the PRWG containing the list and full text of the recommendations relevant to the SC (SC/26/07), and a brief summary containing just the recommendations for the SC synthesised and extracted from detailed context descriptions (SC/26/08).

During the SC/26 meeting, the Secretariat facilitated an interactive process to help the SC identify which recommendations they deemed to be most relevant and to propose possible ways that the relevant recommendations could be implemented to improve their working processes. The results of this interactive exercise and discussion are presented in the following section.

It should be noted that some of the numbers used by the performance review panel (PRP) to structure and refer to their recommendations actually contained text presenting several recommendations. For example, the text under PRP18-RC5 included a recommendation to develop a systematic procedure for assessing stocks and species, together with a recommendation to develop the ability to transparently track actions on committee recommendations, and to implement research recommendations from the GROM. In cases such as this, the SC was presented with the recommendations as individual items and asked to assess their relevance for the SC. This means that the SC had the possibility to highlight some aspects as relevant but not all. Furthermore, in cases where there was overlap in the content of the recommendations being made across different numbers, these were summarised and synthesised for the SC as one recommendation (in SC/26/08), but with both reference numbers included. In the text below, the synthesised and summarised statements on the recommendations that were presented to the SC are used with the hope that this helps provide a document with clear and concise text. However, the associated reference numbers are also always provided and these can be used to refer back to the full text from the performance review panel if additional context and explanation for the recommendations is required.

RELEVANT RECOMMENDATIONS & PROPOSALS FOR IMPLEMENTATION

Based on the process used to review and discuss the recommendations from the PRP at SC/26, the recommendations have been classified into the following categories: 1) Relevant and prioritised recommendations; 2) Relevant recommendations but not of high priority; 3) Relevant recommendations already being implemented. For those recommendations that were not highlighted by the SC as particularly relevant for their work, the following categories have also been used: 4) Additional recommendations already being addressed to some degree, and 5) Recommendations extending beyond the scope of the SC.

The recommendations in each of these categories and the proposals for implementation (where appropriate) are presented below.

1. Relevant and Prioritised Recommendations

PRP18_RC10: Include impacts from other anthropogenic activities beyond hunting

This is a recommendation of high relevance for ensuring a data quality and a precautionary approach to management. The SC noted that good work is already being done to implement this recommendation through the current requirement that working groups (WGs) include other anthropogenic impacts on their agendas. It was also noted that the cumulative impact of all anthropogenic activities are captured in the parameters used in the current population models. It was, however, also acknowledged that there were ways to further improve the work being done on this topic.

Proposals for implementation & improvement:

- Place more weight and emphasis on the topics of pollution and climate change in the work of the WGs.
- Enhance collaboration with those working on the Arctic Monitoring and Assessment Program (AMAP) of the Arctic Council as a way to enhance the knowledge on pollution within NAMMCO, for example by inviting experts working on this program to present findings of relevance to the WGs or SC.
- Prioritise and fund the collection of life history data to support a good time series for species of relevance to NAMMCO.
- Revise the SC agenda so that every item does not need to be covered every year. This would allow more time and attention to be dedicated to topics such as other anthropogenic impacts as appropriate.

PRP18_RC26: Investigate structured cooperation with the IWC SC & develop a robust use of external expertise

This is a recommendation of high relevance for ensuring high data quality and reliability as well as a good way to enhance transparency and communication. This recommendation was one that the SC felt that they were already working to implement (e.g. through the established cooperation with the IWC Abundance Estimate Working Group and the existing practice of inviting external experts to participate in WG meetings). However, it was also recognised that further improvements were still possible.

Proposals for implementation & improvement:

- In addition to inviting external experts to participate in WG meetings, invitations could also be extended to relevant external experts to participate in the meetings of the SC. This could include members of the IWC SC.
- Invitations to external experts need to be sent out in a timely fashion to enhance the possibility that they are able to attend.

- Additional funding be made available to allow a wider range of external experts to be invited to attend NAMMCO meetings.

PRP18_31: Consider developing stock specific reference points and management actions that will be taken if these reference points are exceeded

This is a relevant recommendation for advancing a precautionary approach to management and can also assist in providing grounds for clear and transparent communication regarding advice. This was a recommendation that the SC was motivated to work on in the near term. Such reference points were noted as available and in use for some species (e.g. harp and hooded seals), while there were additional species for which stock specific reference points could also be useful, including narwhal and walrus.

Proposals for implementation & improvement:

- Review the stock specific reference points and advice rules used by other organisations.
- Obtain clear management objectives for the different species and stocks.
- Implement a case by case approach to articulating stock specific reference points and advice rules and in the beginning focus on doing this work for species with small stocks.
- Ask all WGs to consider articulating possible reference points of relevance.
- Consider holding specific meetings to develop reference points for those prioritised species that have a clear stock structure.
- Consider establishing an *ad hoc* WG to examine general issues related to developing such reference points and management advice prior to focusing on species specific work.
- Establish a new process through which scientists and managers may have closer contact and work together to develop management plans.

PRP18_41: Consider articulating rebuilding plans for any stocks found to be depleted

This is a relevant recommendation for advancing a precautionary approach to management. Although there was some disagreement about whether it was the role of the SC to develop such rebuilding plans, there was a sense that this was an important issue and there was a degree of motivation within the SC to advance on this.

Proposals for implementation & improvement:

- The SC could consider this issue in its future efforts to develop reference points and harvest rules and could review for inspiration the way WGHARP (the joint ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals) incorporates plans for rebuilding in their harvest rules.
- Rebuilding plans could be developed in a way that considered not just reducing or halting the harvest of depleted stocks, but also the impacts from by-catch and other anthropogenic activities. Management decisions could then include actions directed towards these activities as well.
- The management committees (MCs) could feed into the process of articulating rebuilding plans for depleted stocks by describing those actions they see as important to implement and/or those already being taken at a management level.

2. Relevant recommendations but not of high priority for the SC

PRP18_RC79: Establish a formal procedure for reviewing and updating information on the NAMMCO website, with periodic review and endorsement from all relevant committees

This is a relevant recommendation for improving communication and particularly data quality in communication. The SC noted that a plan for doing this was agreed at SC/26 and that this new approach would begin to be implemented at their next meeting. It is also worth noting that although

this was recognised as a relevant recommendation for ensuring data quality in NAMMCO's communication with a general public audience, it was not work that the SC expressed motivation to perform and was therefore not considered a top priority.

Proposals for implementation & improvement:

- The proposal that was agreed at SC/26 and which will be implemented for SC/27 is that there be a 5-year cycle for reviewing each species, with the information on a certain number of species (e.g. 4-5) being reviewed each year during the annual SC meeting. The species selected for review in any given year will be determined by the Secretariat on the basis of the importance of the species for the NAMMCO countries and the perceived need for updated information.
- The Secretariat will update the website with new information following each WG meeting.
- SC members will send the Secretariat new publications (authored by its members or others), that are of relevance to NAMMCO and can be used to update the website.

3. Relevant recommendations already being implemented

PRP18_RC5: Develop the ability to transparently track actions on committee recommendations

This is a relevant recommendation for following up on the implementation of the advice provided by the committees, however the SC felt that there were already adequate processes in place for this.

PRP18_RC5: Develop a systematic procedure for assessing species and stocks

This is a relevant recommendation for ensuring data quality and reliability and the implementation of a precautionary approach. The SC emphasised the importance and relevance of having a systematic procedure for assessing species and stocks, but also felt like such a procedure was already in place and part of the operational practice of NAMMCO. The SC did not see the need nor advantage of having a single management procedure. The reasoning behind this position is outlined in the response to Council request R1.6.6 for a description and appropriateness of the management procedures used in NAMMCO presented in the SC/26 report, agenda item 5.7.

PRP18_9 & 19: Ensure that accurate estimates of by-catch are provided for all population assessments and encourage national by-catch monitoring systems based on independent observers

The SC highlighted this as a relevant recommendation with the potential to improve data quality and reliability, as well as to help inform a precautionary approach to management. However, it believed that the extensive ongoing work within the by-catch working group (BYCWG) constituted an adequate response. The SC urges the different parties to respond positively and timely to the BYCWG request for information and data.

PRP18_12 & 18: Have member countries agree on a standard format for reporting and implementing struck and lost data in NPRs and the catch database

This is a relevant recommendation for data reliability and communication, and can be useful for following up on the implementation of advice in some cases. The SC recognised that this is important for the organisation but noted work towards this is already well underway – e.g. see the agreement to having a common format for reporting and their suggestions for additions to this under agenda item 5.3.3 of the SC/26 report.

PRP18_18: Continue efforts to reduce struck and lost and obtain reliable reporting

This is a relevant recommendation for ensuring data quality and reliability, as well as to help inform a precautionary approach to management. The SC recognised the importance of this issue but also felt that efforts were underway to improve struck and lost reporting, drawing attention to agenda item 5.3.1 in the SC/26 report, where the SC emphasised that the use of independent observer programs in selected hunts was still a necessary way to validate the reliability of user reporting.

PRP18_RC23: Establish a searchable catch database and consider including all human-induced mortality and a sighting database (potentially with the IWC)

This is a relevant recommendation for communication, transparency and data quality. The SC noted that sufficient work was already being done to implement this, highlighting that the Secretariat had now made a searchable catch database, that common reporting formats for all human induced mortality are in development by the CHM, BYCELLS and SC, and that discussions with the IWC about collaborating on the development of common databases is ongoing.

4. Additional recommendations already being addressed to some degree

These recommendations were not highlighted by the SC in their assessment of relevance. However, the Secretariat wishes to note the efforts that are underway towards implementation of these recommendations.

PRP18_RC5: Implement research recommendations from the GROM together with other international and national authorities.

Research remains ongoing for monodontid species and there have been some advances on this since the GROM (e.g. see the report of the *ad hoc* working group on narwhal in East Greenland). Additional funding may, however, be required to fully implement all of the research recommendations. No initiative has been taken towards developing a collaboration with Canada on implementing the recommendations.

PRP18_RC12: Coordinate data collection formats and deadlines with other IGOs (e.g. IWC)

The work currently being done to develop a common format and deadline for reporting across all NAMMCO committees (see SC/26 agenda item 5.3.3 and processes started by the different committees ahead of NAMMCO 27) can be seen as foundational work that it is important to complete before attempting to coordinate data collection with other organisations (if this is desirable).

PRP18_RC36: Update the ringed seal assessment and develop an appropriate forum for Greenland and Canada to manage the shared stock.

There are plans to hold a ringed seal working group to update the assessment from 1996, with the potential to also discuss the establishment of an appropriate forum to manage shared stocks. SC/26 proposed that this WG be delayed until 2022 to allow for ongoing studies in Greenland and Norway to be completed so that they could inform the WG.

PRP18_RC79: Examine alternative options for scheduling NAMMCO meetings

There is a process underway on this, with the topic being on the agenda for the FAC November 2019 meeting. SC/25 made an initial proposal for an alternative meeting schedule and an explanation for why this was seen as preferable. SC/26 provided additional inputs to this proposal as well as an additional option for consideration. (Cf. FAC/2019-02/08)

PRP18_RC87: Develop a centralised database on stock assessments (abundance and removals data) as well as for the evaluation of trends in hunters' safety and hunting efficiency.

On the point of most relevance to the SC regarding a centralised database on stock assessments, important foundations laying the groundwork for this are now in place. This includes the development of the online catch database (see SC/26 5.3.2), the work towards a common reporting format for all removals data (see SC/26 5.3.3) and agreement on the overview of management units relevant to NAMMCO for each species (see SC/26 5.2.1, and appendix 4).

5. Recommendations extending beyond the scope of the SC

PRP18_RC28 & RC29: Clarify the different roles of the SC, MCs and Council; especially why MCs may take decisions deviating from the SC advice and eliminate the chances that such deviations occur.

Develop rules of procedure to define the relationship between MCs and SC and their interaction, as well as how MCs use SC advice

This was viewed as a recommendation with the potential to improve communication and the follow up process on the advice provided by the committees. However, the SC did not see it as their responsibility to take action to implement this recommendation. It was therefore deemed beyond the scope of the SC responsibility, however they still offered a proposal for implementation.

Proposals for implementation & improvement:

- Council develop a statement and/or graphic to clarify the different roles of the various committees within NAMMCO and explain why MCs may take decisions that differ from SC advice.

PRP18_RC87: Create a document that specifies the accessibility of data within and outside NAMMCO, the data quality control process, deadlines for data submission etc

The SC made no comment on this recommendation.

CONCLUSION

At its 26th meeting, the NAMMCO SC began the process of considering the results and recommendations of the 2018 performance review. It highlighted those recommendations that it deemed most relevant to improving its work and provided proposals for how the implementation of these recommendations could be approached. It also highlighted where work was already being carried out to address particular recommendations, as well as indicated the recommendations that fell outside the scope of the SC. Given the comprehensive nature of the performance review and the range of recommendations made, the process of response and implementation will necessarily require more time. The SC has however now articulated a clear list of those recommendations that it deems to be relevant and prioritised for action and highlighted several possible avenues for pursuing implementation. This represents an important and necessary first step in the process of learning from the performance review and using this to improve working practices.

Status of Abundance Estimates Following the 2019 NAMMCO SC Meeting

Table Key: TYPE – S=ship, A=aerial; BIAS CORR – bias correction, PER – perception, AVAIL – availability, 1=corrected, 0=uncorrected, P=partially corrected; STATUS – 1=accepted, 2=accepted provisionally pending minor work; 3=further work required

SPECIES		SURVEY	YEAR	DESC.	TYPE	EST.	CV	95% CI		BIAS CORR.		STATUS	ENDORSED BY
										PER	AVAIL		
BA	Minke whale	CIC2016	2016	Iceland coastal	A	13,497	0.5	5,377	33,882	1	1	1	NAMMCO SC/26
BA		NASS	2015	Iceland/Faroes	S	42,515	0.31	22,896	78,942	1	0	1	NAMMCO SC/25
BA		NASS	2015	West Greenland	A	4,204	0.47	1,753	10,085	1	1	1	NAMMCO SC/23
BA		NASS	2015	East Greenland	A	2,681	0.45	1,153	6,235	1	1	1	NAMMCO SC/23
BA		NILS2015	2015	CM1a+CM3	S	17,500	0.35	8,988	34,072	1	1	1	NAMMCO SC/25
BA		NASS+NILS2015	2015	CMA	S	48,016	0.23	30,709	75,078	1	P	1	NAMMCO SC/25
BB	Sei Whale	T-NASS	2007	Iceland/Faroes	S	9,737	0.38	4,189	19,665	0	0	1	NAMMCO SC/26
BB		NASS	2015	Iceland/Faroes	S	3,767	0.54	1,156	12,270	1	0	1	NAMMCO SC/26
BM	Blue whale	NASS	2015	Iceland/Faroes	S	3,000	0.4	1,377	6,534	1	0	1	NAMMCO SC/25
BP	Fin whale	NASS	2015	Iceland/Faroes	S	36,773	0.17	25,811	52,392	1	0	1	NAMMCO SC/25
BP		NASS	2015	West Greenland	A	465		233	929	1	0	1	NAMMCO SC/23
BP		NASS	2015	East Greenland	A	1,932		1,204	3,100	1	0	1	NAMMCO SC/23
BP		NILS02-07	2002-2007	Norway	S	10,004	0.18	6,937	14,426	1	0	1	NAMMCO SC/26
BP		NILS08-13	2008-2013	Norway	S	10,861	0.26	6,433	18,339	1	0	1	NAMMCO SC/26
BP		NILS2015	2015	CM1a+CM3	S	3,729	0.44	1,531	9,081	1	0	1	NAMMCO SC/26
BP		NILS14-18	2014-2018	Norway	S	11,387	0.17	8,072	16,063	1	0	1	NAMMCO SC/26
MN	Humpback whale	CIC 2009	2009	Iceland	A	2,261	0.35	1,142	4,477	1	0	1	NAMMCO SC/26
MN		NASS	2015	Iceland/Faroes	S	9,867	0.37	4,854	20,058	1	0	1	NAMMCO SC/25
MN		NASS	2015	West Greenland	A	1,321	0.44	578	3,022	1	1	1	NAMMCO SC/23
MN		NASS	2015	East Greenland	A	2,681	0.45	2,044	7,873	1	1	1	NAMMCO SC/23
MN		NILS02-07	2002-2007	Norway	S	10,669	0.31	5,695	19,988	1	0	1	NAMMCO SC/26
MN		NILS08-13	2008-2013	Norway	S	12,958	0.31	7,033	23,873	1	0	1	NAMMCO SC/26
MN		NILS2015	2015	CM1a+CM3	S	1,711	0.41	604	3,631	1	0	1	NAMMCO SC/26
MN		NILS14-18	2014-2018	Norway	S	11,662	0.4	5,225	26,027	1	0	1	NAMMCO SC/26

Status of Abundance Estimates Following the 2019 NAMMCO SC Meeting (continued).

Table Key: TYPE – S=ship, A=aerial; BIAS CORR – bias correction, PER – perception, AVAIL – availability, 1=corrected, 0=uncorrected, P=partially corrected; STATUS – 1=accepted, 2=accepted provisionally pending minor work; 3=further work required

SPECIES		SURVEY	YEAR	DESC.	TYPE	EST.	CV	95% CI		BIAS CORR.		STATUS	ENDORSED BY
								LCL	UCL	PER	AVAIL		
PM	Sperm whale	NASS	2007	Iceland/Faroes	S	12,220	0.38	5,807	25,717	1	0	1	NAMMCO SC/25
PM		NASS	2015	Iceland/Faroes	S	23,166	0.59	7,699	69,709	1	0	1	NAMMCO SC/25
PM		NILS02-07	2002-2007	Norway	S	8,134	0.18	5,695	11,617	1	0	1	NAMMCO SC/26
PM		NILS08-13	2008-2013	Norway	S	3,962	0.29	2,218	7,079	1	0	1	NAMMCO SC/26
PM		NILS15	2015	Norway	S	3,828	0.33	1,994	7,595	1	0	1	NAMMCO SC/26
PM		NILS14-18	2014-2018	Norway	S	5,522	0.25	3,325	9,170	1	0	1	NAMMCO SC/26
GM	Pilot whale	NASS	2015	Iceland/Faroes	S	344,148	0.35	162,795	727,527	1	0	1	NAMMCO SC/25
GM		NASS	2015	West Greenland	A	11,993	0.52	4,575	31,438	1	1	1	NAMMCO SC/23
GM		NASS	2015	East Greenland	A	338	1.01	65	1,749	1	1	1	NAMMCO SC/23
Lsp	Lagenorhynchus spp.	NILS02-07	2005	Norway	S	218,640	0.18	150,330	318,000	0	0	1	NAMMCO SC/25
Lsp		NILS08-13	2008-2013	Norway	S	163,688	0.18	112,673	237,800	1	0	1	NAMMCO SC/26
Lsp		NILS14-18	2014-2018	Norway	S	187,482	0.24	112,434	312,624	1	0	1	NAMMCO SC/26
LAC	White-sided dolphin	T-NASS	2007	Iceland/Faroes	S	81,008	0.54	27,993	234,429	1	0	1	NAMMCO SC/25
LAC		NASS	2015	Iceland/Faroes	S	131,022	0.73	35,251	486,981	1	0	1	NAMMCO SC/25
LAL	White-beaked dolphin	CIC2007	2007	Iceland	A	46,683	0.37	22,409	97,251	1	0	1	NAMMCO SC/26
LAL		CIC2009	2009	Iceland	A	75,959	0.56	26,366	218,834	1	0	1	NAMMCO SC/26
LAL		CIC2016	2016	Iceland coastal	A	59,966	0.44	24,907	144,377	1	0	1	NAMMCO SC/26
LAL		T-NASS	2007	Iceland/Faroes	S	91,277	0.53	32,351	257,537	1	0	1	NAMMCO SC/25
LAL		NASS	2015	Iceland/Faroes	S	159,000	0.63	49,957	506,054	1	0	1	NAMMCO SC/25
LAL		NASS	2015	West Greenland	A	2,747		1,257	6,002	1	0	1	NAMMCO SC/23
LAL		NASS	2015	East Greenland	A	2,140		825	5,547	1	0	1	NAMMCO SC/23
OO	Killer whale	NASS	2015	Iceland/Faroes	S							3	
OO		NILS02-07	2002-2007	Norway	S	18,213	0.21	11,486	29,992	1	0	1	NAMMCO SC/26
OO		NILS08-13	2008-2013	Norway	S	8,984	0.36	4,494	17,963	1	0	1	NAMMCO SC/26
OO		NILS14-18	2014-2018	Norway	S	13,909	0.3	7,733	25,018	1	0	1	NAMMCO SC/26

Status of Abundance Estimates Following the 2019 NAMMCO SC Meeting (continued).

Table Key: TYPE – S=ship, A=aerial; BIAS CORR – bias correction, PER – perception, AVAIL – availability, 1=corrected, 0=uncorrected, P=partially corrected; STATUS – 1=accepted, 2=accepted provisionally pending minor work; 3=further work required.

SPECIES		SURVEY	YEAR	DESC.	TYPE	EST.	CV	95% CI		BIAS CORR.		STATUS	ENDORSED BY
								LCL	UCL	PER	AVAIL		
PP	Harbour porpoise	CIC2016	2016	Iceland coastal	A	22,806	0.48	9,166	56,746	1	0	1	NAMMCO SC/26
PP		NASS	2015	West Greenland	A	83,321	0.34	43,377	160,047	1	1	1	NAMMCO SC/23
PP		NASS	2015	East Greenland	A	1,642	1	318	8,464	1	1	1	NAMMCO SC/23
PP		NILS02-07	2002-2007	Norway	S	189,604	0.19	129,437	277,738	1	0	1	NAMMCO SC/26
PP		NILS08-13	2008-2013	Norway	S	30,556	0.57	10,502	88,907	1	0	1	NAMMCO SC/26
PP		NILS14-18	2014-2018	Norway	S	255,929	0.2	172,742	379,175	1	0	1	NAMMCO SC/26
HA	Northern Bottlenose	NASS	2015	Iceland/Faroes	S	18,375	0.59	5,128	65,834	0	0	1	NAMMCO SC/26