Report of the NAMMCO Scientific Committee 25th Meeting

Polarlys Bergen-Tromsø, Norway
13-16 November 2018
(revised 25 June 2019)

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Please cite this report as:

NAMMCO (2018). *Report of the 25th Scientific Committee Meeting*, 13-16 November, Norway.

NAMMCO SCIENTIFIC COMMITTEE
25th MEETING
BERGEN-TROMSØ, NORWAY
13-16 NOVEMBER 2018

EXECUTIVE SUMMARY

The 25th anniversary meeting of the NAMMCO Scientific Committee (SC) was held 13-16 November 2018 on the Polarlys coastal ferry travelling from Bergen to Tromsø, Norway.

New members of the Secretariat were introduced, including the Scientific Secretary Fern Wickson, short-term contract employee Solveig Enoksen and the current intern Sam Smith.

It was noted that all National Progress Reports had been received and observer reports were presented from Canada, Japan, Russia, Nunavut Tunngavik Inc. and Makivik Corporation. During the presentation from Japan, a request was made to hold a joint scientific working group (WG). The SC expressed its willingness to strengthen cooperation but agreed that holding a joint WG would require Council approval.

WORK PROCEDURES IN THE SC *(POINTS 5 & 11 IN MAIN REPORT)*

SWOT Analysis (analysis of the strengths, weaknesses, opportunities and threats)
The Secretariat was asked to finalise the SWOT analysis of the SC and provide it to the FAC and Council.

Updates from Council
Decisions taken during the last meetings of the NAMMCO Council (CN), the Management Committees for Seals and Walruses (MCSW) and Cetaceans (MCC), and their joint meeting (MCJ) were presented. This included the new CN request:

R-1.6.6 (NEW, 2018): *The Council of NAMMCO request the Scientific Committee to 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.*

Population Estimates
How information should appear in the online NAMMCO abundance tables, and particularly how to determine trends, was discussed. The SC agreed that it is important to be open about where trend statements can and cannot be made and to be clear about informational limitations. The SC made a number of proposals for how this could be done.

Reporting of Catches
Working groups (WGs) are asked to identify for which hunts having struck and lost (S&L) data are a priority and the best methods for obtaining this information. The walrus working group was the first to address this request and the SC agreed with its conclusion that S&L data was an equal priority for walrus, beluga and narwhal hunts. Due to practical, logistical and social factors making observer programs difficult, the SC agreed that for science and assessment, good time series surveys were preferred and that honest reporting from hunters was ideal (underlining that S&L data, not rate, is needed). The SC recommended that encouraging honest reporting on S&L be a joint effort with the Committee on Hunting Methods.

The Secretariat noted that the compilation of catch datasets into one easily accessible document for the website is ongoing.

Further cooperation within the SC
Research cooperation within the SC was discussed for genetic and life history analysis of harbor porpoises and satellite tagging and tracking of baleen whales in the North Atlantic. The SC agreed that a collaborative project to develop a 'super-tag' (a smaller tag with better ballistic performance, smaller footprint in the whale and improved retention time) for tracking large cetaceans in the North Atlantic would provide important information for understanding ecological interactions and making management decisions. The SC agreed to deliver a revised description, including a breakdown of the budget, for this project. Japan also expressed interest in collaborating in the project, both scientifically and financially.

Development of management advice
Given the new request R-1.6.6 from CN, the SC recommended that an *ad hoc* working group containing a mix of expertise on large and small cetaceans and seals be established to provide an overview of working procedures in the SC, including the rationale behind specific decisions. This group will work together with the Secretariat to develop a draft document.

NAMMCO Scientific Publications

New 'Guidelines for Authors' were adopted, including a description of how information on animal welfare protocols should be included. Information on the publication process was given and the SC was informed that volume 10 (on age estimation of marine mammals with a focus on monodontids) is completed and volume 11 (with papers analyzing the NASS II surveys) is underway.

Classification and criteria for assessing conservation status in NAMMCO

The NAMMCO website currently presents a summary table of the conservation status of different marine mammal species, based on the quality of available assessments and the level of removals. The SC recommended that the colour coding in the tables be separately applied for removals and assessments and that for some species, the information be further broken down for separate stock areas. The SC also agreed that it would be a good to present the IUCN global and regional statuses to allow for comparisons.

Confidentiality of documents for SC and WGs

The SC recognised the danger that information from outdated documents may be erroneously cited and therefore recommended that NAMMCO keep working documents confidential. It was agreed that if a specific request comes in for access to a working document, it should be forwarded to the authors of the report to decide.

AoB – Time horizon for requests & Efficiency in work flow

The SC asked CN to consider automatically retiring requests older than 10 years (unless they are specifically renewed) and to investigate the possibility of altering NAMMCO meeting times to ensure the most efficient workflow.

COOPERATION WITH OTHER ORGANISATIONS *(POINTS 6 IN MAIN REPORT)*

Cooperation between the SC and IWC, ASCOBANS, ICES, JCNB, the Arctic Council and OSPAR were presented.

ENVIRONMENTAL/ECOSYSTEM ISSUES *(POINTS 7 IN MAIN REPORT)*

Marine mammals-fisheries interactions

Updates on recent research and future work plans were given. Information from the Faroe Islands, Iceland, Greenland and Norway on how they have responded to the recommendations from the 2017 BYCWG was also given. The SC commended the efforts made and underlined the importance of having reliable data on by-catch for all fisheries.

By-Catch Working Group (BYCWG) 2018

BYCWG had a face to face meeting in May 2017 and two conference meetings in April and October 2018, under the chairing of Kimberly Murray (NEFSC, NOAA, USA). The SC commended the work and endorsed the recommendations.

ICELAND: By-catch estimates for marine mammals in *lumpsucker gillnets* from 2014-2017 across 4 different stratifications (non-stratified, stratified by management area, by depth, and by month) were endorsed by the SC. The stratified estimates were preferred over the non-stratified, however, no particular stratification was preferred. The BYCWG provided advice for improving both data collection and analysis. The analysis of by-catch in *cod gillnets* was reviewed at both the April and October meetings, with reanalysis performed on the basis of recommendations. The WG did not endorse the by-catch estimate presented for harbour porpoises or seals in the cod gillnet fishery in Iceland. The SC did, however, agree with the WG that a preliminary estimate could be used for the harbor porpoise workshop as an upper bound for the by-catch in cod gillnets for the period 2013-2017.

The SC discussed problems with accurate seal species identification, including the potential influence of this on low by-catch reporting from inspectors and observers in Iceland and the unreasonably high estimate of grey seal by-catch. The SC strongly recommended that species identification be improved and grey seal estimates be reconsidered.

NORWAY: The reanalysis Norway submitted at the October meeting only dealt with harbour porpoise by-catch and was based on data collected by the coastal reference fleet, which only has vessels <15 m. Landings were used as the measure of effort to produce the fleet by-catch estimates since this was the only information available. The SC agreed that despite the range of concerns identified, the ratio estimates of harbour porpoise in *cod and monkfish gillnet fisheries* in Norway were reasonable to use as a preliminary estimate. However, it was recommended that a revised estimate be presented at the next meeting and noted that this was likely an underestimate due to exclusion of bycatch from other fisheries.

FAROE ISLANDS: The WG recommendations have not yet been implemented, however, the fisheries observers on the pelagic fleet for mackerel and blue whiting must now report marine mammal by-catch.

Multispecies approaches to management/Ecosystem modelling

The SC received an overview of the results of the MareFrame project. They emphasized the importance of building on the extensive foundational work conducted to develop and trial a range of models for understanding ecosystem interactions and the implications of different management options. The SC agreed that funding should be sought to further refine and tune the MareFrame project models to specifically focus on developing scenarios for the management of marine mammals.

Other environmental issues

The SC recommended that the Secretariat conduct a review of pollutant levels in all marine mammals relevant to NAMMCO and continue monitoring developments in the Mary River project in Canada.

SEALS AND WALRUS STOCKS – STATUS & ADVICE TO COUNCIL *(POINTS 8 IN THE MAIN REPORT)*

The SC reviewed information on harp, hooded, ringed, grey, harbour, bearded, and coastal seals and walrus. All research updates are described in the main report while relevant information on additional issues is presented by species below.

Harp & Hooded seals

The ICES/NAFO/NAMMCO working group on harp and hooded seals (WGHARP) will meet in Tromsø, Norway, 2-6 September 2019. New data from all populations is available and the group will do assessments of status and harvest potentials. Although the terms of reference (ToR) are not yet finalised, it is anticipated that new estimates and assessments would be developed for the North West Atlantic and Greenland Sea (harps and hoods) and the Barents-White Seas (harps).

Ringed seal

A ringed seal working group (RSWG) is planned for 2021. Although it was considered too early to define ToR, the intention is to run this WG back to back with a bearded seal WG (BSWG).

The SC noted that addressing request R2.3.2 to assess the status of ringed seals and the effects of harvests was particularly challenging in light of simultaneous changes in sea ice conditions, marine productivity and polar bear predation. Due to the unpredictable changes in these parameters, producing estimates of sustainable catches requires a significant investment of resources for research on: abundance estimates, productivity and age distribution of the catch, and changes in the required environmental parameters such as stable ice and suitable snow for breeding, as well as glacial fronts for foraging.

Grey seal

Updates were given from Norway, Iceland and the Faroe Islands on actions performed to meet the 2016 recommendations of the coastal seal working group (CSWG). The SC commended the work done and underlined the positive indication of an increase in the population in Iceland. It noted that animal welfare concerns were making research increasingly difficult and discussed national legislative differences on requirements for veterinarian involvement during sedation and tagging. The next meeting of the CSWG is planned for 2020, with Kjell T. Nilssen as Chair. ToR will be defined at a later meeting.

Harbour seal

Updates were given from Norway, Iceland and Greenland on the work done to meet the 2016 recommendations of CSWG. The SC expressed concern that catches continue to be reported in Greenland despite the species being protected. Greenland informed that the numbers are inaccurate due to widespread misidentification of species. The SC emphasized the need to improve the accuracy of reporting and recommended that any reported catch of harbour seals be validated.

Bearded seal

The SC reconfirmed Chairs for the BSWG and possible invited participants, as well as an intention to involve CAFF.

Walrus

The report of the walrus working group (WWG) was presented. The WWG considered three stocks: Baffin Bay (BB), West Greenland-Southeast Baffin Island (WGSBI) and East Greenland (EG). The report includes information on: stock structure and catches, abundance, assessments, management advice, other environmental issues, and recommendations. The SC endorsed all of the recommendations of the WWG. The recommended annual landed catch (with carry over permitted) was: for BB a maximum of 84 animals, with 79 being caught in Greenland; for WGSBI a maximum of 86 animals, with 74 in Greenland; and for EG no more than 17 animals.

The SC also discussed the appearance of a new haul-out site in Northwest Greenland and the impact of the law that makes it illegal to take walrus on land but legal to hunt them in the water and when hauled out on ice. Since walrus can easily be scared from land into water, the SC recommended that regularly used haul-out sites be protected as "exclusion zones" to safeguard them from disturbance.

CETACEAN STOCKS – STATUS & ADVICE TO COUNCIL *(POINTS 9 IN MAIN REPORT)*

The SC reviewed abundance estimates and recent research and developments for all the following species: fin whale, humpback whale, common minke whale, beluga, narwhal, sei whale, bottlenose whale, pilot whale, dolphins, harbour porpoise, sperm whale, bowhead whale and blue whale. The endorsed abundance estimates are given in table 1, with other relevant information presented by species below. All research updates are described in the main report.

Abundance Estimate Working Group

The abundance estimate working group (AEWG) met in Copenhagen from May 22-24 2018 and had a follow up email correspondence in October 2018, accepting revised estimates for the Icelandic and Faroese 2015 ship board surveys. Estimates that were accepted by the AEWG and endorsed by the SC are given in table 1 below.

The SC commended the AEWG for the extensive work done and supported the recommendations made by the AEWG. This includes recommendations for a workshop on novel methods for abundance surveys and estimations, cooperation with the IWC to host a common abundance database, and support for a PhD project using NASS/NILS data to perform a large-scale spatial analysis of environmental features influencing variations in population density.

Table 1. Abundance estimates endorsed at SC 25.

SPECIES	SURVEY	YEAR	DESC.	TYPE	EST.	95% CI		BIAS CORR.	
						LCL	UCL	PER	AVAIL
Blue whale	NASS	2015	Iceland/Faroes	Ship	**3,000**	1,377	6,534	Yes	No
Fin whale	NASS	2015	Iceland/Faroes	Ship	**36,773**	25,811	52,392	Yes	No
Minke whale	NASS+NILS2015	2015	CMA	Ship	**48,016**	30,709	75,078	Yes	Partially
Humpback whale	NASS	2015	Iceland/Faroes	Ship	**9,867**	4,854	20,058	Yes	No
Sperm whale	NASS	2007	Iceland/Faroes	Ship	**12,220**	5,807	25,717	Yes	No
	NASS	2015	Iceland/Faroes	Ship	**23,166**	7,699	69,709	Yes	No
Pilot whale	NASS	2015	Iceland/Faroes	Ship	**344,148**	162,795	727,527	Yes	No
White-sided dolphin	NASS	2015	Iceland/Faroes	Ship	**131,022**	35,251	486,981	Yes	No
White-beaked dolphin	NASS	2015	Iceland/Faroes	Ship	**159,000**	49,957	506,054	Yes	No

Humpback whale

Extensive discussion concerned the amended request from CN R-3.2.4 to provide further advice on catch levels of humpbacks in West Greenland. The SC provided a more detailed explanation and justification for its advice and the choice of models used. It reiterated its recommendation that the SLAs developed in the IWC provide the best scientific basis for advice on sustainable takes of large whales in Greenland and can be applied without using needs statements.

Future work to bring together and collate results from all humpback tagging activities in the North Atlantic was proposed. The Secretariat was asked to contact groups working in the Caribbean and investigate their interest in a common workshop.

Beluga

There is not enough data to carry out an assessment or provide advice for beluga in East Greenland as has been requested, and the SC considers request R-3.4.14 answered.

The status of beluga stocks will be reviewed by the next joint NAMMCO- JCNB Joint WG. The SC agreed to postpone that meeting and the associated workshop from March 2019 until 2020.

Narwhal

As requested by the MCC, the SC provided a more detailed justification for its recommendation that three rather than two management areas be recognised for narwhal in East Greenland. Emphasising the decline of narwhal stocks in East Greenland and the possibility that current catch levels are unsustainable, the SC reiterated its previous recommendations that catch quotas be reduced and no hunting be permitted south of 68°. They also agreed that the issue was urgent and of high priority and therefore recommended that an *ad hoc* WG be convened to review the information and assess the population. ToRs, timeframe, location and participants for this WG were all outlined.

Killer whale

The contracted review by Jourdain et al. examining all available information and current research activities on abundance, stock structure and movements of killer whales in the North Atlantic was presented. It revealed an urgent need for research on abundance and population structure off Eastern Canadian Arctic, Newfoundland-Labrador and both West and East Greenland.

The SC agreed that there is currently not enough information to perform a sound assessment of the sustainability of the killer whale harvest in Greenland and recommended that existing catch records be validated and reporting improved (e.g. by including killer whales in mandatory reporting schemes). Since it may take several years for a sound assessment to be possible, the SC also recommended that Greenland regulate the hunt and restrict quotas in a precautionary way.

A discussion on recent research publications highlighted that although contamination with PCBs is a problem for this top predator, especially in some areas, agreement could not be reached within the SC on the extent of the problem. The SC therefore recommended that research continue and that sampling and analysis be enhanced.

Harbour porpoise

The SC was updated on the organisation of the joint Institute of Marine Research-NAMMCO Workshop on the Status of Harbour Porpoise in the North Atlantic and is looking forward to reviewing the outcome of this international effort. The Harbour Porpoise WG will meet in Spring 2019 and its ToRs, timeframe, location and participants were outlined.

SURVEYS *(POINTS 10 IN MAIN REPORT)*

A cooperation between the abundance estimate working groups of NAMMCO and the IWC has begun. As a first step, the Chairs of each WG are now standing invited participants in the meetings of the other.

A table presenting the status of analyses from the 2007 and 2015/16 surveys was presented and a plan for completing the remaining analysis agreed.

Joint analyses being done in collaboration with St. Andrews University (on oceanographic features driving changes in cetacean abundance and distribution) and Duke University (mapping densities of cetaceans in the north Atlantic at different times of year) were presented and discussed as important ways to maximise outputs from the survey data.

The AEWG recommendations for the next NASS survey were presented and the SC agreed that if this survey series is to be continued, the best year will be 2023, although it could wait until 2026 to join efforts in the North West Atlantic. Further inputs on this from Council were requested and decisions on focus, timing, budget etc. delayed.

FUTURE WORK PLANS, BUDGET & ANY OTHER BUSINESS *(POINTS 12-14 IN MAIN REPORT)*

The 2019 SC meeting will be held in the Faroe Islands, with the host determining exact location and time soon.

The work plan for future years was revised and decided by the SC. This is presented in table form below.

2018 (COMPLETED)	2019	2020	2021
Working Groups: - Abundance Estimates - By-Catch (2 meetings) - Walrus **Workshops:** - Joint IMR/NAMMCO harbour porpoise workshop **Other:** - Review of North Atlantic killer whales - Analysis of all remaining TNASS and NASS data for species for which an abundance estimate is possible	**Working Groups:** - Harbour porpoise (spring) - Japan Cooperation (spring) - ICES/NAFO/NAMMCO on harp and hooded seals (autumn) - East Greenland Narwhal (autumn) - Abundance Estimate (autumn) **Other:** - Completing the analysis of all remaining TNASS and NASS data for species for which an abundance estimate is possible. - Review of pollutant levels in marine mammals in NAMMCO countries	**Working Groups:** - Bycatch - Coastal seal - Pilot whale [- Harbour porpoise?] - NAMMCO/JCNB on narwhal and beluga **Workshops:** - Workshop on impacts of climate change on management advice - North Atlantic humpback whale tagging workshop	**Working Groups:** - Bearded seal - Ringed seal

The SC agreed upon draft and forecast budgets for 2019 and 2020, reflecting the agreed work plan.

Bjarni Mikkelsen (FO) was elected as the new SC Chair, Fernando Ugarte (GL) was elected as vice chair.

MEETING CLOSURE *(POINT 15 IN MAIN REPORT)*

The preliminary report was approved during the meeting and following minor revisions by correspondence, the final report was accepted on November 29th 2018.

MAIN REPORT

1 CHAIRMAN'S WELCOME AND OPENING REMARKS [SC/25/02]

The general secretary of NAMMCO opened the meeting by welcoming participants and noting that this was a special occasion, being the 25th anniversary for meetings of the Scientific Committee (SC). She particularly welcomed observers from Russia, Canada and Japan and the representative of the Performance Review Panel.

The Chair also welcomed participants to the meeting and noted the growth of the scientific committee over the last 25 years, particularly aided by the possibility for the Parties to nominate up to 6 scientists to participate. Due to the presence of new people who had not participated in previous SC meetings, the Chair invited a brief round of introductions. It was also noted that some additional scientists will join the meeting at later points in the journey and there will be an open guest lecture upon arrival in Tromsø.

1.1 Presentation of the new Scientific Secretary

The chair introduced Fern Wickson as the new scientific secretary of NAMMCO. Fern gave a brief presentation of her background education and experience working across the science policy interface in environmental management and expressed her enthusiasm for the future work with NAMMCO and the scientific committee.

1.2 NAMMCO new staffing

The general secretary informed that NAMMCO currently has two additional staff members and both were briefly introduced. Samuel Smith, present at the meeting, will work with NAMMCO as an intern until May 2019. He has been particularly involved in the Walrus Working Group and dissemination of news and information through the website and social media. Solveig Enoksen, who was attending a GIS-related course, is working in a short-term contract and it is hoped that this contract can be prolonged. To date she has been particularly involved in the organisation of the Harbour Porpoise Workshop and updating the website and catch database. The secretariat expressed the value of having these additional staff members for enhancing the working capacity of NAMMCO.

2 ADOPTION OF AGENDA [SC/25/01AB]

The general secretary noted that there had been a proposal to review the recent publication in *Science* on the impact of PCBs on killer whales (Desforges et al., 2018, SC/25/FI/29) as a separate point under the agenda, rather than just as an update and the SC agreed.

The agenda was adopted with this minor amendment.

3 APPOINTMENT OF RAPPORTEURS

It was agreed that all those who give presentations or make major interventions would provide summaries for inclusion in the report and all members of the secretariat present at the meeting (Fern Wickson, Charlotte Winsnes, Sam Smith and Genevieve Desportes) would collaborate as a team of rapporteurs for the meeting.

4 REVIEW OF AVAILABLE DOCUMENTS AND REPORTS [SC/25/03]

The Chair summarised the list of available documents and reports and noted when they would be addressed in more detail under later agenda items. This list includes all items described below under agenda item 4.

4.1 National Progress Reports [SC/25/NPR-FO, -GL, -IS, -NO, -CA, -JPa&b, -RU, -MA, -NU]

Full copies of the national progress reports and reports from observer countries are attached as appendices. All of the national progress reports from Parties were received according to the new deadline of March 1.

4.1.1 Update from observer country – Canada

Hammill provided an overview of some of the research performed under the Department of Fisheries & Oceans.

Presenter's summary:

The Newfoundland and Labrador region has maintained a sample collection program for seals since the 1970s. This program, with samplers located around the province collects morphometric, diet and reproductive rate data for harp, grey, hood, ringed and bearded seals. A new program carried out in collaboration with the Central & Arctic region deployed satellite transmitters on 2 fin and 3 humpback whales. Hydrophones were deployed off the east and south coast of Newfoundland and aerial surveys for cetaceans were completed off the south coast. In the Maritime region, satellite transmitters were deployed on weaned pups to monitor movement and dive behaviour. Transmitters equipped with accelerometers were also deployed on adults in autumn 2017 and recovered in winter 2018. Additional transmitters with accelerometers were deployed on adult grey seals in fall 2018. The accelerometers are used to provide insights into foraging behaviour by grey seals. Hydrophones were also deployed on the Scotian shelf. The Quebec region deployed CTD equipped satellite transmitters on hooded seals in March 2018. In addition to diet and movement information, these transmitters also provide temperature and salinity profiles while the animals are in the Gulf of St Lawrence and during the spring migration to Greenland. Hydrophones were also deployed in the Gulf of St Lawrence and D-tags were deployed on St Lawrence estuary beluga. The D-tags provide insights into short term movements and record noise levels that whales are exposed to from shipping. In 2017, 12 north Atlantic right whale carcasses were detected in the Gulf of St Lawrence. Necropsies determined that animals died from ship strikes and entanglements in fishing gear. To reduce the risk of mortalities, the government of Canada initiated new management measures in 2018 that involved a combination of seasonal closures of areas to fishing or speed restrictions on ship traffic and increased levels of surveillance. Several aircraft including aircraft belonging to the conservation and Protection Branch of DFO, as well as aircraft belonging to Transport Canada were involved in the extensive surveillance of Atlantic Canada. DFO personnel also provided support to Transport Canada during testing of a large Unmanned Aerial Vehicle (UAV). The objective was to examine the potential of the UAV to complete surveillance for right whales, instead of using aircraft. The UAV had a flight duration of 8 h, and a cruise speed of approximately 100 knots. The UAV showed considerable potential, but additional testing is needed to determine the most suitable flying altitude that combines a sufficient size of whales on the image, combined with obtaining the largest image footprint possible. In the Central & Arctic region satellite transmitters were deployed on beluga in the Beaufort Sea. A satellite transmitter was deployed on a killer whale and a total of 18 biopsy samples were collected from killer whales near Pond Inlet. A satellite transmitter was also deployed on a sperm whale and biopsy samples were collected from sperm whales and northern bottlenose whales in Baffin Bay. A drone was used to collect footage of bowhead and beluga in Cumberland Sound. The imagery will be used to analyse body condition. Forty biopsy samples were also collected from bowhead whales. Hydrophones were also deployed in the Pacific region. In addition, a large scale ship survey to assess marine mammal abundance was completed off the British Columbia coast, extending to 200 miles offshore. This is the first time that such a large-scale survey has been completed in this region.

Discussion

The SC thanked Canada for providing this update of research activities and expressed its satisfaction with this ongoing fruitful cooperation.

4.1.2 Update from observer country – Japan

Takahashi presented a summary of cetacean research activities conducted by Japan during the period 2016-18.

Presenter's summary:

Scientific information on the following research projects/activities was summarised: 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 and biopsy sampling of 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 marine debris survey; 3) DNA register and market molecular monitoring of large whales; and 4) record and analyses (mainly on population genetic structure) of bycatch and stranding data 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 2017 a total of 31 scientific documents were presented to 5 international meetings, and 7 peer-reviewed publications were made.

Pastene also informed that the Institute of Cetacean Research (ICR) wishes to strengthen its cooperation with the NAMMCO SC in the field of the conservation and management of cetaceans. The ICR requested the NAMMCO SC to hold a joint scientific working group meeting in early spring 2019. The aim of the WG would be to review the information presently available for informing the conservation status of baleen whales off Japan, to identify gaps in knowledge, and provide recommendations on research and analysis needs.

Discussion

The SC thanked Japan for providing an update of activities and noted the significant amount of biological research taking place. It also expressed its support for continuing to exchange scientific information and its willingness to strengthen cooperation on the conservation and management of cetaceans.

The SC discussed the option of holding a joint Working Group with Japanese scientists and **agreed** that a decision on this required approval from Council.

4.1.3 Update from observer country – Russia

Zabavnikov presented the Russian report on recent research activities.

Presenter's summary:

A summary was given of relevant PINRO research conducted in 2017 and current research activities in 2018. Various marine mammal research projects are also being carried out in Russia by the Scientific-Research Institute (SRI) and the Institution of the National Academy of Science, as well as the SRI Ministry of Environmental Resources. Some monitoring research is also being performed by different companies that work on and exploit the shelf of hydrocarbon raw materials in the Barents and Kara Seas. In 2017, PINRO carried out marine mammal research in the south eastern part of the Barents Sea, called the Pechora Sea area, close to the "Prirazlomnaya" oil area. This research has been financed by oil and gas companies. PINRO applied to the funding companies to allow presentation of the results at SC 25 but a solution for this was not achieved. A brief presentation of information was given about first attempts at using drones for conducting a survey of harp seals during whelping time in the White Sea, including some results and preliminary conclusions.

Discussion

The SC thanked Russia for providing an update of activities and noted the importance of the continued cooperation between Russian and Norwegian scientists.

4.1.4 Update from Nunavut

Desportes presented the report submitted from Nunavut Tunngavik Incorporated (NTI) - the designated Inuit Organisation representing Inuit in the Nunavut Settlement Area protected by the Canadian Constitution.

Summary from the secretariat:

NTI advocates the recognition of Inuit economic, social, and cultural well-being, including the protection of Inuit hunting rights, and the entitlement of Inuit to take part in all parts of wildlife management. Current research initiatives at NTI include the Inuit Marine Monitoring Program (IMMP), which aims to understand changes in shipping activities in Nunavut and has been deployed in a number of communities. Also, NTI has recently partnered with the Nunavut Research Institute (NRI) for a pilot study testing for the presence of Trichinella in Atlantic Walrus (*Odobenus rosmarus*). At present, there is a two-year commitment to the study, although there are plans to establish a permanent Trichinella testing program. Finally, NTI has participated in multiple

NAMMCO scientific meetings, notably the meetings of: a) the Joint Working Group of NAMMCO Scientific Committee and the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB), b) the Global Review of Monodontids, and c) NAMMCO Walrus Working Group.

Discussion

The SC thanked Nunavut for this first report of activities.

4.1.5 Update from Makivik

Desportes presented the report giving an overview of activities submitted by Makivik.

Summary from the secretariat:

Makivik and the Makivik-owned Nunavik Research Centre (NRC) collaborate with the Department of Fisheries and Oceans Canada (DFO) on the monitoring of the subsistence beluga harvest by Nunavik Inuit. Primarily two stocks are hunted: Eastern Hudson Bay (EHB) beluga and Western Hudson Bay (WHB) beluga. Conservation concerns have been identified for the EHB stock not for the WHB stock.

Makivik is a member of a newly established Nunavik Beluga Working Group to explore alternative ways of collecting and analysing information (including Inuit Knowledge) to help provide input into the next iteration of management decisions by the Nunavik Marine Region Wildlife Board (NMRWB) - the Institution of Public Government tasked with establishing a total allowable take (TAT) for beluga whales.

Information was also presented on walrus (Trichinella monitoring continues, remote sensing at haul-out sites discontinued), bowhead whales (annual TAT of two but none taken in 2018 at the time of reporting), narwhal (occasionally harvested, sightings increasing, tag transfer agreement with Nunavut in place), ringed seals (observations that stock in some areas is not doing well but no dedicated research efforts from DFO despite ongoing pressure), killer whale (significant increase observed by hunters, believed to be altering beluga behaviour) and minke whales (increased presence observed).

Discussion

The SC thanked Makivik for this first report of activities.

4.2 Working Group Reports

Reports of four WG meetings were available to the meeting as working documents.

By-catch WG April & October [SC/25/13 SC/25/30]

Abundance Estimate WG [SC/25/12]

Walrus WG [SC/25/14]

Each of these is summarised in this report, but unlike previous years are not attached as annexes. This is because of the new policy to make all WG reports publicly available one month after endorsement when they become available on the NAMMCO website (https://nammco.no/topics/sc-working-group-reports/).

4.3 Other reports and documents

List of active Council requests [SC/25/04]

North Atlantic killer whales: a status review [SC/25/18]

Review of Abundance and Trends tables [SC/25/05ab]

NAMMCO guidelines for authors [SC/25/19]

Global Review of Monodontids – final version [SC/25/FI/11]

Cetacean abundance and distribution in the NA workshop – final version [SC/25/FI/16]

Other documents were also available for information as listed in appendix 3.

5 WORK PROCEDURES IN THE SC

5.1 Swot Analysis [SC/25/15]

During SC 24, the committee was asked to provide input for a SWOT analysis (analysis of the strengths, weaknesses, opportunities and threats) of the scientific committee. This was to inform the strategy and capacity building discussion that is ongoing within NAMMCO. This should be taken as an opportunity for strengthening the work of the SC and consolidating/addressing areas where weaknesses have been identified. Only four scientists on the committee sent in inputs and this was combined with inputs from the secretariat and others within NAMMCO to create the analysis presented in document SC/25/15. The Chair noted that having contributions from only four people was undesirably low and there was a need for further inputs from the committee. He also proposed that the secretariat streamline the analysis, condensing it to avoid repetition or overlapping information. It was noted that a finalised and complete document needed to be sent to the FAC and Council. A call was made for further inputs to be given before Wednesday evening, however no further inputs were received.

5.2 Updates from Council: NAMMCO/26 [SC/25/FI/04, SC/25/04]

The Secretariat provided an update on the decisions related to the work of SC taken at the 2018 meetings of the Council (CN), the Management Committees for Seals and Walruses (MCSW) and for Cetaceans (MCC), and their Joint Meeting (MCJ).

5.2.1 Overarching Matters

Related to the Report of the Joint Management Committee (CN 26, 8.1)
[Council] particularly noted that the SC had agreed to provide advice on the prioritisation of the collection of S&L data and the best way of collecting them.

Related to the next NASS survey (CN 26, 9.1)
The Council supported the Russian participation as well as a western extension so that a new trans-Atlantic NASS could be achieved. Collaboration with other European and American surveys, if possible, should also be attempted. Council charged the SC to start the planning of the next survey and prepare a tentative budget to be submitted to the FAC and next Council meeting.

Related to an Ecosystem Approach (MJC 26, 3)
The MCJ endorsed the recommendations to:

- Add non-hunting impacts to the future agendas of the SC WGs.
- Present all information on the Mary River project to the JWG, and for someone from the Fisheries Protection Division in Canada to attend the next NAMMCO-JCNB JWG meeting.
- Consider cumulative effects when new shipping and icebreaking activities are proposed for narwhal and beluga habitat areas.
- Review the results of the MareFrame project and present a review to the next SC meeting.
- Obtain reliable and complete reporting from Norway and Iceland for all removals [including removals around fish farms].

Related to humpback whales (MCC 26, 4.2)

The MCC noted that as a matter of principle NAMMCO does not base management objectives on “Needs Statements”. NAMMCO does not recognise the concept of “aboriginal subsistence whaling” and does not categorise the use of resources based on the people using the resources. The advice in NAMMCO is based on science and sustainable use. Therefore, the management advice from the SC to use the SLA does not follow the principles of NAMMCO and the MCC considers this request as not answered. The MCC reiterated request R-3.2.4 from 2016, and further drew the attention of the SC back to the comments made by the MCs in 2016, both at the joint meeting of the MCs (point 5.4) and at the meeting of the MCC (point 5.2). Furthermore, while this issue has arisen for humpback whales, the MCC noted that it applies to advice given for all large whales.

Related to narwhals (MCC 26, 4.5)

The MCC noted the report of the SC and requested that the SC provide a description of the criteria that are used for defining the management units [for narwhal in East Greenland] before they can endorse the advice of splitting the management units into 3, the catch advice for Ittoqqortormiit, Tasiilaq and Kangerlussuaq, and the advice for no catches south of 68°N, due to the severe effects the regulations can have on the local communities.

5.2.2 New Requests

Council 26 forwarded one new request for advice to the SC:

> ***R-1.6.6 (NEW, 2018):*** *The Council of NAMMCO request the Scientific Committee to 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.*

5.2.3 Endorsed SC work plan [SC/25/24]

The Council agreed to the following work plan for WG's in 2018, 2019 and 2020 (CN 26, 4.2):

2018	2019	2020
- Abundance Estimates WG - By-Catch WG - Walrus WG - Joint IMR/NAMMCO harbour porpoise symposium <u>Contracted work:</u> - Review of North Atlantic killer whales - Analysis of all remaining TNASS and NASS data for those species for which an abundance estimate is possible.	- Harbour porpoise WG - NAMMCO/JCNB joint WG on narwhal and beluga - Workshop on impact of climate change on management advice - Joint ICES/NAFO/NAMMCO WG on harp and hooded seals - Satellite tagging workshop (postponed from 2018)	***Postponed from 2019*** - Coastal seal WG - Pilot whale WG ***Likely postponed to 2021*** - Bearded seal WG - Ringed seal WG

Further developments of this endorsed plan are returned to under agenda item 12.

5.2.4 Super-tag project

Haug presented to Council 26 the SC project proposal on the development of a tag for satellite tracking of cetaceans in the North Atlantic, with common minke whale as target species. The response of CN 26 (under 4.3) was positive and all member countries expressed their support for the project. They saw it as an important technical development that will generate better information on minke whale movements but possibly also other species, therefore engendering better science and management of whale stocks. Therefore, and because it is a joint project involving all NAMMCO countries, it constitutes a good opportunity and flagship for NAMMCO.

Council tasked FAC to consider the project's financial implications and propose avenues for funding.

SC 25 discussed how to move forward with this project in more depth under agenda item 5.5.2

5.3 Population Estimates

5.3.1 Review of NAMMCO abundance tables [SC/25/05a,b,c]

It is the responsibility of the SC to ensure the accuracy and appropriateness of the abundance tables produced and disseminated by NAMMCO. At SC 24 it was agreed that these tables should continue to specify when and which organisation/institution had endorsed the abundance estimates and that SC 25 should further discuss which trends of abundance should be indicated in the table – i.e. the trend between two surveys or a trend over a longer period of time. The outcomes of the discussion on this topic are reported below.

5.3.1.1 Abundance Estimates, trends and status of stocks

The SC **highlighted** that to perform a statistical analysis that allows for the drawing of conclusions about trends, information from more than two data points is needed. This means that statistically significant trends cannot simply be inferred from one survey to the next.

It was proposed that trend analysis was not particularly useful unless population models are available and that model-based estimates (including information on a broad range of factors such as abundance estimates, migration patterns, mark and recapture studies, genetics etc) would ideally be used. However, one challenge with this is that the information available will vary for all species. Furthermore, if population models are required to provide trends about what is happening with a stock as a whole, it is not clear what can be said when information is only available for limited parts of the stock (such as when surveys only cover a fraction of the stock geographic distribution). This may, for example, require distinguishing between trends in particular areas vs stocks as a whole. Since there will always be areas in which information is likely to remain incomplete due to logistical challenges, it may never be possible to have a complete picture of whole populations. This would make limiting ourselves to only saying something about trends for the entire stock problematic.

The issue of having surveys covering different areas in different years was highlighted as a particularly significant factor in why trends cannot be easily calculated. This may mean that the desire to calculate trends should be considered in the planning of future surveys.

One proposal to handle the issue was to present the time series with abundance estimates without any reference being made to general trends. However, this may not satisfy the needs of the NAMMCO. Another proposal was to include a reference for all statements on trends to clearly indicate which working group or article had reported it, as is presently done. A third approach would be to have as a standing point for the Working Group on Abundance Estimates to give a status of the stock where this is deemed possible. Furthermore, all working groups could be asked to consider what it is possible to say regarding trends, as well as to consider the use of population models when determining trends.

The SC **agreed** that NAMMCO needs to be open about where statements about trends can and cannot be made and be clear about the limitations associated with any of the available information and calculations. A proposed way to do this was to create two separate tables – one for abundance estimates and another for stock status. This would enable the limitations and issues involved in drawing conclusions around trends to be clearly presented.

It was noted that the IWC is doing similar work to tabulate abundance estimates for their website and to provide general information on the status of stocks (including for small cetaceans, although this is not a high priority for them). It may therefore be useful to have a joint meeting with the IWC abundance estimate group to agree on how this should be approached, particularly since the same challenges connected to the use of different methods and surveys conducted across different areas are being discussed.

5.3.2 Guidelines for reporting abundance estimates and other results in WG and SC reports

The IWC has recently started implementing an approach in which if there are numbers, results and/or conclusions that are not endorsed by the working group or scientific committee, they do not appear anywhere in the published reports. This is to try and avoid information that has not been officially endorsed being cited, quoted or used elsewhere by other parties. Currently, NAMMCO reports from WGs may include mention of numbers or conclusions (for example under author summaries) that are not endorsed. The question for discussion was therefore whether NAMMCO should adopt a similar approach to the IWC and only contain mention of endorsed numbers and results in its published reports. The SC shared the general concern that it is important to avoid a situation where official documents are mis-cited or mis-quoted because they contain numbers that have not been endorsed. However, it was also noted that formally, the SC report is the official

document that is typically cited. Furthermore, it was highlighted that having a table at the beginning of a WG report that makes the accepted or endorsed numbers clear can minimise the risk.

The SC therefore **agreed** that all numbers and results that require formal endorsement (e.g. estimates of abundance and bycatch) may be described in WG reports but **recommended** that only those accepted and endorsed by the WG and the SC should appear in the published SC report.

5.4 Reporting of Catches

The SC has previously recommended that catch statistics include corrections for struck and lost (S&L) animals for different seasons, areas and catch operations. This led to an ongoing request from council (R1.6.4) that the SC and Committee on Hunting Methods provide advice on the best methods for collecting the desired struck and lost data. At SC 24 it was noted that the importance of identifying S&L rates was more important for some hunts than others and therefore it was agreed that WGs be asked to indicate when having reliable S&L data was a priority for improving the assessment and would make a significant difference for quota allocation. This would make clear for which hunts obtaining S&L data is a priority. It was also agreed at SC 24 that WGs also give recommendations on the best methods for obtaining data in these prioritised hunts.

5.4.1 Struck and Lost

The first WG to be forwarded the request to prioritise hunts and identify best methods for the collection of S&L data was the Walrus Working Group (WWG). It is expected that future WGs will also receive the same request. The WWG concluded that obtaining S&L data was an equal priority for the walrus, beluga and narwhal hunts. Reliable reporting from hunters would reduce the uncertainty on S&L, however it is difficult, and maybe even impossible, to know when S&L reported in this way is reliable. In terms of science and assessment, investments in good time series surveys should be favoured over observer programs for S&L.

The SC discussed the question of best methods for collecting S&L data. It underlined that what was needed was not S&L rate but S&L data. Although observer schemes with neutral personnel are often highlighted as the ideal method for collecting S&L, there are practical (e.g. economic cost), logistical (e.g. small vessels) and social factors (e.g. altered practices when observers are on board) that may prohibit effective implementation of this method. The potential of using on board cameras was also noted, however, this method can be viewed unfavourably by hunters. Trying to ensure that hunters provide honest reports of S&L is an alternative route that suggests that further work and collaborations with hunters may be beneficial.

Another approach discussed was having a good time series of surveys and using this in combination with the information on landed animals to calculate S&L rates (as is currently done for harp seals in Canada, and in the NAMMCO assessments of walrus, beluga, and narwhal). Following this approach, it was proposed that while S&L data may be important for managers and hunters, it may be less important for scientists. Specifically, for performing scientific assessments, investing in time series surveys may be considered more important than investing in expensive observer programs. Since time series data for some stocks and available modelling approaches are improving, it was suggested that having concrete numbers on S&L may be less important than previously thought for scientific assessments.

The SC **agreed** that there was a need to prioritise investments in good time series surveys instead of observer programs and to work with hunters to encourage honest reporting. It was also **recommended** that the issue of encouraging honest reporting on S&L data should be forwarded to the Committee on Hunting Methods and advanced as a joint effort together with the SC.

5.4.2 Catch database [SC25/31]

During SC 24 it was noted that it would be useful to have a compilation of data sets on catches collated in one easily accessible document on the NAMMCO website and the Secretariat agreed to do this. An update was provided that information on the quotas and catches for different years, species and areas has now been collated into a single document (SC/25/31) and that the Secretariat is continuing its work to validate this information and compile it into a single database to be made available online.

5.5 Furthering cooperation in SC

5.5.1 Presentation by SC members at SC meetings

There are no presentations from SC members about their work (beyond those connected to specific agenda points) planned for the 25th meeting. This idea was originally conceived as a way to help foster greater collaboration within the SC and therefore it was **agreed** that the possibility for longer presentations from SC members about their work be kept as a point on the agenda for future meetings.

5.5.2 Super tag project

Heide-Jørgensen reported from meetings with manufacturers of satellite transmitters.

Presenter's summary:

Ideally for long-term tracking of baleen whales in the North Atlantic we need a smaller tag with better ballistic performance that can be deployed remotely at distances up to 25 m. The tag also needs to have a smaller volume and generate a smaller foot print in the whale to improve the retention time. It would also ideally need to remain fixed for a 12-month period so that information on full migration routes could be plotted. The development of a new transmitter design to the point of having a prototype that will meet these requirements will need an investment in the order of $180.000. This will include a tag that is 16.6mm in diameter (instead of 22 mm for the present tags) with a reduction in weight and volume from 30% to 50% compared to existing tag designs. The tag will be produced with a new manufacturing process called Direct Metal Laser Sintering (DMLS) that should make the tag more robust to the impact of hitting the whale as well less likely to be broken by the whales during social interactions. A new tag developed according to these requirements would not be available until 2020 as several tests are needed before it could be commercially viable. The price per tag would then be $2800. It is not known whether the purchase of a large number of tags would compensate for the initial costs of developing a new tag.

If NAMMCO wants to develop a large-scale collaborative tagging project on baleen whales in the North Atlantic then this would require the purchase of at least 200 tags to be distributed among the member countries. One option could be that NAMMCO provides the tags and the member countries cover the costs of deploying tags, data retrieval through Service Argos and analysis of tracks. Data should be deposited in a database held at and administered by the NAMMCO secretariat.

Discussion

Questions were raised about the ideal location for deployment on the whale, which was suggested to be between the dorsal fin and the blowhole where movements are minimal. Questions were also raised concerning the fact that the tag would be 15cm long but the blubber of a minke whale is only between 3-5cm. This would mean that the tag would penetrate the muscle layer.

It was clarified that testing of the prototype tag in the field would have to be done by NAMMCO members before it could be used in a collaborative scientific project. This could include testing penetration and anchoring on dead whales, robustness and longevity of the transmitter and battery, and the anchoring and applicator system. Between 5-10 prototype tags would be required for the various tests to assess how they attach and to look at the ballistics and this would probably lead to a two-year time frame for the tag development.

In terms of the budget for the project, the possibility of distributing the costs over several years was discussed, as well as the possibility to seek funding for the engineering costs associated with developing the prototype from an external source. The SC **agreed** that national research institutes could be asked to cover the costs associated with deploying tags and that a common database for compiling results would be necessary.

In conclusion, the SC **agreed** that a collaborative project on satellite tracking of large cetaceans in the North Atlantic would provide important information on the migrations, exchange between areas, wintering grounds and site fidelity and that this would be of crucial importance for furthering the understanding of ecological interactions and subsequently, the management of large whales in the North Atlantic.

The SC therefore expressed its gratitude to the Council for its continued interest in this project and the request that FAC consider the financial implications and possible sources of funding. To assist in this process, the SC

agreed to deliver a revised project description (SC/25/08), including budget, and expressed its willingness to provide more information if necessary (this revised project description is available as appendix 4).

5.5.2.1 Presentation on tagging activities and developments in Japan

Konishi reported on the progress in the satellite-monitored tag experiments conducted in the Antarctic (Antarctic minke whale) and western North Pacific (common minke, Bryde's and sei whales) by the Institute of Cetacean Research in Japan.

Presenter's summary:

The presentation focused first on technical aspects of the equipment. In general, different technological improvements that have been made have resulted in a longer tracking period for the whales tagged. In the Antarctic, the objectives of the tagging experiments were focused on responding to questions on stock structure (pattern of movement within the feeding grounds and location of low latitude breeding grounds), and movement of animals in relation to environmental conditions. In the western North Pacific, the work has primarily focused on responding to questions regarding stock structure. Preliminary results for Antarctic minke in the Southern Ocean and sei whales in the North Pacific showed that the patterns of movements were consistent with previous hypotheses on stock structure based on genetic data. These tagging studies will be continued in the future and there is a desire to collaborate with the NAMMCO SC members to further develop the tagging equipment.

Discussion

The SC asked the average number of tracking days with the latest Japanese experiments. This was 50 days.

The SC discussed whether the proposed super tag project would offer significant benefits over the present configuration of spot tags being employed by the Japanese and other countries given that the size difference between the two was not significant. It was argued that although the size difference between the two may be negligible, the difference in weight was significant and this had important implications for the distance of deployment, and the volume inside the animal would also be halved. Since the spot tags have been used for several years, their limitations (including their relative short duration) have been documented.

Pastene confirmed Japan's interest in collaborating in the NAMMCO 'super tag' project both by contributing in the discussions on the development of tags, and by providing some financial contribution for such development. Japan would also be willing to purchase tags should a successful prototype be developed. The SC noted with appreciation Japan's interest in participating in the project and contributing to its financing.

5.5.3 Genetics collaboration on harbour porpoise

There is a project ongoing in Norway to analyse samples from bycatch and Greenland has recently completed a study of samples from Canada, Greenland and Iceland that showed Greenland harbour porpoises as a distinct population from both Icelandic and Canadian harbour porpoises. At the moment, collaborative work is taking place on an opportunistic basis and dedicated funding would be required to achieve a more coordinated collaboration. Opportunities for this may be discussed at the harbour porpoise workshop in December 2018.

5.5.4 AOB

A request for collaboration on the life history of harbour porpoise has gone out from Norway. Greenland is, however, already preparing its own papers on this topic from a PhD thesis so is not in a position to share these at the moment but can do so in the future. Iceland has not progressed with this collaboration to date but this may be picked up again during the harbour porpoise workshop in Tromsø in December.

5.6 Development of Management Advice

5.6.1 Review of development of management advice in NAMMCO [SC/25/06]

SC 24 reviewed a draft document providing a "summary of assessment and working procedures in the SC" (SC/25/06) and agreed that for the purpose of transparency, having such an overview of working procedures is important. The aim of this document was not to develop standardised rules for how decisions are made, or advice given, but rather to give a systematic overview of the rationale behind specific decisions and an historical record that can inform future work. Given the new request from council (R-1.6.6) asking for a review of

management procedures, and the fact that the FAC has also expressed a desire to have such a document, the SC considered how to proceed with this work.

The SC **recommended** an ad hoc working group containing a mix of expertise on large and small cetaceans and seals assessment be established to perform this work. As a first step, this group will be tasked to further develop in cooperation with the Secretariat the existing draft document reviewing the procedures used to date. The members of this ad hoc group will include: Bjarki Elvarsson (Chair), Lars Witting, Kjell Nilssen, Sandra Granquist and Mike Hammill. This group will begin by reviewing the existing draft document and sending feedback to the secretariat, who will then revise the draft on the basis of this feedback. Following this process, it will be decided as to what further work is required and whether a face to face meeting is necessary.

5.6.2 Review and status of active requests

R-1.6.4 (ongoing): *Council requested the SC and the Committee on Hunting Methods to provide advice on the best methods for collection of the desired statistics on losses, as the SC has recommended that catch statistics include correction for struck but lost animals for different seasons, areas, and catch operations.*

This is in the process of being answered, through the different working groups.

R-1.6.5 (Standing): *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 practice has been established.

R-1.6.6 (NEW, 2018): *The Council of NAMMCO request the Scientific Committee to 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 SC **recommended** as a first step that a new ad hoc working group focus on further developing the existing draft document providing such a review and outline of the management procedures used by the SC.

5.7 NAMMCO Scientific Publications

5.7.1 Guidelines for authors [SC/25/19]

A new 'Guidelines for Authors' document has been circulated (SC/25/19). This new document outlined the APA referencing system that NAMMCO scientific publications will now use and encouraged authors to use reference software to assist with the easy and accurate implementation of this referencing system. It also provided a draft text on the request from SC24 for the addition of a statement that animal welfare protocols had been followed.

Discussion

Questions were raised as to whether this statement was only required for research conducted on or handling live animals. However, it was noted that animal welfare protocols also exist for killing methods. The level of detail required in the statement was discussed and the SC **recommended** that the request to list the specific legislations and protocols followed could be removed and the request for information on approvals from ethical boards or committees be limited to only the provision of a reference number where this is applicable. The Secretariat will make these amendments and then make the final version available online.

5.7.2 Publication process

Online publication of the SC volumes was made possible by joining the UiT Arctic University of Norway Septentrio Academic Publishing system.

The Septentrio system has specific requirements for publishing papers. These include the demand that all cited references include the DOI identification where this exists. Furthermore, papers must be checked for plagiarism, which is done by the programme https://crosscheck.ithenticate.com

5.8 Classification and criteria for assessing conservation status in NAMMCO (e.g. website) [SC/25/17]

The SC is responsible for ensuring the quality of the scientific information available on the NAMMCO website. The website currently presents information on the most common marine mammal species found in the North Atlantic. Included in this information is a summary table of their conservation status based on the quality of available assessments and the level of removals. The form and style of these tables was presented to SC 25 and input requested on questions such as: the criteria informing the choices being made in the table, how to define key terms (e.g. what constitutes a 'substantial' removal), and how the table should handle very old assessments.

Significant discussion took place around the current use of a traffic light colour coding system to present the conservation status and the appropriateness of how the colours were being used. Specifically, questions were raised concerning whether red is appropriately applied to situations in which assessments are available but removals are at unsustainable levels (as is the current situation) or whether red is better used for situations in which no assessments are available. It was noted that traffic light colour systems are widely used by different organisations in similar visualisations of conservation status, with a colour coding matrix giving information on different factors of importance.

There was also some discussion around whether assessing the sustainability of present levels of removals was within the remit of the SC. While the level of permitted removals was of course a management decision, it was **agreed** that assessing the sustainability of these removals is indeed part of the mandate of a SC tasked with providing management advice on the setting of quotas for sustainable use of marine mammals.

The SC **recommended** that the colour coding in the tables be separately applied for removals and assessments and that the information be further broken down in separate stock areas for grey and harbour seals in Norway as is done for other species.

5.8.1 Presentation on Icelandic national red-list for mammals

A presentation of the Icelandic national red list for mammals was given by Granquist.

Presenter's summary:

A new regional assessment of the status of local populations within Icelandic national waters was published in October 2018. Previously only plants and birds had been assessed, but on the up-dated red-list, mammals were also now included. The assessment was performed by the Icelandic Institute of Natural History, with participation by MFRI (co-assessors for marine mammals), and is based on criteria defined by IUCN (https://www.iucn.org/theme/species/our-work/iucn-red-list-threatened-species). 52 mammal species have been observed in Iceland. The assessment was made for 18 of these species, since imported species, vagrant species and species on the border of their natural abundance area should not be assessed according to the IUCN method. 15 of the assessed species were marine mammals. On the basis of this assessment, five species are currently on the Icelandic national red-list: grey whale is regionally extinct (ER), harbour seal and North Atlantic right whale critically endangered (CR), grey seal endangered (EN) and blue whale vulnerable (VU). Eleven cetacean species were classified as being of least concern (LC), including the two species hunted in Iceland, the fin and common minke whales. In addition, two cetacean species could not be assessed due to data deficiency (DD).

Discussion

As three of the NAMMCO countries have now developed their red-list based on the IUCN criteria, the SC felt that NAMMCO did not need to proceed to such a classification, as had been proposed in the past. However, the SC **agreed** that it would be a good idea to present the IUCN global, regional status and national statuses in the marine mammal species information. This would provide a comparison of the different statuses and reveal differences in status at the species and population levels between these. For example, on the 2018 global listing, the fin whale was classed as Vulnerable, but as being of Least Concern for Iceland, Norway and Greenland.

5.9 Confidentiality of documents for SC and WGs

Since NAMMCO working documents to the Scientific Committee and its WGs have typically been made available upon request, and given national public access legislations, the question was raised as to whether these documents should continue to remain confidential.

The SC highlighted that it can be difficult for some authors to have their work published in scientific journals if it is freely available on the web. It was also noted that it is becoming increasingly common for authors to make their work available on pre-print websites, despite this excluding certain journals for later publication.

The SC **agreed** that as long as working documents continue to have the potential to be changed over time, there was a danger that if they were made public, information from outdated documents may be erroneously cited. The SC therefore **recommended** that the current practice within NAMMCO to keep working documents confidential be maintained. If a specific request comes in for access to a working document, it should be forwarded to the authors of the report to decide.

5.10 AOB

5.10.1 Time horizon for requests from Council

During the meeting, the SC discussed that some of the requests from Council were decades old and potentially no longer relevant. The value of responding to these old requests therefore seemed questionable.

To address this, the SC **recommended** that all requests that are not standing requests be given a 10 year time horizon, after which they are automatically retired as no longer relevant, unless specifically renewed by Council.

5.10.2 Improving efficiency in work flow

Several members of the SC noted that the current structure of meetings does not allow for the most efficient work flow. The short timeframe between the end of the field season (typically from June-September) and the SC meeting often meant that several WGs had to be squeezed in between these times. This limits the time available for completing tasks and preparing for meetings in a comprehensive manner. Data from that year's field season is also typically not able to be presented. With Council meeting in spring, it was also noted that management decisions are typically not able to be implemented until the following year. It was therefore proposed that having the SC meet in spring and the Council meet in autumn may create a more effective and efficient work flow.

The SC **requested** the Secretariat to investigate, together with Council, the possibilities for ensuring that the timetable of NAMMCO meetings enables an efficient work flow for generating scientific advice and implementing management decisions.

6 COOPERATION WITH OTHER ORGANISATIONS

Summaries of reports from cooperation with other organisations are given below and more detailed reports (where available) are included in appendix 5.

6.1 IWC [SC/25/07]

Víkingsson reported from the Annual Meeting of the Scientific Committee of the IWC held in Bled, Slovenia, during 24 April-06 May 2018. A full report is presented in appendix 5.

A major item on the agenda was related to the upcoming renewal of quotas for the aboriginal whaling in Greenland, the USA, Russia and St Vincent and the Grenadines. The main outcomes of relevance to NAMMCO included: finalization of SLA's for Greenlandic hunts of fin and minke whales and provision of management advise for all five stocks of baleen whales taken by Greenland; the Revised Management Procedure (RMP); assessments of whale stocks not subject to direct catches; formal adoption of cetacean abundance estimates for several North Atlantic stocks; methodology for assessments of stock status; bycatch,

entanglements and ship strikes; environmental concerns; ecosystem modelling; whale watching; special permits and results of a workshop on best practices in satellite tagging.

Discussion

The SC noted the report.

6.2 ASCOBANS

Desportes provided an update of activities on cooperation with ASCOBANS.

ASCOBANS AC23 (2017) declined the invitation from NAMMCO and IMR to cooperate on a review of North Atlantic harbour porpoises and in the organisation of the International Workshop on the on the Status of Harbour Porpoises in the North Atlantic. It also later declined the invitation to have the Coordinator of ASCOBANS harbour porpoise Action Plans participating in the workshop as an observer.

Following these two specific decisions and the general unwillingness of the ASCOBANS advisory committee to comply with ASCOBANS MOP8 decision to *Seek to cooperate closely with …, NAMMCO…"* (MOP8 Work Plan activity 61, Resolution 8.2), the Secretariat of NAMMCO had decided that having a NAMMCO observer to the ASCOBANS Advisory Committee was not a priority any longer. Therefore, the NAMMCO Secretariat did not observe the ASCOBANS Advisory Committee (AC24) in 2018. However, the NAMMCO Secretariat and the ASCOBANS and Convention on Migratory Species (CMS) Secretariats remainin contact.

Discussion

The SC noted the report and reiterated its regret that ASCOBANS did not wish to cooperate to nor participate in the international workshop on harbour porpoise.

6.3 ICES

6.3.1 Update [SC/25/09]

Haug reported on the 2018 activities in ICES that have some relevance to the work in NAMMCO SC. A full report is presented in appendix 5.

This included work in the ICES Working Group on Marine Mammal Ecology (WGMME) and the Working Group on Bycatch of Protected Species (WGBYC). Information on the ICES Annual Science Conference (ASC) was also included, which typically involves sessions with marine mammals as an integral part and occasionally sessions entirely devoted to marine mammals.

Discussion

The SC noted the report. It was also informed that the next meeting of the Joint ICES/NAFO/NAMMCO WGHARP will be held in Tromsø in 2019.

6.3.2 RoP for the ICES/NAFO/NAMMCO joint WGHARP [SC/25/26]

Since some of the partner organisations have different processes for reviewing reports and advice and regarding confidentiality of documents, there is a need to establish rules of procedure (RoPs) for the ICES/NAFO/NAMMCO joint WG harp that satisfies the requirements of all of the organisations involved. A draft document outlining RoPs (SC/25/26) developed by the NAMMCO Secretariat was presented by Winsnes.

Discussion

The SC **agreed** that the process should be a joint process up to the point at which the report of the WG is released and then each organisation follow its own process for review and endorsement after that.

The final RoP should be developed in collaboration with ICES and NAFO and the SC **agreed** that the current draft could be forwarded to these organisations.

6.4 JCNB

Hansen informed the meeting that the report of the November/December 2015 meeting of the JCNB Commission meeting had now been finalised. Furthermore, Canada was in charge of inviting for the next meeting, which is expected for 2019.

Discussion

The SC noted that it remained difficult to access the report of the JCNB, as there is no official depository.

6.5 Arctic Council and subsidiary bodies

Ugarte presented a review of the activities taking place under the CAFF-CBMP.

Presenter's summary:

The Circumpolar Biodiversity Monitoring Programme (CBMP) is an international network within the working group on Conservation of Arctic Flora and Fauna (CAFF) under the Arctic Council. The goal is to form networks of scientists that work together to improve detecting, understanding and reporting of arctic biodiversity trends, to shorten the time before identification of trend and management response. The work of the CBMP is organised around the major ecosystems of the arctic and CBMP-marine is one of four groups - with the others being coastal, terrestrial and fresh water. The CBMP-Marine has six expert networks: ice-associated biota, plankton, benthos, fish, marine birds and marine mammals. Several members of the marine mammal expert network are also involved in the SC.

So far, the CBMP work has focused on endemic arctic species (bowhead, narwhal, beluga, walrus and ice-breeding seals), but is contemplating the possibility of adding migrating species as well. After completing the State of the Arctic Marine Biodiversity Report (SAMBR) assessment in 2017, work has been limited to updating the status table, and preparing it as an online database. There is also a ringed seal paper under preparation. One of the original aims was to produce periodical reviews for CAFF, approximately every 5 years, of which the Artic Biodiversity Assessment (ABA) could be seen as the first (2013) and SAMBR as the second (2017).

Possible future tasks have been discussed and are awaiting decisions from the CAFF board. Possibilities include a report about circumpolar harvest of marine mammals and a circumpolar analysis of passive acoustic monitoring (PAM) data. Other candidates for collaboration include health assessments, beluga life history comparisons and telemetry data. A core challenge though is that CBMP has no dedicated funding, so the work is supposed to be based on existing national monitoring schemes. A scoping workshop to identify ecosystem drivers important for arctic change is planned in Greenland next year. The goal of this workshop will be to focus the future tasks of CBMP-Marine.

Discussion

The SC noted the report. With reference to CAFF activities on ringed and bearded seals, no new information was provided. Desportes noted the interest reported by CAFF for developing joint activities on these species with NAMMCO.

6.6 Other

NAMMCO SC has had little dealings with OSPAR. The SC was informed that NAMMCO and OSPAR are in an early stage of defining a MOU. NAMMCO is also looking into the possibility of joining the Collective Arrangement between OSPAR and the North East Atlantic Fisheries Commission (NEAFC).

In the framework of its Joint Assessment and Monitoring Programme (JAMP), OSPAR assesses the environmental impact of a range of human activities as part of its decadal assessment of the state of the marine environment of the North-East Atlantic.

Discussion

The SC **recommended** that the Secretariat investigate how OSPAR data could help answer the request R-1.5.4.

7 ENVIRONMENTAL / ECOSYSTEM ISSUES

7.1 Marine mammals-fisheries interactions

7.1.1 Consumption of resources by marine mammals

7.1.1.1 Update

Granquist presented a new publication (SC/25/FI/31) on fish consumption assessed by DNA metabarcoding (prey-DNA analysis).

Presenter's summary:

The diet of harbour seals hauling out in an estuary area in north-western Iceland was investigated between May and August of 2010 and 2011 by genetic (molecular) analysis of prey in faeces using DNA metabarcoding. The results were compared to previously published results from morphological analysis. Despite Atlantic salmon (Salmo salar), brown trout (Salmo trutta) and Arctic char (Salvelinus alpinus) availability in the study area, neither of the methods found evidence of salmonids in the harbour seal diet. The main species consumed were sandeels (Ammodytes sp.), flatfishes (Pleuronectidae), gadoids (Gadidae), herring (Clupea harengus) and capelin (Mallotus villosus). The results from molecular and morphological analyses were similar in regards to important prey species. However, species diversity was lower in the morphological analysis and 38% of the samples included prey items that were unidentifiable in the morphological analysis. The Icelandic harbour seal population is defined as critically endangered according to the Icelandic red-list for threatened species. The main reason for culling harbour seals in Iceland is to reduce the effect that seal predation is believed to have on salmonid populations and salmon angling. Hence these findings have essential conservation implications and suggest that culling needs to be reassessed.

Discussion

A question was asked regarding when the sampling was done, which was answered as May to September. Questions were also asked about why the seals were not feeding on salmonids. Reasons put forward included that salmonids may be harder prey to catch, that they can in some cases actually be bigger than the seals, that seals may prefer to attack prey from above (i.e. more bottom associated prey than salmon.) Also the conditions of these locations seem to indicate that they may represent important breeding grounds for seals and that this may be what attracts them to the area rather than to feed on the salmonids. It was also noted that the issue of secondary prey may be important to assess.

7.1.1.2 Future work

Haug reported that a high priority part of a planned Joint Norwegian-Russian Research Program on Harp Seal Ecology is to deploy satellite transmitters on harp seals in the White Sea.

Presenter's summary:

In all the years 2007-2018 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 turn out to be unfavourable in early May. However, either formal problems with permissions, lack of funding or difficult ice conditions prevented tagging of seals. In 2019 a new attempt will be made to obtain funding for and carry out satellite tagging in the White Sea. During the tagging experiment, PINRO will provide the necessary logistics required for helicopter or boat based live catch of seals in April-May 2019. IMR, Norway, will, as before, be responsible for the satellite tags, including providing all necessary technical details, as well as for providing experienced personnel and equipment for anaesthetizing seals and tag deployment. For proper planning and budgeting by both institutes, a PINRO scientist must obtain the necessary permissions from Russian authorities before December 2018. The permission from Russian authorities is not dependent on the origin of the transmitters, both UK and Russian transmitters can be used. The transmitters cannot collect geographically positioned temperature and salinity data. After the 2019 tagging season future seal tagging will be decided upon following an evaluation of both the tagging methods and the obtained seal movement data set. Due to low pregnancy rates and decline in pup production it will be important to focus on harp seal ecology and demographics in the coming years.

7.1.2 By-catch [SC/25/13, 30]

7.1.2.1 Update

The 2017 BYCWG formulated a list of recommendations for Iceland, Greenland and Norway which were subsequently endorsed by SC 24 (SC 2017 Report, point 7.1.3). A full list of these recommendations is provided in the SC24. Updates on the national responses to these recommendations are outlined below.

FAROE ISLANDS

The Faroe Islands informed that the responsibility for responding to the recommendations of the by-catch WG lies within the Ministry of Fisheries. A meeting has been requested between the Ministry and Mikkelsen to get a more complete overview of the system in place and look at how best the recommendations related to log books can be implemented.

The Faroe Islands have regulated their fisheries based on fishing days at sea but are now planning to implement a quota system for demersal fisheries. As this system might generate more discard, an increased observation effort will be deployed. These fisheries observers, which will also observe the pelagic fishery, are instructed to also collect data on marine mammal bycatch, for which documentation is a mandatory feature of the observation protocol.

This new observation framework has been in place since early 2018 and data on marine mammal bycatch has been collected, but not yet analysed. The data collected in the monkfish fishery prior to 2015 has also not been analysed yet.

GREENLAND

In Greenland it is presently the Ministry of Fisheries, Hunting and Agriculture that is dealing with the by-catch issue and not the Greenland Institute of Natural Resources and no updates were provided to the meeting.

ICELAND

Iceland provided a general answer and informed that the recommendations related to the analysis of the by-catch data had been implemented and revised analyses presented to the BYCWG at its two 2018 meetings.

Iceland also reported that a new committee working on more general environmental aspects of resources from the sea had been convened by the Ministry of Fisheries and includes by-catch of marine mammals in its deliberations. This is a transdisciplinary group that also includes people from the fishing industry.

It was noted that laws about seal hunting in Icelandic legislation system are limited and outdated. A system for reporting direct hunt of seals is being worked on.

NORWAY

Norway has responded to the recommendations of BYCWG 2017 and endorsed by SC 24 as follows:

- *The ratio-based approach is more robust to different issues identified (such as zero-data, clustered by-catch events, correlated data) and the WG recommended it should be preferred over for the model-based and mark recapture approaches.*

A stratified ratio and a modelling approach were used to estimate by-catch rates. In the modelling approach, it was attempted to model by-catch after Poisson, ziP and NB distributions using GLMs. The model AIC comparisons and QQ plots suggested an NB model was the best fit, but a Poisson model gave the most sensible predictions. It seems likely that vessels must be included in the models as a random effect to account for inter-vessel variation, and this has not been done yet. For these reasons, and those pointed out in the WG, it seems best to defer to the stratified ratio by-catch estimates until the modelling problems can be solved.

- *The total landed weight for all species should be used as a measure of effort, and not only the landed weight of the target species, cod and monkfish, as using only a portion of the catch as a measure of fishing effort may lead to an underestimate of by-catch.*

The reason for using only cod and monkfish catch is because it was desirable to apply the estimated by-catch rates from the Coastal Reference Fleet (CRF) to the entire coastal fleet. To do this, information available in both sets of fish logs (i.e. fish logs from the CRF and from ordinary non-reference vessels) had to be used. If total catch had been applied instead of only cod and monkfish catch, it would have been impossible to "extract" out

the corresponding information from the non-reference fish logs, since they do not include information on gear use. Therefore, it must be emphasized that the obtained by-catch estimate is *only* for the Norwegian coastal cod and monkfish gillnet fisheries, and *not* for the entire coastal fisheries.

- *Other measures of fishery efforts than landings should be explored, as landings do not represent the actual fishing net effort.*

This is obviously true, but the data provided by the Directorate of Fisheries and used to extrapolate by-catch rates derived from CRF data is not currently detailed enough to use with any other measures of effort. Detailed fish logs for the reference vessels are available, and estimates of by-catch rates using other, more sensible measures of effort can be done, but these rates cannot be applied to the entire fisheries. A process has started where the Directorate of Fisheries has been contacted in order to determine whether it is possible to provide more detailed effort statistics for the rest of the non-reference vessel fleet.

- *If the same vessels are used in the CRF year after year, there will be correlation in the data samples which will lead to errors in the by-catch estimate and the WG recommended to modify the design of the selection process.*

Contracts for the coastal reference fleet are renewed every fourth year. The CRF vessels are selected among vessels applying for these contracts. Presumably, the selection processes emphasize quality of reporting over complete randomization. Known reporting inconsistencies or faulty reporting either from previous work with the IMR or with the Directorate of Fisheries can disqualify a vessel from the competition. The CRF also aims to have at least two vessels in each of the nine fishery statistics areas along the Norwegian coast. Within these constraints, the selection process is randomized. Furthermore, there is a turnover of vessels in the CRF. A total of 42 different vessels have been part of the CRF for one or more periods since 2006, with 14-20 vessels comprising the CRF every year. Obviously, there is a trade-off between ensuring independent samples and data quality assurance that should also be considered in the selection process. The intention is to account for correlated observations by including vessels as a random effect in predictive GLMMs. A thorough evaluation of the sampling design for the by-catch monitoring programme is about to get started as part of the work in a current 4-year IMR – University of Oslo PhD project.

- *Some other fisheries are not considered, particularly the gillnet lumpfish fishery which has a high by-catch rate although it is a small seasonal fishery, and the recreational fishery that also uses gillnets.*

The by-catch estimates reported so far are only for the cod and monkfish fisheries. Data are, however, being considered for possible estimation of by-catch for other fisheries, including the recreational fishery.

- *In the mark-recapture approach using tagged animals, the assumption between regarding tag loss and annual mortality rate, emigration and immigration being similar between the two sets of animals (harvested and by-caught) are unlikely to be upheld, also consideration should be given to the implications of different age structures between harvested and by-caught samples. Therefore, the WG recommended to disregard using this method for the estimation of by-catch rates.*

There are several difficulties in using the mark recapture data for estimating seal by-catch. However so far it is the best available method. Simulations to explore possible alternative ways to compile data to estimate by-catches of seals will be attempted. IMR is currently working with the Directorate of Fisheries on improving data collection and exploring the additional existing data that may be available. The Directorate has decided that the coastal fleet should report positional information on their fishery activities. Over the next four years, more and more vessels from the coastal fleet will be required to provide this data. By 2022, all vessels with an overall length less than 15 meters will be required to report positional information. This will improve the possibility to explore risk of by-catch.

Norway agrees with the observation made by SC 24, that the WG had recognized that while it has recommended that marine mammal by-catch reporting is made mandatory in commercial logbook systems for vessels of all sizes, this information is not reliable without validation, which is difficult. While logbook reports can be useful as qualitative indicators, the most reliable means to obtain information on by-catch is via dedicated monitoring by fisheries observers or electronic monitoring.

In 2017, the SC also noted that the WG had discussed interactions between aquaculture and seals and encouraged the work of the Directorate of Fisheries to obtain improved data on the numbers of seals shot at fish

farms. It further supported the suggestion of the WG that Norway should look at the numbers of fish mortalities at the fish farms that have been attributed to seals.

It appears that few seals have been reported shot at fish farms, and IMR has recommended to the Directorate of Fisheries that the legal possibility to shoot seals at fish farms should be terminated.

Discussion

The SC **commended** the efforts made by the different countries and underlined the importance of having reliable data on by-catch for all fisheries, especially since for population assessment, by-catch is one component of total removals in addition to other takes like direct catch.

Norway informed that by-catch (and/or entanglements) in the crab and herring fisheries, (mostly of larger species such as killer and humpback whales) was relevant but presently not the focus of any studies, as Norway had concentrated its effort on the gillnet fisheries.

7.1.2.2 NAMMCO By-Catch Working Group 2018 (BYCWG)

Following its face to face meeting in May 2017, the NAMMCO Scientific Working Group on By-Catch (BYCWG) held two conference meetings on April 4th and October 31st 2018, under the chairing of Kimberly Murray (NEFSC, NOAA, USA). Besides the chair, invited external experts were Marjorie Lyssikatos (NEFSC, NOAA, USA) and Simon Nothridge (University of St Andrews, UK). Iceland and the Faroe Islands participated in the first WG meeting, while Iceland, the Faroe Islands and Norway participated in the October meeting.

The ToRs of the April meeting were:

- *Review the Icelandic lumpsucker and cod gillnet fishery by-catch data and estimates*
- *Updates on answers [From Parties] to BYCWG recommendations from 2017.*

The ToRs of the October meeting were, in order of priority:

- *Review the Icelandic by-catch estimates for cod gillnet (porpoises and seals)*
- *Review the Norwegian by-catch estimate (porpoises and seals) for the ten-year period 2006-2015*
- *Review the Faroese update on progress in implementation of the WG recommendations from May 2017*
- *Review the Parties updates on the collation of effort and by-catch reporting from foreign vessels fishing in national waters (WG recommendation from April 2018).*

For the October meeting, the WG dealt with points 1 & 2 for harbour porpoise by-catch, got a short update on point 3 and did not have time to deal with point 4.

ICELAND

The recommendations from the BYCWG 2017 to Iceland provided the basis for the reanalysis that Iceland submitted to the April WG meeting on by-catch estimates in the lumpsucker and the cod gillnet fisheries. The recommendations from the BYCWG 2018 April provided the basis for the reanalysis that Iceland submitted at the BYCWG October meeting on the cod gillnet fisheries.

Bycatch of marine mammals in lumpsucker gillnets 2014 - 2017

The summary of by-catch estimates across 4 different stratification schemes was presented to the BYCWG: non-stratified, stratified by management area, by depth, and by month. This information is provided in Table 1 below.

BYCWG noted that a broader combined stratification might be more appropriate with the data available and could improve the estimates. For instance, 2 management areas (B&C vs. all others) and 2 seasons (Mar-May, Jun-July) providing 4 strata. It also noted that the four estimates were fairly similar, and it did not appear to matter which stratification was used.

The BYCWG provided the following advice for refining the data collection and analysis:

- The analysis did not show a significant difference between randomly and non-randomly selected inspected vessels, however the data should be further explored. Specifically, whether the difference changes if the analysis uses number of by-catch events rather than number of individuals caught should be investigated (i.e. using a binomial analysis with “catch vs no-catch”). It was helpful to continue selecting vessels randomly and keeping track of which vessels are selected randomly/non-randomly.

- The depth stratification would be improved with more consistent reporting and an agreed consistent definition of how to report the depth.

- The stratification of management areas could be improved by examining the management areas with high by-catch versus low by-catch. This could be done by reducing the management areas to these 2 strata, and then by month or quarter. Collating the data on fewer strata will both improve the estimate and its precision.

Table 1. Summary of four average annual marine mammal bycatch estimates per species (n/year) in the Icelandic lumpsucker fishery 2014-2017. The numbers reported in logbooks by the fleet in 2017 are also shown.

Species	**Non-stratified** (± CV*estimate)	**Stratified by management area** (± CV*estimate)	**Stratified by depth** (± CV*estimate)	**Stratified by Month** (± CV*estimate)	**Logbooks 2017**
Harbour porpoise	551 (412-630)	549 (264-834)	662 (324-998)	428 (240-616)	286
Harbour seal	1367 (1135-1599)	1255 (728-1782)	1663 (915-2411)	1221 (684-1758)	700 (all seal species)
Grey seal	1385 (886-1884)	1091 (502-1680)	1034 (165-1903)	1907 (840-2974)	
Harp seal	177 (113-241)	132 (15-249)	213 (49-377)	190 (55-325)	
Ringed seal	53 (13-93)	33 (1-65)	48 (1-95)	60 (1-118)	
Bearded seal	36 (9-63)	42 (12-72)	NA	42 (13-71)	
White beaked dolphin	0	0	0	0	2
Unidentified dolphin	0	0	0	0	1
Total marine mammals	**3570 (2963-4177)**	**3102 (2016-4188)**	**3620 (760-6480)**	**3847 (2270-5424)**	**988**

The stratified estimates were preferred over the non-stratified estimate. However, the BYCWG did not feel that it had enough information to suggest one stratification over another.

The BYCWG accepted the by-catch estimates presented in Table 1 and recommended forwarding all the estimates – non-stratified and stratified – to the Scientific Committee. It noted that the CVs for grey seal estimates were high and any assessment should take this into account.

BYCWG noted that, as has been observed in most other areas, the logbooks do not provide a reliable source of data to use for estimating by-catch, even when fishermen should be motivated by receiving compensation. It therefore strongly recommended that logbooks not be used for calculating/assuming by-catch rates, but only as indicators for raising concerns when by-catch reporting is increasing.

BYCWG recommended that Iceland provide a description of the coverage and by-catch reports, even if there are none, as it provides more evidence that the by-catch risk is low.

By-catch of marine mammals in cod gillnets 2014 - 2017

The analysis related to the by-catch in cod gillnets was reviewed at both the April and October meetings. The re-analyses presented to the BYCWG in April 2018 implemented recommendations formulated by the WG in 2017, while the one presented in October implemented recommendations formulated by the WG in April. However, the BYCWG still did not feel confident in adopting the estimates for by-catch of porpoises and seals in cod gillnets for the period 2014-2017.

The April cod survey conducted by the Marine Research Institute represents the most reliable data set available, compared to the logbook dataset and the inspectors' dataset. It is being used to infer bycatch rates over the entire coastline throughout the year under the assumption of being representative of commercial effort in other months.

The main concern expressed by BYCWG is that the April cod gillnet survey may not be representative of fishing effort in other times and areas, as by-catch rates may vary by month.

Harbour porpoises:

The harbour porpoise by-catch estimate presumes that April bycatch rates are indicative of activity in other months and is based on the porpoise availability index, which might need some further adjustments. BYCWG is therefore concerned that the harbour porpoise bycatch estimate for cod gillnets might be lower than the presented stratified estimate.

The WG did not endorse the by-catch estimate presented for harbour porpoises in the cod gillnet fishery in Iceland and provided recommendation for revising the analysis, as listed below.

However, regarding the need for information on harbour porpoise by-catch rates off Iceland for the upcoming WSHPNA, the WG agreed that as an interim measure, the stratified estimate presented, i.e. 1841 porpoises a year, could be considered as an upper bound for the by-catch in cod gillnets for the period 2013-2017.

Seals:

The WG found it difficult to evaluate the quality of the seal bycatch estimates due to the uncertainties in the species recorded in the data. There are discrepancies between the species reported and their relative proportions in the April survey, by the inspectors and in the logbooks.

Also, if the survey data are considered the best data available to evaluate the bycatch of seals, the same issues as those mentioned for porpoises above apply here. If April rates are not representative of bycatch in other months, either the stratified or non-stratified bycatch could be biased.

The WG did not endorse the by-catch estimates presented for seals in Iceland and provided several recommendations for revising the analysis, as listed below.

<u>New recommendations for research for the cod gillnet fisheries</u>

Harbour porpoise:

– Responses to each set of comments be circulated by Iceland to WG members prior to the next meeting.
– The bycatch rates be reported by month and statistical areas, and be adjusted for availability.
– Detailed information on the calculations be provided in the next report, rather than the summary format provided, so that the bycatch estimates can be more easily appraised, and recommendations made if necessary.
– Revised analyses be presented to the next WG meeting

Seals:

– The report clarifies the stratification scheme and calculation used for seals.
– The stratified estimates use data from 2014-2017 and that the estimates be reported for each stratum.
– Analyses be presented to the BYCWG at its next meeting.

<u>Other new recommendations</u>

Foreign fisheries:

The WG reiterated its recommendations from April 2018

– Any information that is available on by-catch from foreign vessels be presented to the BYCWG.
– Iceland provide a description of the coverage and by-catch reports, even if there are none, as it provides more evidence that there is little by-catch risk.

Logbook:

- The species identification in the logbooks be improved, perhaps with a picture of the species at different life stages appearing when the species identification is to be entered in the electronic logbook.

General recommendations:

- Iceland provide more detail on the amount of observer effort in pelagic trawl fleets, which would give more confidence in stating that there is no by-catch in the pelagic trawl fleet.
- Logbooks not be used for calculating/assuming by-catch rates, but only as a qualitative indicator for raising concerns when by-catch reporting is increasing.

NORWAY

The recommendations to Norway from BYCWG 2017 provided the basis for the reanalysis that Norway submitted at the October WG meeting. The reanalysis presented only dealt with harbour porpoise by-catch. The analysis is based on data collected by the coastal reference fleet (CRF) and only encompasses vessels <15 m. Landings are used as the measure of effort to produce the fleet by-catch estimates, because until now this has been the only information available from the Directorate of Fisheries for the fleet.

The WG remained concerned that

- the by-catch rates reflect only cod and monkfish landings, and not all landings caught in bottom-set gillnets with meshes ranging from 75-105mm (i.e. cod), or with 180mm (i.e. monkfish). The porpoise will get caught in the net regardless of what the net is catching, so rates could actually be lower if other fish species are caught in these mesh sizes (which it looks like they do from appendix 3 in document #6 for the WG).
- the present approaches used to calculate the by-catch estimates in the CRF do not take into account variation between vessels. Every haul is considered an independent observation. To explore a 'vessel effect', hauls should be grouped by fishing vessels, e.g. by adding the vessel as a random effect term.
- year is not included in the stratification scheme, which would account for annual changes in the bycatch rate due to variation in landings.
- there is harbour porpoise bycatch occurring in other fisheries that are not included in the cod and monkfish by-catch estimate provided.

Acknowledging the caveats formulated, the WG agreed that ratio estimates in Table 2 (presented below) stratified by both time and area (2211 hp/year, 95% CI=1569–2926) seemed reasonable to use for the harbour porpoise workshop but remains a preliminary estimate, pending further review as recommended by the WG. The WG recommended that a revised ratio estimate be presented to the WG at its next meeting. As there are some smaller fisheries that also by-catch harbour porpoises, although likely on a smaller scale, this will be an underestimate and that also needs to be underlined.

New recommendations

Harbour porpoises:

– Comments submitted to the authors should be addressed in their revisions and responses circulated by Norway to WG members prior to the next meeting.
– The possibility of including larger vessels in the by-catch estimation should be explored.
– The inter-vessel variation should be explored and captured in the stratification and the model if further modelling is performed.
– The potential bias in the by-catch rate of excluding other landings in the net than cod and monkfish be acknowledged in the manuscript.
– The authors explain in the manuscript which other fisheries account for 16% of the by-catch and address this missing portion of by-catch in future analyses as well as the by-catch in the lumpsucker fishery.
– Year should be included in the stratification if it has not been done already.
– A revised ratio estimate be presented to the WG at its next meeting.

Table 2. Stratified ratio bycatch estimates with associated CVs and 95% CIs for harbour porpoise in the combined cod and monkfish fisheries in Norway for 2006 - 2016. All values represent averages over ten years of data, rather than a single year. Bycatch refers to yearly bycatch. Bycatch per unit effort is not shown, as it varies between strata.

Stratification	Bycatch	CV	95% CI
Area × month	2211	0.16	1569 – 2926
Region × month	2366	0.12	1854 – 2909
Area	2313	0.27	1108 – 3671

Month	3218	0.17	2279 – 4409
Region	2347	0.14	1742 – 2952

FAROE ISLANDS

Recommendations provided by the WG have not yet been implemented. However, observers have been placed on the pelagic fleet for mackerel and blue whiting. These observers had in their protocol the mandatory reporting of marine mammal by-catch.

The WG reiterated its recommendations from May 2017 and April 2018.

Recommendations

Foreign fisheries:

- Any information on observers and reports of by-catch by foreign fleet be presented by the Faroe Islands to the next BYCWG meeting.

Logbook:

- A selection of local marine mammal species be added to e-logbook design, so that species identification can be easily reported.
- A reporting system for vessels below 15 GMT be implemented.

Discussion

Most of the work in the BYCWG has been driven by the first step effort of obtaining reliable by-catch estimates for the Icelandic and Norwegian gillnet fisheries and there has been good progress in these areas.

For both Iceland and Norway, there is a problem in the identification of seals, as well as other species in some areas. Norway informed that it had provided the reference fleet with identification materials and photos. Dealing with young seals increases the identification challenge. A specific problem to Iceland, which might be related to the identification issue, is the lower by-catch reporting from fisheries inspectors/observers compared with the April survey, where by-caught animals are taken onboard. Also, the Icelandic grey seal by-catch estimate provided is at the level of 20-30% of the population per year for a single fishery. This clearly does not fit with the estimations of population sizes observed between 2012 and 2018 and could partly be explained by the identification issue.

The SC **strongly recommended** that Parties increase their effort in resolving the species identification issue in by-catch reporting.

Regarding the by-catch estimate for the Icelandic lumpsucker fishery, the SC noted that the difference between the different stratified estimates for the different species (except grey seal) was small and not statistically different. The SC **endorsed** the recommendation of the BYCWG to use these estimates as a range. The SC **recommended** that the BYCWG reconsider the grey seal by-catch estimate and provide further advice on that.

The SC **commended** the work of the BYCWG and the effort of Iceland and Norway in responding to the WG recommendations and getting reliable by-catch estimates. The SC **endorsed** the new recommendations formulated by the BYCWG to the Faroe Islands, Iceland and Norway and noted that some of the older endorsed recommendations remained valid as well

7.1.3 Review and status of active requests

R-1.1.5 (standing): *The Council encourages scientific work that leads to a better understanding of interactions between marine mammals and commercially exploited marine resources and requested the Scientific Committee to periodically review and update available knowledge in this field.*

The work on-going under BYCWG provides some answers to this request.

7.2 Multispecies approaches to management/Ecosystem modelling (R-1.1.8, 1.2.1, 1.2.2, 1.4.7)

7.2.1 MareFrame [SC/25/27]

Elvarsson provided an update on the MareFrame project and a review of its results.

Presenter's summary:

MareFrame was a 4-year EU funded FP7 research project with an ultimate objective to identify barriers to Ecosystem Based Fisheries Management (EBFM) and ways to remove them. NAMMCO has previously expressed interest in the results of this project and in 2017, when the MareFrame project was completed. NAMMCOs scientific committee tasked Elvarsson and Skern-Mauritzen to provide a review of the project and prepare a document for SC 25 as response to request R-1.4.7 (prepared as SC/25/27).

The work in the project focused mainly on developing a decision support framework that rested on four key pillars: co-creation with stakeholders, the development of ecosystem models in collaboration with stakeholders, decision support tools illustrating how the effects of management decisions affect individual stakeholder groups and educational resources.

The methods developed by the project were applied in 8 distinct case study areas, one of these was the Icelandic waters case study. Over the course of the project at least two ecosystem models in each case study area were developed to investigate various management questions. In Icelandic waters three ecosystem models were developed based on fairly different modelling approaches - Atlantis, Gadget and Ecopath with Ecosim - with an emphasis on capturing the dynamics of the Icelandic cod fishery.

Although the Barents Sea was not part of the MareFrame project, similar developments have also been made for this region, notably in terms of multi-species and ecosystem models. In both regions, the main emphasis has been on understanding the central drivers for fluctuations in the status of commercially exploited fish stocks. The role of marine mammals did not receive a similar focus in the work.

Discussion

In term of the ongoing requests to the SC, R.1.1.0 and 1.2.0, the SC **concluded** that the results of the MareFrame project, and similar developments for the Barents Sea, represent an important milestone towards answering these requests. However, the SC **agreed** that further work is needed to refine and update the currently available models if they are to provide advice on marine mammal interactions with fisheries, both direct and indirect.

The SC **agreed** that funding should be sought to extend and further develop the outputs of the MareFrame project. This funding should be used to refine and tune the models to specifically focus on developing scenarios for the management of marine mammals and the unique needs of NAMMCO. Investigating marine mammal fishery interactions, and their inclusion into ecosystem-based fisheries management (EBFM) models, is of significant importance to NAMMCO member nations. The SC therefore considered it to be of great importance to build upon the extensive foundational work already conducted by the MareFrame project to develop and trial a range of models that can be used for understanding ecosystem interactions and the implications of different management options.

7.2.2 Review and status of active requests

> ***R-1.1.8 (ongoing):*** *In addressing the standing requests on ecosystem modelling and marine mammal fisheries interaction, the SC is requested 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.*

The joint analyses of the data gathered through the whole NASS series are in progress.

> ***R-1.2.1 (ongoing):*** *consider whether multispecies models for management purposes can be established for the North Atlantic ecosystems and whether such models could include the marine mammal 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.*

The outputs of the recently finished MareFrame project, and similar projects, can now be built upon to address this request.

> ***R-1.2.2 (standing):*** *In relation to the importance of the further development of multispecies approaches to the management of marine resources, the Scientific Committee was requested to monitor stock levels and trends in stocks of all marine mammals in the North Atlantic.*

Analyses of the data gathered through the whole NASS series is close to completion, included analysis of trends.

> ***R-1.4.7 (ongoing):*** *The Scientific Committee is requested to review the results of the MAREFRAME ecosystem management project when these become available. In particular, the results should be reviewed with respect to the ongoing and standing requests on marine mammal interactions (R-1.1.0) and multispecies approaches to management (R-1.2.0).*

The SC considers that the request to review the results of the MareFrame project has now been met.
In response to the MCJ (as described in the Council report of 2018, under item 8.1.1.3), the SC **agreed** that considering economic aspects (as indicated in R1.4.0) falls outside the competence of the SC.

7.2.3 Future work

No plans for future work were discussed.

7.3 Other environmental issues (R-1.5.1, 1.5.3, R-1.5.4)

7.3.1 Updates

7.3.1.1 Murphy et al. (2018) paper on organochlorine contaminants [SC/25/FI/19]

Smith presented a summary of this recently published paper.

Presenter's summary:

A review of a recent paper on organochlorines contaminants in cetaceans was provided. Organochlorines are persistent organic pollutants (POPs) that both bioaccumulate and biomagnify. They have long been identified as a source of adverse health implications in marine mammals, particularly to those feeding at higher trophic levels. Polychlorinated biphenyls (PCBs), and dichlorodiphenyltrichloroethane (DDT) have both been reported to disrupt the endocrine, reproductive, and immune systems within marine mammals. The UK Cetacean Strandings Investigation Programme (CSIP) collected samples of stranded female short-beaked common dolphins (*Delphinus delphis*) between 1990 and 2013, investigating incidences of reproductive abnormalities in association with PCB concentrations sequestered within the blubber. Kannan *et al.,* (2000) identified a threshold toxicity level for PCBs of 17 mg/kg lw for the onset of adverse health effects. Of the 107 common dolphins that were sampled, 18 (16.8%) were found to have reproductive pathologies, with abnormalities in either the reproductive tract or ovaries. All females presented with reproductive abnormalities had PCB burdens above the previously stated threshold. Notable cases include an 18-year-old female with atrophied ovaries and a PCB burden of 45.4 mg/kg lw. It is rare for marine mammals to exhibit reproductive senescence, and thus the reproductive failure may be attributable to a high concentration of PCBs. Another example is the case of a true hermaphrodite found with one ovotestis, yet external female phenotype. Although blubber samples were not available, increased incidences of hermaphroditism in belugas (*Delphinapteras leucas*) have been associated with increased PCB burdens in the St Lawrence Estuary (De Guise *et al.,* 1994). The study has therefore reported evidence of reproductive failure and disfunction in the short-beaked common dolphin, which may be linked to increased exposure to PCBs. As bycatch in the Northeast Atlantic is a great source of mortality in this species, suppression of reproductive capacity will compound problems associated with population recovery. Further, there is some evidence that large scale movements of this species are occurring from offshore waters into continental shelf habitats (Hammond *et al.,* 2017). This will further increased exposure to these anthropogenic legacy pollutants.

Discussion

The SC noted the update provided and **requested** the Secretariat to perform a review on recent research on pollutant levels and impacts in all marine mammals of relevance for NAMMCO Parties to keep the SC updated.

7.3.2 Review and status of active requests

R-1.5.1 (pending): *To describe the possible pathways of radioactive material from blowouts and leakage in existing nuclear power plants, leakage from dumped material and possible accidents in planned recycling plants in the northern part of Scotland into the food web of the North Atlantic and hence into the top predators like marine mammals. This request was sent to ICES by NAC.*

The SC considers that this request is now outdated and asks that Council consider closing the request.

R-1.5.3 (ongoing): *The Council requests the SC 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.*

During SC 25, Hammill provided an update regarding the plan to build a railway to increase shipments from the mine to Milne Inlet and to increase shipping from Milne Inlet to Europe. The SC **reiterated** its previous recommendation that all information on the Mary River Project be presented to the next meeting of the NAMMCO-JCNB JWG in 2020

R-1.5.4 (2017, ongoing): *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.*

As part of the ongoing efforts to address this request, the SC **recommended** that the Secretariat conduct a review of pollutants in all marine mammals relevant for NAMMCO and report the results to SC 26.

8 SEALS AND WALRUS STOCKS - STATUS AND ADVICE TO THE COUNCIL

8.1 Harp Seal

8.1.1 Update [SC/25/13]

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 harp (and hooded) seals.

Presenter's summary:

One fixed-wing aircraft, stationed in Akureyri (Iceland), was used for reconnaissance flights and photographic surveys along transects over the whelping areas. A helicopter, operated from the expedition vessel (K/V "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' 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.

Harp seal breeding was first observed from the fixed-wing on 18 March at approximately 74º00'N / 13º47'W, along with scattered hooded seal families further south. On 21 March, however, a large patch (considered to be the same patch as observed on 18 March) containing whelping harp and hooded seals was discovered in an area between 72º25'N and 72º35'N; 14º30'W and 16º00'W. Colour markers and satellite-based GPS beacons were deployed on ice floes north, east and south of the patch. The ship and helicopter had to depart from the ice on 24 March, but the fixed-wing aircraft continued to conduct reconnaissance surveys in the area. Based on observations made during these surveys, and information on localization of the identified whelping patches obtained from the ice-deployed GPS beacons, photographic surveys were conducted on 27 and 28 March.

Subsequent reconnaissance surveys were conducted during 29 – 31 March to ensure that all whelping patches had been covered by the photographic surveys.

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). Results from the aerial surveys will be used to estimate the 2018 harp and hooded seal pup production in the West Ice. Subsequently, the status of the stocks will be assessed by incorporating the pup production estimates into population models.

Haug also reported that data for assessment of biological parameters was collected from 170 harp seal females during Norwegian commercial sealing in the south eastern Barents Sea (the East Ice) in 2018 – analyses are in progress. In addition to the biological parameters, samples were also taken for studies of contaminants and ecology (stable isotopes) from some of the sampled females and 5 additional males.

Twenty-six harp seal pups were tagged shortly after weaning in April 2017 in the Greenland Sea. The longest lasting tag transmitted for 400 days. Together the tagged seals give the first description of a full annual circle of distribution, haul-out and dive patterns. The seals all swam northward – the majority crossing to the Svalbard area before entering the Barents Sea. In April-May they returned to the molting area off the Greenland coast close to the area where they were born.

Discussion

The SC noted that the survey in the East Ice gave only partial coverage of the whole pup production area.

The SC noted that the West Ice survey observed ice closer to shore but that the quality of the ice seems good.

There are plans for tagging harps seals in 2019, both in the West Ice and also if possible in the White Sea, to see how the seals use the Barents Sea as habitat under different ice conditions. Tags are on route to Russia already.

Hamill reported on the status of the 2017 survey and informed the meeting that the plan was to complete the analysis for consideration at the next WGHARP meeting.

The SC noted the updates and the anticipation that the WGHARP will be able to give new estimates for the North West Atlantic, the West Ice and hopefully the White Sea.

8.1.2 ICES/NAFO/NAMMCO WGHARP 2019

The ICES/NAFO/NAMMCO working group on harp and hooded seals (WGHARP) will meet at IMR in Tromsø, Norway, 2-6 September 2019. New data from all populations is available and the group has been requested to do assessments of status and harvest potentials.

Discussion

The SC **agreed** to invite Kimberly Murray (NOAA) and Sophie Smout (SMU) to join WGHARP. Haug is the convener and Hamill the chair of the WG.

The ToR are not yet finalized and will be circulated to the SC by correspondence.

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

R-2.1.4 (standing): *update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

This will be addressed through the work of WGHARP in 2019.

R-2.1.10 (standing): *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*

The second part of this request is dealt with by the Joint Norwegian – Russian Fisheries Commission and the SC **proposed** that the request be rephrased as *provide advice on Total Allowable Catches for the management of harp seals*.

8.2 Hooded seal

8.2.1 Update

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 (and harp) seals, see 8.1.1.).

Discussion
The SC noted the report.

8.2.2 ICES/NAFO/NAMMCO WGHARP 2019

See agenda item 8.1.2 above.

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

R-2.1.4 (standing): *update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

This will be addressed in the work of WGHARP in 2019.

R-2.1.9 (ongoing): *investigate possible reasons for the apparent decline of Greenland Sea stock of hooded seals; and assess the status of the stock*

Work on this is ongoing and will likely be at least partly answered by the WGHARP at its 2019 meeting.

8.3 Ringed seal

8.3.1 Update

Greenland

Preliminary data from a master thesis by Camilla Hjorth Scharff-Olsen: "Ringed Seal Genomics Population structure and putative ecotypes in Arctic ringed seals (Pusa hispida hispida)" was presented.

This thesis aims to investigate the population structure of Arctic ringed seals with whole genome sequencing. The results are preliminary and the work will continue, but there is an indication of a slight genetic differentiation of the population in Kangia (the icefjord near Ilulissat) from those in other parts of Greenland.

Svalbard

Lydersen reported on a multi-disciplinary study (Everett et al.) based on data collected from ringed seals with GPS-CTD satellite tags (SC/25/FI/18).

Presenter's summary:

The seals foraged just outside the plumes and near the glacier fronts and collected hydrographic data from within the plumes' upwelling cores as they returned to the surface. The seals encountered water with fractions of subglacial discharge as high as 27% at 60 m below the ocean surface. The seals responded rapidly to spatial and temporal variations in subglacial discharge at the glacier terminus, suggesting that prey becomes available quickly following the appearance of plumes. The seals' dive locations were used to monitor the presence of plumes over a four-month period. High surface runoff from Kronebreen catchment created strong plumes, but weak plumes were present even during periods of low surface runoff. The continued retreat of Kronebreen, and other tidewater glaciers, will lead to the loss of these marine-termini as the glaciers retreat onto land. The techniques presented here improve our understanding of the drivers of glacial retreat and the implications of future habitat loss for glacier-associated birds and mammals.

Lydersen also noted that in Svalbard the migrating seals were young individuals while the stationary seals were adults.

Discussion

SC noted the updates provided.

8.3.2 Ringed Seal WG (2021)

A ringed seal working group (RSWG) is planned for 2021. The SC **agreed** that it was premature to define ToR for the WG but noted that the idea is to run the RSWG back to back with a bearded seal WG.

During the recent CAFF-CBMP meeting (Rovaniemi, October 2018), Peter Boveng from MML/NOAA expressed to Desportes and Ugarte his interest in participating in a pan-arctic review of ringed and bearded seals. The MML/NOAA latest review is from 2010. CAFF has also expressed interest in being associated with such a pan-arctic review.

Discussion

SC **welcomed** the involvement of CAFF. However, Greenland pointed out that to prioritise such a review for ringed and bearded seals represents a major work load that is presently not a priority.

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

> ***R-2.3.1 (standing):*** *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.*

This will be addressed by the planned RSWG.

> ***R-2.3.2 (standing):*** *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.*

It was noted that the SC would need to know more about differentiation between hunts to address this (with reference to the master's thesis by Camilla Hjorth Scharff-Olsen above). There are now plans to prioritise this. The SC discussed the options for scientific studies that can help address this request. It is a very difficult task to assess the status of ringed seals and the effects of harvests, especially in light of simultaneous changes in sea ice conditions, marine productivity and polar bear predation. Some studies could contribute to a better understanding of ringed seal dynamics, but due to the unpredictable changes in the parameters mentioned above, it would be challenging to produce estimates of sustainable catches without significant investments in resources. Factors to examine include: standard estimates of abundance, productivity and age distribution of the catch. Ringed seals also rely on stable ice and suitable snow conditions for breeding and glacial fronts for foraging. Therefore, changes in these environmental parameters and their impacts on ringed seals should also be considered in a larger research program.

8.4 Grey seal

8.4.1 Update [SC/25/13]

NORWAY

Updates were given related to the SC 23 meeting endorsed recommendations from the CSWG 2016 (in italics):

- *Development of the population model to explore if it can be modified to account for the observed changes in pup production.*

This work is ongoing work and as yet there are no results to report.

- *Tagging of pups.*

It was decided not to start tagging due to a possible increase in gill net by-catches due to flipper tagging.

- *Age-structure of the hunt assumed to be the same as for the by-catch. Needs to be tested.*

This has not been tested but already sampled data must to be used because catches are zero and by-catches small in the previously most abundant area (Stad-Lofoten).

- *Complete the genetic study within this year*

This study is almost complete but it is still not published.

- *Increase the number of vessels in the reference fleet in areas of high by-catch.*

IMR is now in a process of contracting boats with a possible small increase in the number of vessels.

- *Reporting of all removals. Currently there is little or no reporting of removals around fish farms, or of by-catches in commercial gill net fisheries end recreational fisheries.*

No information available regarding improvements.

Recommendations for the Norwegian Harbour and Grey Seal Management Plans

- *The target population levels for both species should be evaluated as the levels are not based on any biological assessment.*

Population levels were set based on a political decision. The target population levels were set at the current population levels (2006-2008) when the management plans were made but included options to adjust the target levels when new knowledge on population status occurs. This has been suggested (for 2019) by IMR for harbour seals in the south east Norway.

- *The quota is set 0 when the population is at 70% of the target level instead of 50%.*

This has been suggested to the Norwegian management authorities.

- *Management plan should include all sources of mortality.*

It is a question of data availability or possibilities to estimate such mortality. For grey seals, natural mortality was estimated by the population model.

- *A mechanism for consulting IMR on for example seal distribution when fish farms are being built should be required when management plans are revised.*

This will be suggested to the Norwegian management authorities.

The analyses/results of the last Norwegian survey cycle, which was completed in 2017 for grey seals, show that the grey seal population are stable in the south (Lista-Stad) and in the north (Troms-Finnmark) but a new survey in 2018 confirmed that there is still low pup production in mid Norway (Trøndelag-Nordland).

The Directorate of Fisheries has indicated a willingness to remove the possibility to shoot seals around fish farms, although this has not been decided yet.

Discussion

SC noted the update. It was also noted that killer whales have been observed taking adult grey seals. Faroe Islands informed that this phenomenon had been documented from harvested animals from the 1970's.

ICELAND

A complete grey seal aerial survey was carried out during the pupping period in 2017. The preliminary population estimate is 6200 seals, compared to 4200 in the previous estimate from 2012. The current target population level objective put forward by the Icelandic government is 4100 animals. No new management objective has been put forward. MFRI will look into population level objective based on biological criteria. The Icelandic authorities are investigating how a mandatory reporting of catch can be implemented. Increased effort to improve by-catch data collection has been implemented, as discussed under agenda item 7.

Six pups were tagged with satellite tags during the pupping season in 2016 with positive results. Analysis is ongoing.

Discussion

The SC noted the update and **commended** the work done to meet the recommendations. The SC **underlined** the positive indication of an increase in the population.

The SC acknowledged that animal welfare concerns are increasingly making research efforts challenging and national legislation differs. In the longer-term perspective, the strict rules may end up being counterproductive when considering animal welfare of populations. A recent EU regulation makes the assistance from a veterinarian mandatory when sedating animals. Iceland also reported on new regulations requiring veterinarian attendance when sedating animals before tagging. In the Faroe Islands, it is required to obtain a licence from the chief veterinarian, whereas in Norway you need to document that you have the competence for tagging. In Greenland it is required to get a permit, which is given after having consulted a veterinarian. Canada still does not have any requirements to this extent.

FAROE ISLANDS

Mikkelsen informed on progress from the Faroe Islands.

Presenter's summary:

Regarding updates on present knowledge, the first population number appearing in literature was 3000 animals, based on what was needed to support the cull of 930 animals, during 1963-67. In the 1990s, the diet was found to be mainly cod, saithe, sand eel, catfish and flatfish, with some regional differences. In 2008-09, the tracks of 10 animals showed a resident behaviour, with very limited movements outside the 100 meters depth. Four UK flipper tags have been recovered in the Faroes, together with one satellite tracked animal, but it is not believed that this is of any significance for the Faroese populations, since animals emigrate again. This is also indicated by a genetic study, using both mitochondrial DNA and microsatellites, showing that the Faroese population is distinct from animals from adjacent waters.

Removal numbers are believed to be fairly reliable, and show that the harvest, taken exclusively around salmon farms, have numbered more than 200 animals in some years. For the last five years the numbers have been around 100 animals, but with reduced catches in most recent years due to the ASC classifications of the industry.

In the summer of 2018, the first ever survey to estimate the abundance was performed. The approach was to count the total number of animals at haul-out localities along the coastline. During June to September, it was possible to survey the western islands once, the eastern and central islands twice, while due to un-favourable weather it was never possible to survey the southernmost island. During the survey, a drone was also used to film high densities so as to get a better count of animal numbers. The total count, using first visit to all localities, was 300 animals. Using highest count for all visits, assuming balanced movements between areas, the counted number was 400 animals. The plan for 2019, in addition to repeated surveys, is to track up to ten animals with satellite tags in order to explore haul-out behaviour and the occurrence at survey areas during surveys. There are also plans to mount monitoring cameras at hot spot haul-out localities for behavioural studies in relation to weather and currents, and for establishing accurate abundance numbers.

Discussion

The SC **welcomed** the progress that had been made and **encouraged** the work to continue. The SC noted the importance of timeseries both with respect to catch and removals to monitor the population. A removal of 100 animals and a count of 400 seemed alarming. However, following the experiences from related studies in UK waters, applying a multiplier of 3-5 to the counts was recognised as giving a more realistic estimate.

8.4.2 Coastal Seals WG (2020)

The CSWG is planned for 2020. Convener and chair: Kjell T. Nilssen. ToR will be defined at a later meeting.

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

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

This work remains ongoing in the lead up to the CSWG in 2020.

8.5 Harbour seal

8.5.1 Update [SC/25/13]

NORWAY

Updates were given related to the SC 23 meeting endorsed recommendations from the CSWG 2016 (in italics):

- *Increase the number of vessels in the reference fleet.*

See agenda item 8.4.1 grey seals.

- *Increase survey effort. Important areas should be identified to be surveyed between other full-coast surveys.*

This is difficult because IMR is doing assessment surveys every year along the coast. It is probably not necessary to do extra surveys because harbour seal abundance seems to be relatively stable at present.

- *Management by county should be re-examined, as these management units do not always follow the population structure of harbour seals.*

New genetic analyses are ongoing and new samplings of DNA from harbour seal pups in whelping areas are planned.

- *Reporting of all removals.*

See agenda item 8.4.1 grey seals.

- *Collect data from by-catches*.

See agenda item 8.4.1 grey seals.

- *Collect data from by-catches (age, sex, jaws, etc.). It would be particularly helpful to have samples from the reference fleet.*

There will be an effort to try to incorporate jaws from seals in the sampling from the reference fleet.

No update on the level of predation by killer whales and whether it is large enough to warrant inclusion in the population modelling (as natural mortality) due to a lack of data and a suitable model.

Published results (2010) showed that harbour seals from Svalbard, Iceland, south-east Greenland, and northern Norway were genetically distinct populations.

There is no new information on tagging in Svalbard outside the breeding season.

ICELAND

A full population survey was conducted during the moulting period in 2018 and the data analysis is currently ongoing. Aerial population censuses have been conducted twelve times since 1980 and have revealed a declining trend in the Icelandic harbour seal population. The census from 2016 resulted in an estimated population size of 7,652 animals. The estimated population size was then 77% smaller than the first estimate from 1980, and 32% smaller than in 2011. The target population level objective put forward by the Icelandic government is 12.000 animals. The current aim is to conduct censuses every second year while the population is under the target level.

The MFRI advice to the Ministry has been: "*that direct hunt should be prevented and that actions must be taken to reduce by-catch of seals in commercial fisheries. MFRI also advices that a hunting management system should be initiated, and that reporting of all seal hunt should be mandatory*." (https://www.hafogvatn.is /static/extras/images/Landselur277.pdf). No legislation and no new management objective is in place. However, Icelandic authorities are investigating possibilities of how legislation on seal hunting and obligatory reporting of catch statistics can be implemented. Increased effort to improve by-catch data collection has been implemented as discussed under agenda item 7. MFRI will define a population level objective based on biological criteria.

GREENLAND

There was no new information regarding harbour seals from Greenland.

Discussion

Hamill pointed to an ICES report stating that grey seals are predators of harbour seals. No such observations have been reported in Norway or Iceland.

The SC thanked the countries for providing the reports. It noted that harbour seals are monitored every year in Norway and **welcomed** that a full survey had been carried out in Iceland, with an abundance estimate forthcoming.

The SC noted that catches of harbour seals continue to be reported in Greenland despite the fact that the species is protected and expressed concern about this situation. Greenland informed that the numbers reported are inaccurate due to widespread misidentification of species. However, a small number of harbour seal catches have been confirmed. The SC noted that there is a need to improve the accuracy of the reported figures and **recommended** that validation of any reported catch of harbour seals be emphasised and that accurate information be provided to the catch database.

8.5.2 Coastal Seals WG (2020)

See agenda item 8.4.2 above.

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*

The SC noted that this request has been completed for Norway and is ongoing for Iceland.

8.6 Bearded seal

8.6.1 Update [SC/25/13]

Greenland reported that they have a significant amount of abundance data not yet analysed that comes from other types of surveys. Up until now it has not been a priority to do these analyses.

SC noted that there was no news from the work in CAFF and that the anticipation is that CAFF also wants to do work on both ringed and bearded seals.

8.6.2 Bearded Seal WG (2020/2021)

The bearded seal working group (BSWG) will meet back to back with the ringed seal WG. The SC **reconfirmed** chairs and possible invited participants, and also the intention to involve the CAFF group.

8.6.3 Review and status of active requests

There is no active request related to this species

8.7 Walrus

8.7.1 Walrus Working Group October 2018 [SC/25/14]

Summary from the Convenor:

Stock Structure and Catches

The NAMMCO Scientific Committee Working Group on Walrus Stock (WWG) considered three stocks: the Baffin Bay (BB), the West Greenland-Southeast Baffin Island (WGSBI) and the East Greenland (EG) stock. No new stock structure information was presented except for the Baffin Bay stock, where results of satellite tracking of walruses tagged on the eastern (Greenland) side of Smith Sound showed that some of the walrus moved far west and crossed the putative stock boundaries and entered western Jones Sound and the Penny

Strait-Lancaster Sound area. The study demonstrated that the walrus population that winters along the north western coast of Greenland is shared more widely in Canada than previously thought and should be managed as one stock. Therefore, the WWG agreed that there is not enough counter evidence to suggest discrete sub-stocks for high arctic walrus and that the most precautionary approach was to consider a single Baffin Bay Management Unit, irrespective of stock boundaries, and that catches from the four Canadian communities should therefore be added to the Greenland catches when performing the assessment.

In Greenland, statistics on catches of walrus are compiled through the so-called 'Særmeldeskema' that also provides details of each hunt, including data on the sex of the animals, length of tusks and presence of foetus.

In Canada, Inuit hunt statistics are reported by hunters to local hunters and trappers organisations and then relayed to DFO, while sport hunters are required, as part of the licensing process, to provide information to DFO directly. Annual hunt statistics for Nunavut (from 1997-2017) and Nunavik (1994-2017) communities that hunt walrus from the two populations that occupy the eastern Canadian Arctic are available, however, with gaps in the catch history.

The catch data for Baffin Bay shows a decreasing trend until the introduction of quotas and the average annual reported catch in Qaanaaq and the Canadian High Arctic during 2013-2017 was 71 and 5. In the period 2007–2018, the overall catch trend in West Greenland has been slightly increasing. The average annual reported catch in West Greenland and East Baffin Island during 2013-2017 was 48 and 21. Overall in East Greenland catches have been fairly constant during 2013-2017, with a mean of ~6 walrus year^{-1}.

Throughout the years, more males than females have been caught with at ~2/3 of the catches being males in North and West Greenland, while in East Greenland 90% of catches are males. In Qaanaaq, walruses in the catch are between 0 and more than 30 years with the majority being between 4 and 14 years. In West Greenland walruses are between 0 and 25 years, with most catches between 4 and 13 years and in East Greenland walruses are between 5 and 25 years with most in the ranges 9–11 and 18–21 years.

The NAMMCO SC has repeatedly recommended that catch statistics should include data on struck and lost (S&L) animals and the WWG discussed the benefits expected from getting accurate reports of S&L animals. The WWG agreed that much of the error associated with underreported S&L may be offset by regular population surveys. Although the WWG acknowledges that improved S&L data would improve the accuracy of the models used, it also agreed that in some cases, assessment models are somewhat insensitive to variation in S&L rates. The WWG recommended that managers engage in a dialogue with the hunters to find the best way of collecting the data. Specifically, for Greenland, the WWG discussed a method to improve S&L reporting in Greenland, and recommended that losses be reported in the Særmeldeskema, the current system for reporting catches.

Abundance

Aerial surveys of the occurrence and abundance of walrus in late winter in West Greenland have been conducted at irregular intervals since 1981 and constitute a time series of walrus positions and sighting rates from surveys covering the same area in West Greenland. The mean western position of the walruses on the banks did not vary with the sea ice concentration, indicating that the walrus chose the same winter-feeding area even in years where there was a major lack of sea ice that could be used for haul-out. This suggested that they had a strong affinity for the feeding area, regardless of ice extent. The relative abundance of walrus, indicated as sightings per linear kilometre, showed an increasing trend in abundance from 1981 through 2017 ($p=0.06$).

An aerial survey covering the eastern part of the North Water/Smith Sound area was conducted in April 2018 with the purpose of generating an abundance estimate that is compatible with a survey in 2014. The total abundance of walrus on both ice and in water was 1279 (CV=0.16, 95% CI=938-1744) individuals. This is lower than a previous estimate from 2014 and the main difference seems to be the larger extent of fast ice in 2018 that prevented the walrus from entering some of their traditional feeding grounds in the shallow coastal areas, i.e. Wolstenholme Fjord.

An aerial survey of East Greenland was conducted in August 2017 and provided a fully corrected estimate of 177 walrus (CV=0.18, 95% CI=124-252) walrus (Table 1). Surveys of walrus at their terrestrial haul-out sites in August 2017 revealed that 3 out of 26 known haul-out sites were used by walrus and one new haul-out site was discovered. Adding these walruses to the line transect survey gives a total abundance in Northeast Greenland in 2017 of 279 walrus (CV=0.11, 95% CI=226-345). A reanalysis of a walrus survey conducted in

East Greenland in August 2009 gave a fully corrected abundance estimate of 559 (CV=0.23, 95% CI=357-875) walrus. Both abundance estimates are likely negatively biased due to survey coverage and correction factors.

Table 3. Atlantic walrus abundance estimates from aerial surveys conducted in East Greenland and the eastern part of Smith Sound (Baffin Bay stock).

	EGRL Summer 2017	**EGRL Summer 2009**	**Smith Sound Winter 2018**
Walrus in water	142 (0.17)	147 (0.68)	832 (0.16)
Walrus on ice	35 (0.59)	260 (0.30)	447 (0.35)
Walrus terrestrial haul out	102 (0.17)	152 (0.17)	
Total	**279 (0.11)**	**559 (0.23)**	**1279 (0.16)**

Assessments

The assessments for walrus in Baffin Bay, West Greenland/Southeast Baffin Island, and East Greenland were updated with the new data.

An overall decline in the Baffin Bay stock is unclear due to incomplete catch histories, but both the exponential and density regulated model with age structure data estimated a decline from 1960 to about 2007, and an increasing population thereafter. This reflects a decline in the annual catches from about 150 from 1999 to 2003, to about 80 from 2004 to 2008. Both models showed an annual growth rate of 6.6% (90% CI:5.7% - 7.8%) in the absence of catches.

For the assessment of the walrus in West Greenland/Southeast Baffin Island it was assumed that the walrus that winter in West Greenland are a well-defined sub-component of a larger joint population off West Greenland and Southeast Baffin Island. An assessment without age structure data provided an annual growth rate of 7.2% (90% CI:4.9% - 9.4%) in the absence of harvest for this stock, and it estimated a small increase in abundance from 1977 to 1994, followed by a decline to 2007, and an increase thereafter, in response to changes in the annual catches.

In agreement with the earlier assessment for East Greenland, the density-regulated model estimates a stable or slightly increasing population that is close to carrying capacity (depletion ratio of 95%). The current abundance is estimated at 540 (90% CI:300 - 1600) animals, with an estimated annual growth rate of 1.7% (90% CI:0.5% - 5.7%), assuming no catches.

Management Advice

BAFFIN BAY:

It is estimated that there is a 70% chance of increase in Baffin Bay walruses after 5 years with a total annual removal of 94 individuals (Table 2). With an estimated struck and lost rate of 12% and an assumed annual Canadian catch of 5 individuals (based on the average from 2012 to 2016), this results in **a recommended annual catch (landed animals) of no more than 84 walruses, with 79 being caught in Greenland.**

Table 4. The estimated probability of an increasing stock after 5 years for a total removal between 79 and 103 walruses from Baffin Bay.

Removal	79	82	85	88	91	94	97	100	103
Probability	0.95	0.93	0.89	0.83	0.76	0.70	0.60	0.49	0.43

WEST GREENLAND:

It is estimated that there is a 70% chance of increase in the West Greenland-Southeast Baffin Island stock after 5 years with a total annual removal of 97 walruses (Table 3). With an estimated struck and lost rate of 13% and an assumed annual Canadian catch of 12 individuals from the subcomponent (based on the average from 2012 to 2016), this results in a **recommended annual catch (landed animals) of no more than 86 walruses, with 74 being caught in West Greenland.**

Table 5. The estimated probability of an increasing stock after 5 years for a total removal between 72 and 112 walruses from the West Greenland components of the West Greenland – Southeast Baffin Island stock.

Removal	72	77	82	87	92	97	102	107	112
Probability	0.89	0.86	0.83	0.78	0.74	0.70	0.64	0.59	0.54

EAST GREENLAND:

It is estimated that there is a 70% chance of an increasing stock after 5 years for an annual total removal of 19 individuals in East Greenland (Table 4), with a struck and lost rate of 14%. This results in **a recommended annual catch (landed animals) of no more than 17 walruses for East Greenland.**

Table 6. The estimated probability of fulfilling the objective after 5 years is shown for a total removal of 17 to 22 walruses in East Greenland. Based on the density-regulated model with age-data.

Removal	17	18	19	20	21	22
Probability	0.83	0.77	0.73	0.67	0.64	0.59

Other Issues:

The WWG identified shipping, seismic exploration, fisheries interactions and tourism as major stressors on walrus populations. It added to that list habitat destruction through mining (which not only disturbs walrus through the direct mining activities but also through the destruction of the banks that support walrus food populations (bivalves) via the sucking and release of sand and sediment), loss of ice habitat from shipping and climate change, and ballast water discharge that may alter the water chemistry over feeding areas.

The WWG noted that there is an agreement between The Kingdom of Denmark and Canada for cooperation in the marine environment (Treaty no. E101887 http://www.treaty-accord.gc.ca/text-texte.aspx?id=101887) and recommended increased bi-lateral cooperation between Canada and Denmark/Greenland in agreement with the treaty (for example, see articles VI & VII).

Recommendations for research

Recommendations are not listed in order of priority but follow their appearance in the text of the WWG report.

– Improve information on stock structure and seasonal movements of walruses between summering grounds in East Canada and wintering grounds in West Greenland.

– Maintain a regular schedule of surveys of all Greenlandic stocks, ideally coordinated and synchronised with Canadian surveys in the same areas.

– Explore the relationship between the present findings [on distribution related to ice coverage] and hunting and non-hunting anthropogenic impacts[1].

[1] In the first circulated version of the report this recommendation read "Explore the relationship between the present findings related to bycatch and other impacts from hunting and non-hunting related anthropogenic activities". This was however a misinterpretation of the WG recommendation which related to distribution and sea ice coverage. **Correction made by GD on 25 June 2019 after a correction/clarification was introduced in the report of the WWG in agreement with the WG chair.**

– Update age-tusk relationships for all walrus populations in Greenland.

– Incorporate uncertainty around the age structures into the assessment models.

– Investigate the applicability of using two-sex models for walrus populations.

Other recommendations

– The possibility of joint-management process for shared stocks of walrus should be evaluated by Greenland and Canada.

– Canada was encouraged to take action to continue provide more complete catch data.

– A dialogue between managers and hunters should be established in order to discuss the best method of recovering struck and lost data.

– In Greenland, struck and lost individuals should be reported in the Særmeldeskema.

– Bi-lateral cooperation between Canada and Denmark/Greenland in agreement with the bilateral treaty regarding activities that affects resources in the other country, Treaty no. E101887. The shared stocks of walrus represent a good opportunity to apply the treaty (for example, see articles VI & VII).

Discussion

The SC **endorsed** all the recommendations presented by the WWG, including the recommended total allowable landings for Northwest (no more than 79 individuals), West (no more than 74 individuals) and East Greenland (no more than 17 individuals).

Walruses abandoned terrestrial haul-out sites in West and Northwest Greenland before the middle of last century, probably due to disturbance and hunting. Currently, walruses in West and Northwest Greenland use primarily sea ice for hauling out. However, given reductions of sea ice due to climate change, it is possible that terrestrial haul out sites will become more important in the future.

After the WWG meeting it has come to the knowledge of SC that a new terrestrial haul-out site for walrus has appeared in Northwest Greenland. In late June 2018 several groups of walruses were observed on an island in Wolstenholme Fjord close to Thule Air Base. This is the first observation of larger groups of walruses on land in Northwest Greenland for more than 100 years and it will be important to assess if this is a recurrent phenomenon and if any protective measures are needed.

The SC discussed the laws surrounding removals of walrus at haul out sites in Greenland. It is currently illegal to take walrus that are on land, yet animals become available upon entering the water and when hauled out on ice. The concern with this is that walrus can easily be scared once on land, move into the water and therefore become available to hunters. This means that the law, in effect, provides little protection to walrus that are hauled out on land, given the ease in which they can be made available. Furthermore, the protection is not given to specific haul-out sites, rather, to any walrus that is on land at any location. In addition, once walrus are disturbed from a haul-out site, it is not known for sure if or when they will return. The SC **recommended** that haul-out sites in regular use be protected by an "exclusion zone" that safeguards the walrus from disturbance.

8.7.2 Updates

8.7.2.1 Satellite tagging

Lydersen presented some results from the use of GPS loggers on walruses in Svalbard and the Pechora Sea. Tracks from individuals with a duration of 3 and 4 + years indicates that there is a clear difference between where the various animals move. However, one and the same animal appears to be repeating its annual movement pattern to a large degree from one year to the next.

There was also evidence of walrus tagged in the Pechora Sea moving to known breeding grounds of harp seal in the White Sea, potentially to feed on pups during the breeding season.

A wide range of PCB concentrations have been reported in walrus. This was suggested to be due to animals feeding at different trophic levels, yet isotope studies found that even the ones with the highest PCB burdens

assumed to be feeding on seals were still found to be feeding on molluscs. This suggest that molluscs in some localities may be heavily polluted.

8.7.2.2 Paper by Higdon & Stewart (2018) on the state of circumpolar walrus [SC/25/FI/07]

Smith presented a review of this recent publication.

Presenter's summary:

Much of the discussion in this document was similar to that which took place within the WWG 2018. However, greater detail surrounding the non-hunting related human impacts upon walrus was provided in the paper.

Industrial development:

Regarding industrial development, the increased presence of shipping within the region to support mining operations in Baffin Island was considered a serious threat to walrus populations in the shared Greenlandic and Canadian stocks. Furthermore, winter shipping is likely to have significant impacts on walrus populations by disrupting ice environments (e.g. quality of the ice). Similarly, port construction to support industrial development may have caused walrus to abandon nearby haul-outs. Once a haul-out site is abandoned, it is not known for certain if or when walrus might return, even after construction has finished.

Noise disturbance:

The response of walrus to noise disruption (i.e. from shipping, aircraft, construction etc.) varies greatly. Avoidance behaviour can be triggered at varying distances from the source of disturbance, and the response is not always consistent. Furthermore, it is not known whether walrus habituate to noise pollution, thus leaving room for speculation as to the exact effect of anthropogenic disturbance in the long-term.

Pollution:

Aspects of walrus ecology may make walrus more vulnerable to oil pollution, namely their gregarious nature. The risk was thought to be compounded during the breeding season given that calves are thought to be more vulnerable. Organochlorine pollution was also identified as a potential risk factor, yet PCB concentrations observed within walrus vary. This is thought to be due to some individuals feeding at higher trophic levels (seals and seabirds) (see also discussion under 8.7.2.1 above).

Climate change:

Climate change will likely compound the effects stated above, particularly as reduced ice cover will increase the accessibility for development and shipping. New species interactions were also identified as presenting a challenge to walrus, and while direct impacts of invasive species upon walrus is not known, the effect of disease spread within the bivalve beds upon which they feed has been identified as a risk. This could come from expansion of species into the arctic as the climate warms, or simply as a result of ballast water from ships releasing new pathogens into the region.

Regarding the loss of ice, this could be a benefit to walrus, or a detriment, depending on where the loss is experienced. It is thought that walrus would benefit from ice reductions above bivalve beds that are near haul outs as it would mean greater accessibility to food. However, if ice is lost near beds offshore, then there would be reduced accessibility due to a lack of haul-out sites.

8.7.3 Review and status of active requests (R-2.6.3, R-2.6.7, R-1.6.4, R-1.6.5)

> ***R-2.6.3 (ongoing):*** *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.*

Since this request was made in 2006, scallop fisheries may be less of an issue, while fishing and shipping activities are still relevant, and tourism, hydrocarbon exploration and mineral extraction may be new stressors for walruses. The MC may consider rephrasing the request to reflect these changes.

R-2.6.7 (2017, pending): *To provide assessments of, and advice on sustainable removals from, all stocks of walrus in Greenland covering the period from 2019 to 2023, with the advice for Qaanaaq starting in 2021.*

This has been addressed by the WWG.

R-1.6.4 (ongoing): *The SC has recommended that catch statistics include correction for struck but lost animals for different seasons, areas, and catch operations. Council requested the SC and the Committee on Hunting Methods to provide advice on the best methods for collection of the desired statistics on losses.*

This was addressed by the WWG and is reflected in the recommendations.

R-1.6.5 (2017, standing): *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 was done by the WWG.

9 CETACEANS STOCKS - STATUS AND ADVICE TO THE COUNCIL

9.0 AEWG [SC/25/13]

Summary from the Convenor:

The working group met in Copenhagen from May 22-24 2018 and had a follow up email correspondence in October 2018 accepting revised estimates for the Icelandic and Faroese 2015 ship board surveys.

The WG considered abundance estimates developed from Iceland and Faroes NASS shipboard surveys in 2007 for sperm and long-finned pilot whales and white-beaked and white-sided dolphins. The survey consisted of four dedicated survey vessels, each with two observer platforms. Three ships were dedicated solely to the cetacean survey whereas the fourth was also conducting a fishery survey. Five additional vessels conducting fishery surveys were employed as "extension" vessels, each carrying two observers operating from a single platform and surveying areas mainly to the northeast and southwest of the core survey area, but with some overlap.

The WG considered abundance estimates developed from Iceland and Faroes NASS shipboard surveys in 2015 for fin, minke, blue, humpback, sperm and long-finned pilot whales and white-beaked and white-sided dolphins. Three vessels were used in the survey, two of which were dedicated solely to the cetacean survey whereas the third was also conducting a fishery survey. All vessels used double platform observers. Also reviewed was abundance estimates for fin and humpback whales from an Icelandic shipboard survey in October 2015.

The WG considered abundance estimates developed from the Icelandic coastal aerial survey in July 2016 for minke whale, white-beaked dolphin and harbour porpoise. A twin otter airplane was used with a double observer setup.

The WG considered preliminary abundance estimates developed from the Norwegian 6-year cyclical mosaic shipboard survey 2002-2007 for fin, sperm, humpback, blue, sei and killer whales and white-beaked dolphins and harbour porpoise.

The WG considered abundance estimates developed from a shipboard survey in 2015 in the two management areas EW in the Norwegian Sea (part of the cyclical mosaic survey program 2014-2019) and CM in the Jan Mayen area (extension to NASS). Preliminary abundance estimates for fin, sperm, humpback and minke whale were reviewed.

The WG considered a combined abundance estimate for minke whales in the CMA area (as defined by IWC) based on a joint analysis of minke whale abundance in the Central North Atlantic from the NASS 2015 surveys from Greenland, Iceland, the Faroes and Norway.

The WG was informed of the Canadian NAISS abundance estimates (2016) and the European SCANS-III abundance estimates (2016).

Recommendations from the WG:

Workshop: The Group noted the many recent developments in survey methodology, including the use of drone aircraft, automated detection of animals from video or still pictures, and technological developments such as the Geometer. They therefore recommended that the SC consider hosting a workshop on the general topic of "Novel methods for abundance surveys and estimation". This should preferably be held before the next NASS. If adopted, cooperation with other organizations, such as the IWC, and other jurisdictions should be sought. The WG support the development of new aerial and vessel survey software.

Cooperation with IWC: The WG was informed of past and ongoing IWC activities in this area, including categorization of abundance estimates in accordance with the use to which they are put, consistency in the review process, guidelines on the information to be presented when submitting an estimate for review, guidelines for surveys and analysis, validation approaches to software used to implement 'novel' methods and development of an updated survey database (ideally in conjunction with data collection software – *e.g.* see Item 15.1 in the WG report). With regard to the latter, the possibility of hosting a copy of this database at the NAMMCO Secretariat was considered. Noting that this would be advantageous because of continuity of personnel, documentation of procedures and database compatibility, the Group recommended that the SC consider this proposal.

Spatial analysis: An ongoing graduate project at SMRU is using the NASS/NILS data series (Icelandic, Faroese and Norwegian up to 2015) as the basis of a large-scale spatial analysis to investigate which environmental features best explain spatial and temporal variation in density. Given the large changes in distribution that have been observed for several species over the 28-year period of the surveys, the AEWG considered this work to be of great potential value, particularly for identifying priority areas for the next survey and facilitating effective stratification. This work could also be extended to provide model-based abundance estimates for designed strata and other areas of interest. The project is in its final year, and additional support will facilitate its completion. Given the value of this work to future NASS, the WG recommended that NAMMCO or/and NAMMCO parties support the project if possible.

See Table 7, under item 10.3.1, for the status of all of the estimates reviewed by the AEWG 2018.

Discussion

The SC **commended** the WG and the countries for the significant amount of work that has been performed, and especially for the analysis of data for non-target species in NASS 2007-2015.

The SC **welcomed** the offer for NAMMCO to host a copy of the database proposed by the IWC. It also notes that in practice this will be more like a spreadsheet rather than a database per se. It notes however that this will include information not only on the abundance estimates but also on how they were calculated, the limitations of the methods used and the available information, the confidence intervals, the areas covered, the reasons for any discrepancies between reports, and how the information can be used.

A question was raised as to whether this database will include information on small cetaceans or not since this information is not typically given to the IWC.

The SC also **supported** the cooperation that has now been established between the abundance estimate working groups of NAMMCO and the IWC and **agreed** that it is desirable to have joint agreements between the groups on abundance estimates and to avoid duplications in the work being performed.

9.1 Fin whale

9.1.1 AEWG 2018 [SC/25/12]

Norway 2002-7 cycle: Preliminary estimate, not accepted.

Norway 2015: Preliminary estimate, not accepted.

Iceland/Faroes revised 2015: Total abundance was 36,773 (CV=0.17, 95% CI=25,811-52,392) fin whales, corrected for perception bias. This estimate was accepted by the WG and **endorsed** by the SC.

Discussion

It was noted that the IWC has agreed on the AWMP for fin whales in West Greenland and endorsed the resulting quotas.

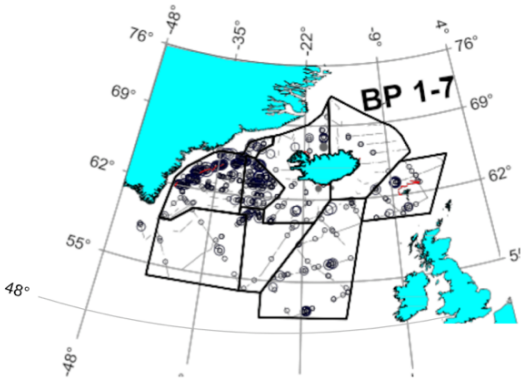

Figure 1. Distribution of fin whale sightings from the NASS-2015 Icelandic and Faroese ship survey.

9.1.2 Update

On 14th November 2018, the IUCN issued a revision of their assessment of fin whales at a global level. According to the new assessment, the fin whale is no longer considered endangered (EN) but classified as vulnerable (VU) and increasing. In the national assessments of Iceland, Norway and Greenland it is classified as Least Concern (LC).

9.1.2.1 Hybrid fin-blue whales in Iceland

Víkingsson presented an update on the hybrid whales caught in Iceland in 2018.

Presenter's summary:

During the 2018 fin whaling season in Iceland, two anomalous whales were landed at the whaling station in Hvalfjörður. The whales had characteristics (colour pattern, morphological) of both fin and blue whales similar to fin-blue whale hybrids identified previously. Based on these characteristics, biologists at the whaling station made a preliminary judgement that these were likely such hybrids, but genetic analysis would be performed to make a final determination. The catch of the first of the two whales evoked world-wide media attention, in particular the assertion by 17 scientists in an official letter to Icelandic authorities that the whale was not a hybrid, but a blue whale. While hybrids are generally not considered to be of much conservation value, and may in fact have a negative effect on the species concerned due to questions about their reproductive capacity, the catch of a blue whale would be considered an illegal infraction. Therefore, the discussion focused on this issue until the results of the genetic analysis showed without a doubt that the whale was a hybrid. In total six fin-blue whale hybrids have been landed at the Hvalfjörður whaling station since 1983 and two additional ones have been identified by biopsies taken in Icelandic waters. Most of these hybrids had a blue whale mother and fin whale father.

Discussion

The SC appreciated the presentation on this issue as it received significant media attention.

The SC asked whether this catch of a hybrid was subtracted from the fin whale quota and whether it was considered to be an infraction in Iceland. It was confirmed that it was subtracted from the quota and not considered as an infraction. This is in accordance with previous practice of reporting cetacean hybrids to the IWC by Iceland and other nations.

9.1.2.2 Tagging of fin whales around Svalbard from helicopter

Lydersen presented some results from satellite tagging of fin whales from helicopters in the Svalbard area. Five whales were successfully tagged during one afternoon, demonstrating that this is a time efficient method for such undertakings.

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

R-1.7.11 (ongoing): *Develop estimates of abundance and trends as soon as possible*

This work is still in progress. See Table 7, under item 10.3.1, for the status of the estimates reviewed by the WG in 2018 and appendix 6 for the status of abundance estimates generated from the 2015-2016 NASS/NILS surveys as of November 1st 2018.

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*

This work remains to be done for fin whales.

9.1.4 Future work

None presented.

9.2 Humpback whale

9.2.1 AEWG 2018

Norway 2002-7 cycle: Preliminary estimate, not accepted.

Norway 2015: Preliminary estimate, not accepted.

Iceland/Faroes revised 2015: Total abundance was 9867 (CV=0.37, 95% CI=4,854-20,058) humpback whales. Corrected for perception bias. This estimate was accepted by the WG and **endorsed** by the SC.

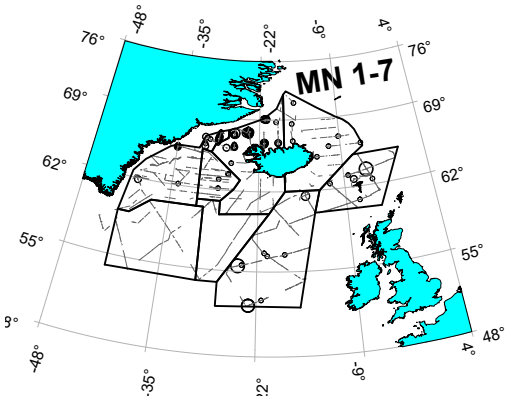

Figure 2. Distribution of humpback whale sightings from the NASS-2015 Icelandic and Faroese ship survey.

9.2.2 Update

Víkingsson noted that a joint Icelandic/Greenlandic research cruise was conducted in September 2018 off East Greenland and North Iceland. The main objective of the cruise was to estimate biomass of capelin but all three vessels had observers collecting sightings data on cetaceans and seabirds. Two humpback whales were instrumented with satellite transmitters in Icelandic waters.

It was also noted that 10 tags were deployed on humpback whales in Norway and that there are tagging efforts ongoing in East Greenland, however there are no results to report from this work as yet.

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

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland water.*

The work is ongoing under the Large Whale Assessment WG, which considered the request at its 2015 and 2017 meetings.

> ***R-3.2.4-amended (ongoing):*** *conduct a formal assessment following the completion of the T-NASS…In addition the Scientific Committee is requested to investigate the relationship between the humpback whales summering in West Greenland and other areas and incorporate this knowledge into their estimate of sustainable yields of West Greenland humpback whales.* ***Amendment (NAMMCO/25):*** *adds the following text: "The SC is further asked to provide advice on future catch levels of humpback whales in West Greenland at different probability levels for a non-declining population evaluated over a 5 year period, similar to the procedure for the advice generated for beluga, narwhal and walrus. The advice should include the latest abundance estimate."*

At the last meeting of the MCC, Greenland reiterated that it was essential to all NAMMCO Parties that the SC adhere to what NAMMCO had decided to base its management advice on, i.e. science and sustainability. This should be the base for all management advice. Clearly, the advice provided by the SC for humpback whale, encompassing the use of a "Needs Statements" did not.

The SC was uncertain how to interpret this response from the MCC, as it might reflect a somewhat unclear communication from the SC to Council. It is true that the use of SLAs in IWC requires 'need statements', but the advice from the SC was based on the humpback SLA without any use of such a need statement. This SLA, as well as any other SLA for Greenland, are the result of many years of scientific work on the optimisation of sustainability in relation to the take of large whales in Greenland.

A main difference, when compared to the RMP, is the incorporation of a hard upper limit on the potential catches of the SLAs, whereas the RMP has no potential upper limit. Another major difference is that the RMP was developed as a general procedure, whereas all of the SLAs were developed and tuned for the specific hunts in Greenland. When deciding on the advice for Greenland, the WG on Large Whale Assessment (LWAWG), as well as the SC, had found that the benefits of the case specific development were outweighing the potential benefits of no upper bound on the RMP. This view is maintained, and the SC **reiterated its recommendation** that it finds that the SLAs that were developed in the IWC provide the best scientific basic for advice on sustainable takes of large whales in Greenland, as long as the SLAs are applied without the use of need statements. The potential use of these SLAs in NAMMCO would benefit from the scientific work in IWC, and it would allow for a pragmatic application that provides a fair balance between the available data and the current levels of takes.

The SC was aware that there might be political or other reasons for choosing otherwise. Given the more detailed explanation above, and in particular the new development where the IWC has now approved SLAs with automatic renewal for all the hunts in West Greenland, the SC **sought advice** from Council on the urgency to proceed with further NAMMCO advice on the hunts of large cetaceans in Greenland.

9.2.4 Future work

Heide-Jørgensen proposed that NAMMCO convene a meeting to bring together the results of all tagging activities on humpbacks in the Atlantic so as to collate the available information, obtain an overview and work towards publishing the results. There is tagging being done to understand migration patterns between summer and winter grounds in the north and south, but also habitat use and movements taking place from west to east that will benefit from being compiled. Such a compilation of information could also cover questions of time spent in different areas etc. Some preparatory work to establish communication between the different groups engaged in tagging could already begin next year.

The SC **agreed** that bringing all the available data together from humpback tagging projects in the Atlantic would be valuable and **recommended** developing a common workshop.

The SC **requested** the Secretariat to establish contact with groups performing tagging in the Caribbean and investigate their interest in being involved in such a common workshop. Since tags are also out now and will require time for analysis, the earliest possible date for such a WS would be 2020 (possibly in connection with the IWC meeting planned for the same year, proposed to take place in the Caribbean).

9.3 Common minke whale

9.3.1 AEWG 2018 [SC/25/12]

Norway 2014-2019 cycle: Preliminary estimates of abundance were presented based on data collected in 2014-2017. This suggested distributional shifts in the population between survey cycles. The WG discussed the use of a synoptic survey of the Icelandic and Norwegian areas to determine the variance attributable to distributional change and to determine whether minke abundance numbers in the central and NE Atlantic are really changing. Another way of trying to understand the large-scale distribution changes over time would be to incorporate the Icelandic and Norwegian data in a model-based approach. The group welcomed the information that will be provided by a project modelling distribution of common minke whales and other species in these larger areas and investigating what environmental covariates are driving distributional changes. The project uses Icelandic, Faroese and Norwegian data from surveys conducted from 1987-2015.

Norway 2015: The preliminary estimate was accepted by the WG pending minor work.

Iceland 2016: The WG recommend that due to a low sample size in some strata that survey blocks be re-analysed and that the final estimate will only be a partial estimate of the total abundance in the survey area.

Iceland/Faroe Islands 2015 (shipboard survey): Preliminary estimate accepted by the WG pending minor work.

Joint Central North Atlantic minke whale abundance: The joint analysis is based on the North Atlantic Sightings Survey (NASS) carried out in 2015, with surveys by Greenland, Iceland, the Faroes and Norway contributing to the estimate. "Central North Atlantic" is assumed to refer to the Central Medium Area (CMA) as defined by the IWC.

Abundance was estimated for the new dataset using methods identical to those described by Pike et al. (2018) for minke whales. Variance estimates from the 3 surveys were considered independent and additive, and log-normal confidence intervals were calculated for the summed survey estimates (Buckland et al., 2001). Density of minke whales was highest in the Norwegian survey blocks, especially CM1a, and in coastal Icelandic waters. The total estimate is 48,016 (CV=0.23, 95% CI=30,709-75,078). The Icelandic/Faroese survey area accounted for 58% of the total estimate, while the Norwegian and Greenlandic survey accounted for 36% and 6% respectively. Coverage was poor in some areas, and the CMA south of 52° N (an area where minke whales have been sighted in some previous surveys) was unsurveyed. All estimates were corrected for perception bias and availability bias is likely of little concern for ship surveys of minke whales. There appears to be large fluctuation in distribution and abundance both within the CMA and between it and other stock areas. The WG discussed the dynamics of the distribution of minke whales in the CMA and other North Atlantic stocks and that there is little evidence of stock structure among feeding areas in the North Atlantic. The WG concluded that the stock area boundaries are putative and not meant to be true stock divisions and the WG agreed to adopt the CMA abundance estimate presented in the Working Paper at this time. The SC **endorsed** the use of this estimate.

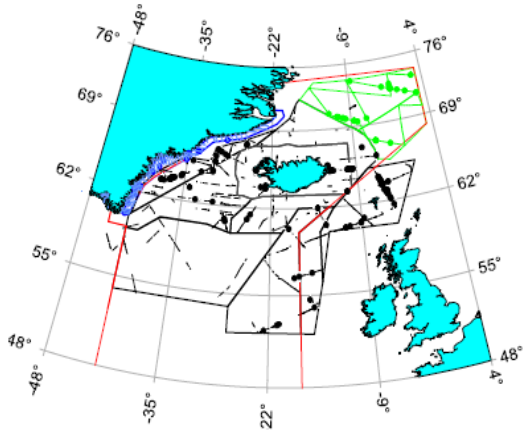

Figure 3. Survey effort and minke whale sightings from the NASS-2007 Icelandic and Faroese ship survey. CMA is outlined in red, Norwegian survey area in green, and Greenlandic survey area in blue.

9.3.2 Update

The SC noted that this year the IWC adopted a newly developed Strike Limit Algorithm (SLA) for the hunt of common minke whales in West Greenland. The population structure of the simulation trials behind the SLA was informed by genetic data across the North Atlantic, including estimates of the mixing of whales between West Greenland, East Greenland, and Canada.

9.3.3 Review and status of active requests (R-3.3.4, 1.7.11, 1.7.12)

R-1.7.11 (ongoing) *To develop estimates of abundance and trends as soon as possible*

This has been done (except for coastal areas of Iceland) and the Norwegian survey results will come in 2020.

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*

Advice on this has been generated through the IWC.

9.3.4 Future work

Satellite tagging will continue to be conducted.

9.4 Beluga

9.4.1 Global Review of Monodontids (GROM) [SC/25/28 & SC/25/FI/11]

The outcomes of the GROM meeting were presented to SC 24, although the report of the meeting was only finalised and circulated in February 2018. However, an error in the text of the report under point 5.1 'Sustainability of Removals' misrepresented the way PBR calculations were made during the meeting. The text of the report was therefore amended on 06 May 2018 as agreed via email correspondence between Hobbs, Reeves and Desportes, with explanations on the calculation of PBR added. The final report is available as SC/25/FI/11.

The report has also been developed into a publishable form (SC/25/28) and submitted to the Marine Fisheries Review in July, together with eight other papers dealing with information presented at the workshop and listed below. The GROM article and the 8 associated papers should appear together in a single issue devoted to Monodontids.

- 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 modeling 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.

9.4.2 Update

Heide-Jørgensen reported that the skull of a strange odontocete was discovered in Disko Bay in the 1990s. It had teeth in the lower jaw and elongated teeth in the upper jaw. New genetic results are under way for publication and have shown that it is a clear hybrid between a narwhal and a beluga.

9.4.3 NAMMCO-JCNB scientific Joint Working Group (JWG) meeting & Workshop

There was a proposal that this be postponed from March 2019 until 2020 and the SC **agreed.**

9.4.4 Review and status of active requests (R-3.4.9, 3.4.11, R-3.4.14)

R-3.4.9 (ongoing): *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; narwhal added at NAMMCO 23*

Work on this topic remains ongoing.

R-3.4.11 (standing): *To update the assessment of both narwhal and beluga*

This is done regularly by the JWG and remains a standing request.

R-3.4.14 (ongoing): *To examine the data existing on beluga in East Greenland (sightings, strandings, by-catch and catch) and examine how this material can be used in an assessment process and advice on how this data can be improved.*

There is currently no data on strandings, bycatch or catch in East Greenland. There have been a few rare sightings (e.g. one sighting in NASS 2015) but there is not enough data to carry out an assessment or provide advice for beluga in East Greenland. The SC considers that this request has now been answered.

9.4.5 Future work

The work continues under the JWG.

9.5 Narwhal

9.5.1 Global Review of Monodontids [SC/25/28 & SC/25/FI/11]

See information given under 9.4.1

9.5.2 Narwhals in East Greenland

The NAMMCO-JCNB JWG decided, with endorsement from SC 24, that to address the decline of narwhals in some areas of East Greenland, three rather than two management areas should be recognised. The MCC requested more information on the rationale for this proposal to divide the management areas, as well as for the recommendations given regarding seasonal closures and hunting prohibitions south of 68°. The following represents the SC's response to the MCC.

SC's response to the MCC:

The joint scientific working group of NAMMCO-JCNB decided at their latest meeting in 2017 to recognize three separate management areas in East Greenland: Tasiilaq, Kangerlussuaq and Ittoqqortormiit. This recommendation is based on the well-established practice in NAMMCO and the JCNB, to consider summer aggregations in separate fjords as representing separate management units because of the site fidelity characteristic of narwhals.

In summer, narwhals reside in the fjords along the east Greenland coast from 65°N and north to Nordost Rundingen (82°N, Figure 4), with larger known concentrations of animals in Scoresby Sound, Tasiilaq and Kangerlussuaq (Heide-Jørgensen et 2010, NAMMCO 2017).

Narwhals in East Greenland are presently recognized as two stocks. One in the Scoresby Sound fjord complex and south to Tasiilaq (called the East Greenland stock) and the other located north of Scoresby Sound (called the Northeastern Greenland stock). Narwhals are not hunted in Northeast Greenland and no assessment is available for this latter stock.

An aerial survey for narwhals conducted in 2008 estimated that there were 1098 narwhals (CV=0.63, 95% CI= 351-3437) in the Tasiilaq area and 1176 (CV=0.29, 95% CI=661-2094) in the Ittoqqortoormiit area (NAMMCO 2017). New estimates from an aerial survey in 2016 showed a significant reduction in the number of narwhals to 288 (CV=0.44, 95% CI=125-663) in the Tasiilaq area and 476 (CV=0.38, 95% CI=232-977) in the Ittoqqortoormiit area. The estimate from the Tasiilaq area is increased by adding narwhals counted in the open sea in another aerial survey in 2015, increasing the total abundance to 797 narwhals (CV=0.69, 95% CI=236-2686). In the survey from 2016, all the narwhals in the Tasiilaq management area were detected in the Kangerlussuaq Fjord and none were seen south of Kangerlussuaq.

The recommendation of the joint NAMMCO-JCNB to recognize 3 separate management areas in East Greenland (Tasiilaq, Kangerlussuaq and Ittoqqortormiit) was made as a consequence of the fact that, despite intense coverage, no narwhals were seen during the survey in 2016 south of 68°N (south of Kangerlussuaq). The abundance of narwhals south of Kangerlussuaq was therefore considered as being so low that catches in this area would not be sustainable. The delineation of a three management areas scenario for East Greenland is in agreement with the precautionary principle and is one way to avoid further depletion or, in worst-case, the eradication of local narwhal stocks (NAMMCO 2017). Surveys of belugas in Canada indicate a threshold in growth with populations unlikely to increase if the abundance is lower than app. 2000 individuals (NAMMCO 2018). The same could be the case for narwhals.

It is likely that the dramatic decline in the number of narwhals in the East Greenland stocks is due to excessive hunting pressure and that the current catch levels are too high for the East Greenland narwhal stocks to increase or even remain stable. The decline in abundance that is suggested by the 2008 and 2016 surveys is supported by the declining population trajectory estimated by the assessment even when the information on trends in abundance is removed. This strongly suggests that the decline is real, and that the current catch levels are unsustainable.

SC 24 advised that catches in Ittoqqortormiit and Kangerlussuaq should be reduced to less than 10 animals per year. The SC also recommended not to hunt narwhals south of 68°N. The sharp decline in abundance estimates necessitates a precautionary catch reduction to allow the stocks to recover (NAMMCO 2017).

The MCC did not endorse the recommendation of the SC and the Government of Greenland issued quotas for narwhals in 2018 at 50 animals in Ittoqqortoormiit and 16 animals in Tasiilaq. The total quota for East Greenland in 2018 was 66 animals (or 560% higher than the SC recommendation).

Advice for a zero catch in the southern zone was initially given in 2017 but has not been implemented, despite clear evidence of a declining population. The SC **expressed deep concern** regarding the status of East Greenland narwhal stocks and a situation in which high catches continue for a declining population.

The SC **agreed** that action on this issue was urgent and of high priority. On the basis of its response to the MCC, it **strongly reiterated its previous recommendations and advice** that catch quotas in Greenland be reduced and no hunting be permitted south of 68°.

The SC also **recommended** that an *ad hoc* WG be convened to review new information, assess the population status of narwhals in East Greenland, and present results at SC 26 in 2019. The SC stressed that the urgency of this issue meant that addressing it could not wait until the next meeting of the JCNB-NAMMCO JWG, which will meet in 2020 at the earliest. Furthermore, since the stocks of East Greenland are not shared with Canada, they are not clearly within the remit of the JWG and therefore specific attention through a new WG is required.

9.5.2.1 Details for new *ad hoc* working group on narwhals in eastern Greenland

Title: NAMMCO Scientific Committee Working Group on the Population Status of Narwhal in East Greenland

Terms of Reference:

1. Review the latest information on surveys in East Greenland including options for updating the surveys from the 1980s.
2. Review information of satellite tracking of narwhals in East Greenland
3. Present the latest information on genetic discrimination of stocks in East Greenland
4. Assess the importance of climate change on the distribution of narwhals in East Greenland
5. Compile hunting statistics and information from hunters on availability of narwhals
6. Assess the future sustainability of catches

Location: Copenhagen, Denmark

Timeframe: September/October 2019, 3-4 days

Chair: Rod Hobbs (Invited expert, NAMMCO co-Chair for the JWG)

Convenor: Rikke Guldborg Hansen (SC, GL)

Proposed participants: Eva Garde (GL), Outi Tervo (GL), Lars Witting (GL), Fernando Ugarte (GL), Rikke Guldborg Hansen (GL), Mads Peter Heide-Jørgensen (GL), Philippine Chambault (GL), Marie Louis (GL), and 2-3 invited experts from DFO.

9.5.3 Update

Heide-Jørgensen presented progress on narwhal research in Greenland. Instrumentation of narwhals with heart-rate and Acousonde recorders were continued in 2017 and 2018 together with tagging with satellite transmitters, including a new CTD transmitter. Results indicate a strong prevalence for water temperatures below 2°C. In 2017, reactions of narwhals to seismic activity was examined on an experimental basis and this study was completed in 2018. Results are presently being analysed and are expected to contribute to the understanding of the effects of disturbances on narwhals.

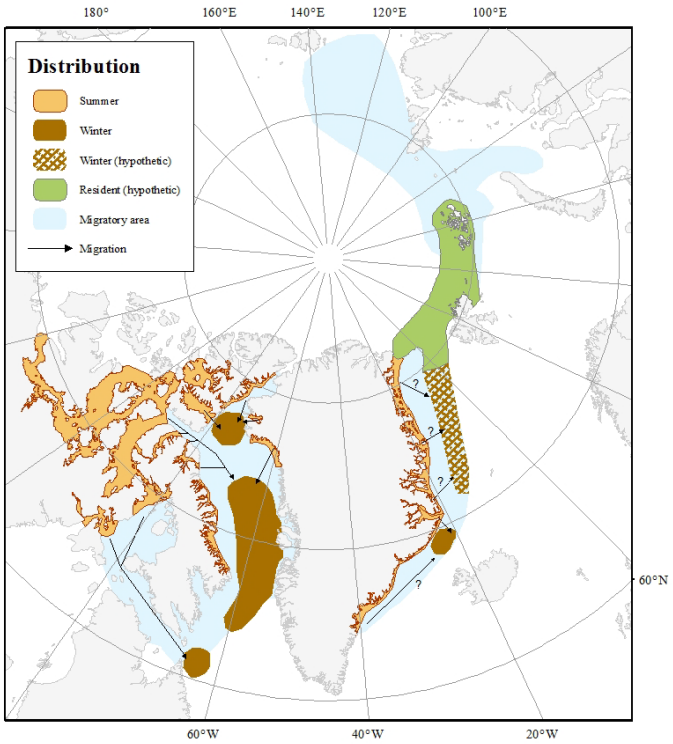

Figure 4: Distribution of narwhals

9.5.4 NAMMCO-JCNB JWG & Workshop March 2019

The information here is the same as 9.4.3

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

R-3.4.9 (ongoing): *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; narwhal added at NAMMCO 23*

There is an ongoing study in Greenland (see section 9.5.3) that should inform this request.

R-3.4.11 (standing): *update the assessment of both narwhal and beluga*

This is done regularly by the JWG and remains a standing request.

9.5.6 Future work

A new *ad hoc* WG specifically focused on narwhals in East Greenland has been recommended and work also remains ongoing under the JWG NAMMCO-JCNB.

9.6 Sei whale

9.6.1 AEWG 2018 [SC/25/12]

No updates on Sei whales.

9.6.2 Update

There has been a recent thesis completed on sei whales regarding ecology and management in the North Atlantic. It is available as SC/25/FI/27.

Pastene summarized the relevant results on stock structure of sei whales in the study by Huijser *et al.* (2018) (SC/25/FI28).

Presenter's summary:

The authors analysed mitochondrial control region DNA (mtDNA) sequences and genotypes from 7 to 11 microsatellite loci in 87 samples of sei whales from three locations in the North Atlantic; Iceland (n=43), the Gulf of Maine (n=18) and the Azores (n=26), and compared this with the North Pacific using 489 previously published samples. No statistically significant deviations from homogeneity were detected among the North Atlantic samples at mtDNA or microsatellite loci. In contrast significant genetic divergence between the North Atlantic and North Pacific Oceans was detected (mtDNA $\Phi ST = 0.72$, microsatellite Weir and Cockerham's $\Theta = 0.20$; $p < 0.001$). The genealogy estimated from the mtDNA sequences revealed a clear division of the haplotypes into a North Atlantic and a North Pacific clade, with the exception of one haplotype detected in a single sample from the Azores, which was included in the North Pacific clade. The authors concluded that although estimates of genetic divergence among the North Atlantic locations examined were low and consistent with the extensive range of movement observed in satellite tagged sei whales, the high uncertainty of the genetic divergence estimates precludes rejection of multiple stocks in the North Atlantic.

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

> ***R-1.7.12 (ongoing):*** *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*

There was insufficient data to generate an abundance estimate for this species.

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

This has not been done as there are no recent abundance estimates available. The recent surveys have not specifically targeted sei whales and were too early in the season to generate a meaningful abundance estimate.

9.7 Bottlenose whale

9.7.1 AEWG 2018 [SC/25/12]

No accepted abundance estimates to report.

9.7.2 Update

Mikkelsen informed that a design-based abundance estimate of bottlenose whales for the Faroese component of TNASS 2007, analysed together with SCANS-II and CODA data, numbered 19,539 (95% C.I. 9921–38,482) animals, with 15 out of 17 sightings coming from the Faroese block.

Víkingsson noted that there was an unusual number of strandings in eastern and northern parts of Iceland this summer – this included 14 strandings of bottlenose whales in about 10 different episodes between June 30th and 20th October and 4 strandings of other beaked whales. There was also news of an unusually high number of strandings of beaked whales in the UK and Ireland. This is currently being investigated by a group of scientists in the UK and Ireland.

Haug also noted that there were 3-4 strandings of bottlenose whales in Norway during the same period – these appeared to have been dead in the water for some time and drifted ashore.

Zabavnikov also informed that bottlenose whales have been observed eating a significant amount of fish from the longline fisheries of cod in the Barents Sea.

9.7.3 Review and status of active requests

There are no active requests for this species.

9.7.4 Future work

The SC **endorsed** the AEWG recommendation that an analysis of the sightings data from 2015 be undertaken.

9.8 Killer whale

9.8.1 AEWG 2018

Norway 2002-2007 and 2008-2013 cycle: Preliminary estimate, not accepted.

9.8.2 Status Review by Jourdain et al. 2018 [SC/25/18]

SC 24 recommended that NAMMCO contract a scientist to prepare a working document for the next SC meeting that reviews all available information and research activities on abundance, stock structure and movements of killer whales in the North Atlantic. Jourdain lead this review and the results are presented below.

Lead Author's Summary:

During the 1980s, dedicated killer whale (Orcinus orca) studies were initiated across several regions of the North Atlantic and a first comprehensive review of available knowledge was published in 1988. Since that time, a growing interest for killer whale research has resulted in a sharp increase in published literature. Research in some of the most highly investigated regions (including Norway, Iceland and the waters around Britain) have enabled a better understanding of occurrence patterns, major food sources, abundance and population structuring of North Eastern Atlantic killer whales. In contrast, much less is known about killer whales occurring in the middle and Western Atlantic, which have only been studied since 2006 after their presence in rapidly changing Arctic regions of Canada and Greenland increased. The objective of this review has been to provide an up-to-date summary of available scientific knowledge about North Atlantic killer whales, with a primary focus on regional populations' distribution, association with prey resources, size and trends, movement, connectivity and threats - all in order to assess conservation status. The authors reviewed 84 peer-reviewed articles and other literature, published from 1957 to date, relevant to status assessment. This revealed a marked imbalance of published research across regions and topics. Importantly, it became clear that there is an urgent need for research on abundance and population structure off Eastern Canadian Arctic, Newfoundland - Labrador and both West and East Greenland. In addition, across most regions, conservation status assessments have not been conducted, highlighting a need for ongoing and future studies to collect information required to undertake these assessments.

Discussion

The SC **thanked** the author for an excellent and comprehensive review and an engaging presentation.

The numbers reported on catches in Greenland were discussed, with questions raised about the interpretation and form of presentation of these numbers. The SC **recommended** that existing catch records should be validated, and reporting on catches (including struck and loss rates) be improved. It also noted that killer whales should be included in existing mandatory reporting schemes.

It was stated that a significant number of samples from historical hunts in Norway had been collected but are no longer available. Analysis of these samples is reported in the published literature, although an assessment of pollutant levels was not a part of this work. It was noted that for the current by-catch of killer whales in fisheries in Norway, no samples are currently being collected. Samples are being collected in Greenland when possible and this includes some sampling of sex organs and foetuses. The SC **recommended** furthering sampling efforts in all NAMMCO countries, as well as further analyses of pollutant levels and genetic analyses to help determine stock structure.

In discussing the recommendations proposed in the review, the SC proposed that it would be valuable for Council to provide clarification on the management objectives for killer whales.

Regarding the recommendations put forward in the review, the SC **agreed** that there is currently not enough scientific information available to perform a sound assessment of the sustainability of the harvest of killer whales in Greenland.

The SC **endorsed** the review's recommendation that further research efforts on abundance and population structure in the West Atlantic are desirable.

Recognising that it will take several years to perform the research necessary to inform a sound scientific assessment, the SC **recommended** that Greenland be advised to regulate the hunt and restrict quotas in a precautionary way. It was noted that providing specific numbers for this would, however, be arbitrary without a formal assessment. The SC noted that the Government had recently advised that due to killer whales containing high levels of pollutants, the meat was not safe to eat and this may decrease the level of catches.

The SC **recommended** that the review include information from the global review on killer whales performed by the IWC in 2007 and published in 2008. Once this is done, the SC **recommended** that the work be published.

9.8.3 Review & response to recent publications on killer whales

9.8.3.1 Overview of three recent publications on the issue of PCBs and killer whales [SC/25/FI/29,30,32]

Rosing-Asvid presented an overview of three recent publications of significance on killer whales.

Presenter's Summary:

Genetics show that killer whales in the eastern part of the North Atlantic (Norway, Iceland and southeast Greenland) are all closely related. They do, however, show significant differences in the level of PCBs in the blubber, indicating that their diets differ. The Norwegian and Icelandic killer whales are known mainly to be feeding on fish (ex. herring and maceral), while killer whales sampled in southeast Greenland had marine mammals in their stomach. Furthermore, a study on fatty acids by Bourque et al. (2018) (SC/25/FI/30) showed that the specific fatty acid markers previously linked to marine mammal feeding in other killer whale populations were significantly higher in killer whales from southeast Greenland compared to captive whales, which had only been eating fish. The study also showed that there is a stratification of the fatty acids down through the blubber column, which will complicate diet analyzes based on fatty acid compositions if they are based on biopsy samples that only get part of the blubber column.

Pedro et al. (2017) (SC/25/FI/32) looked at the stratification of PCBs and other POPs in the blubber. This study concluded that the pollutants were in significantly lower concentrations in the outermost layers when blubber was on wet weight basis, but this was not the case after a lipid correction of the sample.

This allows for a comparison of PCB levels from different killer whale populations. The study of Desforges et al. (2018) (SC/25/FI/29) does this and finds that 10 out of 19 populations have either a moderate or high risk of extinction in the future due to PCB pollution. These threatened killer whale stocks would either be living in some of the most polluted areas or they would be feeding on marine mammals.

That means that the killer whales that live around Norway and Iceland and mainly feeding on fish will be doing well, but those coming to southeast Greenland feeding on marine mammals are at a high risk of decline.

Discussion

The stratification of pollutants in the blubber was discussed and it was noted that the stratification pattern presented in these studies on killer whales appeared to differ from studies with other marine mammals. Typically, pollutants would be found in higher concentrations in the outer layers of the blubber, while this appeared not to be the case for killer whales in these publications.

In the discussion it was argued that PCBs stored in the blubber would only have an impact if the blubber reserves were drawn upon by the animal and this would only happen if the animals were stressed and/or have difficulties finding food. Since the marine mammals in the Atlantic are abundant, the marine mammal-eating killer whales should be in a good nutritional state, which may mean that the presence of PCBs alone may not pose a significant problem for those animals. It was, however, noted that the main driver of the decline observed in some killer whale stocks is the mortality of the calves. As long as the calves drink milk, they will have elevated levels of PCBs in their bloodstream and this can create serious problems even though older animals from the same stock

may be doing fine. It is these challenges with reproduction and calf survival that are predicted to lead to a decline in the population.

It was suggested that it may be important to look at individual variations within populations as well as variations between families to create a representative sample that can give an accurate picture for the stock as a whole. It was also noted that the age of the organism sampled makes a significant difference for what PCB levels are seen.

9.8.3.2 Response to Desforges et al. (2018) paper on PCBs in killer whales [SC/25/20]

Witting provided a summary of a working document (SC/25/20) that he has authored in response to the paper of Desforges et al. (2018) (SC/25/FI/29).

Presenter's summary:

The document SC/25/20 examines the reasons behind the somewhat surprising prediction of a collapse of killer whale populations worldwide. When projecting population dynamics over 100 years it is essential to incorporate a regulation that adjusts the population dynamic growth over time. In relation to PCB contamination, the regulation should reflect the accumulation of PCBs in individuals over time, as a function of the development of the PCB concentration in the environment. This regulation was unfortunately not addressed by Desforges et al. (2018), as they consider only exponential growth with constant PCB levels for the different contamination groups. Their study is thus unable to predict realistic killer whale dynamics, but this does not imply that they are unable to estimate the current impacts of PCBs on killer whale populations worldwide.

The effect of PCBs on calf survival, however, comes from a laboratory response in mink. The predicted population collapse is thus assuming that we can proportionally convert a functional response in a 0.5 kg terrestrial laboratory animal to a free-living marine mammal that is about 10,000 times larger. While it is fair to assume that increased PCB levels will have an effect on calf survival also in killer whales, Desforges et al. (2018) do not address the large degree of uncertainty that is associated with the conversion of an individual response in mink to a population level response in killer whales.

Another issue is how the population model for the non-polluted base-case population of killer whales is estimated from life-history data from contaminated populations of killer whales. The resulting estimate of 0.88% growth per year for pristine non-polluted killer whales appears unrealistically low, as it is about five times lower than the currently observed growth rate in the longest living marine mammal, the bowhead whale.

In estimating the ability of a population to sustain negative impacts it is essential to estimate the impacts on the population's potential for growth. This relates to some kind of maximum growth, and this growth rate is expected to be significantly larger 0.88%. However, Desforges et al. (2018) do not attempt to estimate the impacts on potential growth, but only on current growth, which could be zero, or even negative, in a fully viable non-contaminated population. It is evidently flawed to take, e.g., a growth rate of zero from a population in equilibrium, and indicate a population collapse by a small downward adjustment of the equilibrium growth rate.

There are also a couple of quantitative errors in the estimated growth rate. The first relates to calf survival that Desforges et al. (2018) seem to include twice, with a growth rate estimate that increases to about 1.5% when corrected for this mistake. The second relates to the effect of PCBs on calf survival, an effect that Desforges et al. (2018) do not subtract from the estimated growth of a pristine population. When subtracting this effect, we obtain an overall corrected growth rate estimate in the order of 2.2%. These corrections imply that the estimated growth rates increase from negative to positive in nearly all contaminated killer whale populations. The exceptions are the two highest contamination level groups (6 and 7) where the estimated growth rate is negative, but very close to zero; indicating that even exposure groups 6 and 7 might have the potential for positive growth. There is thus no evidence of a worldwide collapse of killer whale populations. Nevertheless, the observed PCB contamination levels are alarming in light of increased neonate mortality in PCB contaminated minks, and the most exposed killer whale populations might not be able to compensate for the detrimental effects of PCB.

Discussion

The presenter clarified that the aim was not to suggest that PCBs were not a problem for killer whales, only to challenge the legitimacy of the broad claim that half of the killer whale populations are in decline.

The rise, decline and rise again of PCB levels in several marine mammal species (including seals and polar bears) over time was noted and reasons for this discussed. This included the movement of PCBs into different geographical areas (e.g. up towards the arctic) and switches being made to different prey species.

The use of minks as the model species for establishing threshold levels for impacts in Desforges et al. (2018) was also discussed. It was noted that although this is problematic, mink were used so that the levels leading to impacts could be established through controlled experiments and that the levels did correspond to those observed as leading to reproductive difficulties in seals.

The SC noted that the rate of increase of killer whale populations presented in Desforges et al. (2018) and used globally for all killer whale populations was unusually low for any cetacean and was not in agreement with published estimates of rates of increase for this species. The analysis presented by Witting demonstrated that a main reason for the low rate of increase (0.88%) in Desforges et al. (2018) was due to an error in their parametrization of the exponential population model where calf mortality and detrimental effects from PCBs were included twice and that a corrected rate of increase would be closer to 2%, in agreement with an estimate of 2.5% from Brault & Caswell (1993). Given this correction, the SC discussed whether the predicted decline in the killer whale populations examined by Desforges et al. (2018) was unwarranted. Since the working paper had not been circulated prior to the meeting, however, not all SC members felt that they had had sufficient time to draw a firm conclusion on this topic.

The SC **encouraged** Witting to submit the paper for publication in a peer-reviewed journal. The SC also **agreed** that it is important to continue monitoring impacts on killer whale populations and that further research on pollutants in marine mammals is highly valuable for understanding anthropogenic impacts.

9.8.4 Review and status of active requests (R-3.7.2)

> ***R-3.7.2 (ongoing):*** *review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, and to provide advice on research needs to improve this knowledge. Priority should be given to killer whales in the West Greenland – Eastern Canada area.*

This review has now been completed, see discussion under item 9.8.2. The SC **recommended** that reporting on killer whale removals be improved, sampling enhanced, and genetic analyses performed.

9.8.5 Future work

See above.

9.9 Pilot whale

9.9.1 AEWG 2018 [SC/25/12]

Iceland/Faroes revised 2015: Total abundance was 344,148 (CV=0.35, 95% CI=162,795-727,527) pilot whales. Corrected for perception bias. Estimate accepted by WG and **endorsed** by the SC.

Trend analysis: Following a previous analysis that indicated a negative trend, the WG reviewed an analysis of trends in the abundance of long-finned pilot whales in the NASS and associated surveys, covering a large but variable portion of the North Atlantic 6 times from 1987 to 2015.

The varying spatial coverage of the surveys is accommodated by delineating common regions that were covered by i) all 6 surveys, and ii) the 3 largest surveys (1989, 1995, and 2007). These "Index Regions" were divided into East and West sub-regions (Fig. 5), and post-stratification was used to obtain abundance estimates for these areas only. Total abundance in the Index Regions, uncorrected for perception or availability biases, ranged from 54,264 (CV=0.48) in 2001 to 253,109 (CV=0.43) in 2015. There was no significant trend in the numbers of individuals or groups in either the 6 or 3 Survey Index Regions, and no consistent trend over the period.

NAMMCO has planned a long-finned pilot whale assessment for 2020. The AEWG recommended that a "pre-assessment" meeting be convened to determine (1) what long-finned pilot whale data are available and to identify gaps; (2) what approaches might provide the maximal information from these data (such as a model-based abundance estimation approach), and (3) whether additional or different data need to be derived or collected to answer questions around abundance trends, factors influencing density and distribution shifts, hunt recruitment area, and ultimately sustainability.

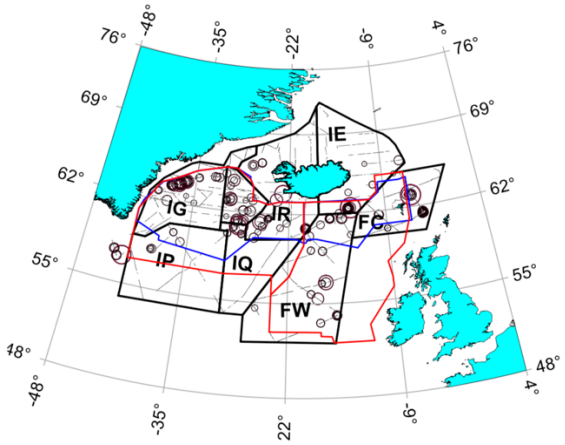

Figure 5. Sightings of long-finned pilot whales in the Icelandic and Faroese NASS-2015 ship survey. Survey index regions are shown in blue (6-SIR) and red (3-SIR).

Discussion

A proposal for new text presenting the trend analysis was made. The SC **concluded** that it was not appropriate to change the information on trends provided by the WG, however, it did wish to note that the work performed on trends by the AEWG was a reanalysis of previous work that had indicated a negative trend.

The SC discussed the need for a preassessment meeting for the pilot whale WG (PWWG). The SC noted that it is not standard procedure to have such a meeting, however, it **agreed** that this was a useful way to set the work in motion and ensure that the data necessary for performing an assessment was available, thereby ensuring that the PWWG was as productive as possible. The SC noted that this preassessment meeting did not necessarily need to be a face to face meeting and could be done via skype.

9.9.2 Update

Mikkelsen gave an update on progress with pilot whale tracking. Four animals in a pod composed of 15 animals were fitted with satellite transmitters in September, but unfortunately the transmitters lasted only up to 50 days. Nevertheless, some new information was added to the overall picture composing a total of six tracked groups now. One behaviour not seen before was that the group stayed east of the Rockall Plateau, close to the UK Shelf, on their southward migration. Furthermore, that the group divided into two, with one component moving southward while the other moved in a northeast direction, although the initial pod only consisted of 15 animals. Further tagging efforts are planned for the future.

Desportes noted that the IUCN recently released the review of its assessment of pilot whales, which shifted the status from Data Deficient (DD) to Least Concern (LC). NAMMCO was involved in this review. The published review also noted that although there have been concerns about the sustainability of the hunts of this species, no declines have been detected in the harvested populations. The SC views this revision of the status of pilot whales under the IUCN as a positive development.

9.9.3 Pilot Whale WG (2020)

The SC **agreed** that it would be beneficial to have an invited expert serve as Chair for this WG, while Mikkelsen will serve as convener. It suggested Randy Reeves as a good candidate. Other invited experts proposed were Doug Butterworth, André Punt and Alex Zerbini.

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

***R-1.7.11 (ongoing)**: To develop estimates of abundance and trends as soon as possible*

This has been conducted.

***R-3.8.6 (ongoing)**: To complete a full assessment of pilot whales in the North Atlantic and provide advice on the sustainability of catches...with particular emphasis on the Faroese area and East and West Greenland. [Part answered: In the short term...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]

This is ongoing and will be addressed under the planned pilot whale WG in 2020.

9.9.5 Future work

Preparations for the WG will be carried out.

The ongoing tagging efforts in the Faroe Islands will continue as opportunities arise. The SC **welcomed** additional tagging efforts for this species.

The SC will continue to be updated on research in the Faroe Islands on life history parameters.

9.10 Dolphins

9.10.1 AEWG 2018 [SC/25/12]

Iceland/Faroes 2007: Preliminary estimate accepted by WG pending minor work.

Iceland/Faroes 2007: Preliminary estimate accepted by WG pending minor work.

Iceland/Faroes revised 2015: Total abundance was 131,022 (CV=0.73, 95% CI=35,251-486,981) for white-sided dolphins. Corrected for perception bias. Estimate accepted by WG and **endorsed** by the SC.

Iceland/Faroes revised 2015: Total abundance was 159,000 (CV=0.63, 95% CI=49,957-506,054) for white-beaked dolphins. Corrected for perception bias. Estimate accepted by WG and **endorsed** by the SC.

Norway 2002-2007 and 2008-2013 cycle: Preliminary estimate, not accepted.

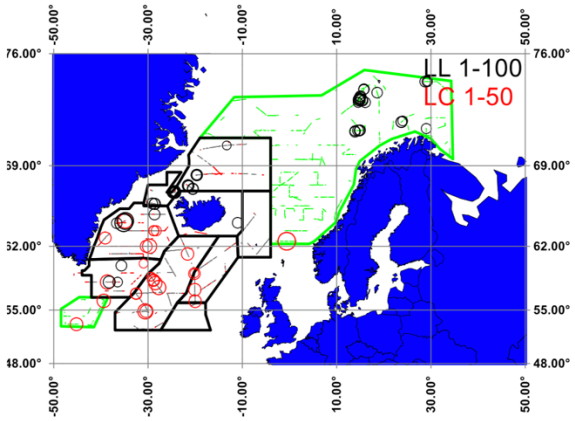

Figure 6. Distribution of white-beaked (black) and white-sided (red) dolphin sightings from the T-NASS-2007 Icelandic and Faroese ship survey, and extensions (shown in green). Symbol size is proportional to group size

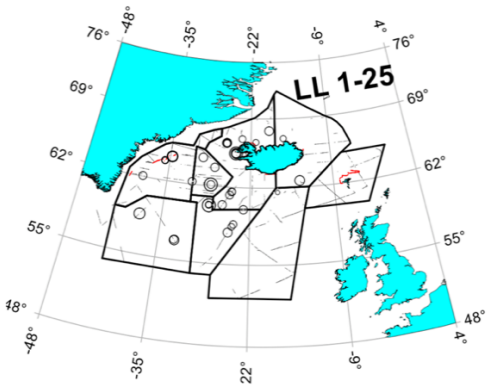

Figure 7. Distribution of white-beaked dolphin sightings from the NASS-2015 Icelandic and Faroese ship survey.

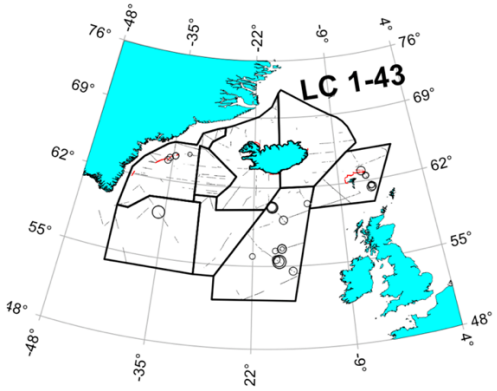

Figure 8. Distribution of white-sided dolphin sightings from the NASS-2015 Icelandic and Faroese ship survey.

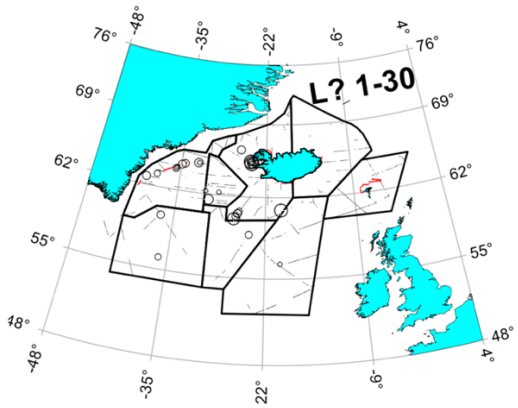

Figure 9. Distribution of unidentified white-sided OR white-beaked dolphin sightings from the NASS-2015 Icelandic and Faroese ship survey.

9.10.2 Update [SC/25/13]

SC 24 noted that increased catches in white beaked dolphins had been observed in east Greenland due to shrinking ice. This continues and may in part be driven by a decrease in the numbers of narwhals available in the area.

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

R-3.9.6 (ongoing): *assessments of dolphin species*

There are abundance estimates and catch data available but the SC does not consider performing assessments for dolphin species a priority at the moment. Assessments of other species are deemed more urgent. The SC **recommended** that Council consider whether this request remains valid.

9.11 Harbour porpoise

9.11.1 AEWG 2018 [SC/25/12]

Norway 2002-2007 and 2008-2013 cycle: Preliminary estimate, not accepted.

The WG recommended that the estimates for Iceland and Norway be completed and this was **endorsed**.

9.11.2 Update [SC/25/13, 30]

NORWAY

A genetic analysis is taking place in Norway on by-catch samples from 2016 and 2017, covering almost the entire Norwegian coast. These by-catches are also being used to look at life history and diet factors. No results are available as yet but the work will be further discussed during the harbour porpoise workshop in December. Surveys were also conducted in the fjords of Norway (from Stavanger to Kristiansund) in the summer of 2018. A high number of sightings were made, although the analysis of this work is still ongoing.

FAROE ISLANDS

Harbour porpoises are allowed to be hunted but in practice this is not really done.

GREENLAND

A PhD thesis on harbour porpoise in Greenland was recently defended and some results will be presented at the coming workshop.

ICELAND

A genetic analysis on kinship in Iceland is ongoing with potential to estimate abundance and trends. There is also a comparative study with Greenland (being performed in collaboration with researchers in Potsdam). Updates on this work will be presented at the workshop in December.

Discussion

It was noted that it may be interesting to extend the comparative genetic work to include samples from Norway to create a wider trans-Atlantic comparison. The SC **recommended** that this be considered by the researchers involved.

9.11.3 Harbour Porpoise Workshop December 2018

The International Workshop on the Status of Harbour Porpoises in the North Atlantic jointly organised by IMR and NAMMCO, will be held in Tromsø on December 3-7 2018. It is organised in cooperation with scientists from the Sea Mammal Research Unit (UK), NEFSC-NOAA Fisheries (US), Fisheries and Oceans (Canada), Galway-Mayo Institute of Technology (Ireland), and the University of Agricultural Sciences (Sweden). The workshop is primarily funded by the IMR and 36 scientists from NAMMCO, Nordic and European countries, as well as the US, Canada and Mauritania will participate.

The workshop aims to:

- Identify the appropriate assessment units (populations/sub-populations/ecological stocks/management units/assessment units) for harbour porpoises in the North Atlantic and/or knowledge gaps for doing so

And for each assessment unit:

- Review information on distribution, abundance, (direct and indirect) removals, life history parameters and trends, in order to determine if it reaches the threshold for conducting a quantitative assessment;

- Review information available on indirect (sub-lethal) pressures, including chemical and plastics, and noise pollution;

- Where sufficient data are available, undertake a quantitative assessment using a population dynamics modelling approach, which includes an evaluation of the sustainability of removals;

- Identify knowledge gaps and define research priorities and opportunities to cooperate to assess the conservation status within each unit, as well as monitoring requirements within each unit.

Twelve larger areas have been identified and for each of these a status review will be provided in preparation of the workshop, including information on stock identity, trends in abundance and removals, lethal and sub-lethal pressures, life history parameters and health status, and feeding ecology.

The SC **looked forward** to receiving the outcomes of the workshop at its next meeting

9.11.4 HPWG 2019

To date, much of the work conducted on harbour porpoises has been conducted within the by-catch WG (with a focus on Iceland and Norway where there are high levels of harbour porpoise by-catch). Recently, the primary

focus has been on preparing for the harbour porpoise workshop (HP WS) that will take place in Tromsø in December.

The harbour porpoise working group (HPWG) will meet in 2019. Mikkelsen is Chair for the HPWG and Mike Hammill, Phil Hammond and Jonas Teilman were proposed as potential invited experts. The WG is planned for spring 2019, with the possibility that a follow up may be needed in 2020 to be able to get through all stocks. Although the location is not yet settled, it is likely to be Copenhagen. This would allow for participation of additional invited experts from Denmark. The ToR for this WG are:

- Conduct an assessment of the sustainability of the harvest of harbour porpoise in West Greenland;
- Review assessments performed in other areas by the HP WS;
- Identify knowledge gaps and needs for further research;
- Assess impacts from non-hunting related anthropogenic stresses (pollution, climate change, noise etc).

Discussion

Some concerns were raised that assessments were planned to be conducted as part of the harbour porpoise workshop. It was noted that this was not a standard procedure for how NAMMCO assessments are conducted. This was seen as particularly inappropriate for Greenland where there are direct catches. It was noted that the original intention of the WS was to assess levels of removals.

Questions were raised regarding the appropriate and most useful timing for the WG. It was noted that Greenland was in a position to conduct an assessment that can provide advice on sustainable harvest but that it can only handle participating in one WG per semester.

The SC **agreed** that the formal assessment of and advice on sustainable harvest in Greenland would be addressed within the WG. It also **agreed** that the WS may perform assessments in other locations, however these will be subject to review by the WG before being adopted.

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

> ***R-3.10.1 (ongoing):*** *To perform a comprehensive assessment of the species throughout its range, which might include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals.*

This work is ongoing and will be addressed during both the upcoming WS and WG.

9.11.6 Future work

There are plans to continue the work on bycatch, population abundance and assessment through the WS & WG.

9.12 Sperm whale

9.12.1 AEWG 2018 [SC/25/12]

Norway 2002-7 cycle: Preliminary estimate, not accepted.

Norway 2015: Preliminary estimate, not accepted.

Iceland/Faroes 2007: Total abundance was 12,220 (CV= 0.38, 95% CI= 5,807-25,717) sperm whales. Corrected for perception bias, but not availability bias. Estimate accepted by WG and **endorsed** by the SC.

Iceland/Faroes revised 2015: Total abundance was 23,166 (CV= 0.59, 95% CI= 95 7,669-68,709) sperm whales. Corrected for perception bias, but not availability bias. Estimate accepted by WG and **endorsed** by the SC.

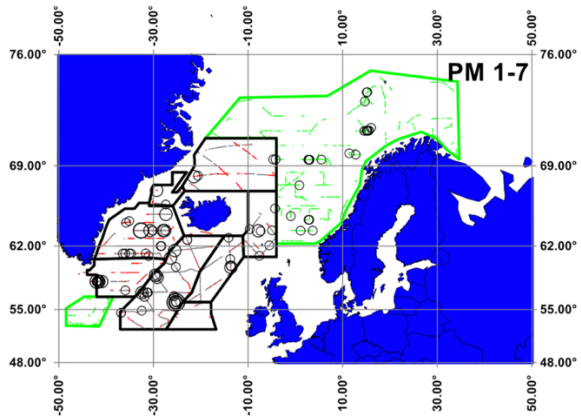

Figure 10. Sightings of sperm whales from the T-NASS-2007 Icelandic and Faroese ship survey. Effort by extension vessels shown in green.

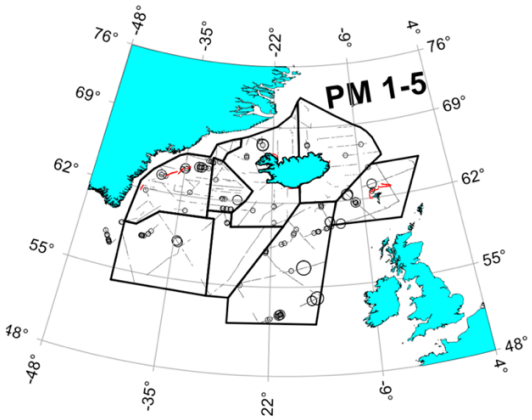

Figure 11. Distribution of sperm whale sightings from the NASS-2015 Icelandic and Faroese ship survey.

9.12.2 Update

None

9.12.3 Review and status of active requests

There are no active request for this species.

9.12.4 Future work

Norway intends to finish the estimates from previous surveys.

9.13 Bowhead whale

9.13.1 Update

9.13.1.1 Spitsbergen bowhead whale stock

Lydersen reported on the ongoing project on the Spitsbergen bowhead whale stock. Nine whales were tagged from a helicopter in August/September close to the Greenland coast at 79-80°N. In addition, biopsies were collected from two animals. Results from the tracking in 2017 was presented and showed that the whales that were initially tagged in the middle of the Fram Strait, spread throughout the assumed distributional area for this stock; from the east coast of Greenland via Svalbard into western Russian waters.

Discussion

Questions were asked about the plans for the genetic analysis of the biopsy samples and Lydersen informed that these would be directed towards investigating whether the population contained influxes from the west or east and whether there was any significant inbreeding. However, it was noted that genetic analysis is still pending.

A question was also asked about whether a biopsy collecting head could be attached to the plastic casing surrounding the satellite tag (used for streamlining during shooting) and it was answered that this may be possible.

9.13.1.2 Research in Greenland

Heide-Jørgensen presented progress on bowhead whale research in Greenland including the development of a new CTD tag that has been tested on bowhead whales in Disko Bay. There is still some work to complete before the tag is fully operational, but the preliminary results are promising as a tool for monitoring oceanographic changes in water masses that are frequented by bowhead whales. The first data confirm the affinity of bowhead whales to the cold polar masses in Baffin Bay as also shown by an analysis of 100 tracked bowhead whales that left the West Greenland feeding grounds in spring when sea temperatures were rising (Chambault et al. 2018).

Discussion

A question was asked about the performance of the tags used in this research and whether the duration of transmission was comparable to that of those used in Svalbard. Heide-Jørgensen answered that many tags lasted for a similar length of time to those deployed in Svalbard. It was, however, also noted that since several different types of tags are used with varying depths of penetration, it was not always easy to compare performance.

9.13.2 Review and status of active requests (none)

9.13.3 Future work

Tagging efforts off Spitsbergen will continue. In West Greenland there is an intention to conduct a mark-recapture abundance analysis as an input to the IWC. Canada will conduct another survey in 2020 for the high arctic, which will include bowhead whales.

9.14 Blue Whales

9.14.1 AEWG 2018 [SC/25/12]

Iceland/Faroes revised 2015: Total abundance, corrected for perception bias, was 3000 (CV= 0.4, 95% CI= 1377-6534) blue whales. This estimate was accepted by WG and **endorsed** by the SC.

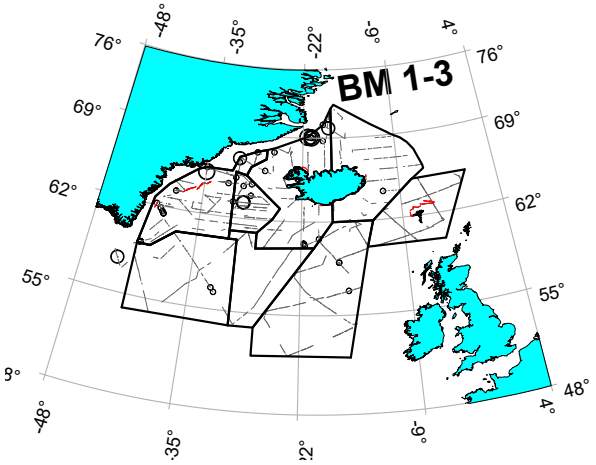

Figure 12. Distribution of blue whales from the NASS-2015 Icelandic and Faroese ship survey.

9.14.2 Update

Lydersen presented results from satellite tagging and biopsy sampling on blue whales in Svalbard. Three tags and four biopsies were collected. One tag was still transmitting and the animal was at the time of the presentation (15th November 2018) close to the west coast of Iceland.

The SC was informed that the IWC has recommended that an estimate of blue whales be generated, with a specific recommendation to use photo ID catalogues. The IWC has specifically requested participation in this work from Iceland, the US and Canada.

Discussion

A question was asked regarding whether it was possible to estimate trends but there is currently not enough data from 2007 to estimate trends. Using historical data before 2007 may enable such an estimate though.

9.14.3 Review and status of active requests

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*

There is a new abundance for the NASS area but not for the eastern Atlantic.

9.14.4 Future work

Tagging in Svalbard will continue.

10 SURVEYS

10.1 Update "Cetacean distribution and abundance in the North Atlantic" [SC/25/FI/16]

The outcome of the workshop "Cetacean distribution and abundance in the North Atlantic" organised by NAMMCO in conjunction with the 2018 SMM conference was presented to SC 24, although the report was only finalised after the SC meeting. The final report was provided as document SC/25/FI/16.

10.2 NAMMCO/IWC cooperation re. AE WGs

NAMMCO has had a working group dealing specifically with reviewing abundance estimates of cetacean species (except narwhal and belugas) since 1997 (AEWG) and the WG has had as invited expert members of the IWC Scientific Committee, but no formal cooperation was established between the two organisations.

The Scientific Committee of the IWC convened an abundance estimates working group in 2017. The NAMMCO Council and SC agreed that a formal cooperation between the NAMMCO and IWC working groups would be beneficial to ensure agreement on criteria for endorsing estimates. The NAMMCO Secretariat therefore invited the IWC scientific committee to establish a cooperation between the two WGs. The response was positive and the Committees agreed that invitations would be issued to facilitate mutual participation both in meetings and intersessional activities, with a first step being that the chairs of the working groups formally become members of the other organisation's working group.

The first steps in this cooperation were taken at the May AEWG 2018, with Donovan representing the chair of the IWC Abundance Estimate Working Group at this meeting.

Discussion

The SC **welcomed** this cooperation that supplements the expertise of each WG through the inclusion of expertise from the other, and will help reduce duplication of work and ensure agreement on adopted estimates.

10.3 Abundance Estimate WG 2018

10.3.1 Status of analyses

The status of the analyses from the 2007 and 2015/16 surveys after the AEWG's review is reflected in Table 7 below. More analysis should be completed in the coming year and it is expected that the remaining analysis or revision could be completed, presented and hopefully accepted, at the next meeting of the AEWG in 2019. A table presenting the status (as of November 1st 2018) of all abundance estimates generated from the 2015-2016 NASS/NILS surveys is available in appendix 6.

The completion and endorsement of these estimates would mean that the data collected through the TNASS 2007 and NASS 2015/16 surveys, as well as the Norwegian mosaic surveys, would have all been analysed. This

would represent a considerable progress from the present situation, where data generated during the 2007 surveys and older Norwegian mosaic surveys were still not analysed.

The SC **welcomed** this progress and **encouraged** all to contribute to and facilitate the completion of these long-standing analyses.

10.3.2 Joint analyses

10.3.2.1 Collaboration with St Andrews University on the project "Oceanographic feature driving decadal-scale changes in cetacean distribution and abundance in the north Atlantic" [SC/25/29]

The preliminary results of the project by Ramirez-Martinez and Hammond were provided in doc SC/25/29 and presented by Víkingsson.

Presenter's summary:

This is a progress report on a spatial modelling project based on NASS data partly sponsored by NAMMCO. Considerable progress has been made in recent months and some preliminary results for three species of baleen whales - common minke whales, fin whales and humpback whales - for the period 1998-2015 were reported. The aim is to model the abundance of each of the species along the transect lines as a function of the following explanatory environmental covariates: depth, slope, aspect, sea surface temperature (SST), cholorophyll a (chl), density ocean mixed layer depth (mlp), sea surface height, sea floor potential temperature (bt) and salinity (sal). Three more variables were also always included in the models and used as a base model. These were a 2-dimensional isotropic spatial smooth to account for spatial variation, and a categorical variable identifying dataset/survey: Iceland-Faroes (NASS) or Norway (NILS).

Besides the variables always included in the base model, (dataset type and spatial interaction x,y), the best fitting model for minke whales included June SST and April mlp, for fin whales August SST and July chl and for humpback whales August sal and August bT.

Predictions of minke, fin and humpback whale density for average values (across 1998-2015) of dynamic covariates were illustrated visually and generally matched the areas of high occurrence of all three species. The authors stressed the preliminary nature of the results but noted that they do illustrate provisionally the information that can be obtained and that will be extended through full analyses. This includes abundance estimates, predictions of the effects of climate change, better understanding of habitat partitioning, extrapolations into poorly or unsurveyed areas and informing environmental impact assessments. Funding of 15,000 GBP is needed to cover the final year student stipend. NAMMCO has provided 4,500 GBP and the authors seek a recommendation that NAMMCO support the balance of 10,500 GBP so that this work can be completed.

Discussion

The project is performing a large-scale spatial analysis of the NASS/NILS data of three NAMMCO countries (Norway, Iceland and Faroe Islands) to investigate which environmental features best explain spatial and temporal variation in density. Besides improving our understanding of the what is causing the observed changes in the distribution and abundance of whales, the results will help in predicting what could be the impact of climate changes. The results of the models will also be valuable for management in a number of ways, as abundance can be estimated for different sized areas and be extrapolated to unsurveyed areas – e.g. areas that were unable to be surveyed in a particular year for logistical (e.g. weather) reasons.

Given the large changes in distribution that have been observed for several species over the 28-year period of the surveys, the work also has a potential value in contributing to identifying priority areas for the next survey and facilitating effective stratification, thus contributing to the planning of future NASS.

The SC viewed the project and its different possible outputs as interesting and supported its work. It considered very positive the fact that the data from three countries produced by the NASS and NIlS surveys were pulled together and used in a predictive exercise. The project represented a good way of combining the national data and producing a modelling exercise that might allow for an interpretation of the distributional changes observed and some predictions for the future.

The project has a strong value for Iceland, Norway and Faroe Islands directly, as well as Greenland indirectly. It represents an added value to the primary rationale for the survey of estimating abundance of whale species

subject to whaling to inform management. Given the value of this work, the SC **strongly supported** that NAMMCO continue financially supporting the project to allow its completion or/and NAMMCO parties support the project if possible.

10.3.2.1 Collaboration with Duke University [SC/25/11]

Ana Cañadas, from Duke University, requested collaboration with data holders in the NAMMCO countries with access to sightings information for cetaceans. Ugarte presented a summary of the request (SC/25/11).

Presenter's summary:

Cañadas is looking for collaborators for a project commissioned by the US Navy to map densities of cetaceans in the North Atlantic at different times of the year. This mapping will be part of a modelling exercise to predict the number of cetaceans that would be affected by the sounds produced during navy exercises. This would help the navy to plan their exercises in a way that minimizes the disturbance of cetaceans. They are particularly interested in the area east of Southern Greenland and west and east of northern Iceland, from Greenland to Norway, as well as waters between Europe and Iceland (regions 2 and 4 – 10 in the map from Anna's letter).

They are interested in any data regarding effort and sightings. Distance sampling data is preferred, but any data is accepted. They are looking for both aerial and ship-based data for as many seasons as possible. They offer co-authorship in a report and one or more peer reviewed publications. They can accommodate data in areas adjacent to their target area, and can offer development of more models and analysis if the data provider is interested in other topics. They also offer to prepare MoUs suitable for the data owner's wishes, and flexibility regarding publication time, to adapt to the contributors' own publication schedule.

Besides the maps of cetacean density commissioned by the navy, they aim to produce results regarding:

- Overall abundance estimates for each species or group of species with enough data (outcome for the Navy), as well as stratified estimates for areas of interest (e.g. particular areas of interest for the data contributors)

- Year-round, seasonal, or monthly absolute density maps (as allowed by the data availability), both overall and for local areas of interest for the data contributors.

- Identification of hot spots for each species/groups of species and the environmental covariates that may be driving them, either overall or through inter-annual or seasonal variations.

- Detailed biodiversity maps, e.g. species richness or other diversity indices, derived from the density maps

They have already secured access to data from Azores, Madeira, Canary Islands, Ireland, UK, Germany, Holland, Spain and France.

Discussion

The project aims at limiting the disturbance of cetaceans through underwater anthropogenic noise. Disturbance by anthropogenic noise is also a focus issue in NAMMCO.

Iceland informed that they have already committed their data to the analysis. Norway informed that a similar project was going on in Europe, with a request for data circulated by a German scientist, to which they had committed their data.

The SC **agreed** that the project contributed to the conservation of cetaceans and that it was positive that the data collected through the series of sightings surveys could be used by many projects supporting different outputs, while also recognising that the data owners were the Parties, which had to respond to the request of data.

10.4 Review and status of active requests and recommendations

R-1.7.11 (ongoing): *To develop estimates of abundance and trends as soon as possible*

The work of estimating abundance and trends from the surveys data is well underway and will continue, with the aim of being completed in Autumn 2019 and presented to the AEWG and later to SC 26. It is expected that all remaining analyses from the 2007 and 2015 NASS, as well as earlier Norwegian mosaic survey cycles, will finally be completed in 2019. For further details, see point 10.3.1.

Table 7. Abundance estimates considered by the 2018 AEWG and their status as of November. 1st

TYPE – S=ship, A=aerial; MODE – IO=independent observer method, BT=Buckland-Turnock method; 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	MODE	EST.	CV	95% CI		BIAS CORR.		STATUS	CITATION
									LCL	UCL	PER	AVAIL		Reference to WG document
BA	Minke whale	NASS	2015	Iceland/Faroes	S	IO					1	0	2	NAMMCO SC/25/AE/06
BA		NILS2015	2015	CM1a+CM3	S	IO					1	1	2	NAMMCO SC/25/AE/13
BA		NASS+NILS2015	2015	CMA	S	IO	48,016	0.23	30,709	75,078	1	P	1	NAMMCO SC/25/AE/08
BA		CIC2016	2016	Iceland coastal	A	IO					1	1	3	NAMMCO SC/25/AE/07
BM	Blue whale	NASS	2015	Iceland/Faroes	S	IO	3,000	0.4	1,377	6,534	1	0	1	NAMMCO SC/25/AE/06_rev
BP	Fin whale	NILS02-07	2005	Norway	S	IO					1	0	3	NAMMCO SC/25/AE/10
BP		NASS	2015	Iceland/Faroes	S	IO	36,773	0.17	25,811	52,392	1	0	1	NAMMCO SC/25/AE/06_rev
BP		NILS2015	2015	CM1a+CM3	S	IO					1	0	3	NAMMCO SC/25/AE/12
MN	Humpback whale	NILS02-07	2005	Norway	S	IO					1	0	3	NAMMCO SC/25/AE/10
MN		NASS	2015	Iceland/Faroes	S	IO	9,867	0.37	4,854	20,058	1	0	1	NAMMCO SC/25/AE/06_rev
MN		NILS2015	2015	CM1a+CM3	S	IO					1	0	3	NAMMCO SC/25/AE/12
PM	Sperm whale	NASS	2007	Iceland/Faroes	S	BT	12,220	0.38	5,807	25,717	1	0	1	NAMMCO SC/25/AE/05
PM		NASS	2015	Iceland/Faroes	S	IO	23,166	0.59	7,699	69,709	1	0	1	NAMMCO SC/25/AE/06_rev
GM	Pilot whale	NASS	2015	Iceland/Faroes	S	IO	344,148	0.35	162,795	727,527	1	0	1	NAMMCO SC/25/AE/06_rev
LAC	White sided dolphin	NASS	2007	Iceland/Faroes	S	BT					1	0	2	NAMMCO SC/25/AE/05
LAC		NASS	2015	Iceland/Faroes	S	IO	131,022	0.73	35,251	486,981	1	0	1	NAMMCO SC/25/AE/06_rev
LAL		NILS02-07	2005	Norway	S	IO					0	0	3	NAMMCO SC/25/AE/11
LAL	White beaked dolphin	NASS	2007	Iceland/Faroes	S	BT					1	0	2	NAMMCO SC/25/AE/05
LAL		NASS	2015	Iceland/Faroes	S	IO	159,000	0.63	49,957	506,054	1	0	1	NAMMCO SC/25/AE/06_rev
LAL		CIC2016	2016	Iceland coastal	A	IO					1	0	3	NAMMCO SC/25/AE/07
OO	Killer whale	NILS02-07	2005	Norway	S	IO					1	0	3	NAMMCO SC/25/AE/11
PP	Harbour porpoise	NILS02-07	2005	Norway	S	IO					1	0	3	NAMMCO SC/25/AE/11
PP		CIC2016	2016	Iceland coastal	A	IO					1	0	3	NAMMCO SC/25/AE/07

10.5 Plans for next NASS

Council 26 charged the SC to start the planning of the next survey and prepare a tentative budget to be submitted to the FAC and next Council meeting. It supported Russian participation as well as a western extension so that a new trans-Atlantic NASS could be achieved. Collaboration with other European and American surveys should also be favoured.

The IWC RMP now requires repetition of abundance surveys at an 8 year interval. The next NASS survey should therefore be in 2022-2023.

The 2018 AEWG provided several recommendations for the future survey:

Extent: The next survey should have a similar coverage to the 2015 survey, with a south-eastern expansion of the survey area for pilot whales to achieve coverage similar to what was achieved in 2007 in combination with CODA. The latter could best be achieved by coordination with a possible future European survey.

Timing: Given that the past interval between surveys has been 2-8 years, the next NASS survey should occur in 2021 at the earliest after an interval of six years. The WG recommends the on-going collaboration and coordination of surveys with other jurisdictions including continental Europe, the UK, Canada and the USA. Canada will likely not do another survey until 2026 (10 year cycle).

Planning for 2021 should begin 2.5 years in advance of the survey. The Council will need a proposal for the next meeting in March 2019.

Priorities for next survey: The primary purpose of the NASS is to obtain accurate and unbiased abundance estimates of cetaceans for use in management, and also for monitoring and general ecological studies.

The WG recommend the use of biopsy sampling, satellite tagging and improvements of group size estimation, especially for pilot whales that will help in interpreting abundance estimates in the framework of an assessment.

Discussion

The SC recognises that it would be important to evaluate and discuss the rationale behind this series of surveys, their frequency and whether another form should be adopted, possibly with specific surveys answering specific questions of importance also informing the management of whale stocks (e.g. survey dedicated to specific species as sei whale or to better estimate school size for example for pilot whales, using another survey form like drones). The present surveys are extremely costly and time consuming.

So far, the frequency of the surveys is driven by the requirements generated by the use of the RMP and AWMP in the IWC. It would be worth evaluating what are the minimum requirements that need to be complied to. Canada indicated that they would conduct a large cetacean survey in 2026 in the North West Atlantic.

The SC **agreed** that if such a series of surveys is to be continued, the best year would be 2023 and could wait until 2026 if efforts in the North West Atlantic should be joined.

The SC therefore **agreed** that it needed further input from Council on this issue and referred the discussion on focus, final timing, time-line and budget to its next meeting, as the best year for a survey was 2023 and therefore there was still time to initiate planning and preparation.

11 NAMMCO SCIENTIFIC PUBLICATIONS

11.1 Age estimation of MM with a focus on Monodontids [SC/25/FI/12]

Volume 10 of the *NAMMCO Scientific Publications* "Age estimation of marine mammals with a focus on monodontids" was completed in September 2018, after being four years in the making. The volume has Christina Lockyer, Aleta Hohn, Robert E.A. Stewart, Rod Hobbs and Mario Acquarone as editors. It encompasses, besides the Introduction chapter and two workshop reports dedicated to age estimation in monodontids, 12 peer reviewed articles related to different age estimation methods used in marine mammals from baleen whales, to monodontids, dolphins, manatees and seals.

The volume marks NAMMCO's complete transition to purely digital publishing, as it is the first volume of the *NAMMCO Scientific Publications* to only be available in digital format.

The SC **commended** the authors and editors for the completion of this volume.

11.2 NASS II [SC/25/23]

Volume 11 "North Atlantic Sightings Surveys – Counting whales in the North Atlantic 2002-2016" will be devoted to abundance estimates of cetaceans covering both the 2007 and 2015/6 surveys, as well as trends of abundance over longer periods. It has Daniel Pike, Rikke Guldborg Hansen and Geneviève Desportes as editors. Twenty papers have now been committed (as listed in doc SC/25/23), two of these have entered the final publication process.

The SC **commended** this step forward and **encouraged** all to contribute to the completion of the volume with as short a delay as possible.

The completion of that volume will mean that all feasible design-based abundance estimates that could be generated by the data collected through the TNASS 2007 and NASS 2015/16 surveys will have been both analysed and published. This will represent a considerable progress from the present situation, where analyses from 2007 data are still missing.

Discussion

There is a need for the editors of *NAMMCO Scientific Publications* to make an assessment of the digital plagiarism reports before these are returned to the authors requesting revisions. In certain aspects of the paper (such as the description of methods) similar words are necessarily used. The SC **recommended** that the editors review the plagiarism reports generated by the automatic scanning software and make judgements as to where revisions are indeed necessary before returning the reports to the authors.

The SC also **recommended** that the author guidelines explicitly state that NAMMCO does not object to papers being available in advance on a pre-print server.

In some cases, reviewers have requested that the analysis be done using different methods even though the choice of method has been made to meet particular management objectives (e.g. in Greenland the desire to use methods that match the requirements of the IWC). The SC **agreed** that this is an issue that the editor can assess and decide upon. Authors can also clearly state why they have made particular methodological choices in the manuscript and send rebuttals to the editor regarding any reviewer comments they disagree with.

12 FUTURE WORK PLANS

12.1 Scientific Committee 2019 Meeting

12.1.1 Timing and place

The 2019 SC meeting will be held in the Faroe Islands and the host will determine the exact location. The timing will be in early November and a specific date will be selected by the host as soon as possible.

12.1.2 Presentations

Someone from the fisheries laboratory in the Faroes Islands will be invited to give a presentation in connection with the 2019 meeting.

12.2 Working groups/Symposia/Other meetings [SC/25/24]

A proposed work plan for future years is given in the table below. This will be reviewed by Council.

2018 (COMPLETED)	2019	2020	2021
Working Groups: - Abundance Estimates - By-Catch (2 meetings) - Walrus **Workshops:** - Joint IMR/NAMMCO harbour porpoise workshop **Other:** - Review of North Atlantic killer whales - Analysis of all remaining TNASS and NASS data for species for which an abundance estimate is possible	**Working Groups:** - Harbour porpoise (spring) - Japan Cooperation (spring) - ICES/NAFO/NAMMCO on harp and hooded seals (autumn) - East Greenland Narwhal (autumn) - Abundance Estimate (autumn) **Other:** - Completing the analysis of all remaining TNASS and NASS data for species for which an abundance estimate is possible. - Review of pollutant levels in marine mammals in NAMMCO countries	**Working Groups:** - Bycatch - Coastal seal - Pilot whale [- Harbour porpoise?] - NAMMCO/JCNB on narwhal and beluga **Workshops:** - Workshop on impacts of climate change on management advice - North Atlantic humpback whale tagging workshop	**Working Groups:** - Bearded seal - Ringed seal

13 EXPENSES 2018 AND BUDGET 2019-20 [SC/25/25]

13.1 SC Expenses 2018 & Budget for 2019-20

The SC reviewed the present and predicted expenses in 2018. The SC noted that the 2018 expenses were well within the budget, notably because the By-Catch WG had not held a face to face meeting, meeting twice via teleconference instead.

The SC and **agreed** upon draft and forecast budgets for 2019 and 2020, which reflected the agreed workplan.

14 ANY OTHER BUSINESS

14.1 Election of officers

Bjarni Mikkelsen (FO) was elected as the new SC Chair, Fernando Ugarte (GL) was elected as the new vice chair. Both terms will begin at the closure of the Council Meeting in April 2019.

14.2 Presentation SC 25: Paul Wassmann "Whales are ecosystem engineers: fact or fake?"

The Chair informed the committee that Prof. Paul Wassmann will give a presentation on the topic of "Whales are ecosystem engineers: fact or fake". This will take place on Friday November 16th at 15:15 at the Fram centre in Tromsø. This presentation will be open for attendance from members of the public.

Presenter's summary:

In the literature we find claims that whales operate as ecosystem engineers in their environment, i.e. they maintain and control the ecosystem machinery and structure. The pumping of nutrients back to the surface water (stimulating primary production) and supplying the deep sea with food (carcasses) belong to the engineering activates attributed to whales. No doubt that whales contribute to those organisms that shape nutrient cycling, the carbon pump and carbon sequestration. Although the selection of the term engineering is

unfortunate (engineering is the creative application of science, mathematical methods, and empirical evidence to the innovation, design, construction, operation and maintenance of structures, machines, materials, devices, systems, processes for the benefit of human kind) the proposed role of whales is a fact. Placing the engineering activity of whales into a wholistic ecosystem perspective prevails that their role for nutrient cycling, the carbon pump and carbon sequestration is insignificant. That is in particular true for the North Atlantic and Pacific, but probably also for the Southern Ocean. The application of anthropocentric jargon in science which is eagerly picked up my media and environmentally concerned citizens does not support knowledge-based ecosystem and resource management. Most other marine organisms play a far greater role in ecosystem engineering than whales. The manner the engineering role of whales is published and presented leads rather to misunderstanding than insight. We are confronted with the needle in the hay stack and only marine ecosystem specialist do understand that it is the needle, not the hays stack that is presented.

15 MEETING CLOSURE

15.1 Acceptance of report

The preliminary report was approved, and following minor revisions by correspondence, the final report was accepted November 29th 2018.

15.2 Closing remarks

The Chair congratulated the new officers and thanked the whole SC for their efforts during the last three years of his chairmanship. The SC thanked the outgoing chair for his able and engaged chairing. The General Secretary also extended her thanks to the Chair and the Secretariat for all their hard work in steering the meeting towards a successful conclusion.

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NAMMCO SCIENTIFIC COMMITTEE

25th MEETING

Polarlys Bergen-Tromsø, Norway

13-16 November 2018

Agenda

Paper numbers in [ ].

1. CHAIRMAN'S WELCOME AND OPENING REMARKS
1.1. Presentation of the new Scientific Secretary
1.2. NAMMCO new staffing

2. ADOPTION OF AGENDA [SC/25/01ab]

3. APPOINTMENT OF RAPPORTEURS

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS [SC/25/03]
4.1. National Progress Reports [SC/25/NPR-FO, -GL, -IS, -NO, -CA, -JP, -RU, -MA, -NU]
4.1.1. Update from observer country – Canada
4.1.2. Update from Japan
4.1.3. Update from Russia
4.1.4. Update from observer country – Nunavut
4.1.5. Update from observer country – Makivik
4.2. Working Group Reports
By-catch WG [SC/25/13-30]
Abundance Estimate WG [SC/25/12]
Walrus WG [SC/25/14]
4.3. Other reports and documents
List of active Council requests [SC/25/04]
North Atlantic killer whales: a status review [SC/25/18]
Abundance and Trends tables [SC/25/05abc]
NAMMCO guidelines for authors [SC/25/19]
Global Review of Monodontids – final version [SC/25/FI/11]
Cetacean abundance and distribution in the NA workshop – final version [SC/25/FI/16**]**
Others

5. WORK PROCEDURES IN THE SC
5.1. Presentation SC 25: Paul Wassmann "Whales are ecosystem engineers: fact or fake?"
5.2. Swot analysis [SC/25/15]
5.3. Updates from Council: NAMMCO/26 [SC/25/FI/04, SC/25/04]
5.3.1. General Comments
5.3.2. New requests

R-1.6.6 (NEW, 2018): *The Council of NAMMCO request the Scientific Committee to 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.*

5.3.3. Endorsed SC work plan [SC/25/24]
5.3.4. Super-tag project
5.4. Population Estimates
5.4.1. Review of NAMMCO abundance tables [SC/25/05a,b]
5.4.1.1. Abundance Estimates
5.4.1.2. Trends and status of stocks
5.4.2. Guidelines for reporting abundance estimates and other results in WG and SC reports

5.5. Catches
5.5.1. Struck and Lost
5.5.2.Catch database
5.6. Furthering cooperation in the SC
5.6.1. Presentation by SC members
5.6.2. Super tag project
5.6.3.Genetics collaboration on harbour porpoise
5.6.4. AOB
5.7. Development of Management Advice
5.7.1. Review of development of management advice in NAMMCO [SC/25/06, SC/25/21]
5.7.2. Review and status of active requests

R-1.6.4 (ongoing): *Council requested the SC and the Committee on Hunting Methods to provide advice on the best methods for collection of the desired statistics on losses, as the SC has recommended that catch statistics include correction for struck but lost animals for different seasons, areas, and catch operations.*
R-1.6.5 (Standing): *Struck and loss rates should be subtracted from future advice on sustainable removals in Greenland, with the advice being given as total allowable landings.*
R-1.6.6 (NEW, 2018): *The Council of NAMMCO request the Scientific Committee to 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.*

5.8. NAMMCO Scientific Publications
5.8.1.Guidelines for authors [SC/25/19]
5.8.2.Publication process
5.9. Classification and criteria for assessing conservation status in NAMMCO (e.g. website) [SC/25/17]
5.10. Confidentiality of documents for SC and WGs

6. COOPERATION WITH OTHER ORGANISATIONS
6.1. IWC [SC/25/07]
6.2. ASCOBANS
6.3. ICES [SC/25/09]
6.3.1 Update from Tore
6.3.2 RoPs for the ICES/NAFO/NAMMCO joint WGHARP [SC/25/26]
6.4. JCNB
6.5. Arctic Council and subsidiary bodies
6.6. Other

7. ENVIRONMENTAL / ECOSYSTEM ISSUES
7.1. Marine mammals-fisheries interactions (R-1.1.5)
7.1.1. Consumption of resources by marine mammals
7.1.2. By-catch [SC/25/13,30]
7.1.2.1. Update
7.1.2.2. NAMMCO By-Catch WGs 2018
7.1.2.3. Others
7.1.3. Review and status of active requests

R-1.1.5 (standing): *The Council encourages scientific work that leads to a better understanding of interactions between marine mammals and commercially exploited marine resources and requested the Scientific Committee to periodically review and update available knowledge in this field.*

7.2. Multispecies approaches to management/Ecosystem Modelling (R-1.1.8, 1.2.1, 1.2.2, 1.4.7)
7.2.1. MAREFRAME
7.2.2. Other updates
7.2.3. Review and status of active requests

R-1.1.8 (ongoing): *In addressing the standing requests on ecosystem modelling and marine mammal fisheries interaction, the SC is requested 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.
R-1.2.1 (ongoing): *consider whether multispecies models for management purposes can be established for the North Atlantic ecosystems and whether such models could include the marine mammal 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.*
R-1.2.2 (standing): *In relation to the importance of the further development of multispecies approaches to the management of marine resources, the Scientific Committee was requested to monitor stock levels and trends in stocks of all marine mammals in the North Atlantic.*
R-1.4.7 (ongoing): *The Scientific Committee is requested to review the results of the MAREFRAME ecosystem management project when these become available. In particular, the results should be reviewed with respect to the ongoing and standing requests on marine mammal interactions (R-1.1.0) and multispecies approaches to management (R-1.2.0).*

7.2.4. Future work

7.3. <u>Other environmental issues</u> (R-1.5.1, 1.5.3, R-1.5.4)

7.3.1. Updates

7.3.2. Review and status of active requests

R-1.5.1 (pending): *To describe the possible pathways of radioactive material from blowouts and leakage in existing nuclear power plants, leakage from dumped material and possible accidents in planned recycling plants in the northern part of Scotland into the food web of the North Atlantic and hence into the top predators like marine mammals. This request was sent to ICES by NAC.*

R-1.5.3 (ongoing): *The Council* ***requests the SC 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.***

R-1.5.4 (2017, ongoing): *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.*

7.3.3.Future work

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

8.1. <u>Harp Seal</u>

8.1.1. Update [SC/25/13,30**]**

8.1.2. ICES/NAFO/NAMMCO WGHARP 2019

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

R-2.1.4 (standing): *update the stock status of North Atlantic harp and hooded seals as new information becomes available.*
R-2.1.10 (standing): *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*

8.1.4. Future Work

8.2. <u>Hooded seal</u>

8.2.1. Update

8.2.2. ICES/NAFO/NAMMCO WGHARP 2019

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

R-2.1.4 (standing): *update the stock status of North Atlantic harp and hooded seals as new information becomes available.*
R-2.1.9 (ongoing): *investigate possible reasons for the apparent decline of Greenland Sea stock of hooded seals; and assess the status of the stock*

8.2.4. Future work

8.3. <u>Ringed seal</u>

8.3.1. Update [SC/25/13, 30**]**

8.3.1.1. Update on the Ringed seal ecotypes project

8.3.1.2. Others
8.3.2. Ringed Seal WG (2020/2021)
8.3.3. Review and status of active requests (R-2.3.1, 2.3.2)

R-2.3.1 (standing): *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.*

R-2.3.2 (standing): *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.*

8.3.4. Future work

8.4. <u>Grey seal</u>
8.4.1. Update [SC/25/13, 30**]**
8.4.2. Coastal Seals WG (2019)
8.4.3. Review and status of active requests (R-2.4.2)

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

8.4.4. Future work

8.5. <u>Harbour seal</u>
8.5.1. Update [SC/25/13, 30**]**
8.5.2. Coastal Seals WG (2019)
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*

8.5.4. Future work

8.6. <u>Bearded seal</u>
8.6.1. Update [SC/25/13, 30**]**
8.6.2. Bearded Seal WG (2020/2021)
8.6.3. Review and status of active requests (none**)**
8.6.4. Future work

8.7. <u>Walrus</u>
8.7.1. Updates
8.7.2. Walrus Working Group October 2018 [SC/25/14**]**
8.7.3. Review and status of active requests (R-2.6.3, R-2.6.7, R-1.6.4, R-1.6.5)

R-2.6.3 (ongoing): *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.*

R-2.6.7 (2017, pending): *To provide assessments of, and advice on sustainable removals from, all stocks of walrus in Greenland covering the period from 2019 to 2023, with the advice for Qaanaaq starting in 2021.*

R-1.6.4 (ongoing): *The SC has recommended that catch statistics include correction for struck but lost animals for different seasons, areas, and catch operations. Council requested the SC and the Committee on Hunting Methods to provide advice on the best methods for collection of the desired statistics on losses.*

R-1.6.5 (2017, standing): *Struck and loss rates should be subtracted from future advice on sustainable removals in Greenland, with the advice being given as total allowable landings.*

8.7.4. Future Work

9. CETACEANS STOCKS - STATUS AND ADVICE TO THE COUNCIL
9.0 <u>AEWG 2018</u>

9.1. Fin whale

9.1.1. AEWG 2018 [SC/25/12**]**

9.1.2. Update

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

R-1.7.11 (ongoing): *Develop estimates of abundance and trends as soon as possible*

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*

9.1.4. Future work

9.2. Humpback whale

9.2.1. AEWG 2018

9.2.2. Update

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

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*

R-3.2.4-amended (ongoing): *conduct a formal assessment following the completion of the T-NASS…In addition the Scientific Committee is requested to investigate the relationship between the humpback whales summering in West Greenland and other areas and incorporate this knowledge into their estimate of sustainable yields of West Greenland humpback whales.* ***Amendment (NAMMCO/25):*** *adds the following text: "The SC is further asked to provide advice on future catch levels of humpback whales in West Greenland at different probability levels for a non-declining population evaluated over a 5 year period, similar to the procedure for the advice generated for beluga, narwhal and walrus. The advice should include the latest abundance estimate."*

9.2.4. Future work

9.3. Common minke whale

9.3.1. AEWG 2018 [SC/25/12**]**

9.3.2. Update

9.3.3. Review and status of active requests (R-3.3.4, 1.7.11, 1.7.12)

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*

9.3.4. Future work

9.4. Beluga

9.4.1.Global Review of Monodontids [SC/25/FI/12**]**

9.4.2. Update

9.4.3. NAMMCO-JCNB JWG & Workshop March 2019

9.4.4. Review and status of active requests (R-3.4.9, 3.4.11, R-3.4.14)

R-3.4.9 (ongoing): *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; narwhal added at NAMMCO 23*

R-3.4.11 (standing): *To update the assessment of both narwhal and beluga*

R-3.4.14 (ongoing): *To examine the data existing on beluga in East Greenland (sightings, strandings, by-catch and catch) and examine how this material can be used in an assessment process and advice on how this data can be improved.*

9.4.5. Future work

9.5. Narwhal

9.5.1. Global Review of Monodontids [SC/25/FI/11-12**]**

9.5.2. Update

9.5.3. NAMMCO-JCNB JWG & Workshop March 2019

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

R-3.4.9 (ongoing): *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; narwhal added at NAMMCO 23*

R-3.4.11 (standing): *update the assessment of both narwhal and beluga*

9.5.5.Future work

9.6 Sei whale

9.6.1 AEWG 2018 [SC/25/12**]**
9.6.2 Update
9.6.3 Review and status of active requests (R-3.5.3 amended, 1.7.12)

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*
R-3.5.3 amended (ongoing): *assess the status of sei whales in West Greenland waters and the Central North Atlantic and provide minimum estimates of sustainable yield*

9.6.4 Future work

9.7 Bottlenose whale

9.7.1 AEWG 2018 [SC/25/12**]**
9.7.2 Update
9.7.3 Review and status of active requests (none)
9.7.4 Future work

9.8 Killer whale

9.8.1 Status Review by Jourdain et al [SC/25/18**]**
9.8.2 AEWG 2018 [SC/25/12**]**
9.8.3 Update
9.8.4 Review and status of active requests (R-3.7.2)

R-3.7.2 (ongoing): *review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, and to provide advice on research needs to improve this knowledge. Priority should be given to killer whales in the West Greenland – Eastern Canada area.*

9.8.5 Future work

9.9 Pilot whale

9.9.1 AEWG 2018 [SC/25/12**]**
9.9.2 Trends [SC/25/22**]**
9.9.3 Update
9.9.4 Pilot Whale WG (2020)
9.9.5 Review and status of active requests (R-1.7.11, 3.8.6)

R-1.7.11 (ongoing): *To develop estimates of abundance and trends as soon as possible*
R-3.8.6 (ongoing): *To complete a full assessment of pilot whales in the North Atlantic and provide advice on the sustainability of catches...with particular emphasis on the Faroese area and East and West Greenland. [Part answered: In the short term...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]*

9.9.6 Future work

9.10 Dolphins

9.10.1 AEWG 2018 [SC/25/12**]**
9.5.6. Update [SC/25/13, 30**]**
9.10.2 Review and status of active requests (R-3.9.6)

R-3.9.6 (ongoing): *assessments of dolphin species*

9.10.3 Future work

9.11 Harbour porpoise

9.11.1 AEWG 2018 [SC/25/12**]**
9.11.2 Update [SC/25/13, 30**]**
9.11.3 HP Workshop December 2018
9.11.4 HPWG 2019
9.11.5 Review and status of active requests (R-3.10.1)

R-3.10.1 (ongoing): *To perform a comprehensive assessment of the species throughout its range, which might include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals.*

9.11.6 Future work

9.12 Sperm whale

9.12.1 AEWG 2018 [SC/25/12**]**

9.12.2 Update
9.12.3 Review and status of active requests (none)
9.12.4 Future work

9.13 Bowhead whale
9.13.1 Update
9.13.2 Review and status of active requests (none)
9.13.3 Future work

9.14 Blue Whales
9.14.1 AEWG 2018 [SC/25/12**]**
9.14.2 Update

9.14.3 Review and status of active requests (R-1.7.11)
R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from TNASS2015 for all large baleen whales in West Greenland waters*
9.14.4 Future work

10. SURVEYS
10.1 Update "Cetacean abundance and distribution in the North Atlantic" workshop [SC/25/FI/16**]**
10.2 NAMMCO/IWC cooperation reg. AE WGs
10.3 Abundance Estimates WG 2018 [SC/25/12**]**
10.3.1 Status of analyses
10.3.2 Joint analyses [SC/25/11, 29**]**
10.4 Review and status of active requests and recommendations (R-1.7.11)
R-1.7.11 (ongoing): *To develop estimates of abundance and trends as soon as possible*
10.5 Plans for next NASS
10.5.1 Focus
10.5.2 Timing and time-line
10.5.3 Tentative budget

11. NAMMCO SCIENTIFIC PUBLICATIONS
11.1. Age estimation of MM with a focus on Monodontids [SC/25/FI/13]
11.2. NASS II [SC/25/23**]**

12. FUTURE WORK PLANS
12.1. Scientific Committee 2019 Meeting
12.1.1. Timing and place
12.1.2. Presentations
12.2. Working groups/Symposia/Other meetings [SC/25/24**]**
12.2.1. 2019
12.2.2. 2020
12.2.3. Long-term planning

13. EXPENSES 2018 and BUDGET 2019-20 [SC/25/25**]**
13.1. SC Expenses 2018
13.2. SC Budget 2019-20

14. ANY OTHER BUSINESS
14.1. Election of Officers

15. MEETING CLOSURE
15.1. Acceptance of report
15.2. Closing remarks

NAMMCO SCIENTIFIC COMMITTEE
25th MEETING

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NAMMCO SCIENTIFIC COMMITTEE

25TH MEETING

LIST OF DOCUMENTS

Doc.No.	Title	Agenda item
SC/25/01a	Draft Agenda	2
SC/25/01b	Draft ANNOTATED Agenda	2
SC/25/02	Draft List of Participants	1
SC/25/03	Draft List of Documents	4
SC/25/NPR-FO	National Progress Report 2017 – Faroe Islands	4, many
SC/25/NPR-GL	National Progress Report 2017 – Greenland	4, many
SC/25/NPR-IS	National Progress Report 2017 – Iceland	4, many
SC/25/NPR-NO	National Progress Report 2017 – Norway	4, many
SC/25/NPR-CA	National Progress Report 2017 – Canada	4, many
SC/25/NPR-JP	National Progress Report 2016/17 – Japan (Small Cetaceans)	4, many
SC/25/NPR-JPb	National Progress Report 2017/18 – Japan (Large Cetaceans)	4, many
SC/25/NPR-RU	National Progress Report 2017 – Russian Federation	4, many
SC/25/NPR-MA	National Progress Report 2017 - Makivik	4, many
SC/25/NPR-NU	National Progress Report 2017 – Nunavut Tunngavik Inc.	4, many
SC/25/04	Active Requests to SC from Council	many
SC/25/05a	Table Abundance & trends- cetaceans	5.4.1, 5.4.2
SC/25/05b	Table Abundance & trends- pinnipeds	5.4.1, 5.4.2
SC/25/05c	Table Abundance & trends- All Species	5.4.1, 5.4.2
SC/25/06	Development of management advice in NAMMCO	5.7
SC/25/07	Observer's report: 66th meeting of the IWC SC (Víkingsson)	6.1
SC/25/08	Satellite tracking – A tool for Cetacean Research in the north Atlantic: updated project description	5.5.2
SC/25/09	Observer's report on activities in ICES (Haug)	6.3
SC/25/10		
SC/25/11	Letter to the NAMMCO SC from the Marine Geospatial Ecology Lab, Duke University, requesting cooperation	10.3.2
SC/25/12	Report of the Abundance Estimate WG meeting, May 2018 (Incl. email review and decision, October 2018)	4.2, 9.0-14, 10.2, 10.3
SC/25/13	Report of the By-Catch WG meeting, April 2018	4.2, 7.1.2, 6.6
SC/25/14	Report of the Walrus WG meeting, October 2018	8.7.2
SC/25/15	SWOT-SC analysis	5.2

SC/25/16	Update on the preparation of the Joint IMR/NAMMCO Workshop on harbour porpoises.	9.11.3
SC/25/17	Conservation status tables from the NAMMCO website	5.9
SC/25/18	Jourdain, Ugarte, Vikíngsson et al. Manuscript. North Atlantic killer whales (*Orcinus orca*): a status review.	4.3, 9.8.1
SC/25/19	NAMMCO Guidelines for Authors	5.8.1
SC/25/20	Witting, L. Reconsidering a global collapse of killer whale populations.	9.8
SC/25/21	Reviews and assessments of pinniped and cetacean stocks by NAMMCO	5.7
SC/25/22	Pike, Gunnlaugsson, Desportes et al. Pilot whale trend paper	9.9.2
SC/25/23	NASS volume II – list and status of publications	11.2
SC/25/24	SC Workplan as adopted by Council 26	5.3.3, 12.2
SC/25/25	NAMMCO Scientific Committee Expenses 2017 and Budget 2018	13
SC/25/26	Draft RoP for the joint ICES/NAFO/NAMMCO WGHARP	6.3.2, 8.1.2, 8.2.2
SC/25/27	Review of the MareFrame Project	7.2.1
SC/25/28	Hobbs et al. Submitted. Global Review of the Conservation Status of Monodontid Stocks. Submitted to MFR	9.4.1, 9.5.1
SC/25/29	Ramirez-Martinez & Hammond. Update on the project: "Oceanogaphic features driving decadal-scale changes in cetacean distribution and abundance in the North Atlantic"	9
SC/25/30	Report of the By-Catch WG meeting, October 2018	7.1.2
SC/25/31	NAMMCO catch database	5.5

FOR INFORMATION DOCUMENTS

Doc.No.	**Title**	**Agenda item**
SC/25/FI/01	Report of SC 23	many
SC/25/FI/02	Report of SC 24	many
SC/25/FI/03	Annual Report 2016	many
SC/25/FI/04	NAMMCO 26, Report of Council and Management Committees	many
SC/25/FI/05	Report of ICES WGBYC 2018	6.3
SC/25/FI/06	Report of ICES WGMME 2018	6.3
SC/25/FI/07	Higdon and Stewart. 2018. State of circumpolar walrus (*Odobenus rosmarus*) populations. Prepared by Higdon Wildlife Consulting and Arctic Biological Consultants, Winnipeg, MB for WWF Arctic Programme, Ottawa, ON. 100 pp.	8.7.2

SC/25/FI/08	Rogan, E. et al. 2017. Distribution, abundance and habitat use of deep diving cetaceans in the North-East Atlantic. *Deep–Sea Research Part II (2017)*	9.7.2
SC/25/FI/09	FAO. 2018. *Report of the Expert Workshop on Means and Methods for Reducing Marine Mammal Mortality in Fishing and Aquaculture Operations, Rome, 20-23 March 2018.* FAO Fisheries and Aquaculture Report No.1231. Rome, Italy.116pp.	7.1.2.3
SC/25/FI/10	Murphy, S. et al. 2018. Organochlorine Contaminants and Reproductive Implication in Cetaceans: A Case Study of the Common Dolphin. Pp. 3-38. In Fossi and Panti (eds). 2018. Marine Mammal Ecotoxicology. 1st Edition. *Impacts of Multiple Stressors on Population Health* - Section I. Legacy and Emerging Contaminants. Pp.512.	7.3.1
SC/25/FI/11	NAMMCO. 2018. Report of the NAMMCO Global Review of Monodontids. 13-16 March 2017, Hillerød, Denmark – Final version	9.4.1, 9.5.1
SC/25/FI/12	NAMMCO. 2018. *Age estimation of marine mammals with a focus on monodontids*. NAMMCO Scientific Publications 10. Available at https://nammco.no/topics/volume-10-age-estimation/	9.4, 9.5, 11.1
SC/25/FI/13	Booth, L. et al. 2017. *Using the Interim PCoD framework to assess the potential impacts of offshore wind developments in Eastern English Waters on harbour porpoises in the North Sea.* Natural England Joint Report, Number 024.York	9.11.2
SC/25/FI/14	Biuw, M. et al. 2018. Report from surveys to assess harp and hooded seal pup production in the Greenland Sea pack-ice in 2018. Toktrapport / Havforskningsinstituttet / ISSN 15036294/ Nr. 7–2018	8.1.1, 8.2.1
SC/25/FI/15	Hammond, P. et al. 2017. Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys.	10
SC/25/FI/16	Report of the "Cetacean abundance and distribution in the North Atlantic" workshop	10.1
SC/25/FI/17	AMAP. 2018. AMAP Assessment 2018: Biological Effects of Contaminants on Arctic Wildlife and Fish. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. vii+84pp	6.5
SC/25/FI/18	Everett, A. et al. 2018. Subglacial discharge plume behaviour revealed by CTD-instrumented ringed seals. *Scientific reports*, *8*(1), p.13467.	8.3.1.2
SC/25/FI/19	Scotter, S.E. et al. 2018. Contaminants in Atlantic walruses in Svalbard part 1: Relationships between exposure, diet and pathogen prevalence. *Environmental Pollution*.	7.3, 8.7.1
SC/25/FI/20	Storrie, L. et al. 2018. Determining the species assemblage and habitat use of cetaceans in the Svalbard Archipelago, based on observations from 2002 to 2014. *Polar Research*, *37*(1), p.1463065.	9
SC/25/FI/21	Stafford, K.M. et al. 2018. Extreme diversity in the songs of Spitsbergen's bowhead whales. *Biology letters*, *14*(4), p.20180056.	9.13.1

SC/25/FI/22	Øren, K. et al. 2018. Assessing site-use and sources of disturbance at walrus haul-outs using monitoring cameras. *Polar Biology*, pp.1-14.	8.7.1
SC/25/FI/23	Cameron, M.F. et al. 2010. *Status Review of the Bearded Seal (Erignathus barbatus)*.	8.6.1
SC/25/FI/24	Kelly, B.P. et al. 2010. *Status Review of the Ringed Seal (Phoca hispida)*.	8.3.1
SC/25/FI/25	Update on Research Activities, Nunavik Research Centre, Makivik BOD, October 2018	4.1.2
SC/25/FI/26	Vacqui-Garcia, J. et al. 2018. Habitats and movement patterns of white whales Delphinapterus leucas in Svalbard, Norway in a changing climate. Movement Ecology 6:21. https://doi.org/10.1186/s40462-018-0139-z	9.4.2
SC/25/FI/27	Silva, R. 2014. Sei Whale (*Balaenoptera borealis*) Ecology and Management in the North Atlantic. (Thesis).	9.6.2
SC/25/FI/28	Huijser, L.A.E. *et al.,* 2018. Population Structure of North Atlantic and North Pacific Sei Whales (*Balaenoptera borealis*) Inferred from Mitochondrial Control Region DNA Sequences and Microsatellite Genotypes. *Conservation Genetics*.	9.6.2
SC/25/FI/29	Desforges, J.P. et al. 2018. Predicting global killer whale population collapse from PCB pollution. *Science* 361, *pp1373-1376.*	9.8.3
SC/25/FI/30	Bourque, J. et al. 2018. Feeding habits of a new Arctic predator: insight from full-depth blubber fatty acid signatures of Greenland, Faroe Islands, Denmark and managed-care killer whales *Orcinus orca*. *Marine Ecology Progress Series* **603** pp1-12.	9.8.3
SC/25/FI/31	Granquist, S. M. et al. 2018. Fish consumption of harbour seals (Phoca vitulina) in north western Iceland assessed by DNA metabarcoding and morphological analysis. *Polar Biology*, 41(11), 2199–2210. https://doi.org/10.1007/s00300-018-2354-	7.1.1
SC/25/FI/32	Pedro, S., et al. 2017. Blubber-depth distribution and bioaccumulation of PCBs and organochlorine pesticides in Arctic-invading killer whales. *Science of The Total Environment*, 601–602, 237–246. https://doi.org/10.1016/j.scitotenv.2017.05.193	

Satellite Tracking – A Tool for Cetacean Research in the North Atlantic

(The 'Super Tag' Project)

Project proposal from the NAMMCO SC
Project Manager: Mads-Peter Heide-Jørgensen

Proposed as a collaborative project together with Japan

Tracking of marine mammals by satellites has long been recognized as one of the most important and promising techniques available for studies of movement, migration, behaviour, diving, stock identity and habitat use of cetaceans. In the past two decades there has been an enormous growth in the use of satellite telemetry on whales, but most of the advances in the research community have been accomplished by studies of small cetaceans that can be captured and restrained while they are being instrumented. These techniques are, however, not well developed for use on large baleen whales, which are too big to be captured and handled at sea. A number of studies of bowhead and humpback whales have demonstrated the enormous potential satellite tracking studies have for gaining insights into whale biology. However, the costs and failure rates of these tracking experiments have been unacceptably high. It is clear that before satellite telemetry can be used as a routine method for monitoring movements of baleen whales it is fundamental to develop new, smaller and more reliable tracking instruments as well as better methods for deploying the tags.

There are many questions that can only be addressed through satellite tracking. These include, for example: Where do North Atlantic baleen whales spend the winter? Are there separate stocks of baleen whales that need to be managed separately? What is the habitat use of the whales and how do they react to oceanographic changes? Satellite tracking of baleen whales can also be used to identify changes in the fish resources (e.g. capelin schools) and provide data on surface time that is crucial for converting survey estimates into total abundance estimates.

Different satellite tracking systems are currently used in the four NAMMCO member countries for studying the movement of several species of baleen whales, including minke, fin and blue whales at Svalbard and Norway, minke and humpback whales in Iceland, minke, fin, humpback and bowhead whales in Greenland and fin whales in the Faroe Islands. A high level of investment in terms of both effort and funding has been spent on scattered attempts to acquire data on the whales. However, what is really needed to make significant progress is a joint effort to refine the methods in a way that will eventually benefit the cetacean research in all four countries. Reliable and well-performing satellite transmitter systems are currently available for birds, seals, terrestrial mammals and small cetaceans. There is therefore an opportunity to refine these systems to address the need to develop effective satellite tracking systems for baleen whales, and especially for more cryptic species like minke and fin whales.

In all four NAMMCO member countries, it would be extremely valuable to have a reliable, cheap and well-tested satellite tracking system in the toolbox for cetacean studies. It would also be particularly valuable to develop a NAMMCO program in which the scientists in all four countries collaborate in their use of satellite tracking methods to solve major management issues that cannot be addressed with other techniques. It cannot be expected that research groups outside NAMMCO will focus on developing the new satellite tracking techniques and technologies necessary to advance the research being used to inform ongoing NAMMCO assessment process. One example of where an effective satellite tracking system for large baleen whales would be of particular importance to all NAMMCO member countries, is to better understand the seasonal movements and long-term distributional changes of minke and fin whales.

This proposal therefore describes how a joint NAMMCO satellite-tracking program could be developed and what would be required to reach a point where the technique can be used as an efficient and reliable field technique.

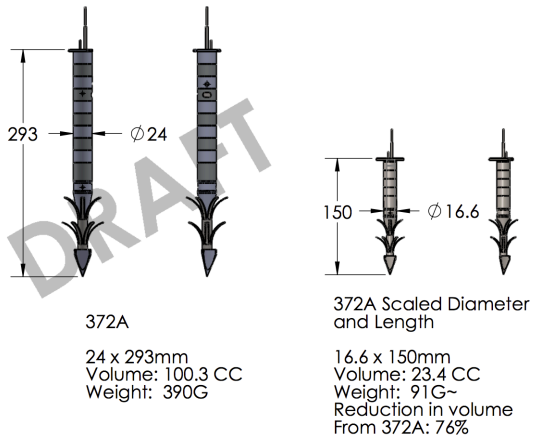
Development of a satellite transmitter for remote instrumentation of cetaceans

A major obstacle with tagging large whales is that the instruments need to be deployed at a distance from the whales with the use of an airgun, crossbow or pole system. Currently there are two types of pneumatic guns that can be used for launching satellite transmitters: the ARTS (Air Rocket Transmitter System; Restech, Norway) and the DanInject rifles (Vejle, Denmark). Crossbows are not sufficiently powerful for launching the tags available today and pole systems can only be used for slow moving whales like humpback and bowhead whales.

The main issue with the tag launching system is that the shape and mass of the satellite transmitters works against an optimal ballistic performance. The result is that many deployments are at best of short duration and at worst result in failed instrumentations of the whales.

The way to improve the success rate and duration of the tags is to develop smaller tags with better ballistic performance. This is only technically and commercially feasible if the quantity of tags to be manufactured is sufficiently large. That is why joint effort and collaboration between all the NAMMCO countries is needed. Programs and efforts in whale tagging within the individual NAMMCO countries are too small to generate sufficient commercial incentive for developing an optimal transmitter configuration for large cetaceans.

For long-term tracking of baleen whales in the North Atlantic, a smaller tag with better ballistic performance that can be deployed remotely at distances up to 25 m is required. The tag also needs to have a smaller volume and generate a smaller footprint in the whale to improve the retention time. Ideally the tag would need to remain fixed in the whale for at least a 12 month period so that information on the full migration cycle can be obtained. The development of a new implantable transmitter design with a prototype that will meet these requirements will require an initial investment in engineering costs in the order of $US 180.000. This will cover the costs associated with developing a tag that is 16.6mm in diameter (instead of 22 mm for the present tags) with a reduction in weight and volume from 30% to 50% compared to existing designs. The diameter of the tag is determined by the availability of smallest cylindrical lithium battery that is commercially available (the AAA cell). The tag will be produced with a new manufacturing process called Direct Metal Laser Sintering (DMLS) that should make the tag more robust to the impact of hitting the whale as well less likely to be broken by the whales during social interactions. A new tag developed according to these requirements would not be available until 2020 as several tests to ensure performance would be needed before it could become commercially available.



This image shows a proposed design for a new tag (right side of figure) compared with one of the existing tag models widely used in the US (left side of figure).

The new smaller tag will have a weight of 91 g and an outside diameter of 16.6 mm. It will include one AAA cell but a longer version with 2 batteries could be also be developed.

The tag will be manufactured by Wildlife Computers, Redmond, WA, USA.

Program for studies of movements and changes in occurrence of baleen whales in the North Atlantic

Minke whales are the most abundant of the large cetaceans in the North Atlantic and are hunted by three countries in the North Atlantic. However, we currently know very little about their wintering grounds, migratory routes and changes in distribution in relation to biotic and climatic factors. Other species of large whales, that are easier to study, have been subject to various tracking studies in the North Atlantic (e.g. humpback and blue

whales), while only sporadic and opportunistic attempts to track minke whales have been conducted. This is despite their significant ecological and economic importance for NAMMCO countries.

Here we propose a joint and coordinated effort to study the detailed movements of baleen whales in all four NAMMCO countries. Based on the development of a smaller and more efficient satellite transmitter design (as described above), we propose to purchase a large number of tags that can be allocated to the four NAMMCO countries and used for a coordinated research effort. A test procedure will be developed that will involve interested scientists from the member countries and a deployment scheme that will allow for comparison of instrumentation will be part of the field programs.

It is proposed that the field effort to deploy tags will be conducted by the national institutes, which will also cover the costs associated with tagging the whales and the Argos CLS (Toulouse, France) satellite fees. The launching gear, including applicators, will also be provided by each national research institute.

Costs

- Initial engineering costs for developing a transmitter based on AAA cells with a diameter similar to these batteries. This includes 5 prototype transmitters for test purposes, as well as 10 dummy tags for ballistic testing.
  The price offer for this work from Wildlife Computers = $US 180.000

- After the development of the prototype, the price per tag would be $US 2800 and it is suggested that NAMMCO purchase 200 tags over a 3 year period for use in all four countries.

It is noted that this differs from what was proposed in the original presentation of the project in 2017, which was 50 tags for approximately $1800 each. This is because the SC believes having all NAMMCO countries collaborate in the project will deliver the most beneficial results and this requires the purchase of additional tags. The cost of each tag is also higher than that suggested in 2017 because the SC now has a formal price quote, which was not available in 2017, and has chosen to have the tags cast in one piece using direct metal laser sintering. Using this process increases the price for each tag, however it makes the tags significantly stronger and more durable and therefore better suited to meet the aims of the project. Short tag duration has been a major problem in the past for baleen whales, with tags often breaking as the animals interact.

- As part of the development of this project the NAMMCO SC will provide a common web-based database for exchanging results from the tracking studies of all species. The database will primarily be used for exchanging the results from this project among SC members, but it could also be expanded to include tracking data from other species and researchers outside of the NAMMCO SC. The database would also serve as a long-term depository of the tracking data. This will ensure that the obtained data will be available for future studies of marine mammal movements in the North Atlantic. It is also increasingly becoming a requirement that data from published studies are deposited at sites accessible for future generations.
  The initial costs for establishing and running the database is estimated at 100.000 NOK.

The SC hopes that Council and FAC recognise the value of this project for developing scientific knowledge on species of economic and ecological importance for NAMMCO countries and the importance of this for providing sound management advice. The project is therefore requesting funding from NAMMCO to cover all of the costs outlined in above.

Alternative approaches that may be considered if full funding is not available include seeking support to cover the initial engineering costs from an external source or seeking increased investment from other interested collaborators. The potential for success from pursuing these alternatives remains unknown.

Support for the collaboration from Japan

In 2018, Japan expressed its interest in improving the use of satellite tracking technologies, particularly for Minke whales, and therefore in working collaboratively with NAMMCO on this project. They stated that in 2018, they had $US 17,000 available to invest in the initial development costs. They also indicated that they would be interested in purchasing tags in future years should a successful prototype be developed. Although the number of tags they would be interested in purchasing was still under discussion, there is the potential that any additional tag purchases may reduce the costs per unit for all participating partners.

Break down of costs per year	Price per unit $US Dollars	$US Dollars	NOK
2020			
Part 1 of contract on development costs		100.000	850.000
Sum			850.000
2021			
Part 2 of contract on development costs		$80.000	700.000
Purchase of 80 tags for deployment in the North Atlantic	$2800	$224.000	1.900.000
Sum			2.600.000
2022			
Purchase of 80 tags for deployment in the North Atlantic	$2800	$224.000	1.900.000
Costs for establishing and running the database			100.000
SUM			2.000.000
2023			
Purchase of 40 tags for deployment in the North Atlantic	$2800	$112.000	950.000
SUM			950.000
TOTAL			6.400 000

Observers Report for the 2018 Annual Meeting of the Scientific Committee of the IWC (67b).

Gísli A. Víkingsson

Marine and Freshwater Research Institute, Reykjavik, Iceland

The meeting (SC/67b) was held in, Bled, Slovenia, from 24 April-06 May 2018. The following summarizes some of the main outcomes of the meeting of relevance to NAMMCO.

Revised Management Procedure (RMP).

The SC continued it's discussion on ways in which the results from RMP Implementations could be used for evaluation of Status of Stocks. Two RMP implementation reviews are ongoing. That for Western North Pacific Brydes whales is expected to be finalized in 2018 and implementation review for Western North Pacific common minke whales was initiated in 2018.

Aboriginal subsistence whaling

With upcoming renewal of quotas in 2018, issues related to aboriginal subsistence whaling,were prominent at SC67b. The primary issues comprised: (1) finalising the development of SLAs (Strike Limit Algorithms) for Greenlandic hunts, with a focus on fin and common minke whales; (2) finalising the work on the scientific components of the AWS (Aboriginal Subsistence Whaling Management Scheme); (3) completion of the Implementation Review for Bering-Chukchi-Beaufort Seas stock of bowhead whales; and (4) providing management advice for aboriginal hunts.

Extensive intersessional work had been conducted on fin and common minke whales in Greenlandic waters that enabled the finalization of SLA's and providing management advise for both species in 2018. The Committee agreed that special attention should be given to stock structure issues for both species at the next implementation review. Following a request from USA and Greenland, the SC agreed that a carryover provision for up to 3-blocks meets the Commission´s conservation objectives for West Greenland humpback whales and BCB Bowhead whales. Corresponding request for other Greenland SLA´s will be considered at the 2019 meeting.

For common minke whales of East Greenland the SC agreed that the request from Greenland for an annual quota of 20 animals (increase from the previous 12) and extension of the hunting season to 12 months will not harm the stock and meets the Commissions conservation objectives. Although SLA´s have not been developed for this hunt, the SC noted this catch is a small proportion of the number of animals in the Central and Western stocks. For West Greenland common minke, fin, bowhead and humpback whales whales the SC advised that unchanged level of catch for the next block will not harm the stocks. These are annual catches of 164 common minke whales, 19 fin whales, 2 bowhead whales and 10 humpback whales.

In addition, the SC provided whaling advice to the USA (67 bowhead whales/year), The Russian Federation (140 gray whales/year) and St Vincent and the Grenadines (4 humpback whales/year). It also accepted a management plan for Eastern North Pacific gray whales submitted by the USA (Makah whaling).

Whale stocks not subject to direct catches

The SC has adopted a procedure for assessments of species/populations that are not presently subject to directed takes. Potential new assessments include two North Atlantic stocks, North Atlantic right whales and sei whales. The Committee reiterated its serious concern over the status of the western North Atlantic stock of right whales as it is probably the only viable population of this species, for which entanglements and ship strikes have long been identified as key threats. The SC made strong recommendations to US and Canadian Authorities in this respect.

An intersessional correspondence group will compile information on North Atlantic sei whales for discussion at the next annual meeting with the aim of finalising stock structure hypotheses in 2020. Other North Atlantic stocks discussed under this item include humpback, Bryde´s and blue whales. Regarding

blue whales, the SC made a special recommendation to US, Canadian and Icelandic scientists to conduct a new comparison of photo-id catalogues for presentation at the 2019 meeting.

Stock structure

Two former sub-committees have been merged into one, Stock Definition and DNA Testing. Several methodological issues were discussed including close-kin mark-recapture techniques, environmental DNA, guidelines and methods for genetic studies and the need for standardized terminology used to discuss "stock issues".

Cetacean Abundance estimates, stock status

Recently the SC established a Standing Working Group on Abundance Estimates, Status and International Cruises (ASI) to formally review and agree on the status of the abundance estimates submitted to the Scientific Commitee. The IWC Secretariat maintains a consolidated table of all agreed abundance estimates. Several

SC/25/07

abundance estimates of relevance to NAMMCO have been formally adopted by this procedure in recent years and at the 2018 meeting the SC agreed abundance estimates for the following stocks:
North Atlantic common minke whales (E-Greenland 2015, W-Greenland 2007 and 2015)
North Atlantic fin whales: (E-Greenland 2015, W-Greenland 2005, 2007 and 2015)

North Atlantic humpback whales (E-Greenland 2015, W-Greenland 2015, Iceland/Faroe Islands 2007, 2015)
Bowhead whales (East Canada/West Greenland 2013)

The SC discussed several methodological issues including survey technologies and model-based abundance estimation. It agreed to pay special attention to the topic of Status of Stocks at a pre-meeting to be held prior to next year´s SC meeting.

Bycatch, entanglements and ship strikes

The IWC has recently adopted a Bycatch Mitigation Initiative (BMI) and assigned a special coordinator to bring forward the work. The IWC continues to develop a global database of ship strike incidents

Environmental concerns (E)

The Commission and the Scientific Committee have increasingly taken an interest in the environmental threats to Cetaceans and this year a special sub-committee was established on Environmental concerns. The Pollution 2020 initiative is scheduled to be completed and the results presented at SC/68a (2019). The SC agreed to hold a pre- meeting on noise before SC/68b. For, cetacean diseases of concern and marine litter were identified as major points of discussion at next year´s agenda of the E subcommittee.

Ecosystem modelling

In response to a Commission resolution requesting the SC to investigate the contribution of cetaceans to ecosystem functions, the SC concluded that it is unlikely that the ultimate goal of reliably determining the contribution of cetaceans to ecosystem functioning could be achieved in under a decade, given the complexity of the issue and the data gaps. It suggested identifying the major gaps as a first step in this process.

Whale watching

The SC continued it´s discussions on whale watching and it´s impacts on cetacean populations. An IWC whale watching handbook has now been finalized and was presented at the meeting. It will be made public on the IWC website later in 2018.

Special Permits

Special Permits have been among the most contentious issues discussed by the SC and for several years, efforts have been made to structure the evaluation process in formalized way detailed in the so-called Annex P. Streamlining this process is a regular item on the SC agenda. The SC discussed progress in the Japanese Special Permit programs in the Antarctic (NEWREP-A) and North Pacific (NEWREP-NP). The outcome of the discussions was systematically tabulated for each program.

Satellite tagging development and best practices

The SC discussed the outcome of a workshop on cetacean tag development, tag follow-up and tagging best practices was held in USA from 6-8 September 2017. Particular emphasis was on (a) recent tag attachment improvements, (b) follow-up studies that examined the effects of tagging, and (c) reviewing and providing input on draft cetacean tagging best practices guidelines. A follow-up worshop was scheduled in June 2018 to discuss future directions in tag attachment technologies.

Future work

The SC suggested a work plan and priorities for the biennium 2019-2020. Proposed work of relevance to NAMMCO includes a Marine Debris workshop, noise pre-meeting, workshop on ecosystem function (gap analysis), *Balenid* workshop (focus on N-Atlantic right whale), modelling whale watching impacts, the IWC Strandings Initiative, global review of mercury in cetaceans, incorporation of spatial modelling approaches to estimate abundance.

Election of officers

In accordance with the RoP of the SC, the Chair, Caterina Fortuna (Italy) will be replaced by the Vice Chair Robert Suydam (USA) at the end of the Commission meeting in 2018 after three years in office. Zebrini (Brazil) was elected a new Vice Chair.

SC/25/07

Observer's Report from the 2018 activities in ICES

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ICES WGMME

The ICES Working Group on Marine Mammal Ecology (WGMME) met in La Rochelle (France), 19–22 February 2018. It reviewed and reported on recent information on seal and cetacean population abundance, population/stock structure, management frameworks, and anthropogenic threats to individual health and population status. The group also performed reviews of population trends of seal stocks in the Baltic Sea and Wadden Sea, as well as producing charts illustrating population trends of seals in the North Atlantic, where data could be made available. For cetaceans, information was provided regarding the passive acoustic monitoring of harbour porpoises in the Baltic Sea as well as updates regarding visual survey monitoring and strandings of several cetacean species. With respect to the development of common indicators and targets for the Marine Strategy Framework Directive, updates from France and the Macaronesian region were provided. A revision of the delineation of assessment units for harbour porpoises in the Belt Sea was discussed. New information on anthropogenic stressors were compiled and a further stressor category "Tourism" was introduced.

Furthermore, WGMME reviewed current issues in relation to indirect impacts of seals on fisheries (direct impacts were reviewed in the 2017 report). The review includes a coverage of competition for resources (fish stocks), also reviewing the latest information on seal diet, and the role of seals in the transmission of nematode parasites. The group also aimed to review aspects of marine mammal fishery interactions not covered by ICES WBYC. However, it was not possible to obtain information on the topics to be covered by WGBYC in time before the WGMME meeting. WGMME therefore decided to produce a review of recent marine mammal bycatch data and development of mitigation measures.

Updating the database for seals, is also a standing term of reference, and WGMME decided to thoroughly rework the ICES WGMME SEAL database. WGMME also endorsed the format for a data call pro-posed by OSPAR to provide data for assessments under OSPAR indicators M3 and M5 on seal abundance and distribution. WGMME found the proposed data submission format relevant and useful and will assist OSPAR in the data call.

ICES WGBYC

The Working Group on Bycatch of Protected Species (WGBYC) met at the Marine and Freshwater Research Institute in Reykjavik, Iceland 1–4 May 2018. Highlights from the meeting include:

Review of ongoing bycatch mitigation research projects;

Bycatch risk assessments (BRAs) for harbour porpoise and common dolphin in the Celtic Seas and Bay of Biscay and Iberian Coast Ecoregions;

Review of the WKPETSAMP (= Joint ICES WGBYC/WGCATCH Workshop on sampling of bycatch and Protected, Endangered and Threatened species) compiled inventory of the various sampling programmes that provide information on bycatch of protected species at the national level;

Comparison of fishing effort from different sources (ICES Regional Database; WGBYC database; Logbooks);

Review and application of the fishPi method to inform relative risk of bycatch in different gears.

The working group was also able to deliver responses to recommendations from the joint WGCATCH and WGBYC workshop PETSAMP held the week before WGBYC.

Reviewing and summarizing annual national reports, submitted to the European Commission under Regulation 812/2004, and other published documents and collated bycatch rates and estimates in EU waters occupied a substantial amount of the meeting. The UK is the only member state (MS) with a dedicated PETS (=Protected, Endangered and Threatened Species) observer programme; other MS use non-dedicated observers through the DCF ((EC) No 2017/1004) and DC-MAP (Commission Decision 2016/1251/EU). WGBYC remains concerned

about the likely negative bias in PETS data recorded by non-dedicated observers and therefore discussions on training for onboard observers were recommended.

WGBYC continues to incorporate monitoring, effort and bycatch data from non-EU states/countries that have fishing fleets in the North Atlantic and adjoining seas; this will facilitate more robust bycatch estimates for the many wide-ranging species that fall under WGBYCs remint. Bycatch of marine mammals and sea-birds was evident in most ecoregions.

The harbour porpoise BRA highlights the risk to this species in the Celtic Sea Ecoregion from net fishing; mortality may represent 1–2.4% of the best available abundance estimate for the Celtic Sea (CS). The BRA for common dolphin in midwater trawls and nets, suggest that the total mortality in the CS and the Bay of Biscay (BoB) is between 0.53 and 1.57% of the best regional abundance estimate; the mortality is highest in the BoB. However, there are incomplete observation and fishing effort data to inform this approach. The results from the BRA are biased and they should only be considered as indicators of areas and métiers in need of further investigation.

The results from bycatch assessments using cetacean strandings show comparable numbers of bycaught harbour porpoise and common dolphin. The applied stranding analysis is subject to several assumptions that are not yet fully understood and therefore contribute to uncertainty in the estimates derived from strandings data.

Ongoing challenges with the WGBYC data are the basis for a number of recommendations regarding improved onboard sampling protocols, training of bycatch observers and regional design of sampling programmes. The next WGBYC/ICES data call will be improved by providing greater clarity on the species of interest and will increase the number of mandatory data fields to improve data consistency.

ICES ASC

The 2018 ICES Annual Science Conference (ASC) was held in Hamburg, Germany, 24-27 September 2018. The conference included no particular theme session devoted entirely to marine mammals. Nevertheless, some sessions were designed with marine mammals included as an integral part – of the most relevant sessions were: “Modernizing fisheries stock assessment and monitoring with genetic methods”, “The Nordic seas and the Arctic – climatic variability and its impact on marine ecosystems, fisheries and policy making” and “Technical approaches to reduce the environmental impact of fishing”.

More information is available at the ICES web side www.ices.dk

Status as of November 1st 2018 of abundance estimates generated from the 2015-2016 NASS/NILS surveys

Some estimates accepted by SC 23 in 2016 have been revised (BA, BP, MN) by the AEWG in 2018.
The 2018 revised estimates were endorsed by SC 25 and supersede the ones accepted in 2016.
Not presented to the 2018 AEWG were abundance estimates for sei whale, bottlenose whale and killer whales for some areas.

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
								LCL	UCL	PER	AVAIL		by
BA	Minke whale	NASS	2015	Iceland/Faroes	S					1	0	2	NAMMCO SC/25
BA		NILS2015	2015	CM1a+CM3	S					1	1	2	NAMMCO SC/25
BA		NASS+NILS2015	2015	CMA	S	48,016	0.23	30,709	75,078	1	P	1	NAMMCO SC/25
BA		CIC2016	2016	Iceland coastal	A							3	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
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	NILS2015	2015	CM1a+CM3	S							3	NAMMCO SC/25
BP		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
MN	Humpback whale	NASS	2015	Iceland/Faroes	S	9,867	0.37	4,854	20,058	1	0	1	NAMMCO SC/25
MN		NILS2015	2015	CM1a+CM3	S							3	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	4,012	0.45	2,044	7,873	1	1	1	NAMMCO SC/23
PM	Sperm whale	NASS	2015	Iceland/Faroes	S	23,166	0.59	7,699	69,709	1	0	1	NAMMCO SC/25
PM		NILS2015	2015	CM1a+CM3	S					1	0	3	NAMMCO SC/25
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
LAC	White sided dolphin	NASS	2015	Iceland/Faroes	S	131,022	0.73	35,251	486,981	1	0	1	NAMMCO SC/25
LAL	White beaked dolphin	NASS	2015	Iceland/Faroes	S	159,000	0.63	49,957	506,054	1	0	1	NAMMCO SC/25
LAL		CIC2016	2016	Iceland coastal	A							3	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
PP	Harbour porpoise	CIC2016	2016	Iceland coastal	A							3	NAMMCO SC/25
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	1.00	318	8,464	1	1	1	NAMMCO SC/23