Agenda Item 4.5 Reports

Reports from Observer Organizations

Information Document 4.5.a

Reports from Observer Organizations: NAMMCO

Action Requested

- Take note

Submitted by NAMMCO

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

Annual Report
2015

North Atlantic Marine Mammal Commission

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COMMITTEES AND OFFICE BEARERS

Members of the Commission		**Councillors**
Faroe Islands	(F)	Mr Ernst Olsen/ Mr Stefan í Skori
Greenland	(G)	Ms Amalie Jessen
Iceland	(I)	Ms Ásta Einarsdóttir
Norway	(N)	Mr Ole-David Stenseth

Council

Chairs –	*1992-1995*	Mr Kjartan Høydal (F)
	1995-1997	Mr Halvard P. Johansen (N)
	1997-1999	Mr Arnór Halldórsson (I)
	1999-2004	Ms Amalie Jessen (G)
	2004-2008	Ms Kate Sanderson (F)
	2008-2009	Mr Halvard P. Johansen (N)
	2009-2012	Mr Ole-David Stenseth (N)
	2012..	Ms Ásta Einarsdóttir (I)

Committee on Hunting Methods

Chairs –	*1994-1998*	Ms Amalie Jessen (G)
	1998-2005	Mr Jústines Olsen (F)
	2005-2012	Dr Egil Ole Øen (N)
	2012-2015	Mr Eyþór Björnsson (I)
	2015..	Ms Nette Levermann (G)

Committee on Inspection and Observation

Chairs –	*1993-1995*	Mr Einar Lemche (G)
	1995-2005	Dr Egil Ole Øen (N)
	2005-2011	Mr Ole Heinrich (G)
	2011-2012.	Mr Eigil Tofte Bjørvik (G)
	2012-2015	Ms Nette Levermann (G)
	2015…	Ms Ulla S. Wang (F)

Finance and Administration Committee

Chairs –	*1999-2000*	Mr Øyvind Rasmussen (N)
	2000-2005	Mr Einar Lemche (G)
	2005-2009	Ms Ásta Einarsdóttir (I)
	2009-2012	Ms Kate Sanderson (F)
	2012-2014	Mr Einar Tallaksen (N)
	2014-2016	Mr Ole-David Stenseth (N)
	2016..	Mr Joánnes Hansen (F)

Management Committee (as of 2008 divided into MC for Cetaceans and MC for Seals and Walruses)

Chairs –	*1993-1994*	Mr Kjartan Høydal (F) interim
	1994-1998	Mr Einar Lemche (G)
	1998-2004	Mr Kaj P. Mortensen (F)
	2004-2008	Mr Halvard P. Johansen (N)

Management Committee for Cetaceans

Chairs -	*2008-2012*	Ms Ásta Einarsdóttir (I)
	2012..	Ms Ulla Wang (F)

Management Committee for Seals and Walruses

Chairs –	*2007-2011*	Ms Amalie Jessen (G)
	2011-2016.	Ms Hild Ynnesdal (N)
	2016..	Iceland

Scientific Committee

Chairs –	*1993-1995*	Dr Jóhann Sigurjónsson (I)
	1995-1997	Prof. Tore Haug (N)
	1997-2000	Dr Mads Peter Heide-Jørgensen (G)
	2000-2004	Mr Gísli A. Víkingsson (I)
	2004-2005	Prof. Lars Walløe (N)
	2005-2009	Dr Geneviève Desportes (F)
	2009-2012	Dr Lars Witting (G)
	2012-2016.	Mr Þórvaldur Gunnlaugsson (I)
	2016..	Dr Tore Haug (N)

Secretariat

General Secretary	Dr Geneviève Desportes
Scientific Secretary	Ms Jill Prewitt
Deputy Secretary	Ms Charlotte Winsnes

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SECTION 1 COUNCIL

REPORT OF THE 24th MEETING OF THE COUNCIL

10-11 February 2016, Oslo, Norway

1. OPENING PROCEDURES

1.1 Welcome address

The meeting was opened with a welcoming address by the Chair of Council, Ásta Einarsdóttir (Appendix 4). The Chair welcomed the new General Secretary, Geneviève Desportes, to her first Council meeting in this function. She remembered the late Dorete Bloch, a strong personality in NAMMCO since its beginning and a member of the Scientific Committee between 1992 and 2009, and recalled her warmth and not the least her endless hospitality.

She underlined that 2015 had been a very active year for NAMMCO and listed the most important events. With all these activities as background, she welcomed all the participants (Appendix 1).

1.2 Admission of Observers

The Chair welcomed all observers, noting representatives from Canada, Denmark, Japan, the Russian Federation, and in addition representatives from intergovernmental organisations, the International Whaling Commission (IWC), Northwest Atlantic Fisheries Organisation (NAFO), North East Atlantic Fisheries Commission (NEAFC) and South East Atlantic Fisheries Organisation (SEAFO) as well as the IWMC World Conservation Trust.

Regrets had been received from Inuit Circumpolar Conference (ICC) Greenland, the EU (EC, DG Mare and DG Environment), and the North Atlantic Salmon Commission (NASCO).

1.3 Opening statements

Opening statements were presented by member nations, the Faroe Islands, Greenland, Norway and Iceland. Canada, Russia, Japan and the International Whaling Commission also made opening statements. All statements are contained in Appendix 4.

1.4 Adoption of agenda

The agenda (NAMMCO/24/2rev5) was adopted without amendments (Appendix 2). An update from Japan on their new whale research programme in Antarctica, NEWREP-A, would be dealt with under point 14. Documents relating to the agenda points are listed in Appendix 3.

1.5 Meeting arrangements

The General Secretary, Geneviève Desportes, welcomed all participants on behalf of the Secretariat which hosted this year's meeting, and presented the meeting arrangement and practicalities. She drew particular attention to the structural changes brought to the programme, with the meetings of the Management Committees being held prior to the Council meeting proper. She also mentioned that meeting updates would be posted on the NAMMCO Facebook page. All participants were invited to a reception hosted by the Secretariat at the Grand Hotel.

1.6 Invited speaker

A presentation entitled "Why do marine mammals need ecosystem-based management? And what have they ever done for us? An exploration of the ecosystem service approach to support NAMMCO framework" was given by Dr Nicola Beaumont from the Plymouth Marine Laboratory. A summary of this presentation is provided in Appendix 5.

A number of questions followed, relating to the implementation of such an ecosystem approach in the framework of NAMMCO. One question related to the general application of the valuation, monetary or not, of ecosystem services, as this valuation would be very different according to societal and cultural values. The importance of identifying all important linkages within the ecosystem and monitoring changes in all compartments was also underlined, and not only those related to species/sectors of commercial interest.

Particular references was made to the fact that the late monitoring of plankton in many areas prevented a complete understanding of the distributional changes presently observed. Plankton is a crucial element in relation to marine mammal distribution, directly or through their prey, but because it was not commercially interesting, its monitoring had only started recently. A long-term trend was lacking and only the present situation could be referred to.

Beaumont was thanked for her thought-provoking, inspiring, excellent and lively presentation.

2. FINANCE AND ADMINISTRATION

2.1 Report of the Finance and Administration Committee (FAC)

The Chair of the FAC, Ole-David Stenseth (Norway), presented the report of meetings held since NAMMCO 23 in February 2015 (NAMMCO/24/04). The main subjects dealt with and of relevance to Council were:

- The streamlining, clarification and aligning of NAMMCO rules (RoP of Council and Committees, Staff Rules, Rules for Observers, attendance of External experts),
- The possibility of NAMMCO conducting a performance review,
- The improvement of NAMMCO visibility and the need for developing a communication, information and outreach strategy,
- The Accounting for 2015, and the preparation of the budget 2016 and draft budget 2017.

Stenseth also informed that the Committee had elected Joánnes Hansen from the Faroe Islands as its new chair.

Comments

The Chair of Council thanked Stenseth for his able chairing of the Committee during the past four years. She invited comments to the report, and subsequently the **report was accepted and its recommendations and conclusions endorsed.**

2.1.1 Audited accounts 2015

Stenseth highlighted that the 2015 accounts (NAMMCO/24/05; appendix 6) had closed with a surplus of NOK 402,840. The auditors' report had been received without comments, and the accounts were adopted by FAC.

He also recalled the Council's decision (2013) to rebuild the General Reserve to 10% of operating expenses estimated to approximately NOK 600,000 within 5 years. As of 31.12. 2014, Stenseth was pleased to announce that the General Reserve had now reached this level.

Comments

The 2015 accounts were approved and **adopted** by Council.

2.1.2 Communication and Outreach Strategy

Stenseth drew attention to the draft Communication and Outreach Strategy prepared by the Secretariat (NAMMCO/24/25). Considering that it would be beneficial for NAMMCO to have a Communication and Outreach Strategy in order to obtain more focussed and coherent information work, the FAC recommended Council to support the idea of NAMMCO adopting such a strategy.

The FAC underlined that communication and outreach work should not be solely the task of the Secretariat, but also of the NAMMCO countries.

In the framework of this strategy the FAC recommended that prioritisation was given to a complete upgrade of the present website on a new digital support, offering more up to date technological features and also that the completion of the species sites was given high priority.

Comments

Council **agreed** with the FAC proposal and tasked the FAC to continue developing a communication, information and outreach strategy on the basis of the present document with the goal of adopting it at the next meeting of the Council.

Council **endorsed** FAC's priority to develop a new technically updated website, serving as a hub of all NAMMCO information, communication and outreach activities, both internal and external. Council also noted that this would have implication on the work priorities of the Secretariat and the budgets for 2016 and 2017.

2.1.3 Performance Review

Considering that it would be beneficial for NAMMCO to take on an external review of the organisation, as called by the 2006 UN Resolution 61/105 for Regional Fisheries Management Organisations (RFMOs), the FAC recommended Council to adopt the proposal outlined in document NAMMCO/24/28.

Comments

Council **endorsed** the idea of a performance review of the organisation and tasked the FAC to prepare for such a review process with the aim of endorsing it at NAMMCO 25.

2.1.4 Amendments to Rules

Noting that the NAMMCO set of Rules needed clarification and improvement and in an effort of clarification and streamlining, the FAC proposed a series of amendments to the present Rules and the addition of Rules for observers.

2.1.4.1 Amendments to RoP of Council and Committees

Stenseth underlined that most of the changes proposed were not substantial in essence, but for clarity and consistency between the RoP of the different committees and their alignment.

There was, however, one change of substance concerning the accreditation of observers, which governed some of the other changes put forward. The FAC proposed that, as a simplification and streamlining measure, only Council should have the ability of accrediting observers to NAMMCO. Accredited observers may then observe at all NAMMCO meetings, unless otherwise decided by the majority of the subsidiary body.

The General Secretary presented the amendments proposed by the FAC to the RoP of Council (NAMMCO/24/15), Management Committees (NAMMCO/24/16), Scientific Committee (NAMMCO/24/17rev), Committee on Hunting Methods (NAMMCO/24/18), Committee on Inspection and Observation (NAMMCO/24/19). She noted that, according to the RoP of Council and committees, the amendments proposed had been circulated on December 22, 2015, by the Secretariat on behalf of the Chair of the Council, to the Council at large, including Heads of Delegations, Chairs and members of all committees.

Comments

Council **agreed** that, as proposed, only Council should accredit observers and the RoP of the different Committees should be changed accordingly. It was also agreed, that in the name of transparency, all committees except FAC should, as a general rule, accommodate observers.

Council **adopted** all the proposed amendments as presented in the documents cited above.

2.1.4.2 Amendments to Staff Rules

The present Staff Rules did not have text referring to the conditions for staff relocation. The FAC therefore proposed to incorporate the text contained in document NAMMCO/24/21 into the Staff Rules for the NAMMCO Secretariat.

Comments

Council **adopted** the text presented as an amendment to the present Staff Rules and tasked the FAC to make a general review of the Staff Rules, without changing the existing balance of benefits and duties, with the aim of presenting possible amendments to the next Council meeting for adoption.

2.1.4.3 Adoption of Rules for Observers

Considering that it would be beneficial for NAMMCO to have Procedures & Rules for Observers attending NAMMCO meetings, the FAC proposed Council to adopt the guidelines presented in document NAMMCO/24/22.

Comments
Council **adopted** without changes the proposed rules and guidelines for observers.

2.1.5 Budget 2016 and draft Budget 2017
The agenda item remained open pending the outcome of the reporting from the different committees with respect to financial consequences. Stenseth introduced the 2016 budget and draft budget for 2017 (NAMMCO/24/06). Explanations of the budget items and their rational were presented.

The General Reserve had been rebuilt to a level of 10% of the annual operating expenses. The FAC recommended that all efforts and priority be given to updating and upgrading the NAMMCO website, as a first step in implementing a communication strategy and facilitating access to information. The FAC further recommended that funds should be allocated to this task, so professional support could be sought.

Running costs should be kept as low as possible and the Secretariat was encouraged to regularly investigate possibilities of cost reduction. The possibility of having interns at the NAMMCO Secretariat should be investigated.

Comments
Council **endorsed** the prioritisation given by the FAC to develop a new website with updated technology, serving as a hub of all NAMMCO information, communication and outreach activities.

Council **adopted** the budget 2016 and the draft budget 2017 as contained in NAMMCO/24/06.

2.2 Adoption of the ROP for the Scientific Joint Working group of NAMMCO and JCNB
The Greenland-Canada Joint Commission on Narwhal and Beluga (JCNB) had proposed amendments to the RoP for the Scientific Joint Working Group of NAMMCO and JCNB. These amendments, presented in NAMMCO/24/29, had already been adopted by the JCNB but required the endorsement of the Council of NAMMCO.

Comments
Council **adopted** the proposed amendments to the RoP for the Scientific Joint WG of NAMMCO and JCNB.

2.3 Other business
The Chair of the FAC commended the work of the new General Secretary and thanked her for presenting initiatives, which contributed to streamlining and supporting the work of the Committee.

3. SCIENTIFIC COMMITTEE

3.1 Report of the Scientific Committee (SC)
The Chair of the Scientific Committee, Thorvaldur Gunnlaugsson (Iceland), presented the SC report (NAMMCO/24/07) to the Council. The species-specific details had already been presented at the meetings of the Management Committees, and the presentation focused on the other work of the SC and the work plan for 2016.

3.1.1 Overall work in 2015
In 2015, the SC held three Working Group (WG) meetings. The NAMMCO-JCNB Joint WG met in Ottawa from 9-13 March 2015 to complete the development of the narwhal catch allocation model and to update the assessments of narwhal and beluga. A Survey Planning WG was held in Reykjavik from 13-15 April 2015 for the final preparations for NASS2015. The Large Whale Assessment WG met in Copenhagen from 5-7 October 2015 and gave management advice for fin and common minke whales in Iceland, and humpback whales in Greenland.

In addition, the SC held a symposium entitled “Impact of human activities on Arctic marine mammals, with a focus on narwhal, beluga and walrus” from 13-15 October in Copenhagen. The Symposium had 46 participants and 22 presentations were given on the focal species, but also on bowhead and humpback whales and harbour seals. Concerns were raised at both the Symposium and the SC meeting about a mining project currently under development in the Canadian Arctic. TheMary River Project (see point 5.1 for detail), is an iron-ore mining project that continues expanding, currently with the prospect of shipping up to 10 months of the year through Baffin Bay. Other industrial activities that were addressed at the symposium as being particular important disturbance factors for marine mammals were seismic exploration in Canada, and West and East Greenland.

The SC held its Annual meeting in Tórshavn from 9-12 November 2015 where they reviewed the work of the WGs, received updates on research activities, and proposed future work. The SC drew the attention of the Council to the potentially severe consequences of the industrial activities mentioned above. They will likely have impacts on the hunting of the species concerned, and could affect the management advice given.

3.1.2 Cooperation with other organisations

The SC has close ties to the JCNB, IWC SC and ICES. The NAMMCO-JCNB JWG held a meeting in March 2015 to complete the development of the narwhal catch allocation model and to update the assessments for narwhal and beluga. Work on fin and common minke whales in the IWC RMP Implementation Review process was used during the NAMMCO Large Whale Assessment WG. The ICES WGHARP is now officially the ICES/NAFO/NAMMCO WGHARP, which will hopefully streamline and facilitate scientific advice for harp and hooded seals.

3.1.3 Officers

Elections were held at the 22nd SC meeting. Tore Haug (Norway) was elected Chair, and Bjarni Mikkelsen (Faroe Islands) was elected Vice-Chair. The SC thanked outgoing Chair Thorvaldur Gunnlaugsson for his efforts during his chairmanship.

3.1.4 Other business

There was no other business.

3.2 Priorities and work plan of the Scientific Committee in 2016-2017

Gunnlaugsson presented the schedule of the WGs recommended by the SC.

Work Plan and Working Groups in 2016

By-catch Working Group (BYCWG)
29 February, Reykjavik. Convenor: Geneviève Desportes
This half-day meeting, convened just prior to the Coastal Seal WG, has as specific terms of reference the planning of the work of the BYCWG, including future meetings and cooperation with other organisations, as well as the identification of a Chair and relevant Scientific Experts (also fishery experts).
It is anticipated that a full WG will meet in the fall 2016.

Coastal Seals Working Group (CSWG)
1-4 March 2016, Reykjavik. Chair: Kjell Tormod Nilssen
The WG will mainly address R-2.4.2 and R-2.5.2.
The Terms of Reference for the WG had been broadened (see agenda item 7.1) and were now the following:
a) Assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway,
b) Address by-catch issues in Norway, Iceland, and the Faroe Islands,
c) Re-evaluate the Norwegian management plans for grey and harbour seals,
d) Review all of the available grey seal data from the Faroes and develop specific plans for monitoring grey seals in the Faroes, e.g., obtaining a relative series of abundance (if a full abundance estimate is not possible at this time).

Abundance Estimates Working Group (AEWG)
1-3 days, May 2016, Copenhagen or Bergen. Chair: Daniel Pike, Convenor: Geneviève Desportes
At this first meeting, the WG will review the progress of and give advice on the analyses of the new abundance data
A second meeting may be scheduled in October 2016, depending on progress with the analyses. It could be held back to back with a LWAWG meeting in October 2016.

ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHARP)
3 days, August 2016, ICES HQ, Copenhagen. Chair: Mike Hammill, Convenor: Tore Haug

This WG will review the status and assess the catch potential of harp and hooded seals in the North Atlantic. Norway has forwarded a request to ICES requesting an assessment of status and harvest potential of the harp seal stocks in the Greenland Sea and the White Sea/Barents Sea, and of the hooded seal stock in the Greenland Sea. This request will form the basis for the next WGHARP meeting.

Large Whale Assessment Working Group (LWAWG)
Fall 2016. Chair: Lars Walløe, Convenor: Gisli Víkingsson
The terms of reference for the meeting is to incorporate the new abundance estimates ensuing from NASS2015 in stock assessments and generate longer-term advice.

Scientific Committee 23rd Annual Meeting
4 days, November 2016, (hosted by Greenland)
The SC suggested that it would be very cost and time efficient to have the next SC meeting in Copenhagen rather than Greenland. Should the meeting be held in Copenhagen, the SC urged all countries to send all of their SC members to the next meeting to take advantage of the cost savings.

Comments
Council **agreed** with the proposed work plan and endorsed the recommendation pertaining to attendance to the next SC meeting. It also approved the 2017 work plan, pending budget considerations.

3.3 Other business
The amendment to the SC Rules of Procedure (NAMMCO/24/17rev) was approved by Council under point 2.1.4.1.

There was no other business.

4. NATIONAL PROGRESS REPORTS

National Progress Reports (NPR) had been received from member countries (NAMMCO/24/NPR-F, NAMMCO/24/NPR-G, NAMMCO/24/NPR-I, NAMMCO/24/NPR-N; see Section 4). National Progress reports were also received from the observer countries Canada, Japan, and the Russian Federation, all of whom were thanked for their contributions.

Comments
No further comments were made by Council.

5. JOINT MEETING OF THE MANAGEMENT COMMITTEES

5.1 Report of the Joint Meeting of the Management Committees (JMC)
The Chair of the Joint Meeting of the Management Committees, Ulla S. Wang (Faroe Islands), presented the report (NAMMCO/24/08, section 2).

Under Environmental questions, the JMC was presented with an update on the Disturbance Symposium and especially the Canadian iron-ore mining project (Mary River project) that is of concern to marine mammals in Baffin Bay. Furthermore the effects of climate change seen in marine mammals in the North Atlantic were highlighted. The JMC reviewed updates on past requests for advice from the Scientific Committee related to environmental questions, and one new request was proposed. The JMC also discussed using management procedures developed in other organisations for decision making in NAMMCO.

Disturbance Symposium and Mary River Project
The Symposium organised by NAMMCO and entitled "Impacts of Human Activities on Arctic Marine Mammals" was held in October 2015 in Copenhagen. Pending the full report from the symposium, the Scientific Committee at their meeting in November 2015 had been informed of a few issues of concern, in particular the Mary River mining project.

Mads Peter Heide-Jørgensen, one of the organizers of the Disturbance Symposium, had been invited to present an update on this specific project to the JMC. The Mary River Project operated by Baffinland Iron Mines Corp, may result in 10-month of shipping through the heavy pack ice in Baffin Bay. This will have severe, unpredictable consequences for the large numbers of marine mammals (narwhals,belugas, bowheads, ringed seals and walruses) using the area in summer and winter, both for the populations themselves and also for the accessibility to hunting and/or its sustainability.

Heide-Jørgensen highlighted three main concerns with this project:

1) The effects of the shipping routes
2) Vessels moving through the pack ice, and the effects of their presence and the noise generated
3) The possibility of accidents, including spills of oil or other chemicals

The JMC noted the preliminary report, and acknowledged that there appears to be reason for concern for human activities negatively affecting marine mammals in the Arctic. The Committee noted that it looked forward to getting advice from the SC after their review of the full report of the symposium at their next meeting.

The JMC also proposed a new Request for Advice from the SC (**R-1.5.3**):
"The Council requested that the SC 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."

Climate change

The SC vice-chair, Tore Haug (Norway) presented updates from the SC on environmental issues, particularly the impacts of climate change. Harp seals and common minke whales were exhibiting declines in body condition in recent years, and competition for food with the increasing cod stock (likely due to climate change) was suggested as a possible explanation. Harp seals were also experiencing decreasing ice conditions. This was a matter of concern, considering that this species was dependent on ice for breeding, moulting and resting.

The shifts in distribution of common minke whales away from Icelandic coastal waters was likely due to a northward shift in summer distribution of capelin and a crash in the abundance of sand eel. Continued monitoring of the distribution and abundance of cetaceans was considered essential for conservation and management of cetacean populations and as part of wider studies of ongoing changes in the ecosystem.

Procedures for decision making on conservation and management measures

The Secretariat had drawn attention to the potential conflict of NAMMCO Scientific Committee using management procedures developed in other organisations when these do not meet the management objectives of NAMMCO.

The JMC underlined the importance of keeping in mind NAMMCO management objectives if using management procedures from other organisations in formulating an advice.

By-catch data and monitoring and Trade-related issues

The NAMMCO co untries had reviewed their by-catch reporting systems, which were quite different in nature and scope.

Norway informed on the possibility that the USA will be implementing rules potentially banning import of marine products from countries with fisheries with unmanaged high by-catch. It was unclear whether the USA was planning to ban all marine products or just products from the problematic fisheries. This is a potentially significant economic issue for all NAMMCO countries, which was another reason for the increased emphasis on future work on by-catch in general.

No new recommendations for Conservation and Management had been proposed.

Comments

Council took note of the report and concerns of the joint meeting of the Management Committees and adopted the recommendations.

Norway informed that the letter from the USA related to the by-catch issue was received in August 2015 and referred to all kinds of sea food, both wild-caught and maricultured. USA required that stock assessment of a certain standard be carried out and mitigation measures of a certain quality be taken. Norway was currently in the process of discussing this issue (terms of the letter and consequences) with the USA and will provide an update in the future. No deadline had been given to a response by Norway.

At the time of the meeting the other NAMMCO countries had not received similar letter, but they agreed that this was potentially a matter of concern for all NAMMCO member countries.

5.2 Recommendations for requests for advice

There was one new request for advice from the SC that was **adopted** by the Coucil.

R-1.5.3 The Council request 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.

5.3 Other business

There was no other business.

6. MANAGEMENT COMMITTEE FOR CETACEANS

6.1 Report of the Management Committee for Cetaceans (MCC)

The Chair of the Management Committee for Cetaceans, Ulla S. Wang (Faroe Islands), presented the report (NAMMCO/24/7; Section 2). The MCC was presented with the status of NASS2015 and the recommendations from the Steering Committee, and the narwhal catch allocation model developed in the NAMMCO-JCNB Joint WG. The MCC was also presented with updates on past requests for advice from the Scientific Committee and their status were discussed. Past proposals for conservation and management were also discussed.

NASS2015

The Chair of the NASS2015 Steering Committee, Mads Peter Heide-Jørgensen (Greenland), had been invited to present an update on NASS2015. Despite challenges with late notification of funding and weather in parts of the survey areas, the surveys were generally successful and abundance estimates were expected for fin, humpback and pilot whales. The Icelandic coastal aerial survey will be repeated in 2016 due to poor weather conditions in 2015, and hopefully this will allow for development of abundance estimates for common minke whales.

The NASS Steering Committee had recommended a plan for analysing the data from these surveys. After the completion of the initial analysis, the preliminary results will be presented for review to the Abundance Estimate Working Group (AEWG), with a meeting proposed for mid-May 2016 in Copenhagen.

The MCC agreed that the Steering Committee had completed its work and refered future work to the SC and its Abundance Estimation WG (AEWG).

Narwhal Catch Allocation Model

Mads Peter Heide-Jørgensen, also gave a presentation on the Catch Allocation model that had been developed in the NAMMCO—JCNB JWG. The model allows for assigning catches from the narwhal meta-population that Canada and Greenland share to the appropriate summering aggregations, by different hunting grounds and seasons. It includes all information that is available on narwhal movements including telemetry data, abundance estimates, seasonal occurrence and historical catch data.

The MCC commended the work of the WG on developing this model and endorsed the use of the model in management procedures. The MCC was also pleased to hear that Greenland had already implemented this advice into their management procedures.

Comments

Council took note of the report and **adopted** the recommendations of the Management Committee for Cetaceans.

Council also noted the uniqueness of the Narwhal Catch Allocation Model, which was a step forward in this complex assessment situation and further noted that it could potentially be applied in many situations where migratory populations were exploited in several areas under various jurisdictions. Council complimented the Joint WG and the SC for this work.

6.2 Recommendations for requests for advice

There were one proposal for a new request for advice from the SC and three proosals for amendments to exicting requests that were **adopted** by the Council.

__New Request__

R-3.4.14 The Council request the SC 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.

__Amendments__

R-3.2.4 The original text reads: "The Commission requested the Scientific Committee to 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." (NAMMCO/15)

The new amendment add 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."

R-3.1.7 The original text reads: "The SC is requested to complete an assessment of fin whales in the North Atlantic and also to include an estimation of sustainable catch levels in the Central North Atlantic. This work should be initiated as soon as all estimates become available and before the meeting of the SC in 2009 (NAMMCO/17). In 2014 it was amended to include "While long-term advice based on the outcome of the RMP Implementation Reviews (with 0.60 tuning level) is desirable, shorter term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015." (NAMMCO/23)

The new amendment replace the NAMMCO/23 amendment and reads: The SC is requested to complete an assessment of fin whales in the North Atlantic and also to include an estimation of sustainable catch levels in the Central North Atlantic. A long-term advice based on the new NASS2015 abundance estimate and the available results from the RMP Implementation Reviews (with 0.60 tuning level) is needed in 2016.

R-3.3.4 The original text reads: "The SC is requested to complete assessments of common minke whales in the North Atlantic and include estimation of sustainable catch levels in the Central North Atlantic. While long-term advice based on the outcome of the RMP Implementation Reviews (with 0.60 tuning levels) is desirable, a shorter-term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015." (NAMMCO 23)

The new amendment replace the NAMMCO/23 amendment and reads: The SC is requested to complete assessments of common minke whales in the North Atlantic and include estimation of sustainable catch levels in the Central North Atlantic.

6.3 Other business

There was no other business.

7. MANAGEMENT COMMITTEE FOR SEALS AND WALRUSES

7.1 Report of the Management Committee for Seals and Walrus

The Chair of the Management Committee for seals and walruses, Hild Ynnesdal (Norway), presented the report (NAMMCO/24/10, Section 2), highlighting the main recommendations and request for advice from the

Scientific Committee. The MCSW endorsed one new request on struck and lost listed below under agenda item 7.2.

The Committee endorsed the recommendation of the SC that all available grey seal data from the Faroes should be presented to the CSWG for review. The terms of reference of the CSWG was broadened with the following task: Reviewing all of the available grey seal data from the Faroes and developing specific plans for monitoring grey seals in the Faroes, e.g., obtaining a relative series of abundance (if a full abundance estimate is not possible at this time).

Special attention was drawn to the updated assessment of the Baffin Bay walrus population that resulted in a new recommendation of sustainable takes of no more than 85 walruses annually in Qaanaaq from 2016 to 2020.

Comments

Council took note of the report and **adopted** its recommendations.

Council noted the deliberations of the Committee on species and stocks of seals and walruses.

Council also noted that the Terms of Reference for the Scientific Committee Working Group on Coastal Seals (CSWG) had been broadened to include development of specific monitoring plans for grey seals in the Faroe Islands.

Council reiterated its contentment that there is scientific cooperation between ICES and NAMMCO and welcomed the new ICES/NAMMCO Working group on harp and hooded seals (WGHARP).

Finally, Council thanked the outgoing Chair Hild Ynnesdal (Norway) for her very able chairmanship during four years and noted that the new chair would be Iceland and the Vice-Chair Faroe Islands.

The Faroe Islands thanked the outgoing chair for her excellent work carried out for the last four years.

7.2 Recommendations for requests for advice

There was one proposal for new request for advice from the SC that was **adopted** by the Council.

R-1.6.4 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.

Council noted that this request, although brought up regarding walruses, not only pertains to walrus but to all species.

7.3 Update on the EU sealskin ban and Inuit exemption

Greenland made the following statement:

The final WTO conclusions and the effects of the EU sealskin ban from 2015 are one example of the lack of respect for the facts and realities seen in communities depending on wildlife resources.

The Government of Greenland has recently been forced to make drastic decisions in trying to adjust the Greenlandic sealing industry. The situation is serious and the survival of the sealing industry in Greenland can be a matter of time, even though the hunt of course will continue.

Greenland and Denmark had a very constructive working relationship on the issue and Greenland appreciated the effort Denmark put into the case. However, the so-called Inuit exemption is not functioning. The Government has decided to continue its subsidy and is using a lot of effort to keep the negative effects as low as possible, focussing its funding to reach small communities and full time hunters. It is therefore the hope that the EU Commission will fullfill its responsibilities and disseminate information on the trade restrictions and arise awareness on the Inuit exemption.

Comments

Council expressed great concern for the negative consequences faced by Greenland due to the EU-ban. The Faroes reiterated that they fully support the right to usemarine mammals and marine resources in a sustainable manner.

7.4 Any other business

There was no other business.

8. HUNTING METHODS

8.1 Report of the Time to Death (TTD) Expert group meeting

The Chair of the Committee on Hunting Methods, Nette Levermann (Greenland), presented the report from the Expert Group meeting on assessing time to death data from the large whale hunts (EG). The meeting, held 4 – 6 November 2015 in Copenhagen (NAMMCO/24/12, Annex1) was chaired by Dr Christina Lockyer. The EG was composed of 21 experts in fields related to the issue of killing mammals.

Council, at NAMMCO 23 (February 2015) had tasked the Committee on Hunting Methods to convene a second expert group meeting on TTD data from large whale hunts with the following terms of reference:

- To undertake a review and evaluate the whale killing data submitted to NAMMCO by member countries and associated hunting nations, as well as data and information on recent and ongoing research on improvements and technical innovations in hunting methods and gears used for the hunting of large whales.

TTD data and other relevant information on hunting methods were presented from Greenland, Iceland, Norway, Japan, USA (Alaska and Makah hunts) and Canada. TTD, Survival time (ST) and the Instantaneous death rate (IDR) were the parameters used to measure and quantify killing efficiency. The standardised collection and analysis of these parameters, together with relevant covariates, made it possible to compare killing practices and monitor the effects of new developments, changes in hunting practices and training of hunters.

The "Norwegian method" of collecting and analysing TTD, recommended by the first Expert Group meeting in 2010, had been used both in Norway and Iceland. Results from the Norwegian minke whale hunt indicated an increase in IDR of 65% in the period 1981 to 2012, from 17% to 82%. The average TTD had been reduced from 11.5 min to 1 min. The angle of the shot relative to the animal's long axis influenced the TTD significantly. Shots directed at the thorax from the recommended side position of about 45°-135° relative to the animal's long axis resulted in 92% instant kills.

Iceland had collected TTD data from the minke whale hunts in 2014 and 2015. Although the weapons used in Iceland are identical to the ones used in Norway, the IDR was 69%, thus lower than the 82% registered in the Norwegian hunt. The EG was unable to draw any firm conclusions regarding this discrepancy in killing efficiency due to the very limited set of data. Much effort has been dedicated to improving hunting efficiency in the Icelandic fin whale hunt through modifications of the penthrite grenade. The resulting 84% IDR was the best of all presented hunts.

Japan presented TTD data for all their whaling operations. IDR continues to be substantially lower than in comparable hunts (Norway, Iceland), where the penthrite grenade is used as the primary weapon. The EG reiterated its advice from 2010 that the use of sonar (affecting the whale behaviour) and the chase with high speed boats (resulting in shot angle well below 45°) likely prevent achieving a high IDR. The EG also recommended that Japan develops and uses a more effective back-up weapon than the lance as secondary method in the coastal whaling.

The Greenlandic IDR for the harpoon grenade minke hunt had improved to around 50%. The IDR and TTD were still less than in the Norwegian hunt and it was suggested to make an analysis of strike locations, which may explain the discrepancy. The EG expressed concerns from an animal welfare point of view that the rifle hunt seemed to be increasing and Greenland was encouraged to evaluate and analyse the hunting sequences and efficiency in this hunt. An increased penthrite charge had resulted in a higher IDR in the fin whale hunt but not in the humpback whale hunt, likely because of poor shooting angles. In general, the importance of correct shooting angle, strike and detonation location was emphasised.

In Alaska, struck and lost had been drastically reduced from about 50% to less than 10%, due to the introduction of the penthrite grenade in the darting gun and the training programmes organised by AEWC. The EG encouraged Alaska to collect TTD and IDR data from the bowhead hunt and present the results at the next EG meeting to allow comparison of bowhead hunt effectiveness with other nations.

Canada presented detailed observations of five bowhead hunts conducted in different communities in 2010-2014. The EG agreed that the long TTD observed could be substantially reduced through further training of hunters, exchange of information and sharing of experience with other bowhead-hunting nations. The Canadian hunting method deviats considerably from the successful and efficient Alaskan method and Canada was encouraged to adopt this technique.

The Makah tribe presented a very thorough and efficient training program. The EG pointed out that using traditional methods like harpooning first and then shooting is problematic both from an animal welfare point and from the point of view of hunters' safety.

The meeting was successful with in-depth and informed discussions, and resulted in specific conclusions and recommendations agreed by consensus. In addition, the meeting also resulted in two protocols, one on collection of TTD and one on analyzing TTD.

<u>Comments</u>
Council thanked the Committee on Hunting Methods for organising the second expert group meeting on TTD for large whales and expressed great appreciation of the work of the Expert Group. The specific conclusions and recommendations deriving from the EG meeting was dealt with under the next agenda item.

Japan noted that it had submitted data and information on whale killing methods to NAMMCO since 2009. Japanese scientists participated in the Expert Group meeting in November 2015, where they submitted TTD data and received various constructive comments. Japan expressed its appreciation on this collaboration on evaluating killing data and wished to pursue it to further improve killing methods for cetaceans.

Iceland questioned why Japan was using a lance as secondary weapon in the minke coastal whaling. In Europe the alternative was a 2nd grenade, which was a more efficient killing method. The Japanese delegates informed the meeting that they would convey this question to their colleagues dealing with killing methods.

Norway reiterated the point of the Committee that shooting the whale while chasing them at high speed resulted in too narrow shooting angles and consequently lower IDR. They recommended Japan to modify its way of approaching the whales so IDR rates could be improved.

Norway also reiterated the point of the Committee that Canada should consider using the hunting methods developed in Alaska in order to reduce TTD, which presently were of over half an hour in the Canadian hunt. The Faroes thanked all those involved in this Expert Meeting and for the reporting of the results. It noted that improving hunting and killing technics was a focus area for NAMMCO, and all should make every effort to improve them.

8.2 Report of the Committee on Hunting Methods
The chair of the Committee on Hunting Methods, Nette Levermann (Greenland), presented document NAMMCO/24/11 (Section 1.2), containing the report of the Committees activities since the last Council meeting.

The Committee had held two face-to-face meetings and four telephone meetings, the last exclusively dealing with the organising of the Expert Group Meeting.
The Committee had also organised a one-day seminar on the statistical analysis and presentation of TTD data, with Lars Walløe (Norway) as convener. Walløe had also produced a protocol on the Norwegian method of analysing and presenting TTD data.

Representatives from Japan had held a meeting with members of the Hunting Committee concerning the small cetaceans hunt in Tajii: Japan was considering holding a workshop on this hunt and wanted NAMMCO's input. A preliminary program including a budget and the NAMMCO manual on pilot whaling had been forwarded to Japan.

In 2015 , Justines Olsen, a long standing member of the Hunting Committee for the Faroe Islands had retired. Olsen had been a member of the Hunting Committee since the beginning and his expertise and dedication to developing new hunting equipement in the pilot whale hunt had greatly contributed to the successful work of the Committee.

Both Greenland and Faroe Islands reported on revised executive orders and new laws. All members reported on quota numbers, catches, number of active vessels, hunting periods, strandings and irregularities in their respective whaling and/or sealing activities.

The Committee discussed at length the problems related to by-catch, strandings and entanglement of live whales. It recognised that its terms of reference focused on direct takes, but at the same time acknowledged that these issues have great animal welfare consequences which is of concern to the Committee. The Committee therefore agreed to ask advice from Council on how best to address these questions.

The Committee also agreed to draw the attention of the Council to the issues mentioned under agenda item 8.3 below.

Comments

Council thanked the Committee for its work. The importance of openness and transparency when dealing with issues like TTD and IDR continues to be at the core of NAMMCO principles.

Iceland recalled that the main involvement of NAMMCO's Hunting Committee resides in improving methods for direct catches. Methods for euthanising stranded whales and disentangling live whales are very different matters, and not in the remit of the Committee.

Greenland stressed that this was a growing problem in their waters and that they would like to get advice and guidelines from NAMMCO on the matter.

Norway commented that IWC has developed principles on how to address both euthanasia of stranded cetaceans and disentanglement of large whales. There should be no need for NAMMCO to duplicate this exercise. Norway also informed that they were currently working on practical guidelines on how to conduct appropriate euthanasia of stranded cetaceans. When finished, these guidelines would be made available to all NAMMCO member countries, and these and the supporting principles could then be discussed in NAMMCO.

The Faroes noted that it was important to learn from best practices, wherever they come from. These should then form the background of a discussion within NAMMCO.

Greenland highlighted that, as a matter of principle, the IWC had no competence regarding small cetaceans and seals. Greenland, however, agreed with the statement of the Faroes and pointed out that this discussion was relevant in the NAMMCO context.

Council **agreed** that a discussion be initiated in NAMMCO, on the background of both the Norwegian preparatory work and guidelines and the IWC recommendations and conclusions. Such discussion should enlighten how to best apply locally the recommendations brought forward.

Greenland asked whether the By-catch WG in the Scientific Committee could be an adequate forum. The General Secretary pointed out that the By-catch WG had no expertise in dealing with entanglement and euthanasia of live marine mammals. It will be composed of experts on by-catch and fisheries data and statisticians. She suggested the possibility of convening an ad hoc WG.

Council **decided to ask** the Committee on Hunting Methods to review its Terms of Reference and to come up with suggestions on how best to deal with the animal welfare concerns related to by-catch, entanglements and strandings in the NAMMCO framework.

8.3 Recommendations arising from the Committee

The Committee on Hunting Methods drew the attention of Council to the following issues arising from the conclusions and recommendations of the EG meeting on TTD data:

- The concern that the rifle hunt in Greenland seems to be increasing, as a result of demand for meat that is not being met by the harpoon grenade hunt.
- The importance of increasing, through training, hunters' awareness of the influence of the shooting angle relative to the animal's body in order to reduce TTD.
- The need for monitoring TTD at 10 years intervals.
- The need to organise a workshop on alternative methods for collecting standardised TTD data that are less expensive, thus making it easier to compare TTD between countries.
- The need to review the underlying reasons for struck and lost, with the aim of decreasing rates.

Comments

Council noted and **endorsed** the recommendations of the Committee. It **agreed** to

- Express concern to Greenland that the rifle hunt is increasing.
- Recommend to monitor TTD at 10 years intervals
- Recommend to enhance hunters' awareness of the impact of the shooting angle on the TTD.

Council also **agreed** to organise a workshop for developing alternative means of collecting standardised TTD and to the need of reviewing underlying reasons for struck and lost.

Council **tasked** the Committee on Hunting Methods to return to Council with a proposal for how these recommendations best can be dealt with, including budget implications.

8.4 Other business

There was no other business.

9. THE JOINT NAMMCO CONTROL SCHEME

9.1 Report of the Committee on Inspection and Observation

The Chair of the Committee, Ulla S. Wang (Faroes) presented document NAMMCO/24/13 (Section 1.3), containing the report of the Committee.

The Committee had held one telephone meeting January 12, 2016, where it had discussed the activities carried out in 2015 and the planned 2016 observation activities (see agenda item 9.2 and 9.3 respectively).

Members of the Committee had reported on the national control effort, monitoring type and data collection.

Comments

Council took note of the report from the Committee on Inspection and Observation.

9.2 Observation in 2015

The Deputy Secretary, Charlotte Winsnes, presented document NAMMCO/24/14 containing the report from the Secretariat on the implementation of the NAMMCO International Observation Scheme in 2015.

Pilot whaling in the Faroe Islands had been the focus of the observation scheme in 2015. Two observers were contracted from 3 – 24 August and 7 – 28 September respectively. During the total observation period of 44 days one pilot whale hunt took place and was observed. No violations had been observed, and observer reports had been submitted to the Secretariat.

Comments

Council took note of the report from the Secretariat.

9.3 Observation planned in 2016

Winsnes presented document NAMMCO/24/14 containing the plans for the Observation scheme in 2016.

A list of nominated observer candidates had been circulated prior to the Council meeting in January 2015. The suggested scope of observation activities of the NAMMCO International Observation Scheme for 2016 is whaling in Norway. It is proposed to contract three observers, one from Greenland and two from Iceland/Faroes Islands, with observation periods from two weeks up to 1 month depending on the hunting grounds of the observed vessels.

The hunting season starts 1 April with varying ending dates. In 2015, the majority of the boats started around middle of May and the season closed on September 28. In the 2015 season, 21 vessels participated representing 546 weeks of hunting activities. Based on the 2015 season, the effort suggested for 2016 (maximum 10 weeks) would represents a coverage of less than 2% of the total activity. The suggested budget of NOK 230 000 had been approved by the FAC and was included in the revised 2016 budget.

Comments

Council **appointed** the nominated observer candidates and **approved** the proposal for observation activities in 2016.

9.4 Other business

There was no other business.

10. ENVIRONMENTAL QUESTIONS

Greenland made the following statement:

Greenland is concerned about the increased shipping activity in the Arctic and the disturbance to marine mammals this may cause. In particular, ice breaking through pack ice areas like Baffin Bay and the Greenland Sea is a concern because of the pristine environment that hosts large numbers of marine mammals. Some of these areas have never before been exposed to shipping activities during winter months and the effects from noise pollution from large vessels is unknown. Furthermore, accidents with oil spills in ice-covered areas are known to be detrimental to most of the food chain from phyto- and zooplankton, to fish larvae, birds and mammals.

Greenland is particularly concerned about the development of the Mary River Project on northern Baffin Island, Canada, where biweekly shipping with large ice breaking cargo vessels is currently being considered. Shipping through one of the most important narwhal summering grounds, the Eclipse Sound, could potentially risk collision with 123 narwhals and 1 bowhead whale per year, according to model estimates. Considerably noise pollution locally that will ensonify the entire narwhal summering ground may cause the narwhals to abandon the area. It is important to notice that the Eclipse Sound narwhal population is both supplying the local hunt in the area and the hunt in West Greenland and advice for future sustainable harvest will have to be revised accordingly.

The year-round shipping through the Baffin Bay, planned in the Mary River Project, will affect the wintering grounds for bearded and ringed seals, belugas, bowheads and narwhals from several populations, as well as walruses in West Greenland that have one of their few feeding, mating and whelping grounds in this area.
Activities that affects important concentrations in international waters and trans-boundary migrations of marine mammals need to be assessed and regulated through existing international legal arrangements.

Comments

Council took note of and **supported** Greenland's concerns and **adopted** the recommendation from the Management Committees to request that the SC "monitor the development of the Mary River Project and to assess qualitatively or if possible quantitatively the likely impact and consequences on marine mammals in the area (see point 5.2, R-1.5.3)".

Canada made the following statement concerning the Mary river project:

The Mary River Iron Ore Project is an approved iron ore mine by Baffinland located on Baffin Island approximately 100km south of Pond Inlet, Nunavut. The Project was subject to an environmental assessment conducted by the Nunavut Impact Review Board.

In October 2014 Baffinland submitted the Mary River Phase 2 project proposal for an amendment to the approved Project to increase production which would necessitate an increase to the shipping season to 10 months per year.

Full details in support of the revised proposal have not yet been submitted to the Nunavut Impact Review Board, so the assessment of the revised proposal has not substantively begun. Once it commences, Fisheries and Oceans Canada will be providing expert advice to the Nunavut Impact Review Board in relation to potential project impacts to fish and marine mammals and their habitats.

11. MARINE MAMMAL AS FOOD RESOURCES

The Ministerial Meeting in 2012 had emphasised the importance of an increased focus on marine mammals as a food resource. A Planning Group was established at NAMMCO 21 to advance this theme. The Planning Group had outlined two main parts – firstly, production of a background document reviewing and compiling the existing material on the topic, and secondly, communicating the message. The second part required a communication strategy, involving expert help to develop the message.

11.1 Report of the Planning Group

The Chair of the Planning group, Amalie Jessen (Greenland) presented the progress report (NAMMCO/24/23).

The planning group has met twice (June 11, 2015, February 07, 2016). Key elements and messages were:

- The overarching principle for exploitation of natural resources should be sustainability. Either a hunt was sustainable or not.
- There should be no reference to indigenous peoples or the concept of rights of small communities to hunt for special reasons.
- Exploitation of animals must take into consideration the welfare aspects of the hunt i.e. to carry out the hunt in a manner that minimizes animal suffering and waste of landed animals.
- The goal of the project was to normalize marine mammals as food resources, as other marine resources. The working title was therefore changed from “marine mammals and food security” to “marine mammals as a food resource”. The issue of food security was one of many concerns/issues deriving from this.

Funds available to the project, excluding secretariat salaries, were NOK 325.000 in 2016 and NOK 220.000 in 2017.

The background document prepared by the Secretariat represented a very valuable and comprehensive tool, touching upon most aspects of the issues at hand. The ideas brought up at the February meeting will be incorporated into the document, after which it will be sent to the member countires for comments.

A communication and outreach strategy will then be developed on the basis of this document. The Planning Group decided that this would be done by the Secretariat in cooperation with a communication expert, using funds available to the project for this task. The strategy would be presented to the Group at its meeting in June. It should include, for each target group identified, the relevant key messages to be delivered and the information best substantiating these key messages. The strategy should also define the respective outreach role of NAMMCO and the member countires.

The target group was defined as the group of persons situated between those accepting sealing and whaling as normal providers of food resources and those “religiously” against the use of marine mammals. If the project succeeded in getting some acceptance and respect, if not automatically support, from this target group, then the project would have succeeded. Opinions are often based on false premises or lack of information. Well-founded facts may help to change views and/or the level of acceptance.

The importance for NAMMCO of being pro-active in communication and visible on social media was underlined, as well as the necessity of being totally open and transparent. NAMMCO should be proud of its management, and its management results and the improvement in hunting methods and its observation scheme.

While the project had changed in character and had been delayed, the Group felt that it was now well on its way and that the present background document represented a very valuable base to work from. The Group felt confident and positive in the outcome of the project and its chance of success, but it was important to focus on the success criteria and to progress in logical steps, monitoring progress and gaining experience on the way. Finally, the Planning Group agreed that Members should learn from each other's success in public relations.

Comments

Council took note of the report and is looking forward for the continuation of the project.

Greenland thanked the Secretariat for the work it had put into the background document.

Iceland referred to the present situation where there are few available export markets for whale products. CITES has placed most whale stocks on Appendix I with the consequence that only countries that have made reservations to the listing such as Iceland, Norway and Japan can trade in whale products. Iceland noted that Japan continue to introduce special trade barriers to such an extent that the export trade in whale products is hardly viable. Iceland would like to see an end to this kind of protectionism and Iceland encouraged the NAMMCO Governments to work towards this.

The IWMC noted that the list of international conservation meetings of relevance to management and sustainable use of wild resources (mainly marine resources) is unprecedented in 2016, with the CITES 66th Standing Committee Meeting in January, the NAMMCO Council meeting, and the FAO Committee on Fisheries, 15th Sub-Commission Fish Trade in February, the CITES Livelihoods Working Group in April, the Meeting on Sustainable use of Marine Living Resources including Cetaceans and the INFOFISH Tuna Forum in May, the FAO Committee on Fisheries in July, the IUCN World Conservation Congress and the CITES CoP17 in September, the IWC 66th meeting in October and the CBD in November. Interestingly each one of these international conservation institutions has a component and/or program dealing with the importance of livelihoods in the achievements of conservation objectives.

Furthermore IWMC noted that att its 38th Conference held in Rome in June 2013, the UN Food and Agricultural Organization (FAO) adopted Five Strategic Objectives (SOs), which are naturally adhered to by NAMMCO:

- Help eliminate hunger, food insecurity and malnutrition;
- Make agriculture, forestry and fisheries more productive and sustainable;
- Reduce rural poverty;
- Enable inclusive and efficient agriculture food systems; and
- Increase the resilience of livelihoods to disasters.

IWMC sees the objective sought by the members of NAMMCO to be to "… ensure effective conservation, sustainable marine resource utilization and development with due regard to the needs of coastal communities and indigenous people". This is a perfect match with the FAO's five SOs, and IWMC recommended that NAMMCO officially subscribes to the FAO Five Strategic Objectives and links itself to the laudable objective of using wild resources to provide subsistence for human beings and, in return, to enhance the possibility of "effective conservation".

Greenland thanked the IWMC for its continuous support to the sustainable use of resources.

12. EXTERNAL RELATIONS

12.1 Cooperation with other organisations

The General Secretary introduced NAMMCO/24/24 which presented summaries of observer reports from attendance at meetings of a number of organisations with which NAMMCO has established formal relations, as well at two Conferences. The former included meetings of the IWC 66th Annual Scientific Committee meeting, the IWC Expert Workshop on Aboriginal Subsistence Whaling, the 6th Meeting of the Arctic Council

Task Force for Enhancing Scientific Cooperation in the Arctic (SCTF), the Board Meeting of Arctic Council Working Group PAME & CAFF meeting, as well as the joint meeting of the PAME, CAFF, AMAP and ACAP Working Groups, the CAFF Circumpolar Biodiversity Monitoring Programme (CBMP) Marine Annual Meeting, the ASCOBANS Advisory Committee meeting, the NEAFC 34th Annual Meeting, the NAFO 37th Annual Meeting and the NASCO 32st Annual Meeting. In addition, the Secretariat attended the Nordic Committee on Bioethics Symposium on Ethical Dilemmas of Consuming Animals and the 21st Biennial conference of the Society for Marine Mammalogy (SMM).

Presentations on NAMMCO activities were prepared for the PAME Board Meeting and the ASCOBANS Advisory Committee, as well as the Norwegian Diplomatic Excursion. At the SMM Biennial a stand had been organised with the NAMMCO banner, leaflets and Scientific Publications that was well visited and functioned as the contact hub for scientists involved in or cooperating with NAMMCO.

Desportes underlined the IWC Expert Workshop on Aboriginal Subsistence Whaling as particularly interesting in its inclusion of “the outside of the IWC world” – by placing cultural, subsistence and nutritional issues in the broader world context of internationally recognised Indigenous people’s rights. In adherence to and as a result of these rights most of what has been debated in IWC related to questions of ASW quota became uncalled for. Many IWC member states were committed to uphold the rights of Indigenous Peoples through ratification and adherence to various international instruments. It will therefore be interesting to observe how this potential conflict/challenge will be dealt with at the next IWC meeting.

Referring to the CBMP Marine Annual Meeting, Desportes highlighted the opportunities gained by re-enforcing links with AC and subsidiary bodies & making the work of NAMMCO and its success stories known. It was important in particular to have NAMMCO’s work and assessments ascribed to NAMMCO when referred to. NAMMCO had much to contribute to the CBMP, as the assessments of most marine mammal stocks in the Atlantic Arctic and adjacent waters were the remit of NAMMCO. She announced that the CAFF board had responded positively to the proposition made by NAMMCO to cooperate on the Global Review of Monodontids.

Desportes pointed out that in the time of climate change, with unforeseeable consequences for marine mammals and consequently the coastal communities using them as resources, it was essential to re-inforce the scientific cooperation between those bodies striving for the conservation of marine mammals and make use of each other’s expertise and competence.

Comments

The Faroes, Iceland and Greenland concurred to thank the Secretariat for its active role and good work in outreach and representation and encouraged it to continue. They underlined the importance for NAMMCO of being a transparent and visible body.

IWMC noted that the next meeting of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), CoP17, could be subjected to two proposals of interest to NAMMCO, which are the Narwhal (Monodon monoceros)—to be transferred from Appendix II to Appendix I and for the inclusion in Appendix I of the Walrus (Odobenus rosmarus).

IWMC also informed that Article XV, paragraph 2, sub-paragraph (b) of the CITES Convention states the following: "For marine species, the Secretariat shall, upon receiving the text of the proposed amendment, immediately communicate it to the Members. It shall also consult inter-governmental bodies having a function in relation to those species especially with a view to obtaining scientific data these bodies may be able to provide and to ensuring co-ordination with any conservation measures enforced by such bodies. The Secretariat shall communicate the views expressed and data provided by these bodies and its own findings and recommendations to the Members as soon as possible." This represented an excellent opportunity for NAMMCO to officialise a link with CITES and to have an influence on its decision making-process.

12.2 ASCOBANS

As noted above, the General Secretary underlined the benefits to conservation of joining forces and competence when possible. She presented three areas where a scientific cooperation with ASCOBANS would be of relevance to both organisations.

The assessment of North Sea harbour porpoises, so far considered a single stock and therefore a shared stock between one NAMMCO party (Norway) and several ASCOBANS parties (Sweden, Denmark, UK, Germany, Netherlands, Belgium, France), was the most obvious. The estimation of life parameters, population health status, impact of anthropogenic disturbances, including by-catch, and their mitigation were all difficult areas which would benefit from the broadest possible expertise.

Within the framework of ecosystem-based management, it was relevant for NAMMCO to monitor / support monitoring the actual impact of persistent organic pollutants on marine top predators, to inform conservation management. Such monitoring was also a theme within ASCOBANS.

ASCOBANS had announced its intention of developing a Conservation Plan for Common Dolphins. In the present occurrence of the species as north as Tromsø, the development of this plan may also be an area where sharing of data between both organisations could be beneficial.

Comments
The Council **agreed** that a scientific cooperation between ASCOBANS and NAMMCO would be beneficial in some areas. It tasked the Secretariat to consult with the ASCOBANS Secretariat to explore which areas would be best suited for initiating such a scientific cooperation.

12.3 Other business

In general, with climate change and unforeseeable consequences for marine mammals, the Council agreed that it was essential to increase the scientific cooperation between organisations dealing with marine mammals. NAMMCO should therefore aim at strengthening its cooperation with the Arctic Council, the International Council for the Exploration of the Sea (ICES), the International Whaling Commission (IWC), OSPAR, the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) and any other international instrument, which may require the advice of NAMMCO.

IWMC noted that NAMMCO wishes to strengthen its cooperation with the organisations having competence in marine mammals. In that respect, IWMC advised NAMMCO to develop in particular stronger links with the FAO and CITES.

13. INFORMATION AND COMMUNICATION

The Chair of Council commended the work and activity of the Secretariat in this domain and in particular the leading role of the new General Secretary.

13.1 Website

The Scientific Secretary, Jill Prewitt, gave an update on the new website, which went on line in July 2015. The new site represented a complete upgrade of the old site, including lots of new material and information. All NAMMCO documents, both basic texts, reports from Council, committees and subsidiary bodies and all publications were available on the site. Species site and stock status were completed for walrus, ringed seal, fin, minke and pilot whales as well as narwhal and beluga. However, the upgrade had been done on a very low budget, and technicalities were not up to date. The site was actually difficult to manage and update, and many common features, like e.g. a search instrument and a visit counter, were not available.

The Secretariat was presently examining the cost of changing the website support and had contacted different providers of websites that were thought to be well designed and user-friendly and which also allowed password areas for internal and meeting communication.

Comments
Council commended the work done on the website and the amount of information contained, in particular the stock status part and thanked the Secretariat for this. As noted under point 2.1.2, Council **agreed** to transfer the NAMMCO website to a more technically updated support, which could also be used as a communication hub. The priority of NAMMCO possessing such a website was underlined in the draft Communication and Outreach strategy and will be taken into account in the budget for 2016 and 2017.

13.2 Stock Status List

As noted above, a comprehensive account was now completed and available online for seven species.

Comments

Council commended the work done on these seven species and agreed to prioritise he development of comprehensive stock status for all exploited species, and to use external help to accomplish this rapidly.

13.3 Social Media

The Secretariat had opened a NAMMCO Facebook page in November. The site contained both internal information (related to NAMMCO events, meetings, projects, new assessments, activities) and external news (generated by other bodies and related to marine mammals, conservation-related issues, release of reports, conference announcements).

The General Secretary also informed that journalist S. Leth Nissen, as part of an assignment and her final exam for the diploma education on Social Media in Strategy and Communication (DMJX, Denmark), had developed a social media strategy for NAMMCO. This work would be an input in the NAMMCO general communication and outreach strategy presently being developed.

Comments

The Faroes commended the Secretariat for its activity on the Facebook page and urged everyone to invite friends to like the NAMMCO page in order to increase the volume of persons and institutions reached and boost the size of the network.

13.4 Flyers

The Secretariat developed in December a short flyer informing on the NAMMCO vision and its wide spectrum of activities, spanning from marine mammal stock assessments to improving killing methods. The flyer also describes some NAMMCO success stories in management and in improving hunting efficiency. The flyer had been largely distributed and well received.

General Comments to points 13.1-4:

The Faroes thanked the Secretariat for its active involvement in outreach work, through the website, social media and flyer. They found it very positive for the organisation to be open and transparent and to actively engage with different kinds of public. They looked forward to the development of the general communication and outreach strategy as this will further enhance the visibility of NAMMCO

Greenland was also supportive of these developments and considered the adoption of a communication strategy a positive step forward. Informing the general public on the challenges inherent to the sustainable management of marine mammals is an important task of NAMMCO. Greenland concurred with the Faroes in thanking the Secretariat for these initiatives.

13.5 Scientific Publications

The Scientific Secretary summarised the activities pertaining to the online publications. In 2016 the journal website (http://septentrio.uit.no/index.php/NAMMCOSP/index), had about 5,000 visitors from 94 countries. All volumes were now accessible on the journal website.

The volume 10 on Age estimation of marine mammals with a focus on monodontids has 8 papers and one workshop report published online as “online early versions”. Additional papers will be online soon, and professional typesetting of completed papers will begin shortly.

Ideas for future volumes include a survey volume containing any previously unpublished NASS papers, and the new results from NASS2015.

Another possible future volume could be based on the planned Global Review of Monodontids. Of particular interest are papers presented by Russian scientists because these scientists normally do not publish in English, and therefore their information is usually not accessible.

Comments
Norway proposed the idea of having the results of all surveys, 2015 NASS and the European and Canadian 2016 surveys, assembled in a NAMMCO special publication, as the surveys covered adjacent areas.

Iceland asked whether there could be any possibility in summarizing some of the articles published, so they would be in a form more suited for interested non-scientists/specialist. The same was valid for the species stock status, which contained a lot of information, but by the same token were unfriendly for non-specialists. The Secretariat informed that summarising the articles seemed difficult, but that summary sheets were planned for the website for different subjects such as stock status, legislative instruments, etc.

13.6 Other business
Iceland noted that NAMMCO celebrates its 25-year Jubilee next year and was pleased that Greenland would be the host for this celebration. It suggested that it would be a good opportunity to extend invitations to Canada and Russia to join the organisation. In view of the changes in the Canadien government and the Minister of Fisheries coming from Nunavut, it may be a particular good timing to revisit the question of membership.

The Chair of Council agreed that this was indeed a good opportunity and referred the question to the FAC. The Chair of FAC, Ole-David Stenseth, mentioned that there had been some discussions already within FAC, which was looking at different ways of approaching the question.

Iceland suggested that NAMMCO should undertake a Gallup survey in member Countries to see how successful NAMMCO had been at making itself known and recognized.

Greenland underlined that it would be very beneficial for member countries to share information about their media material and their communication success (or mistakes).

14. ANY OTHER BUSINESS

Japan presented the outline of the Plan for the New Scientific Whale Research Program in the Antarctic Ocean, NEWREP-A (NAMMCO/24/20) and informed the meeting about the Meeting on the Sustainable Use of Marine Living Resources including Cetaceans, to be held in Tokyo in spring 2016.

Japan made the following statement:
As mentioned in Japan’s opening statement, in accordance with the review procedure agreed on at the IWC Scientific Committee, Japan developed the New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A) taking account of the Judgment of the International Court of Justice in March 2014 and started the research.

Objectives of the research are (1) Improvements in the precision of biological and ecological information for the application of the RMP to the Antarctic minke whale and (2) Investigation of the structure and dynamics of the Antarctic marine ecosystem through building ecosystem models. To achieve these objectives both lethal and non-lethal means are used appropriately.

Information to be obtained from the research plan will promote the sustainable use of the marine living resources. Japan would like to ask NAMMCO members’ support to this research.

In the meeting on sustainable use in Tokyo in December last year, participants shared their views on various issues in a constructive and proactive manner. Japan would like to express its appreciation to Norway, Iceland and Greenland for their participation. Again this year Japan will organize a meeting on Sustainable Use of the Marine Living Resources including Cetaceans to discuss strategies for the next IWC meeting. It will be held in Tokyo in mid-May this year. Japan will invite a representative from each IWC member state which supports the sustainable use of cetaceans. Japan would appreciate active participation to this meeting.

Comments
The Council noted this information and the Chair thanked Japan for its presentation.

15. CLOSING ARRANGEMENTS

15.1 Press Release

The General Secretary presented the draft press release prepared by the drafting group (Geneviève Desportes and the journalist Stine Leth Nissen) and reviewed by the HoDs, Nette Levermann (Greenland), Guðni M. Eiríksson (Iceland) and the Secretariat.

Council **approved** the press release (Appendix 7). The text was distributed to Council, meeting participants, range state governments, national and international media and was posted on the NAMMCO website and Facebook site.

15.2 Next meeting and closing of meeting

The next meeting will be hosted by Greenland at a venue to be determined.

Greenland was pleased to host the meeting celebrating the 25-year Jubilee of the organisation, especially since the agreement was signed in Nuuk on April 12, 1992. Amalie Jessen announced that the date would likely be postponed to April to encompass the day when the Agreement was signed. She underlined that Greenland sees NAMMCO as an adult organisation, which, besides developing itself into a well-functioning organisation, had also achieved many accomplishments in various domains during this 25 years.

The Chair of Council thanked all delegates, participants and the Secretariat for a productive meeting, and declared the meeting closed.

Greenland thanked Ásta Einarsdóttir for her able chairing of the meeting.

The Report of the 24th Council Meeting of NAMMCO was adopted by correspondence on 15th March 2016.

Appendix 1 - List of participants

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Ms Jill Prewitt
Ms Charlotte Winsnes
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Appendix 2 - Agenda

1. OPENING PROCEDURES
   1.1. Welcome address
   1.2. Admission of Observers
   1.3. Opening statements
   1.4. Adoption of agenda
   1.5. Meeting arrangements
   1.6. Invited speaker presentation: Dr. Nicola Beaumont, Plymouth Marine Laboratory, UK.
   Title: "*Why do marine mammals need ecosystem-based management? And what have they ever done for us? An exploration of the ecosystem service approach to support the NAMMCO framework*".
2. FINANCE AND ADMINISTRATION
   2.1. Report of the Finance and Administration Committee
      2.1.1. Audited accounts 2015
      2.1.2. Communication and Outreach Strategy
      2.1.3. Performance review¨
      2.1.4. Amendments to Rules
         2.1.4.1. Amendments to RoPs of Council and Committees
         2.1.4.2. Amendments to Staff Rules
         2.1.4.3. Adoption of rules for Observers
      2.1.5. Budget 2016 and Draft Budget 2017
   2.2. Adoption of RoP for the Scientific Joint Working Group of NAMMCO and JCNB
   2.3. Other business
3. SCIENTIFIC COMMITTEE
   3.1. Report of the Scientific Committee
      3.1.1. Overall work in 2015
      3.1.2. Cooperation with other organisation
      3.1.3. Officers
      3.1.4. Other business
   3.2. Priorities and work Plan of the Scientific Committee in 2016-2017
   3.3. Other business
4. NATIONAL PROGRESS REPORTS
5. JOINT MEETING OF THE MANAGEMENT COMMITTEES
   5.1. Report of the Joint Meeting of the Management Committees
   5.2. Recommendations for requests for advice
   5.3. Other business
6. MANAGEMENT COMMITTEE FOR CETACEANS
   6.1. Report of the Management Committee for Cetaceans
   6.2. Recommendations for requests for advice
   6.3. Other business
7. MANAGEMENT COMMITTEE FOR SEALS AND WALRUSES
   7.1. Report of the Management Committee for Seals and Walrus
   7.2. Recommendations for requests for advice
   7.3. Update on EU sealskin ban and Inuit exemption
   7.4. Other business
8. HUNTING METHODS
   8.1. TTD Expert Group
   8.2. Report of the Committee on Hunting Methods
   8.3. Recommendations arising from the Committee
   8.4. Other business
9. THE JOINT NAMMCO CONTROL SCHEME
   9.1. Report of the Committee on Inspection and Observation
   9.2. Observation in 2015
   9.3. Observation planned in 2016
   9.4. Other business

10. Environmental questions
11. Marine Mammals as food resources
12. External relations
    12.1. Cooperation with international organisations
    12.2. ASCOBANS
    12.3. Other business
13. Information and communication
    13.1. Website
    13.2. Stock Status List
    13.3. Social media
    13.4. Flyers
    13.5. Scientific publications
    13.6. Other Business
14. Any other business
15. Closing arrangements
    15.1. Press release
    15.2. Next meeting

Appendix 3 – List of documents

Doc Reference	Title	Agenda item
NAMMCO/24/01	List of Participants	1.2
NAMMCO/24/02	Agenda	1.4
NAMMCO/24/03	List of Documents	
NAMMCO/24/04	Report of the Finance and Administration Committee	2.1
NAMMCO/24/05	Audited accounts 2015	2.2
NAMMCO/24/06	Budget 2016 and forecast budget 2017	2.3
NAMMCO/24/07	Report of the Scientific Committee	3.1 & 3.2
NAMMCO/24/08	Report of the Joint Meeting of the Management Committees	5.1
NAMMCO/24/09	Report of the Management Committee for Cetaceans	6.1
NAMMCO/24/10	Report of the Management Committee for Seals and Walrus	7.2
NAMMCO/24/11	Report of the Committee on Hunting Methods	8.1
NAMMCO/24/12	Report of Expert Group meeting on Assessing TTD	8.2
NAMMCO/24/13	Report of the Committee on Inspection and Observation	9.1
NAMMCO/24/14	Report of the NAMMCO observation scheme 2015 season and plans for 2016 season	9.2 & 9.3
NAMMCO/24/15	Proposed amendments to the RoP for the Council	2.4
NAMMCO/24/16	Proposed amendments to the RoP for the Management Committees	2.4
NAMMCO/24/17	Proposed amendments to the RoP for the Scientific Committee	2.4
NAMMCO/24/18	Proposed amendments to the RoP for the Committee on Hunting Methods	2.4
NAMMCO/24/19	Proposed amendments to the RoP for the Committee on Inspection and Observation	2.4
NAMMCO/24/20	Outline of the Japanese New Scientific Whale Research Program in the Antarctic	15
NAMMCO/24/21	Proposed for amendment to the Staff Rules	2.5
NAMMCO/24/22	Procedures & rules for Observers attending NAMMCO meetings	2.6
NAMMCO/24/23	Report from the Marine Mammal and Food Security Project	11
NAMMCO/24/24	Observers' report	12.1
NAMMCO/24/25	Proposed Communication and Outreach Strategy	13
NAMMCO/24/26	NAMMCO Flyer 2015	13.5
NAMMCO/24/27	*No document*	
NAMMCO/24/28	Proposal for NAMMCO Performance Review	14
NAMMCO/24/29	RoP for the Scientific Joint Working Group of NAMMCO and JCNB	2
NAMMCO/24/NPR-F	National Progress Report Faroe Islands	4
NAMMCO/24/NPR-G	National Progress Report Greenland	4
NAMMCO/24/NPR-I	National Progress Report Iceland	4
NAMMCO/24/NPR-N	National Progress Report Norway	4
NAMMCO/24/NPR-C	National Progress Report Canada	4
NAMMCO/24/NPR-J	National Progress Report Japan - compilation	4
NAMMCO/24/NPR-R	National Progress Report Russian Federation	4

Appendix 4 - Opening statements and welcome address

WELCOME ADDRESS BY THE CHAIR OF NAMMCO COUNCIL

Delegates, Observers and Guests

It gives me great pleasure to open the 24th Annual Meeting of NAMMCO here in Oslo. I would like to express my gratitude to the Secretariat, for carrying out good work in preparing this meeting and providing us with excellent meeting facilities.

Last year brought about big changes in the Secretariat. We said goodbye to our former General Secretary, Dr Christina Lockyer, who had been with us for 10 years, and welcomed our new General Secretary Dr Geneviève Desportes. Many of you may know Geneviève as she has been greatly involved in the Scientific Committee of NAMMCO that she chaired from 2005 to 2009. And you will know that she is buzzing with enthusiasm, energy and ideas when it comes to NAMMCO. The work of the Secretariat will thus continue efficiently under the leadership of our new appointee. I welcome Geneviève to this her fist NAMMCO Council Meeting as the General Secretary of NAMMCO. I am also very pleased to be able to announce that Jill Prewitt will be continuing as NAMMCO Scientific Secretary for - at least four - years more and I would like to thank her for her very good work.

I would also like to thank the outgoing chair of the Scientific Committee, Thorvaldur Gunlaugsson from Iceland for his good work, and welcome the incoming chair, Dr Tore Haug from Norway. I wish him, and the Scientific Committee under his guidance, all the best.

In February last year we received sad news when we heard about the passing away of our dear friend Dorete Bloch. Dorete was involved in many aspects of NAMMCO since the beginning and was member of the SC from 1992 until 2009. I did not know Dorete personally, but from what I have heard she was a big personality of NAMMCO and quite a character. She is remembered for her warmth and not the least her endless hospitality and good food.

I am particularly pleased to open this annual meeting, because it concludes a year, 2015, where activities have been booming in NAMMCO.In March, the NAMMCO-JCNB Joint Working Group on narwhal and beluga finalised a new and unique Catch Allocation Model for the meta-population of narwhals shared by Greenland and Canada. This Model represents a big step forward in this very complex assessment situation. NAMMCO is looking forward to follow its implementation.

The North Atlantic Sightings Survey was completed during summer. The extension part, allowing for a synoptic coverage of minke whales in the Central North Atlantic, was finally carried through, thanks to funding from the Norwegian Ministry of Foreign Affairs, and - not the least the flexibility of the survey organisers in Greenland and Norway, which were willing to change their plans at the very last stage for accommodating the late funding confirmation. I would also like to thank and commend the Secretariat for its dedicated work in finding a solution for the implementation of NASS 2015. NASS 2015, occupied many weeks for many scientists, ships and plane crews in NAMMCO countries. Although the weather gods were not the most generous with calm and clear seas, lots of good surveys were carried out. NAMMCO is looking very much forward to the new abundance estimates.

In October, a very successful symposium on the Impacts of Human Disturbance on Arctic marine mammals was held. It´s results and recommendations are important for NAMMCO and the conservation of marine mammals in the Arctic and confirm NAMMCO‘s involvement in Ecosystem Approach to Management.

In November, the Expert Group on Assessing Time-to-Death Data from Large Whale Hunts met for the second time. The results of the meeting confirm the success of NAMMCO in improving hunting methods, and thereby animal welfare. We are very pleased that Alaska, Canada and Japan choose to present their killing data to NAMMCO and look forward for continuing this beneficial cooperation.

On the basis of all these activities, it is therefore my great pleasure to welcome you all to this meeting, NAMMCO Member Countries, Delegates, Observer Governments, Organisations and the Secretariat. I am looking very much forward to these two days with you, and to the good presentations and discussions we will have.

FAROE ISLANDS – OPENING STATEMENT

Madam Chairman, Delegates, Observers, ladies and gentlemen

It is a great pleasure to be here in Oslo for the 24th Annual Meeting of NAMMCO.

We would like to thank our host and everyone in the secretariat for preparing the meeting and making us feel so welcomed. We look forward to work with the new General Secretary and all her staff during this meeting.

We in the Faroes regard NAMMCO as a very important organisation in managing marine mammals in the North Atlantic Ocean. We in the Faroes firmly believe that marine mammals should be managed in a sustainable way and through regional cooperation. Furthermore, we in the Faroes believe that the management should be based on full transparency and the best available scientific advice. This should happen by sharing information and by the development of the best possible practice.

We in the Faroes believe that NAMMCO fulfils all of these requirements, which therefore places NAMMCO very close to our hearts in the Faroes. We believe that we should further strengthen the outreach of NAMMCO and promote NAMMCO as a successful organisation managing marine mammals in the North Atlantic.

Madame Chairman,
We come here in good faith and good spirit and we look forward to be working with all of you in what promises to be yet another good annual meeting.

Thank you for your time and consideration.

GREENLAND – OPENING STATEMENT

Mrs Chair, Ladies and Gentlemen,

The Need for an Information and Communication Strategy for Sustainable, Responsible Management of Whaling and Sealing and Food Security:

NAMMCO is a responsible international science-based management organisation for marine mammals that will celebrate its 25 years Jubilee next year. Greenland is looking forward to organise this important event with you all back in Greenland where it all originally started.

Since the establishment, NAMMCO has always strived to work in a transparent way. Various Committees and member countries have not been shy to say what had to be said and done so that a species would be managed in a sustainable way. Including when our shared marine mammal species needs to undergo scientific assessment and it being very costly and the animals are distributed in very remote and isolated areas bigger than the size of Europe.

Greenland is therefore thankful and proud that TNASS 2015 was able to be organized with such a high level of achievement. We are looking forward to seeing the final recommendations.

Greenland also sees fruitful and constructive results in the work of the Management Committees and the two technical Committees. However, Greenland sees a need for more focus and continual follow-ups of the many recommendations provided to member countries. Greenland also notes that NAMMCO needs to coordinate on a larger scale with non-member neighbouring countries that we share stocks with. Especially when the demand for ecosystem based management is increasing.

All the work we already have achieved and the many coming activities to be solved needs to be communicated in a clear voice not only to the member and observer countries, but also to the general public. Therefore, NAMMCO needs to focus on its public relations. Greenland is looking forward to an active participation in the process that has been started with a strengthening of the information and communication strategy of NAMMCO.

Unfortunately, no other relevant countries in the North Atlantic area have joined the NAMMCO Agreement since its beginning in 1992. Greenland as always would like to invite to a tighter and more direct cooperation on shared stocks in the North Atlantic.

As it is known, the utilization of marine mammals outside the NAMMCO countries is often substance for emotional discussion. Probably because of this marine mammals are ignored as a common food resource. Greenland wish to continue its engagement in the promotion of increased knowledge of the many possibilities marine mammals have as a food resource. The aim is to develop and finalize a communicational tool that can be used in promoting for a normal concept of marine mammals as a healthy, ecologically, abundant, underutilized food resource to the public and in other relevant fora.

We are engaged in the debate of food security to highlight that marine mammals is an under-estimated protein source that could benefit the worlds growing human population and the shortage of food in the developing countries.

The key word concerning management for NAMMCO is sustainable use. NAMMCO does not categorize member countries into certain groups of people or categorize the hunts into aboriginal, small-type whaling or commercial whaling or sealing. We stand behind this way of managing marine species.

The final WTO conclusions and the effects of the EU sealskin ban are one example of lack of respecting the facts and realities. The Government of Greenland have recently been forced to make drastic decisions in trying to adjust the Greenlandic sealing industry. The situation is serious and the survival of the sealing industry in Greenland can be a matter of time, even though the hunt off course will continue. The so-called Inuit exemption is not functioning.

Greenland is committed to finding ways to enhance the capacity of NAMMCO as a regional and international science-based management organisation. This requires a strong Scientific Committee that can develop management procedures for all our marine mammals.

I will therefore invite the Council to discuss which steps NAMMCO should take in the next 5-10 years. Only by dialogue and cooperation within the Council, can we build on the capacity in NAMMCO to the benefit of all North Atlantic peoples.

Thank you for your attention.

NORWAY – OPENING STATEMENT

Madam Chair, Delegates, Observers and Guests - Dear friends

Welcome to Norway and welcome to Oslo and welcome to our 24th meeting!

We are happy to see that NAMMCO, over the last years, has strengthened its position as a well-functioning management body that generates high quality advice to its members, observers and other interested parties.

Through NAMMCO we have created an instrument and an environment for researchers and managers that enable us to fulfill our need to cooperate and thereby meet our international obligations under the Law of the Sea.

Nevertheless we must ask ourselves if the scope and quality of our organisation meet our future needs, and enable us to strengthen both the understanding and acceptance of our way of life in the international community.

NAMMCO's work on animal welfare and hunting methods is a prime example of high quality advice that hands-on management needs. I would like, once again, to commend the Committee on hunting methods. The relevance and quality of its work are reflected in the fact that all whaling nations now use NAMMCO for guidance in this field.

It is Norway's goal to secure and further develop our organisation in this respect. We need to be at the forefront of what constitutes relevant and reliable knowledge.

Progress reports have also this year been submitted by Canada, Japan and Russia. This is a sign of strengthening cooperation between our countries that Norway very much welcomes. And we would like to repeat our wish for a closer cooperation between these countries and NAMMCO.

I look forward to and wish us all a fruitful meeting.

ICELAND – OPENING STATEMENT

Madam Chair, Delegates, Observers, Ladies and Gentlemen.

It is with great pleasure that the Icelandic delegation attends the 24 th Annual Meeting of NAMMCO here in Oslo.

First I would like to welcome our new General Secretary Dr Genevieve Desportes to this meeting. I would also like to express our gratitude to the Secretariat that has done a good work in preparing this meeting and providing us with excellent meeting facilities

Iceland values its membership in NAMMCO and the close cooperation between the NAMMCO countries regarding marine resources that is of great importance to us.

As you know, Iceland resumed its commercial whaling in 2006 after a 20 year break. All commercial whaling ceased in 1986 following the decision by the International Whaling Commission (IWC) on the so-called moratorium on commercial whaling. This year's sustainable catch limits for minke and fin whales followed the advice of the Marine Research Institute (MRI) in Iceland and the Scientific Committee of NAMMCO for a catch of 154 fin whales and 229 minke whales.

Iceland places great emphasis on sustainable management of all living marine resources. Sustainable management of marine mammals is not only important to Iceland but it is crucial for all of the NAMMCO member states. The main basis for Iceland's economic welfare has been utilising the living resources of the sea and therefore the international co-operation within NAMMCO in this field is very important. The work done within NAMMCO has made valuable contributions to the conservation and sustainable management of marine mammals, not least through the work of the Scientific Committee.

The 6th North Atlantic Sightings Survey (NASS) was conducted in the summer of 2015. These surveys constitute the single most important basis for scientific assessments and advice concerning conservation and management of whale stocks in the NAMMCO area. As in previous surveys, funding was mostly achieved through national budgets but coordination of the survey was under the auspices of NAMMCO. In 2015, a considerable additional coverage was achieved though NAMMCO facilitated funding. For this we are particularly grateful to the TNASS Steering Committee and Norwegian authorities in particular. Although various obstacles were encountered during the planning phase, all pieces fell in place at the last minute and the survey was conducted successfully.

Thank you.

CANADA – OPENING STATEMENT

Madame Chair, Distinguished delegates, fellow observers.

Canada is pleased to participate as an Observer in this 24th meeting of the NAMMCO Council. We would like to take this opportunity to thank our Norwegian colleagues for hosting this meeting and to the Secretariat for doing such a good job in organizing this meeting.

NAMMCO continues to be an organisation that is well-known for providing strong and impartial science advice on marine mammals and has shown a dedication to the sustainable management of marine mammals.

Canada is also committed to promoting the sustainable use of living marine resources, including marine mammals. We have subsistence harvests of bowhead whales, beluga and narwhal which take place in communities in Northern Quebec, Nunavut and the Northwest Territories.

Canada continues to work on ensuring that harvests of marine mammals are based on the best available scientific and traditional information in order to provide long-term social and economic benefit to the small communities throughout these regions. Canda continues to recognize the strong value which NAMMCO provides to the conservation of these species.

Canada recognizes the importance of collaborating with our international partners on both the science and management of these species and maintaining our close relationship with NAMMCO participants to ensure a coordinated approach to research and conservation.

As you may know, the Department of Fisheries and Oceans Canada has a new Minister from the North, the Honourable Hunter Tootoo who is well aware of harvests of marine mammals .

Canada is of course looking forward to continued bilateral engagement with NAMMCO members within other fora, such as Convention on International Trade of Endangered Specimens of Wildlife Fauna and Flora (CITES) and the Joint Commission on Management of Narwhal and Beluga (JCNB).

We are looking forward to positive discussions over the next two days.

JAPAN – OPENING STATEMENT

The delegation of Japan would like to thank the Government of Norway for its hospitality and the NAMMCO Secretariat for the meeting arrangements. We recognize that the NAMMCO has achieved a great success in the sustainable management of living marine resources including cetaceans, and we are honoured to attend the meeting and contribute to the discussion as an observer. It is obvious that Japan and the NAMMCO share the goal of the sustainable use of living marine resources. We believe that the cooperation between Japan and the NAMMCO allows us to efficiently utilize knowledge and experiences for managing resources in a sustainable manner.

In accordance with the review procedure agreed on at the IWC, Japan developed the New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A) duly taking account of the Judgment of the International Court of Justice in March 2014 and started the program in December 2015. Japan believes than scientific information is the most important tool we can rely on in promoting the sustainable use and management of whale resources at the IWC, which, to our deep regret, does not seem to be working towards the very objective it was created for. Scientific information collected by Japan has contributed to the discussion at the Scientific Committee of the IWC, and we believe this is the case also at NAMMCO.

Japan has been engaged in the intersessional discussion, including the participation in the IWC expert workshop held in Greenland in 2015, to resolve these issues for the next revision of aboriginal subsistence whaling quotas in 2018. While Japan observes such positive developments at the NAMMCO during last year, it recognizes the complex range of issues still unresolved, such as how to standardize the needs statements and interests based on the local consumption principle and those based on the commercialism. Japan is willing to commit itself to the discussion to resolve these issues under the framework of IWC, and believe that the cooperation among member countries to resolve these long-term issues will positively affect the situation inside and outside the IWC.

On the other hand, it is regrettable that Japan's proposal on small-type coastal whaling has not yet been adopted by the IWC. At the IWC 65, IWC members that opposed Japan's proposal did not provide any sound scientific reasons for their positions, while stating the unconditional need to maintain the moratorium on commercial whaling and their unconditional opposition to commercial whaling. During the intersessional period, through the IWC website, Japan asked the members further clarification for their reasons of opposition for the purpose of highlighting their lack of any sound reasoning. The responses provided, however, simply repeated the same arguments these members made at IWC 65. NAMMCO and Japan undoubtedly share the same position that whale resources should be subject to sustainable use. Japan intends to continue this approach ahead of the IWC 66 meeting in Slovenia, and hopes to work with the parties in NAMMCO to achieve this end.

Finally, it is Japan's view that all these issues are inter-related and our unity is a vital force to resolve them and to promote sustainable use of living resources including marine mammals. Japan plans to hold a meeting on the Sustainable Use of Marine Living Resources including Cetaceans in Tokyo in May 2016, where our friends gather to discuss detailed strategies for the upcoming CITES CoP 17 and IWC 66 meeting. Japan wishes to enhance the cooperation through such valuable opportunities.

Thank you.

THE RUSSIAN FEDERATION – OPENING STATEMENT

Dear NAMMCO Chair and Vice-Chair, NAMMCO countries, members of the NAMMCO Secretariat, delegates, colleagues, observers, ladies and gentlemen,

It is a great honor for me to represent the Russian Federation as observer at the 24th meeting of the NAMMCO Council.

On behalf of the Russian Federation, I would like to thank the NAMMCO Secretariat and the Norwegian authorities for hosting this annual meeting in Oslo Thank you very much for the excellent arrangements, and for the preparations for this meeting.

I would like to commend the excellent work undertaken by different NAMMCO bodies, especially the NAMMCO Secretariat and the Scientific Committee including its different working groups during the intersessional periode. The Russian Federation would also like to note that NAMMCO has very good cooperation with different countries not only observer countries, and different North Atlantic organisations and Commissions like NAFO, NEAFC, ICES and IWC.

NAMMCO management and scientific advice is built on a strong ecosystem approach, taking into consideration the precautionary principle. Based on many years of scientific results and sighting surveys marine mammal stocks have been and can safely be exploited. The results of the last North Atlantic Sighting Survey undertaken in 2015 will be part of this.

I would like to tell you once more that the Russian Federation is very interested in a long term cooperation with NAMMCO, and I hope that this cooperation will be develop.

We have a full agenda ahead of us during this week, and I am looking forward to a successful and productive meeting.

Thank you very much for your attention.

SECRETARIAT OF THE INTERNATIONAL WHALING COMMISSION – OPENING STATEMENT

The IWC is an Inter-governmental organisation with a membership of 88 Contracting Governments. It was established under the International Convention for the Regulation of Whaling (1946) and its purpose is to provide for the conservation of whale stocks and the management of whaling.

The Commission is active in setting catch limits for subsistence whaling and in developing conservation and recovery measures for stocks which have previously been over-exploited. In addition, through the work of its Scientific and Conservation Committees, the Commission studies a broad range of environmental factors affecting the health and habitat of cetaceans. The Commission's work and studies extend across all ocean basins, and from the tropics to the Polar Regions. Several IWC initiatives have commonalities with NAMMCO's objectives on the conservation, management and study of marine mammals in the North Atlantic.

2014 IWC Workshop on Impacts of Increased Marine Activities on Cetaceans in the Arctic
In March 2014, at the suggestion of the Government of the United States, the IWC convened a workshop to consider how the growing anthropogenic uses of the Arctic Ocean are relevant to cetaceans. The workshop focussed upon human activities related to oil and gas exploration, commercial shipping and tourism as well as likely changes to the ecosystem as a result of climate change.

The workshop was successful in bringing together representatives of many key stakeholders working on Arctic affairs relevant to cetaceans. The workshop's conclusions and recommendations highlighted the over-arching requirement for collaboration with inter-governmental organisations including in particular the Arctic Council, the International Maritime Organisation and NAMMCO. This recommendation for collaboration on cetacean related issues was echoed by the Arctic Council's PAME working group at its meeting last week in Stockholm.

2015 IWC Expert Workshop on Subsistence Whaling
The IWC regulates subsistence whaling undertaken by four of its Contracting Governments. In 2014 the Commission adopted Resolution 2014-1 which recognised the need to regulate subsistence whaling through a more consistent and long term approach. Following from this, and at the invitation of the Government of Greenland, the Aboriginal Subsistence Whaling Working Group organised an expert workshop to examine options for achieving a more consistent approach.

During the workshop native hunters provided first-hand accounts of their respective hunts, and the workshop received expert input from a range of invited experts from the anthropogenic sciences and international human rights law.

The workshop made an extensive series of recommendations, many of which examined possibilities for improving the Commission's process and timelines for decision making, and for developing its approach to receiving statements of subsistence need. These recommendations will be transmitted to the IWC, via the Aboriginal Subsistence Whaling Sub-committee when it next meets in October 2016.

Conclusion
The two examples above are illustrative of the opportunities for collaboration between NAMMCO and the IWC. Other synergies are present in development of whaling management procedures, on consideration of hunting safety and welfare, on methods for population assessment and on scientific research relating to habitat and health issues.

Appendix 5 - Summary of the presentation by the invited speaker

"Why do marine mammals need ecosystem-based management? And what they ever done for us? An exploration of the ecosystem service approach to support NAMMCO framework"

Dr Nicola Beaumont
Plymouth Marine Laboratory, Plymouth, UK

Dr Beaumont's presentation covered four key areas. Firstly, an introduction to the Plymouth Marine Laboratory and specifically the Science and Society group; secondly, an introduction to Ecosystem Based Management (EBM), focusing on why EBM is relevant to marine mammals; thirdly, she introduced the concept of Ecosystem Services, using this to explore the full range of benefits which humans receive from marine mammals; and finally she discussed how the ecosystem service approach could be used to support Ecosystem Based Management and the NAMMCO framework.

The ecosystem approach was first coined in the early 80s, and was formally accepted at the 1992 Rio Earth Summit in response to declining stocks and ocean health. It is an underpinning concept of the Convention on Biological Diversity and has been defined as 'A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way'. EBM is not concerned with managing or manipulating ecosystem processes, rather it is tightly linked to the governance of human behaviour which impacts the marine environment. EBM is a key aspiration in marine policy and management across the world, including Europe, Antarctica, the United States, and Australia, for example in the Marine Strategy Framework Directive; Water Framework Directive; Convention for Biological Diversity; Marine Spatial Planning; Helsinki Convention, Barcelona Convention and the Australia Great Barrier Reef management plan.

There are a number of guides to EBM available, including the UNEP Introductory Guide, and these tend to encourage 7 key steps:

1. Define Spatial Boundaries. This includes identification of the relevant ecosystems, and their boundaries and characteristics; recognising the connections within and across ecosystems and other marine sectors
2. Define Objectives: Agree objectives (ecosystem factors and stakeholder groups), including humans and governance regimes.
3. Undertake Research: including on cumulative impacts, future stressors and humans
4. Monitor progress: including establishment of sustainability indicators, to inform future pro-active management
5. Enforcement: any management plans needs an accompanying enforcement regime.
6. Include Uncertainty: embrace change through the application of Adaptive Management and the Precautionary Principle and be aware of uncertainty at all stages.
7. Utilise an Ecosystem Services Approach

The management of marine mammals benefits particularly from EBM due to the profound interactions between marine mammals and their supporting ecosystem, for example they are dependent on ecosystem productivity and health, and equally their utilisation by humans has an effect on the ecosystem. In addition, marine mammals have a global reach with vast spatial distributions, including to depth, and with no enforceable boundaries; unclear ownership and cultural use patterns; their habitat is separate from humans making it harder to manage; there is a paucity of data; and finally, unlike the terrestrial equivalent one marine area may have many uses (fish, renewables, C sequestration, marine mammal habitat etc.). All these factors mean EBM is essential to ensure the sustainable management of marine mammals, and it is clear from the NAMMCO literature that this is a long term key aspiration within NAMMCO.

Unfortunately practical examples of EBM are rare, there are often multi-fish or multi-species examples, but these rarely include human activities or broader environmental benefits. Again unfortunately, when there are multiple uses of a marine space prioritisation of user is often based on monetary and commercial uses. Biological and non-commercial "uses" are often particularly difficult to communicate, and this is where the Ecosystem Services approach can be useful to raise the profile of these previously under-represented benefits. Ecosystem Services can be defined as "the aspects of ecosystems utilised (actively or passively) to produce human well-being" (Fisher et al. 2009), and include a range of environmental benefits such as fisheries, carbon sequestration and recreation. These can be valued in monetary terms enabling their direct comparison with commercial uses, but in some cases simply identifying these benefits can be enough to raise their profile and ensure they are properly represented in policy and management decisions.

Ecosystem services relating to marine mammals are extensive and varied, and include:

1. Food provision, with whale consumption undertaken in Japan, Norway, Iceland, Faroe Islands, United States, Canada, Greenland, Siberia, and the Caribbean Sea.
2. Carbon sequestration is the service of the balance and maintenance of the chemical composition of the atmosphere and oceans by marine living organisms, and is mediated by marine mammals, for example as documented by "the Impact of Whaling on the Ocean Carbon Cycle: Why Bigger Was Better A. J. Pershing, L. B. Christensen, N. R. Record, G. D. Sherwood, P. B. Stetson, PLOS One, August 26, 2010"
3. Recreation and tourism, for example, worldwide whale watching generates about $2.1bn per year (International Whaling Commission (IWC), 2009)and 13 million people went to sea to watch cetaceans in 119 countries in 2008
4. Cultural heritage and identity, including religion, folklore, painting, cultural and spiritual traditions, for example whale hunting is fundamental to a way of life e.g. since Iceland was settled and with Norwegian traditions in rock carvings and written accounts to 9th century, and marine mammals are integral to art, music, and literature across the ages.
5. Cognitive, including research and education, for example university and research, including historical context e.g. UK research and development in the marine sector to be £292 million plus education and training was valued at £24.8 million. This is in addition to the information 'held' in the natural environment which can be adapted, harnessed or mimicked by humans, for technological and medicinal purposes, for example an enzyme for low temp washing powder was found in the deep sea degradation of whale carcass and dolphins have been used for navigation and even finding mines.
6. Non-Use value which we derive from marine organisms without using them, for example Hageman (1985) and Loomis and White (1996) estimated the average household's willingness to pay to ensure the continued survival of various sea mammals: £19 and £46 annually, depending on the sea mammal, so with 2.4 million households in Norway this extrapolates to £45.6 million – £110.4 million per year.

These six ecosystem services are provided by marine mammals in their own right and can be quantified and valued (monetarily and non-monetarily). However, in addition, it is critical to keep in mind the influence which marine mammals have over a wide range of other ecosystem processes, or "supporting services". These include: nutrient movement; maintenance of biodiversity and balance, for example through scoop feeding on seabed and spatial heterogeneity; provision of biologically mediated habitat; and contributions towards resilience and resistance of the system, this is the extent to which ecosystems can absorb recurrent natural and human perturbations and continue to regenerate without slowly degrading or unexpectedly flipping to alternate states. If we can value these ecosystem services (monetarily and non-monetarily) it can help to influence and inform the policy agenda, showing marine mammals have varied and high values in both their own right and in supporting terms. This enables us to start to understand the comparable importance of these species, and potential impacts and stressors upon them, and also to organise research programmes, for example to highlight linkages, indicators, key stressors, data gaps etc.

So in conclusion it is considered that both an Ecosystem Service approach and Ecosystem Based Management can play a substantial role in supporting NAMMCO. The application of an Ecosystem Service assessment of marine mammals can enable the communication of the broad range of marine mammal benefits to a wide range of stakeholders, and provide clarity of both the role of marine mammals in the ecosystem, and also the impact of changes in the ecosystem on marine mammals. This clarity of the role of marine mammals will enable negotiation within wider governance regimes, and can also support the identification of indicators and enhance monitoring regimes. Finally, ES and EBM approaches can be used to shape the future research agenda ensuring a proactive and strategic approach to future management.

Appendix 6 - Audited accounts for 2015

All figures in NOK

INCOME AN EXPENDITURE

Income	
Contributions	4,292,323
Interest	32,922
Book sale	4,643
Employers Tax	227,690
NASS	1,489,294
Total income	**6,046,872**
Expenditure	
Staff related costs	2,874,213
Rent of premises	223,855
Meetings	11,554
Travel and subsistence	295,528
Communications/Data & office supplies	129,206
Information, incl subscription	172,350
Accounts & auditing	99,072
Observation Scheme	174,508
Other expenses	10,701
Scientific Committee	52,450
NASS	1,489,294
Hunting Committee	97,769
Disturbance symposium	13,532
Total expenditure	**5,644,032**
OPERATING RESULT	**402,840**

BALANCE

Assets	
Outstanding claims	295,795
Bank deposits	8,573,037
Total assets	**8,868,832**
Equity	
Distributable equity	289,291
General Reserve	600,000
Restricted equity	118,816
Total equity	**1,008,107**
Liabilities	
Other	7,661,454
Creditors	146,472
Employers tax	52,799
Total liabilities	**7,860,725**
TOTAL LIABILITIES AND EQUITY	**8,868,832**

Appendix 7 - Press release

NAMMCO - 24th Annual Council, Oslo, February 11, 2016

Whales and seals: Management matters!

The increasing stocks of narwhal, beluga and walrus are a clear result of sound and science-based management, following advice from NAMMCO, the North Atlantic Marine Mammal Commission.

This was one of several positive results and initiatives presented to the Council of NAMMCO at its annual meeting in Oslo on February 10-11.

However, the NAMMCO Council recognises that increased human activities (shipping, mining, etc.) in the Arctic may threaten the ecosystem. The parties were particularly concerned by a large scale iron-ore project (Mary River Project operated by Baffinland Iron Mines Corp) which includes year round shipping through some of the most important areas for narwhal, beluga and walrus. The increased shipping activities and noise disturbances could lead to the marine mammals abandoning these areas. This could have severe consequences for local communities, both in Canada and Greenland.

Also, climate change carries serious consequences for marine mammals. This can already be seen from the decreasing blubber thickness of harp seals and minke whales in the Barents Sea, and the changes in geographical distribution of minke whale and fin whale around Iceland.
Therefore, effective ecosystem-based management matters.

For more information concerning the Council Meeting outcome, see below (Annex to Press Release).

Annex to Press Release
NAMMCO - the North Atlantic Marine Mammal Commission - is an international body for cooperation on the conservation, management and study of marine mammals in the North Atlantic. The North Atlantic Marine Mammal Commission held its 24th Council meeting from 10 – 11 February 2016, in Oslo, Norway. The member countries of NAMMCO, the Faroe Islands, Greenland, Iceland and Norway again confirmed their commitment to ensuring the conservation and sustainable use of marine mammals through active regional cooperation and science-based management decisions.

The Governments of Canada, Denmark, Japan and the Russian Federation were represented by observers at the meeting, as well as other international governmental organisations within the fields of fisheries (Northeast Atlantic Fisheries Organization, NAFO; North East Atlantic Fisheries Commission, NEAFC) and whaling (International Whaling Commission, IWC) and conservation (IWMC World Conservation Trust).

Key events and conclusions from the meeting included the following:

- **Ecosystem-Based Management of Marine Mammal**

Dr. Nicola Beaumont of the Plymouth Marine Laboratory talked about marine mammals in the framework of an ecosystem approach. She underlined the importance of assessing the full array of services they provide to the ecosystem as well as their interdependencies with the other components of the ecosystem. Their immense importance to nature and human beings made it essential to work toward their conservation. She was impressed to see how NAMMCO had applied an ecosystem approach since its very beginning.

- **Improving Hunting Methods**

NAMMCO's 2nd expert group meeting to assess killing data in the large whale hunts in the member countries, and also in Japan, Canada and USA confirms positive development in quick and efficient kills. The introduction of the explosive grenade and the continuous development of hunting methods is improving animal welfare. The number of animals killed instantaneously has increased significantly in many hunts.

- **Inspection and Observation of Hunts**

NAMMCO operates an international observation scheme to monitor whether national legislation and decisions made by the Commission are respected. Observers are appointed to report on hunting activities in member countries. The scope for 2016 is minke whaling in Norway.

- **Whale Surveys**

New surveys were carried out in the NAMMCO member countries in 2015 to update knowledge on abundance and distribution of cetaceans in the North Atlantic. Although the weather was not always cooperative in all areas, the amount of area covered by the surveys and the number of sightings was good, and new abundance estimates are expected for fin, humpback, common minke and pilot whales.

- **Shared Resources between Canada and Greenland**

Council highlighted the good work and cooperation between NAMMCO and the Joint Commission on Narwhal and Beluga, which has developed a catch-allocation model that allows managers to assign catches from the different narwhal stocks that are shared by Canada and Greenland.
Council welcomes this new methodological development for this complex management situation. The development and implementation of the allocation model is considered a step forward and could potentially be applied in many situations where migratory populations are exploited in several areas under various jurisdictions.

- **International Cooperation**

With climate change and unforeseeable consequences for marine mammals, it is essential to increase the cooperation between organisations dealing with marine mammals. NAMMCO aims therefore at strengthening its cooperation with the Arctic Council, the International Council for the Exploration of the Sea (ICES), the International Whaling Commission (IWC) and Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) and any other international instrument which may require the advice of NAMMCO.

- **Scientific Advice**

The best scientific evidence forms the basis of management advice in NAMMCO. Through the Scientific Committee, many specialist topics are addressed by Expert Working groups. During 2016, topics to be dealt with include stock assessments of coastal seals, fin, minke and humpback whales, as well as by-catch issues. The Scientific Committee has also been tasked to assess the impact of the Mary River Project.

SECTION 2 MANAGEMENT COMMITTEES

REPORT OF THE JOINT MEETING OF THE MANAGEMENT COMMITTEES

9 February 2016, Oslo, Norway

1. CHAIRMAN'S OPENING REMARKS

The Chair, Ulla Svarrer Wang (Faroe Islands), welcomed the members and observers to the Joint Session of the Management Committees.

2. ADOPTION OF AGENDA

The agenda was adopted without revisions (Appendix 1).

The Chair drew the attention of the JMC to the list of documents (Appendix 2, page 77).

3. APPOINTMENT OF RAPPORTEUR

Jill Prewitt from the Secretariat acted as rapporteur, with help from participants as needed.

4. ENVIRONMENTAL QUESTIONS

4.1 Disturbance symposium

The Symposium organized by NAMMCO and titled "Impacts of Human Activities on Arctic Marine Mammals" which was held this past October 2015 in Copenhagen. This Symposium was organized to address requests from Greenland and the NAMMCO Council to the Scientific Committee (R-2.6.3 and 3.4.9... *provide advice on the effects of human disturbance, including noise and shipping activities, on the distribution, behaviour and conservation status of belugas, narwhals (and walrus) particularly in West Greenland*.)

The organizer's report was available to the Joint MC, however the Chair reminded the MC that although they will consider its contents, the report was not yet available to the Scientific Committee at their meeting in November 2015. However, Mads Peter Heide-Jørgensen, SC Convenor for the Symposium, informed the SC orally about a few issues of concern, in particular the Mary River mining project. Based on this, the SC noted that these industrial activities would likely have impact on the hunting of several marine mammal species in the area.

Although the SC will provide their comments later, the report highlights a number of concerns for the potential for impacts from human activities on many marine mammals in the Arctic, specifically for belugas, narwhals, and walrus, but possibly other marine mammals such as bowhead whales and ringed seals.

The MC noted the report, and acknowledges that there appear to be reason for concern for human activities negatively affecting marine mammals in the Arctic. Therefore, the MC asked the SC to fully consider the report at their 2016 meeting and provide comments in their next annual report.

4.2 Mary river project – Baffinland

Mads Peter Heide-Jørgensen, from the Greenland Institute of Natural Resources, and one of the organizers of the Disturbance Symposium, provided an update on a specific project that was brought up at the Symposium. Concerns were raised at both the Symposium and the SC meeting about a mining project currently under development in the Canadian Arctic, the Mary River Project operated by Baffinland Iron Mines Corp, that continues expanding, currently with the prospect of shipping 10 months of the year through the heavy pack ice in Baffin Bay. It will have severe consequences for the large numbers of marine mammals using the area in summer and winter, not only narwhals ut also belugas, bowheads, ringed seals and walruses, with unpredictable consequences for the populations themselves but also for the accessibility to hunting and/or its sustainability.

Initial approval was obtained in December 2012 for shipping 18 million tons of iron ore from a port in northern Foxe Basin through Hudson Strait. But due to the high costs of this operation approval was obtained in 2014 for shipping a smaller amount (4.2 mill tons) of iron ore from Milne Inlet on the east coast of Baffin Island through Baffin Bay during the open water season. A new alternative proposal has been prepared involving shipment of 12 million tons iron ore through Eclipse Sound and Baffin Bay for 10 months including winter icebreaking in the Baffin Bay.

The area in Milne Inlet that is planned to be the port of the ore shipping activity is located at one of the most important summering grounds for narwhals. Narwhals are known to be skittish, highly sensitive to human activities and easily disturbed by approaching boats, even in areas without hunting. Studies at the ice edge in Lancaster Sound have demonstrated that narwhals react at long distances to underwater noise from vessels, with and without icebreaking (Finley et al. 1990). The risk is that the narwhals may abandon the summering ground in Milne Inlet with unpredictable consequences for the population.

Of even larger concern is the prospect of shipping through the heavy pack ice in Baffin Bay. Large numbers of marine mammals rely on the quiet pack-ice environment during winter. Bowhead whales are crossing Baffin Bay both in early winter and in spring where they congregate just outside the entrance to Eclipse Sound, the main shipping area for the iron ore transportation. Belugas also seasonally cross Baffin Bay and in winter they are found in large numbers in West Greenland precisely in the shipping lane. Narwhals from all of the Baffin Bay populations winter in various areas of Baffin Bay over deep water or along the West Greenland where they forage for most of their annual food intake. Shipping in these areas will not only create unprecedented underwater noise in otherwise very quiet environments, but it will also create artificial ice-free channels that may be used by several species of marine mammals with likely detrimental consequences.

Comments

Greenland was pleased to be informed about the project and raised the question of whether it was possible yet to say how much negative impact it will have on narwhal stock if the project continues. Heide-Jørgensen answered that it is not possible yet to make a total assessment of the impact, and this would be quite a challenging task. However, one example of an attempt to address this is the ship strike model that the Canadians have performed which estimated that 123 narwhals and 0.8 bowhead whales would be susceptible to ship strikes each year. It should be noted that the estimate of 123 narwhals is as much as the entire Eclipse Sound quota and therefore the level of potential ship strikes alone could have a significant impact.

The MC also discussed the level of other ship traffic in this area. Eclipse Sound is considered a pristine area, with the only other traffic in the summer time bringing supplies to the Canadian village of Pond Inlet, and a few some smaller vessels and sailboats. Baffin Bay has no traffic in the winter (January through June), as there is nearly impenetrable pack ice.

The MC expressed interest in hearing what the opinion is of the Canadian government. This issue may be raised again in Council when the Canadian observer is expected to attend.

Heide-Jørgensen informed the MC that there is a Canadian impact assessment process, but this process appears to only have concerned the reloading of the iron ore and not the shipping of the product through Baffin Bay. Any impact assessment that would be conducted in Greenland would not have legal impact for Canadian laws. It may be possible to address this through UNCLOS, as it is an activity in one country that affects another country.

Greenland informed the MC that the Mary River project is an activity that Greenland has not been consulted with, either during the planning stages, or now that the activities have started. Greenland and Canada are neighbour states and have many shared marine mammals and seabirds, including polar bears. Greenland and Canada have existing MOUs on narwhal, beluga, and polar bears, and conduct bilateral meetings on seal issues. Greenland expressed concern that they have not been part of the assessment review process. Greenland will follow the project and work to be directly involved in this issue in the future, as it has a potential to seriously negatively affect some of their most important resources, narwhal, beluga, seals.

The MC highlighted that there appear to be 3 main concerns with this project:

- The effects of the shipping routes
- Vessels moving through the pack ice, and the effects of their presence and the noise generated

- The possibility of accidents, including spills of oil or other chemicals

The MC proposed a **New** request for advice from the SC: R-1.5.3

"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."

The MC looks forward to further comments on this issue after the SC has fully reviewed this issue, and the other issues raised at the Disturbance Symposium.

4.3 Climate change

Tore Haug from the Institute of Marine Research in Norway, and vice-chair of the SC, presented updates from the SC on environmental issues, particularly the impacts of climate change. Although there are no active requests for advice from the SC on environmental issues from Council, the SC feels these are important issues to address.

In the Barents and Norwegian Seas, cod abundance has increased, and its range has extended northwards in recent years. One implication of this is a new overlap of feeding grounds with harp seals and common minke whales, two other important top predators in the area. Both these mammal species have exhibited declines in body condition in recent years, and competition for food with the increasing cod stock is suggested as a possible explanation.

Harp seals are experiencing decreasing ice conditions. This is a matter of concern, considering that this species is dependent on ice for breeding, moulting and resting. Norway plans to continue satellite tagging efforts with harp seals in both the Barents and White Seas.

In Icelandic waters during the last two decades, substantial increases in sea temperature and salinity have been reported. Concurrently, pronounced changes have occurred in the distribution and abundance of several cetacean species and their prey since regular monitoring began in 1987. A northward shift in summer distribution of capelin and a crash in the abundance of sand eel are suspected to be the primary cause of the recent shift in distribution of common minke whales away from Icelandic coastal waters. Continued monitoring of the distribution and abundance of cetaceans is essential for conservation and management of the cetacean populations and as a part of wider studies of ongoing changes in the ecosystem.

Comments

The MC discussed the importance of satellite tagging to obtain information movements. This information can also inform on the amount of time that the seals spend travelling between the ice where they rest, breed, and moult, and their foraging areas. The increased travelling time increases their energetic costs.

Greenland noted that these issues are very relevant to Greenland, especially the changes in distribution of whales and seals.

Greenland also informed the MC that even though they are not involved in the "Pikialasorsuaq project" KNAPK is following the project. This project is following the effects of climate change on the North Water Polynya (NOW) area near the villages of Qaanaaq and Upernavik. The project also includes many fish species on the East Greenland shelf.

4.4 Other topics

Greenland informed the MC they are following the Arctic Biodiversity assessment in the Arctic Council's CAFF WG which is following the effects of climate change on the flora and fauna in the Arctic. A meeting was held recently in Nuuk, where a Greenlandic scientist had the opportunity to give input on this project.

GINR also has created a new Institution on Environment and Mineral Resources dealing with environmental issues. This department will give advice on development of natural resources in the area in a responsible manner that will maintain food security.

As an update from last year's MC meetings, Greenland informed that the Nutrition Board has repeated their advice that pollution from industrialised countries has had a long term negative effect on Arctic marine mammals. The levels of persistent organic pollutants (POPs) in marine mammals, including a favoured food in Greenland, mattak, is among the most toxic food items. The Nutrition Board is making recommendations, via distribution of leaflets, to adult women of reproductive age not to eat products from toothed whales and large seals where heavy metals are highest. The advice is to eat other local resources, not Western food. This is particularly concerning for the residents of Qaanaaq and East Greenland who are highly dependent on marine mammals, particularly narwhal and polar bears.

The issue is concerning. Greenland would like NAMMCO to make a statement to relevant bodies to bring awareness to the problem of pollution.

The MC raised concerns that if NAMMCO makes a statement regarding pollutants in marine mammals that they are careful to be clear about the higher levels of pollutants in toothed whales versus baleen whales.

5. MANAGEMENT ISSUES

5.1 Marine mammal - fisheries interactions

There are a few standing and ongoing requests for advice from the Scientific Committee on this agenda item.

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.*

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. See also 1.1.6 and 1.4.6.*

R-1.4.7 (NAMMCO/23-2015): *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 reported at their last meeting that the European MAREFRAME project includes several components addressing marine mammal fisheries interactions. These include research on interactions between cod and common minke whales in Icelandic waters and between cod and seals off Scotland. The MAREFRAME project is scheduled to be concluded in 2017, after which the SC will review the result as requested by the Council.

Comments

The MC notes the report of the SC, and will await the SC's review of the MAREFRAME project after its completion in 2017.

5.2 By-catch data and monitoring

By-catch is problematic in both Iceland and Norway. In Norway, a coastal reference fleet has been established to develop by-catch estimates of marine mammals in gillnet fisheries. The vessels in the reference fleet are regular fishing vessels which are particularly requested to report catches of marine mammals. Using data from this fleet, Norway realized that there is extensive by-catch of marine mammals, particularly harbour porpoise and harbour and grey seals.

Mitigation experiments using pingers are in progress in Norway. In addition, an aerial survey designed for harbour porpoises will be conducted in 2016 from southern Norway to Lofoten, with the aim of developing an abundance estimate to determine whether these by-catches are sustainable.

A NAMMCO By-catch WG meeting will be held directly before the Coastal Seals WG in the first week of March to discuss a plan for addressing by-catch issues in NAMMCO, versus, for example the work done in the ICES By-catch WG.

Comments

The MC discussed that the by-catch problems arise mainly in the gillnets fisheries, not trawls, and specifically the cod and lumpfish fisheries. Prior to the development of the reference fleet, Norway did not have a reliable reporting system, and the number of reports of by-catch before the reference fleet were close to zero.

Greenland reported that as part of their new MSC certification of their lumpfish fisheries there has been a change in the national reporting requirements and process for by-catch of marine mammals and seabirds. The fisherman reports by-catch to the fisheries organisations they sell the fish to, then the organisation reports to the ministry on a daily to weekly basis. Prior to this system, all reported by-catches as part of the annual catch reporting. All vessels are also required to report by-catch via logbooks.

Greenland reported on an increasing number of entanglements of humpback whales. In 2015, 10 humpback whales were entangled: 9 in West Greenland, 1 in East Greenland. Of these 10 entangled whales, it was confirmed that 5 died, and the other 5 had an unknown fate. This issue was raised as a possible welfare issue in the NAMMCO Committee on Hunting Methods. Greenland inquired which forum in NAMMCO to address these issues. The MC discussed that this will be discussed in Council when the report of the Committee on Hunting Methods is presented.

Faroes informed the MC that vessels are required to report by-catch of marine mammals in the electronic logbooks, including zero by-catch, and if there is any by-catch the species should be reported.

Iceland updated the MC that there is legislation requiring that all by-catch must be reported to the Directorate. Recently there have been technical problems regarding sending the information to MRI, however working is being done on resolving these issues. In the past there have been problems of the Directorate not receiving any reports of by-catch. Inspectors in the Directorate of Fisheries are actively working on this issue.

Norway informed the MC that fishermen are required to report all by-catch, but reports are very few.

Russia also informed the MC that there have been reports of by-catch of large whales in crab fisheries (using bottom set traps) in the open area of the Barents Sea. In 2016 PINRO plans to organize data collection on marine mammals by-catch onboard crab vessels by observers. The first results of these data collection and monitoring efforts will be prepared and presented in the Russian Progress National Report at the next NAMMCO Scientific Committee Meeting.

5.3 Trade issues

At the SC/22 meeting, the SC discussed a recent letter from USA to Norway informing them that the USA is implementing rules potentially banning import of marine products from countries with fisheries with high by-catch (gillnets). It was noted that the letter is unclear whether the USA is planning on banning all marine products or just products from the problematic fishery. This is a potentially significant economic issue for all NAMMCO countries, which is another reason for the increased emphasis on future work on harbour porpoises and by-catch in general.

Norway informed the MC that they are currently in the process of discussing this issue with the USA and will provide an update in the future.

Greenland and the Faroe Islands reported that they have not received such a letter from the USA, but agreed that this is potentially a matter of concern for all NAMMCO member countries.

5.4 Ecosystem-based management

There are a two standing and ongoing requests to the Scientific Committee on this agenda item.

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

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.*

The Chair of the MC referred the committee to the upcoming presentation on the first day of the Council meeting from Nicola Beaumont, an Invited Speaker, who will talk about ecosystem-based management. The MC looks forward to hearing from Dr. Beaumont, and how NAMMCO can continue to strive for ecosystem-based management.

5.5 Procedures for decision making on conservation and management measures

The Secretariat informed the MC of an issue that arose during the Large Whale Assessment WG and the SC meeting regarding NAMMCO using management procedures developed in other organisations.

As background to the issue, the management advice for humpback whales in Greenland is based on the management procedure, the *Strike Limit Algorithm*, which was developed in the Aboriginal Whaling Management Procedure sub-committee of the IWC. This IWC procedure uses the *Needs Statement* in its calculations. The Needs Statement is a document that Greenland submits to the IWC stating how many whales they “require”.

At the NAMMCO Large Whale Assessment WG, the WG and the SC gave the advice

“The NAMMCO WG endorsed th[e] SLA *as the best current basis for providing management advice for West Greenland humpback whales, as well as the current advice of up to 10 strikes per year requested by Greenland (within the IWC system) as being safe. The WG discussed but did not come to a conclusion on whether NAMMCO should consider the impact that the IWC’s Needs Statement has on the quotas given by the SLA, considering that it is a component of the SLA procedure.*

Based on the work of the WG, the SC ***endorsed*** *the advice of 10 strikes per year based on the SLA that was accepted by the IWC, and noted that a higher number may be sustainable.”*

Comments

Greenland noted that they receive a limited number of humpback whales within the IWC system. The quota of 10 whales based on the Aboriginal Subsistence Whaling procedures and are not formed in a similar manner to how NAMMCO usually develops its management advice. Greenland plans to proposed a request to the SC “for advice on a sustainable catch level of humpbacks in WG”. The proposed text of the request will be presented to MCC.

The MC informed the SC that anytime management procedures from another organisation are used in formulating management advice, the SC should make sure that those procedures meet the NAMMCO management objectives before basing their advice on those procedures.

5.6 Other topics

There were no other topics raised.

6. USER KNOWLEDGE IN MANAGEMENT DECISION-MAKING

Greenland informed the MC that the Ministry of Fisheries, Hunting and Agriculture plan to make a campaign for the public, in north Greenland and also East Greenland, on the inclusion of user knowledge in management decision making process. This campaign will primarily focus on narwhal and beluga, but also polar bears. There is a national action plan to fulfil agreements in the range states of polar bears. Although NAMMCO does not deal with polar bears, this species is an important Arctic species, and these issues also have implications for ringed seals.

Greenland also referred to past presentations to the MC discussing programmes where local people are monitoring the distribution and presence of local wildlife. The local residents are also helping make management advices for local wildlife. Greenland will report more information on these programmes to the MC in the future.

KNAPK also informed the MC that an application for funding has been submitted to the Danish Environmental Ministry for a project working on how user knowledge can fit into management decisions. The application includes funds for a joint WG with NAMMCO.

7. ANY OTHER BUSINESS

No additional business was raised. The Chair closed the meeting of the Joint Management Committees.

Appendix 1 - Agenda

1. CHAIR'S OPENING REMARKS
2. ADOPTION OF AGENDA
3. APPOINTMENT OF RAPPORTEUR
4. ENVIRONMENTAL QUESTIONS
   4.1 Disturbance symposium[1]
   4.2 Mary river project – Baffinland
   4.3 Climate change
   4.4 Other topics
5. MANAGEMENT ISSUES
   5.1 Marine mammal - fisheries interactions
   5.2 By-catch data and monitoring
   5.3 Trade issues
   5.4 Ecosystem-based management
   5.5 Procedures for decision making on conservation and management measures
   5.6 Other topics
6. USER KNOWLEDGE IN MANAGEMENT DECISION-MAKING
7. ANY OTHER BUSINESS

[1] NAMMCO Symposium "Impacts of Human Disturbance on Arctic Marine Mammals" 13-15 October 2015

REPORT OF THE MANAGEMENT COMMITTEE FOR CETACEANS

9 February 2016, Oslo, Norway

1. CHAIRMAN'S OPENING REMARKS

Chair Ulla Svarrer Wang (Faroe Islands) welcomed all participants to the meeting.

The Chair drew the attention of the Management Committee (MC) to the following meeting documents (Appendix 2, page 77).

2. ADOPTION OF AGENDA

The agenda was adopted without revision (Appendix 1).

3. APPOINTMENT OF RAPPORTEUR

Jill Prewitt (Scientific Secretary) was appointed as rapporteur, with the help of participants when needed.

4. NASS 2015

Update from the NASS2015 Steering Committee

Mads Peter Heide-Jørgensen, the Chair of the NASS2015 Steering Committee, presented an update on the status of NASS2015.

On behalf of the NASS2015 Steering Committee and the Scientific Committee (SC), Heide-Jørgensen extended thanks to the Council and also to the Norwegian MFA for majority of the funding for the extension surveys. Although he acknowledged that the funding arrived quite late which presented many challenges in performing some aspects of the survey, among them difficulties in chartering aircraft for the Greenlandic surveys.

Heide-Jørgensen reported that in East Greenland, their surveys achieved good coverage, however there were challenges with weather in West Greenland due to unfavourable weather conditions, because the survey was pushed late in the season. There were large numbers of fin whales sighted in East Greenland which is clearly an area of importance for fin whales. For minke whales, this survey may need to be repeated in West Greenland, as quotas have been reduced due to lower estimates from recent surveys.

The Icelandic shipboard surveys covered 5 strata and achieved relatively good coverage and a good number of sightings. Large numbers of blue whales and killer whales were sighted, which may mean that the SC could be able to provide more useful killer whale advice in the future. The coastal areas of Iceland were covered by aerial surveys, however due to very unfavourable weather conditions a large area of north Iceland was not covered. This presents a problem for developing a minke whale abundance estimate.

The surveys in Norway included areas both in the CM area (Jan Mayen) and the Norwegian Sea. About 50% of the CM area was covered, with few baleen whale sightings, however the results should still be a useful survey for developing abundance estimates.

The Faroese surveys mainly concentrated on pilot whales in the Faroese area and the extension surveys South West of the Faroese area. These results will be combined with sightings from the Icelandic surveys and appear to be sufficient for developing an abundance estimate for pilot whales. The Faroese fin and minke whale sightings will also be combined with the Icelandic data.

The NASS Steering Committee also recommended a plan for analysing the data from these surveys. The data has been submitted to IMR (Øien) to create maps of survey effort. After the initial analysis completed, the preliminary results will be presented to an AEWG meeting proposed for mid-May 2016 in Copenhagen. This meeting will review these initial results.

Comments

The member countries thanked the Steering Committee for their work, and agreed with the Steering Committee's recommendation that they have completed their work and will refer future work to the SC and its Abundance Estimation WG (AEWG). The MC looks forward to the future work of the SC, and its AEWG, on the analysis of the NASS2015 data.

Iceland updated the MC that they have received funding for repeating the coastal aerial minke whale survey in 2016. The MC looks forward to the results of this survey.

5. CONSERVATION AND MANAGEMENT MEASURES FOR WHALE STOCKS

The Chair of the SC, Thorvaldur Gunnlaugsson from Iceland, presented the updates from the SC for each species.

5.1 Fin whales

Requests by Council for advice from the SC

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 NASS2015 for all large baleen whales in West Greenland waters*

R-3.1.7 amended (ongoing): *complete an assessment of fin whales in the North Atlantic and also to include an estimation of sustainable catch levels in the Central North Atlantic. Amendment: "While long-term advice based on the outcome of the RMP Implementation Reviews (with 0.60 tuning level) is desirable, shorter term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015."*

Update from the SC

Iceland informed the MC on a recent capelin survey which also had whale observers on board using the NASS-15 methodology. This survey generated the first abundance estimate for fin whales in the capelin area in the autumn (October-November). This estimate was higher than expected.

New advice

The Large Whale Assessment Working Group met 5-7 October 2015, and they provided advice on estimation of sustainable catch levels of fin whales in the Central North Atlantic. The SC **agreed** with the conclusions of the WG that a catch limit of 146 fin whales that can be taken anywhere in the EG+WI region is safe and precautionary, and that this advice should be considered valid for a maximum of 2 years (2016 and 2017). This is interim advice because 1) the abundance estimate is close to 10 years old, and 2) delays in the IWC RMP *Implementation Review* process, which is scheduled for completion in June 2016.

Future work

The SC recommends another Large Whale Assessment WG be held in fall 2016 to use new abundance estimates generated from NASS2015 to generate new, longer-term advice.

Research Update

Iceland is conducting studies using both genetics and tagging to inform further on stock structure of fin whales in the North Atlantic. Satellite tagging is ongoing, and results are not expected within the next couple of years. The genetics work is currently using genetics to identify close kin relationships. Iceland is working on obtaining samples from Norway and Greenland, both from catches and biopsies. Biopsies will be very useful particularly because they come from a wider geographical area. The SC encouraged this work, and urged member nations to participate by supplying samples.

The SC **encouraged** collaborative genetic research led by Iceland aimed at identifying close kin relationships within the North Atlantic and urged member nations to participate by supplying samples.

Comments

The MC discussed that the quota advice is slightly lower than the previous advice, which reflects that the abundance estimate is now older than for the previous assessment. Iceland reported that the total catch in 2015 was 155.

The MC discussed what the outcome would be of using a tuning of 0.72, and was informed by the SC Chair that the advice would be lower. The IWC SC has previously recommended using a tuning level of 0.6, however the IWC Commission did not accept this advice. The NAMMCO SC has been using tuning of 0.6.

The MC **endorsed** the advice of the WG and the SC. Iceland commented that they encouraged a NAMMCO WG for long-term advice. The SC Chair reported that they will not wait for the completion of the work in the IWC, and will move forward with the NAMMCO WG.

Iceland proposed amending **R-3.1.7** to the following text **R-3.1.7 amended (ongoing):** complete an assessment of fin whales in the North Atlantic and also to include an estimation of sustainable catch levels in the Central North Atlantic. A long-term advice based on a the new NASS-15 abundance estimate and the available results from the RMP Implementation Reviews (with 0.60 tuning level) is needed in 2016.

The MC **agreed** with the SC to encourage members to collect genetic samples of fin whales and provide them to Iceland for this project.

Status of past proposals for conservation and management

Proposal **3.1.3**: (assessment of fin whales in the Faroes) …uncertainties about stock identity are so great as to preclude carrying out a reliable assessment of the status of fin whales in Faroese waters, and thus the Scientific Committee was not in a position to provide advice on the effects of various catches.

Comments

There are presently no plans for a fin whale hunt in the Faroes, but the Faroes would like to continue investigating fin whales as a potential future resource that could be sustainably utilised.

Updates

Greenland informed the MC that they have been given advice for fin whales from IWC which is a quota of 19 fin whales; 11 fin whales were caught in 2015.

5.2 Humpback whales

Requests by Council for advice from the SC

R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from NASS2015 for all large baleen whales in West Greenland waters*

The SC noted that **R-1.7.12** has not been considered yet as the abundance estimate from NASS2015 is not yet available.

R-3.2.4 (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.*

Update from the SC

New advice

The Large Whale Assessment WG met 5-7 October 2015, and provided advice on sustainable yields of West Greenland humpback whales. Based on the work of the WG, the SC **endorsed** the advice of 10 strikes per year based on the *SLA* that was accepted by the IWC, and noted that a higher number may be sustainable (because the *SLA* calculations are based on the 10 strikes per year that were requested by Greenland to the IWC and included needs).

Research update

Iceland reported that they satellite tagged a humpback whale which was followed between North Icelandic waters and Silver Bank off the coast of the Dominican Republic. This is the first documentation of a complete migration track of a baleen whale between feeding and breeding grounds in the North Atlantic.

Comments

This situation with the IWC's Needs Statement was discussed during the Joint Session and as discussed in that meeting, this management advice does not achieve the management objectives of NAMMCO.

Greenland proposed a **new Request for advice from the SC:** *"The SC is requested 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."*

The MC discussed how Greenland would use the advice from the NAMMCO SC, given that the current management advice is taken from the IWC. Greenland informed that the quota situation in the IWC is not necessarily stable, and they would like to obtain advice based on sustainable use rather than the "Needs Statement." The next quota block in the IWC is starting in 2018 in IWC, and if quotas are not given by the IWC, then the advice generated by NAMMCO WG based on scientific advice and sustainability could be used.

Updates

Greenland updated the MC that the current quota is for 10 whales, with a carryover of 2, and 6 whales were caught in 2015.

Status of past proposals for conservation and management

3.7.1 (sustainability of the hunt in Greenland)

Proposal 3.7.1 deals with sustainability of the hunt in Greenland which will be addressed by the Large Whale Assessment WG proposed for fall 2016.

5.3 Minke whales

Requests by Council for advice from the SC

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 NASS2015 for all large baleen whales in West Greenland waters*

R-3.3.4 amended(ongoing): *full assessment, including long-term sustainability of catches, of common minke whales in the Central North Atlantic… assess the short-term (2-5 year) effects of the following total annual catches: 0, 100, 200 and 400*

Update from the SC

New advice

The Large Whale Assessment Working Group met 5-7 October 2015 in Copenhagen, where they provided advice on catch limits for common minke whales in the CIC sub-area. The SC **endorsed** the advice provided by the WG that a catch limit of **224** common minke whales in the CIC sub-area is safe and precautionary, and that this advice should be considered valid for a maximum of 3 years (2016 – 2018). This is interim advice because 1) the most recent abundance estimate is from 2009, which will then be approaching 10 years old, and 2) delays in the IWC RMP *Implementation Review* process.

Research update

Iceland reported that they will develop abundance estimates from the results of the shipboard NASS2015 surveys. However, unfavourable weather conditions seriously impacted the coastal aerial survey and the data are insufficient to develop abundance estimates for the entire Icelandic continental shelf area (CIC). Iceland has submitted a proposal to fund a repeat survey in 2016, and the decision on this funding is expected in early 2016.

Comments

The MC **endorsed** the new advice provided by the SC and welcomes the results of the repeated aerial coastal survey.

Update

Norway informed the MC that they have a carryover system, and from a quota of 1,286 common minke whales, 660 were caught by 21 vessels.

Iceland reported that with the carryover system, there was a quota of 275 common minke whales, and 29 were caught in 2015 by a single vessel.

Greenland reported a catch in 2015 in West Greenland of 164 common minke whales with a carry-over of 15 from 2014, and 130 were caught. The quota for East Greenland was 12 minke whales with a carry-over of 3 from 2014, and 6 were caught.

Greenland raised a question to the MC of whether NAMMCO has a shared policy of how to divide quotas, or whether there could be future discussions in NAMMCO of how to share quotas and advice for shared resources. Greenland suggested that bilateral dialogues between member countries would be a good way forward in allocation of resources from shared stocks.

The Faroes noted that they support the principle that when there are shared stocks between member countries, the countries come to an agreement on how to share these stocks.

5.4 Beluga

Requests by Council for advice from the SC

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 22*

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

Status of past proposals for conservation and management

Proposal **3.4.4** is the only relatively recent proposal for conservation and management, and it deals with quotas. New quota advice was given at last year's NAMMCO-JCNB Joint Working Group meeting.

Update from the SC

The NAMMCO-JCNB Joint Working Group (JWG) met in Ottawa, Canada, 11-13 March 2015 to update the assessment and advice for belugas.

New advice

The SC **endorsed** the recommendations of the JWG that the total annual removal of beluga in West Greenland is no more than 320 over period from 2016 to 2020 (Table 2 in SC report).

The JWG also noted that under-reporting of catches remains a potential problem, and this is problematic as no straightforward correction is possible.

Comments

The MC endorsed the advice of the JWG and the SC.

Greenland informed the MC that the JCNB meets every 2nd year, and their last meeting was in fall of 2015. The JCNB is based on a MOU, and is not a binding agreement. Through the JCNB, Canada and Greenland coordinate on science, and the management and monitoring of the hunt. When they receive scientific advice, the decision is made by the individual governments on how to follow this advice.

Greenland reported that the quota in 2015 for beluga in West Greenland was 320, and 120 were caught. In Qaanaaq, the quota was 20 and 7 were caught. A technical 5 year quota block is given of 100 animals, with the first year starting in 2014.

The MC noted that the recovery of beluga stocks in Greenland is a success story (see Figure 2 of the SC report) and clearly shows that after quotas were set there have been steady increase in beluga abundance estimate. The MC commends the work of Greenland on this issue, and highlights this good work.

Greenland updated the MC that although belugas are rarely seen in east Greenland, a few recent observations have been made in the Tasiilaq and Ittoqqortoormiit areas. It is unknown how many animals are in east Greenland, but Greenland is interested in knowing which stocks these beluga might be coming from (Svalbard being one possibility). The Ministry have consulted with GINR, which informed them that beluga are not currently a research priority. The Ministry has therefore proposed asking hunters to make written records of the beluga observations and behaviour.

Greenland proposed a **new Request for advice from the SC (**R-**3.4.14**):

The Council requests the SC to examine the data existing on beluga in East Greenland (sightings, strandings, by-catch, catch) and examine how these material can be used in an assessment process and advice on how this data can be improved.

The MC endorsed this proposal.

<u>Global Review of Monodontids meeting - planning</u>

The Secretariat updated the MC that the planning for this meeting continues. An earlier plan was to hold the meeting in conjunction with the Marine Mammals of the Holarctic meeting in Russia this fall (October 2016), however, the organising committee now suggested that the meeting would be better held in conjunction with the next JCNB JWG meeting in March 2017 in Copenhagen. The organising committee consists of Arne Bjørge (Chair, Norway), Jill Prewitt (NAMMCO), Robert Suydam (North Slope Borough, Alaska, USA), Roderick Hobbs (USA), Steve Ferguson (Canada), Randy Reeves (Canada), Rikke Hansen (Greenland), and Olga Shpak (Russia).

The SC suggested that the organizers inquire whether the Arctic Council's CAFF WG would be interested in joining NAMMCO organizers for this meeting. The CAFF Secretariat was contacted, and has informed the NAMMCO Secretariat that the CAFF WG is interested in participating in the organisation of the meeting. The Secretariats will hold a meeting in the near future to discuss the CAFF's level of involvement with the meeting.

<u>Comments</u>

Greenland informed the MC that the responsibility of management for narwhal and beluga is in the JCNB. Greenland recognizes the importance to work internationally and although they support working together on the Global Review of Monodontids meeting, the Arctic Council will not provide management advice. The MC agreed that this meeting will not generate management advice, but will instead be a forum for sharing scientific findings.

5.5 Narwhal

<u>Requests by Council for advice from the SC</u>

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 22*

As was discussed in the Joint Session, the Disturbance Symposium was held to address this request, and the SC will consider the full report at it's next meeting.

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

This request is regularly addressed at the NAMMCO-JCNB JWG meetings.

<u>Update from the SC</u>

Catch allocation model

Mads Peter Heide-Jørgensen from the Greenland Institute of Natural Resources gave a presentation to the MC on the Catch Allocation model that has been developed in the NAMMCO—JCNB JWG to assign catches from the narwhal metapopulation that is shared by Canada and Greenland to the appropriate summering aggregation, by different hunting grounds and seasons. The model includes all information that is available on narwhal movements including telemetry data, all abundance estimates, seasonal occurrence and historical catch data.

Many years of work on narwhal (and beluga) regarding shared stocks between Canada and Greenland have indicated that:

1) Narwhals use strict migratory corridors, Move through these at predictable certain times of the year
2) Strict wintering grounds
3) Discrete summering aggregations, do not intermingle in the summer

This information is mainly based on satellite tracking, because the low genetic diversity of narwhals does not allow for discrimination of stock structure.

A total of 8 distinct summering stocks of narwhals have been identified and whales from these stocks are hunted at 11 hunting grounds in different seasons. Different fractions of the migrating stocks of narwhals are available at these 11 hunting grounds, during the different seasons giving a total of 24 hunts.

The allocation model was developed to mirror these seasonal patterns of occurrence consists of a matrix with 24 rows and 8 columns. The eight columns are the individual summer aggregations of Smith Sound, Jones Sound, Inglefield Bredning, Melville Bay, Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island. The catch allocation model allocates the catches in different hunting areas and seasons to the different summer aggregations.

The NAMMCO SC agreed with the recommendations of the JWG and welcomed this new methodological development of the complex assessment situation for the narwhal metapopulation that is shared between Canada and Greenland. The advancement of the allocation model is considered a step forward and could potentially be applied in many situations where migratory populations are exploited in several areas under various jurisdictions.

Comments

The MC thanked Mads Peter for his informative presentation on this complex model.

Greenland informed the MC that after the new advice from the NAMMCO-JCNB JWG, they had to change the allocation of licenses. The Etah area received a quota of 5 whales for the first time. There were limits imposed for each zones in West Greenland, and the government have allocated different numbered licenses to each zone so that the catches can be tracked. With the implementation of this procedure, the quotas have increased in some areas and decreased in others, leaving some hunters more appreciative than hunters in other areas. This has also increased the administrative workload, but Greenland has managed to implement this system reliably.

Greenland also noted that if new advice is expected on changing the boundaries of the summering aggregations, lots of time is requested to prepare. Greenland encouraged as much advance notice as possible.

KNAPK commented on the stock definition of narwhals, and informed the MC that experienced hunters have observed some differences in morphology and behaviour between different groups of narwhals. In addition, hunters have reported that after seismic testing in 2013, narwhals have changed their distributions.

In Greenland, a revision to the Executive Order regulating the hunt on narwhal and beluga (2016) was recently approved. It is based on the newest scientific information of stock status, area and hunting grounds.

The MC commends the work of the WG on the work of developing this model and endorses the use of the model in management procedures. The MC is also pleased to hear that Greenland has already implemented this advice into their management procedures.

Other updates from the SC

East Greenland narwhals

The assessments of narwhals in the two stocks in East Greenland (Ittoqqortoormiit and Tasiilaq/Kangerlussuaq areas) were updated with recent catch information. The updated assessment estimates a slightly smaller sustainable catch (Table 6 in the main report) than the previous assessment, reflecting that we are further away in time from the available abundance estimate. The total annual removal was estimated to be no more than 50 for the Ittoqqortoormiit area and 16 for the Tasiilaq/Kangerlussuaq. The SC **agreed** with the advice of the JWG and noted that the quota for Tasiilaq was recently increased by 10 narwhals above the previous management advice.

Recommendations for research
The SC **recommended** that future research includes

1) New surveys of narwhals in the two stocks where recommended catch levels has decreased, i.e. East Greenland and Melville Bay
2) More satellite tag and dive data from the stocks in West Greenland and Eastern Canada to obtain more information about movement between summer aggregations and information for availability bias for survey correction factors

Comments
The MC endorsed the advice from the SC on narwhal catches.

Greenland informed that there is large pressure for a new survey in EG in 2016 due to the decreased quotas, and the MC endorsed the recommendations for new research, which includes new surveys for narwhals in East Greenland and Melville Bay.

Greenland reported quotas and catches of narwhal in 2015 narwhal: West Greenland; quota, 144, catch 72. Inglefield Bredning; quota 85, caught 75; A technical 5 year quota block is given of 485 animals, first year starting in 2014.

For Melville Bay the quota was 81, with a catch of 71. In East Greenland the quota was 88 plus an extra political allocated quota of 10, with a catch of 94.

Status of past proposals for conservation and management
Proposal 3.3.6: The Management Committee strongly **recommends** that "struck and lost" data be collected from all areas and types of hunt and that all "struck and lost" animals be included in the advice (NAMMCO 19).

Comments
Greenland informed the MC that hunters are required to report struck and lost.

Greenland will propose a new request for advice from the Scientific Committee regarding collection of struck and lost data. This request will come during the Management Committee for Seals and Walrus.

Global Review of Monodontids meeting - planning
The planning for this meeting was discussed under belugas.

5.6 Sei whales

Requests by Council for advice from the SC
R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from NASS2015 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*

Updates from the SC
Iceland reported that there were not very many sightings during NASS2015 but that this was not unexpected as the timing and coverage of the survey was not appropriate for estimation of sei whale abundance.

Iceland informed the SC that they have been requesting a RMP *Implementation Review* in the SC of the IWC, however it was decided at this year's IWC SC meeting to postpone this work.

5.7 Northern bottlenose whales

Status of past proposals for Conservation and Management

There are no current Proposals for Conservation and Management.

Updates from the SC

The Faroese data from T-NASS 2007 has been integrated into a model-based assessment of deep diving species being done in the UK. Mikkelsen informed the SC that the manuscript is planned to be submitted within a few months.

Comments

The Faroes informed the MC that 2 whales stranded in 2015. They further informed the SC that the data from TNASS-07 will be incorporated into a paper together with the results from the CODA survey.

The MC noted that there is no direct harvest of bottlenose whales in the Faroes, only strandings.

Greenland have reported catches of bottlenose whales in the past, however validation of these catches have revealed that they are actually catches of harbour porpoises that have been reported wrongly on the reporting catch form. An update will be provided in the future. This is not a species that is normally targeted in Greenland.

5.8 Killer whales

Requests by Council for advice from the SC

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.*

Updates from the SC

At the SC meeting in 2013, the SC noted higher levels of annual catches (19 on average per year from 2010 and 2012) in West Greenland. The SC was then informed that the recent catch statistics on killer whales in West Greenland have not been validated, and at this meeting the SC noted that these catch statistics still have not been validated. The SC **reiterates the recommendation** that all catch data on killer whales are validated before the next SC meeting, so that it is possible for the SC to monitor the development of the hunt.

Comments

Greenland informed the MC that validation of these catches is expected to be completed in 2016, going back to 2010. The Ministry have received reports of catches in 2014 and 2015.

The MC looks forward to having more information at the next MC meeting.

5.9 Long-finned pilot whales

Requests by Council for advice from the SC

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

R-3.8.3 (ongoing): *to develop a proposal for the details of a cost-effective scientific monitoring programme for pilot whales in the Faroes*

R-3.8.4 (ongoing): *methodology and the coverage of T-NASS take into account the need for reliable estimates for pilot whales. In addition, priority should be given to the analysis of data on pilot whales after the completion of T-NASS*

R-3.8.5 (ongoing): *assess the status of long-finned pilot whales in West Greenland waters and provide minimum estimates of sustainable yield*

R-3.8.6 (ongoing): *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. 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*

Update from the SC

Regarding **R-1.7.11**, the SC awaits results of NASS2015 and expects that these will allow for the development of an abundance estimate, and will be incorporated into the trend analysis.

Regarding **R-3.8.3**, taking into account the recommendations made by the 2008 Pilot Whale WG (Qeqertarsuaq, Greenland) that were organized in response to this request, the Faroes has developed a scientific monitoring programme to update biological parameters. As reported in the NPR, a number of samples have been collected including samples for ageing, reproductive information, and stomach samples for diet. The plan is to continue to collect samples from every drive and deliver results to the next assessment meeting. Based on this information, the SC considers **R-3.8.3 completed** and awaits further guidance from Council.

R-3.8.4 refers to T-NASS 2007, and the SC considers this request now **completed**.

Regarding **R-3.8.5**, the SC considers this request replaced by **R-3.8.6**. The remaining unanswered portions of **R-3.8.6** awaits new data from NASS2015. The West Greenland part was dealt with during SC/19 and the SC refers Council to that report.

Comments

MC agrees to await results of NASS2015 to address R-1.7.11.

MC agrees with the SC that R-3.8.3 is completed.

The MC agrees with the SC that R-3.8.4 is completed.

The MC agrees with the SC that R-3.8.5 can be replaced by R-3.8.6.
MC awaits the results of NASS2015 and hopes that these will help address R-3.8.6.

Update from SC

Sampling

The Faroes have developed a scientific monitoring programme to update biological parameters. A number of samples have been collected including samples for ageing, reproductive information, and stomach samples for diet. The plan is to continue to collect samples from every drive and deliver results to the next assessment meeting. The SC commended the Faroes for the work on the sampling programme.

Satellite tagging

Tags placed after NASS2015, preliminary results showed that the whales moved widely throughout the North Atlantic. Hope to continue tagging efforts, up to 4 groups.

The aim is to complete a full assessment of pilot whales in the near future. The past approach (due to lacking data to perform a full assessment) was to perform an ad hoc advice calculating the abundance that would be needed to sustain the hunt in the Faroes.

Comments

The MC welcomes the update on the sampling programme in the Faroes and encourages this work to continue.

MC looks forward to the completion of a full assessment of pilot whales in the North Atlantic.

Status of past proposals for conservation and management

There are no current proposals for Conservation and Management.

Updates

Greenland informed the MC that catches appear to be increasing over the last 10 years (from an average of 130 to an average of close to 300). It is unknown whether this is due to a change in distribution or if this species has become targeted more heavily by hunters. There is currently no executive order for pilot whales (or any other toothed whales other than beluga and narwhal) in Greenland. There are no plans to collect samples from pilot whale catches in Greenland.

Faroes reported a catch of 501 pilot whales in 6 drive hunts in 2015.

5.10 White-beaked, white-sided and bottlenose dolphins

Requests by Council for advice from the SC

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

Update from the SC

Some sampling has been occurring in the Faroes previously, however no new samples have been collected recently because there have been very few catches in recent years. The results from the previous sample collections have yet to be published.

Comments

The MC notes the report of the SC, awaits the publication from the previous sampling.

The Faroes informed the MC that catches in the Faroes have decreased greatly after 2007, with few drive hunts in recent years.

Greenland updated the MC that catches in the last 5 years on average were close to 190 dolphins, compared to previous 5 years where annual average numbers were 70. It is unknown whether this is because of increased distribution in Greenland or if dolphins have become a more targeted species by the hunters.

MC discussed whether there were any plans in Greenland to collect samples from the catches, and Greenland informed that they had no plans for sample collection.

5.11 Harbour porpoise

Requests by Council for advice from the SC

R-3.10.1 (ongoing): *comprehensive assessment of the species throughout its range*

Update from the SC

By-catch is the main issue with harbour porpoise in Norway. Previous calculations in Norway on level of by-catch may have included an error, which will likely reduce the estimates, but the by-catches are still of concern. As mentioned in the JMC, a new aerial survey for harbour porpoises will be conducted from southern Norway up to Lofoten for a new abundance estimate, the goal mainly being assessing the sustainability of these by-catches.

Mitigation studies using pingers are being conducted in the lumpfish gillnet fisheries in Lofoten. These studies will continue, and Norway has obtained external funding for this work.

In Iceland, harbour porpoises are mainly caught in gillnets as by-catch in the lumpfish fishery.

Comments

Greenland informed the MC that they have not seen any changes in catch numbers, and the average annual catch has been stable at about 2,500. By-catch is not separated out currently from catch reporting, but with the new MSC process with the lumpfish fishery, they may be able to obtain some information.

Status of past proposals for conservation and management

Proposal ***3.8.1****: abundance estimates, by-catch/removals estimates*

These issues are being addressed by both the By-catch WG, and a future Harbour Porpoise WG that will be scheduled when new information is available.

5.12 Sperm whale

Updates from the SC

A photo-ID study is being conducted in Norway, and sperm whales are also being counted during sightings surveys.

<u>Comments</u>
MC notes the report.

5.13 Bowhead whale

<u>Requests by Council for advice from the SC</u>
R-1.7.12 (ongoing): *Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from NASS2015 for all large baleen whales in West Greenland waters*

The MC was informed that there likely will not be a new abundance estimate for bowhead whales generated from NASS2015.

<u>Updates from the SC</u>
A strip-width survey estimated 100 (95% CI: 32-329) bowhead whales in the North East Water Polynya off Northeast Greenland in 2009 (Boertmann et al. 2015). This estimate is considerably higher than observations in the past.

Passive acoustic devices in Fram Strait between Greenland and Svalbard detects bowhead whales year round.

<u>Comments</u>
The MC notes and welcomes the higher than previous estimates.

Greenland reported a catch of 1 bowhead in 2015, which was the first catch in 3 years. The current quota is for 2 whales, with a carry-over system.

5.14 Blue Whale

<u>Updates from the SC</u>
Iceland reported that they had tagged 2 blue whales during 2014.

An increasing number of blue whales are reported in the waters around Svalbard including in inner parts of the fiord systems especially on the west coast. As reported for fin whales, the Norwegian Polar Institute has started instrumenting animals with satellite tracking devices and collect biopsies for studies of genetics diet and ecotoxicology. In 2015, 3 whales were tagged. Blue whales were also detected on the passive acoustic listening devices that have been deployed at various sites around Svalbard and thus collecting data on the phenology of arrival and departures to the area.

<u>Comments</u>
The MC noted the SC report.

6. ANY OTHER BUSINESS

The Chair thanked Thorvaldur Gunnlaugsson for his presentations of the SC report, and thanked the members of the MCC.

Appendix 1 - Agenda

1. CHAIRMAN'S OPENING REMARKS
2. ADOPTION OF AGENDA
3. APPOINTMENT OF RAPPORTEUR
4. NASS 2015
5. CONSERVATION AND MANAGEMENT MEASURES FOR WHALE STOCKS
   5.1 Fin whales
      - Requests by Council for advice from the Scientific Committee
      - Proposals for Conservation and Management
      - Updates

   5.2 Humpback whales
      - Requests by Council for advice from the Scientific Committee
      - Proposals for Conservation and Management
      - Updates

   5.3 Minke whales
      - Requests by Council for advice from the Scientific Committee
      - Proposals for Conservation and Management
      - Updates

   5.4 Beluga
      - Requests by Council for advice from the Scientific Committee
      - Proposals for Conservation and Management
      - Updates
      - Global Review of Monodontids planning

   5.5 Narwhal
      - Catch allocation model
      - Requests by Council for advice from the Scientific Committee
      - Proposals for Conservation and Management
      - Updates
      - Global Review of Monodontids planning

   5.6 Sei whales
      - Requests by Council for advice from the Scientific Committee
      - Updates

   5.7 Northern bottlenose whales
      - Proposals for Conservation and Management
      - Updates

   5.8 Killer whales
      - Requests by Council for advice from the Scientific Committee
      - Updates

   5.9 Long-finned pilot whales
      - Requests by Council for advice from the Scientific Committee
      - Proposals for Conservation and Management
      - Updates

   5.10 White-beaked, white-sided and bottlenose dolphins
      - Requests by Council for advice from the Scientific Committee
      - Updates

   5.11 Harbour porpoise
      - Requests by Council for advice from the Scientific Committee
      - Proposals for Conservation and Management
      - Updates

   5.12 Sperm whale
      - Updates

   5.13 Bowhead whale
      - Updates

   5.14 Blue Whale
      - Updates
6. ANY OTHER BUSINESS

REPORT OF THE MANAGEMENT COMMITTEE FOR SEALS AND WALRUSES

9 February 2016, Oslo, Norway

1. CHAIRPERSON'S OPENING REMARKS

The Chair, Hild Ynnesdal, Norway, opened the meeting and welcomed all participants.

2. ADOPTION OF AGENDA

The agenda was adopted and the list of documents reviewed, both documents are contained in Appendices 1 and 2 (page 77) respectively.

3. APPOINTMENT OF RAPPORTEUR

Charlotte Winsnes (Deputy Secretary) acted as rapporteur.

4. CONSERVATION AND MANAGEMENT MEASURES FOR SEAL STOCKS

The Chair drew attention to the following documents:

- NAMMCO/24/MC/05 summarising past proposals for conservation and management and responses.
- NAMMCO/24/MC/06 summarising past requests to the Scientific Committee (SC) and responses.

The vice-chair of the Scientific Committee, Tore Haug, presented the information on seal and walrus stocks from the Scientific Committee report (NAMMCO/24/07) under each species.

4.1 Harp Seals

Requests by Council for advice from the SC

R-2.1.4 - NAMMCO/12-2003 (standing): *to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

R-2.1.10 – NAMMCO/17-2008 (standing*): to provide advice on Total Allowable Catches for the management of harp seals and the establishment of a quota system for the common stocks between Norway and the Russian Federation, leaving full freedom to the Committee to decide on the best methods to determine this parameter based on an ecosystem approach.*

Advice from the SC

The NAMMCO SC had reviewed and endorsed the following advice of the ICES WG on Harp and Hooded seal that had met in November 2014:

- Pup production surveys (Russia (PINRO)) have been carried out in the White Sea since 1998. From 2004 onwards there are indications of a significant reduction in pup production without firm knowledge of why. Estimates have gone from around 340 000 (2003) to 129 000(2013).
- The population assessment model used for the White Sea/Barents Sea harp seal population provide a poor fit to the pup production survey data. ICES never the less decided to continue to use the model which estimated a total 2015 abundance of 1,368,200 (95% C.I. 1,266,300 – 1,509,378). The population is classified as data poor, still ICES *concluded* that the estimated equilibrium catches were the most preferred option. The *equilibrium catch level is 19 200* 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), *in 2015 and subsequent years*.
- An analysis of the effects of potential increases in Canadian catches (designed to reduce the NW Atlantic population of harp seals over a 10 year period) on Greenlandic catches indicates that if catches of young of the year in Canada increase (e.g. if sealskin prices increase), this will significantly reduce the availability of young harp seals for Greenland hunters. Although it is unlikely that Canadian catches will increase in the near future, the situation should be monitored.

The Joint ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals will meet again in August 2016 at the ICES HQ in Copenhagen, Denmark, to review the status and assess the catch potential of harp and hooded seals in the North Atlantic.

ICES and the North Atlantic Fisheries Organization (NAFO) have accepted NAMMCO's request to join the WGHARP, and the Secretariat will communicate with the ICES Secretariat before the next WGHARP meeting (scheduled for August 2016) to clarify the procedures in WGHARP on how requests should be forwarded for review.

Other information

Traditional photo aircrafts to assess seal populations in remote areas, such as the West Ice, is expensive and becoming more difficult to operate. IMR (Norway), with funding from the Norwegian Research Council (NRC), are investigating alternative (and cheaper) methods to perform photo-based aerial surveys. Unmanned Aerial Vehicles (UVA) have been tested in the West Ice with promising results. Both harp and hooded seals, including pups, were easily identified on the images taken at an altitude of 300 m (the usual altitude for photographing during traditional surveys).

A new population model for harp seals in the Barents and White Seas is being developed by Norwegian scientists, that is more flexible in capturing the dynamics of the observed pup production data. The current management model predicted that the pup abundance would give a slight increase over the next 15 years, whereas the new (state-space) model predicted that the pup abundance would increase substantially. The state-space model show some promising results and might be a step forward towards more realistic modelling of the population dynamics of the Barents Sea/White Sea harp seal population.

A recent paper using a new genetic analysis supports the hypothesis that harp seals comprise three genetically distinguishable breeding populations, in the White Sea, Greenland Sea, and Northwest Atlantic.

Discussion

Greenland informed the meeting that in 2014 approximately 63000 harp seals had been caught. For 2014 only preliminary numbers are available but the catch numbers seems to at the same level. There is no quota for harp seals only regulations on hunting methods. It was also reported that the average catches the last 5 years gave an annual catch of 74 000 animals compared to the previous 5 years when the annual catch was 86000 animals. The reduction in catch levels was explained by a shift to cod fisheries as opposed to the seal hunt.

Norway informed that in the West ice the quota for 2015 had been 21 270 seals (1+ animals or an equivalent number of pups where 2 pups equals one 1+ animal) and the catch was 1 165 1+ animals, including 8 animals taken for research purposes. As had been the case for previous 6 years there were no catches in the East ice in 2015.

The meeting welcomed the new ICES/NAFO/NAMMCO WG on harp and hooded seals.

Conclusion

The Management Committee took note of the report from the Scientific Committee, and endorsed the advice from the SC pertaining to the White Sea/Barents Sea population of an equilibrium catch level of 19 200 1 + animals in 2015 and subsequent years.

It also noted the need to monitor the catch level in Canada with respect to the effect this will presumably have on the availability of young harp seal for Greenland hunters.

The Committee was pleased to learn that NAMMCO now is part of the ICES WGHARP, and noted that the Secretariat will ensure that NAMMCOs request to review the status and assess the catch potential of harp and hooded seals in the North Atlantic will be dealt with at the meeting of this group in August 2016.

There were no recommendations for new scientific research or recommendations to member countries.

4.2 Hooded Seals

In 2007 the Management Committee for Seals and Walruses recommended a commercial catch level of zero only allowing limited research catches.

Requests by Council for advice from the SC

R-2.1.4 - NAMMCO/12-2003 (standing): *to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available.*

R-2.1.9 – NAMMCO/16-2007 (ongoing): *to investigate possible reasons for the apparent decline of the Greenland Sea stock of hooded seals; assess the status of the stock on basis of the results from the survey in 2007.*

Update from the SC

The joint analyses of the Norwegian and Russian data on female hooded seal reproductive biology in the Greenland Sea are currently being prepared for publication.

The WGHARP will meet again in August 2016 at the ICES HQ in Copenhagen, Denmark, to review the status and assess the catch potential of hooded seals in the North Atlantic.

Discussion

Greenland informed the meeting that the average catches the last 5 years gave an annual catch of 1 850 animals compared to the previous 5 years when the annual catch was 3 400.

Norway informed that 11 animals had been taken for the purpose of scientific research in 2015.

Conclusion

The Management Committee took note of the report from the Scientific Committee, and looked forward to the result of the August meeting in ICES/NAMMCO WGHARP.

There were no recommendations for new scientific research or recommendations to member countries.

4.3 Ringed Seals

Requests by Council for advice from the SC

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

R-2.3.2 - NAMMCO/7-1997 (standing): *to advice 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.*

Advice from the SC

Ongoing studies in Greenland have shown that ringed seals from the Ilulissat Icefjord (Kangia) are significantly different in size, pelage pattern, and behaviour (e.g., movements and diving patterns) than other ringed seals in the Arctic. In 2016 Greenland plan to continue investigations of possible genetic differences and survey the area for abundance of these seals in the Icefjord.

The increasing number of hunters could potentially have an impact on the population in the area, and it was recommended that Greenland continue the ongoing genetic work, that abundance surveys are carried out, and that Greenland consider protecting this small population until more information is available. A separate management plan should be developed for the Ilulissat ringed seal as soon as the survey is conducted.

There is still not enough information to warrant convening a NAMMCO Ringed Seal WG and it is recommended that this should occur after new surveys and genetics studies are completed.

Other information:

Research in Svalbard has shown dramatic shifts in movement patterns and foraging behaviour of ringed seals before and after a major collapse in sea-ice around the archipelago. These behavioural changes suggest increased foraging effort and thus likely increases in the energetic costs of finding food. Continued declines in sea-ice are likely to result in distributional changes, range reductions and population declines in this keystone arctic species.

Discussion

Greenland informed the meeting that the average catches the last 5 years gave an annual catch of 62 000 animals compared to the previous 5 years when the annual catch was 77 000.

Greenland also informed that the trade of ringed seal skins has been closed down from the south up to Disco bay, due to a surplus built up over the last 6 years. Hunting still continues but the lack of income from the skin sales in these areas can have a dramatic consequence for hunters.

Conclusion

The Management Committee took note of the report from the Scientific Committee.

The MC recommended that Greenland continue the genetic work and planned survey, and encouraged Greenland to take a precautionary stand and protect the Ilulissat population until more information is available.

There was no recommendations for new scientific research.

4.4 Grey Seals

Requests by Council for advice from the SC

R-2.4.2 - NAMMCO/11-2002 (standing): *provide a new assessment of grey seal stocks throughout the North Atlantic.*

Advice from the SC

Norway

The most recent pup production estimate of grey seals in Norway is based on data obtained in 2006 – 2008. The management plan require that abundance data be updated every 5 year, and boat-based visual surveys obtaining new estimates were conducted from 2013 – 2015. Some of the new estimates obtained in mid Norway were much lower than in the previous survey, and quotas were immediately reduced in these areas as a result.

It is assumed that some animals in the Tromsø/Finnmark area come from the Murman Coast, and the quota is higher than the usual 5% of current abundance estimate for the area. Russia does not allow hunting of grey seals and there is likely no by-catch as Russian fisheries do not use gillnets.

If possible Norway and Russia will conduct a joint survey of grey seals on the Murmansk Coast – last survey was in 1991.

Faroe Islands

A reporting system, implemented in the Faroes to obtain estimates of removals of grey seals at salmon farms, indicate removals of about 100+ seals per year.

Removal numbers are high and this is a concern because the population size is unknown. Therefore all available grey seal data should be presented for the review of the Coastal Seals Working Group (CSWG). It was recommended that the CSWG develops specific plans for monitoring grey seals in the Faroes.

Pup counts of grey seals in the Faroes are challenging because they pup in caves, however direct counts at haulout sites, perhaps using drones, should be considered for surveys. These surveys could aim to obtain, at the least, information on relative abundance.

Iceland

An abundance estimate from 2012 is available, and there is a plan for a new grey seal survey in 2016 pending funding.

Coastal Seals WG (CSWG)

The CSWG (Chair: Kjell Tormod Nilssen) will meet in early March 2016 and mainly address grey seals and harbour seals requests R-2.4.2 and R-2.5.2.

It is anticipated that the CSWG will have both by-catch estimates and a new grey seal estimate in Norway for consideration at the meeting.

The Terms of Reference for the meeting of the WG agreed upon in 2015:

1) assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway.
2) address by-catch issues in Norway, Iceland, and the Faroe Islands
3) re-evaluate the Norwegian management plans (which have been already implemented) for grey and harbour seals.

Discussion

The Faroe Islands remarked, with reference to number 2 of the Terms of Reference of the WG, that by-catch of seals is not a problem in the Faroes as the Faroes do not have gillnet fishery.

The Committee acknowledged that several recommendations/proposals had been tabled pertaining to the request that the Faroe Islands develop a management plan, get abundance estimates and get numbers on removals.

Russian observations made from coastal sites along central parts of the Kola Peninsula (in the southern Barents Sea) seems to indicate some redistributions of grey seals from Norwegian sites and eastwards to Russian sites.

Conclusion

The Management Committee took note of the report from the Scientific Committee. The Committee recommends that the CSWG in addition to the already agreed Terms of Reference also develop specific monitoring plans for grey seals in the Faroe Islands as suggested by the SC.

The Committee is looking forward to the results of the CSWG in anticipation that this will finalise request R 2.4.2.

There was no recommendation for new scientific research or recommendations to member countries.

4.5 Harbour Seals

Requests by Council for advice from the SC

R-2.5.2 - NAMMCO/16-2007 modified **NAMMCO/19-2010** (pending): *To conduct a formal assessment of the status of harbour seals for) as soon as feasible.*

Advice from the SC

Norway

Aerial and boat based visual surveys to obtain a new abundance estimate in Norway were conducted from 2011 - 2015. This has yielded a new point estimate of 7,594 for the species for the entire Norwegian coast. This new estimate is implemented in the current management of the species – this management now follows the management plan reviewed by NAMMCO SC in 2011.

Norwegian catch is reported by hunters and is considered reliable. The quotas are precautionary so some underreporting is not considered problematic.

IMR, in collaboration with the Swedish Natural History Museum, are considering tagging harbour seals in Sweden to see if they visit Norwegian coast.

Iceland

Results from the partial survey of harbour seals in 2014 shows an appreciable decrease in abundance in the most important haul-out areas. Aerial surveys of harbour seals are planned for 2016, if funds are available.

Large uncertainties in abundance and catch statistics, both direct catches and by-catches, make assessments of the present status and sustainability of removals problematic. The Marine Research Institute (MRI) in Iceland therefore said in 2015 that in the absence of new abundance estimates it was unable to evaluate whether the existing management objectives of grey seals and harbour seals are being met.

Greenland

In Greenland a new small group of harbour seals (three mothers with pups) was documented. Only four regularly used haul-out places (with a total of less than100 seals) is presently known in Greenland. All hunting on this species was banned in 2010 and it is believed that several small remnant populations still exist, but live undetected.

Discussion

Greenland informed the meeting that hunting of this species has been banned since 2010 based on NAMMCO advice. Normally a few catches are still reported by hunters and in 2014 12 were reported as taken. However there has been several cases of misidentification, and the Greenland Institute of Natur Research has been asked to validated the data.

Norway informed the meeting that the catch was 297 of a quota of 455 animals.

Conclusion

The Management Committee took note of the report from the Scientific Committee and noted that the Working Group on Coastal seals meet in March 2016 in order to finalise request R-2.5.2.

There was no recommendation for new scientific research or recommendations to member countries.

4.6 Bearded seal

Update from the SC

The Scientific Committee had no new information on this species.

Discussion

Since 2009 the Management Committee has recommended that the status of this species be assessed. The Chair noted that there is no request for advice from the Scientific Committee on this species, and pointed out that a request for advice would have to be formulated if the meeting wanted to uphold this request. No request was tabled.

Greenland informed the meeting that the average catches the last 5 years gave an annual catch of 1 250 animals compared to the previous 5 years when the annual catch was 1 500.

Conclusion

The Management Committee reiterates the conclusion from the last meeting that there is still not much information on bearded seals, and that this probably reflects that this is not a highly target species for NAMMCO members.

There is no recommendation for new scientific research or recommendations to member countries.

4.7 Walrus

Requests by Council for advice from the SC

R-2.6.3 - NAMMCO/15-2006 (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.*

The Chair reminded the meeting of the debate arising from the 2013 quota assessment for West Greenland, and the decision to carry out a supplementary survey of the northern stock (Baffin Bay stock in NW Greenland, Qaanaaq area). This survey, completed in early April 2014, combined with updated hunting statistics allowed for a new abundance estimate to be developed. Therefore at the last meeting in 2015 the Committee asked the SC to update the advice on sustainable takes of walrus from the Baffin Bay stock.

Advice from the SC

The assessment and quota advice was updated for the Baffin Bay population, and it is recommended that no more than 85 walruses are taken annually in Qaanaaq from 2016 to 2020.

Due to inconsistencies between the two reporting schemes (*Piniarneq* and *Særmeldingsskema*) in Greenland, it was recommeded to streamline the reporting system including to find out why the numbers are different between the reporting schemes.

In lack of any formal agreement on sharing of information between Canada and Greenland on this shared stock of walruses, the SC recommended that NAMMCO request the Canadian catch data.

The SC also recommended a new survey in the North Water Polyna (NOW; Baffin Bay stock) area as a means of monitoring this population. The SC also recommends that new age data and struck and lost data be obtained from both Canada and Greenland.

Satellite tagging of walruses continues in Svalbard, and the researchers are training Russian scientists so that they can use these techniques in the Pechora Sea. Genetics studies on walruses in the Pechora Sea indicate that they are similar to the Svalbard-Franz Josef Land walruses.

Discussion

Greenland informed that there is still a lack of coordination with Canada. The catches in West Greenland was 53 animals (quota 69), the catches in North Water was 74 (quota 86) and in East Greenland 4 animals (quota 18). Greenland further informed that they were presently reviewing the reporting system.

Greenland informed that the Government has set the struck and lost (S&L) level in Qaanaaq to 3% not following the NAMMCO scientific advice on 11 % . For the rest of Greenland the scientific advice is followed.

Greenland has been asked to report on catch statistics including corrections for killed but lost animals for different seasons, areas and hunts. In Greenland the hunting licenses in the narwhale, beluga, walrus, harbour porpoise and seal operations are closely related to struck and lost reporting in such a manner that reporting of S/L may lead to a hunter loosing his/her license. It is therefore difficult to get reliable data on S&L and Greenland seek guidance from the Management Committee on how to handle and collect such data on S&L. Greenland asked if one possibility was to look at the contract between scientists and Norwegian fishermen to collect by-catches (the so-called reference fleet).

In 2015 a three year Russian research programme, financed by a Russian oil and gas company, on walrus was completed. The main focus area was the Pechora Sea. Main participants were scientists from different Institutes of Russian Academy of Science, WWF, and oil and gas Company Institutes. During the program period, data on distribution, abundance and biological parameters were obtained. The methodology included deployment of satellite based transmitters and aerial surveys. Also, visual observations from vessels and coastal sites were made. Preliminary results from the "Walrus Programme" are being published in a special book issue, first in Russian but later with translations to English.

Conclusion

The Management Committee took note of the report from the Scientific Committee, and endorsed the recommendation on sustainable takes of walrus from the Baffin Bay stock based on the updated assessment.

The Committee also agreed to recommend the Council to request NAMMCO to provide advice on the best methods for collecting struck and lost data in Greenland.

5. ELECTION OF OFFICERS

New Chair: Iceland
Vice-chair: Faroes Islands

The meeting tanked the outgoing chair, Hild Ynnesdal, for her professional and good work during the last 4 years and welcomed the new officers.

Appendix 1 – Agenda

1. Chairman's opening remarks
2. Adoption of agenda
3. Appointment of rapporteur
4. Conservation and Management measures for seal stocks
   - 4.1. Harp seals
     - Requests by Council for advice from the Scientific Committee
     - Proposals for conservation and management
     - Updates
   - 4.2. Hooded Seals
     - Requests by Council for advice from the Scientific Committee
     - Proposals for conservation and management
     - Updates
   - 4.3. Ringed Seals
     - Requests by Council for advice from the Scientific Committee
     - Proposals for conservation and management
     - Updates
   - 4.4. Grey Seals
     - Requests by Council for advice from the Scientific Committee
     - Proposals for conservation and management
     - Updates
   - 4.5. Harbour Seals
     - Requests by Council for advice from the Scientific Committee
     - Proposals for conservation and management
     - Updates
   - 4.6. Bearded seal
     - Proposals for conservation and management
     - Updates
   - 4.7. Walrus
     - Requests by Council for advice from the Scientific Committee
     - Proposals for conservation and management
     - Updates
5. Any other business
   - 5.1. Elections

Appendix 2 - List of documents ALL Management Committees

Document no	Title	Agenda item
NAMMCO/24/MC/01	Joint List of Documents for the Management Committees	
NAMMCO/24/MC/02	Draft Agenda MCJ	
NAMMCO/24/MC/03	Draft Agenda MCSW	
NAMMCO/24/MC/04	Draft Agenda MCC	
NAMMCO/24/MC/05	Status of Past Proposals for Conservation and Management	MCC, MCSW
NAMMCO/24/MC/06	Summary of Requests by NAMMCO Council to the Scientific Committee, and Responses by the Scientific Committee	MCJ, MCC, MCSW
NAMMCO/24/MC/07	*No document (no recommendations to member countries in 2015)*	*MCC, MCSW*
NAMMCO/24/MC/08	Report from the Disturbance Symposium	MCJ 4.1
NAMMCO/24/MC/09	NASS 2015 – Post survey report from the Steering Committee	MCC 4.
NAMMCO/24/MC/10	US document on by-catch issue	MCJ 5.2
NAMMCO/24/07	Report of the 22d Meeting of the Scientific Committee	MCJ, MCC, MCSW

MC: Management Committee
MCJ: Joint Meeting of the Management Committees
MCC: Management Committee for Cetaceans
MCSW: Management Committee for Seals and Walruses

ANNEX 1 - List of proposals for conservation and management

This table provides a summary of all proposals for conservation and management made by the Management Committees, and the responses of member countries to these proposals as stated at later meetings. This document will be continually updated to serve as a resource for both the Council and the Management Committees. Codes beginning with: 1 – relevant to all Management Committees; 2 – relevant to seals; 3 – relevant to whales.

CODE	PROPOSAL FOR CONSERVATION AND MANAGEMENT	MANAGEMENT MEASURES/RESPONSE BY MEMBER COUNTRIES
1.1.0	**Incorporation of the users' knowledge in the deliberations of the Scientific Committee**	
1.1.1	The Management Committee endorsed the proposals and viewpoints contained in section 6 in the Scientific Committee report, and suggested that the "Draft Minke Whale Stock Status Report" (NAMMCO/9/7) could usefully serve as a pilot project for cooperation with the hunters. (NAMMCO/9).	Status Reports under development.
1.1.2	The Management Committee had previously asked the Secretariat to proceed with a proposal by the Scientific Committee to use stock status reports as a starting point for discussions with resource users to incorporate their knowledge in advice to Council, and to use the stock status report on minke whales as a pilot project. However, in 2000 the Management Committee recommended that a proposal for a conference on incorporating user knowledge and scientific knowledge into management advice should proceed, and asked the Conference Advisory Group to plan this conference to evaluate whether and how the previous proposal for incorporating user knowledge into the Scientific Committee's deliberations could be incorporated into the Conference (NAMMCO/11).	Greenland informed the Committee that a person had been hired at the Greenland Institute of Natural Resources to deal with these issues, and that this employee is also on the Advisory Board of the Conference. (NAMMCO/11)
1.1.3	The Management Committee re-established the Working Group on User Knowledge in Management and provided new Terms of Reference for the Group (NAMMCO/15). However, in 2006 the Committee had not met and no progress has been made. The Management Committee reaffirmed the importance of this issue, and considered that the process might be facilitated by focussing on a few key species at first. The Management Committee therefore **recommended** that the Working Group focus narwhal and beluga in the near term. It was also noted that this Working Group will report to the Council henceforth (NAMMCO/16). The Management Committee agreed that the issue of user knowledge in management decision-making, while also being a general item on the Council agenda, should be included on future agendas of the Committee to allow for the presentation of relevant new information from member countries and discussion in relation to the management of specific species and stocks. Council agreed to this recommendation from the MC and as a result agreed to dispense with the associated Working Group, noting that any further dedicated treatment of this issue would be decided in relation to deliberations in the respective MC's at future meetings (NAMMCO 17).	Greenland informed about plans for an information campaign on the inclusion of user knowledge in management decision making. (NAMMCO 24)

CODE	PROPOSAL FOR CONSERVATION AND MANAGEMENT	MANAGEMENT MEASURES/RESPONSE BY MEMBER COUNTRIES
1.2.0	**Marine mammal – fisheries interactions**	
1.2.1	The Management Committee noted (NAMMCO/16) the long-standing requests to the Scientific Committee in this area, and the conclusion of the Scientific Committee that no further progress was likely unless more resources were dedicated to modelling efforts already begun in Iceland and Norway, and to gathering the data necessary as model input previously identified by the Scientific Committee. In this respect it was noted that the Icelandic Research Program, which will provide required data on the feeding ecology of minke whales, will be completed by 2007. The Management Committee therefore agreed to recommend that the Scientific Committee review the results of the Icelandic program on the feeding ecology of minke whales and multispecies modelling as soon as these become available (NAMMCO/16). The Management Committees **expressed** a general support for the modelling exercise proposed and **recommended** the Secretariat and the Scientific Committee to continue the planning. The four modelling approaches proposed are: 1. Minimal realistic model implemented using GADGET 2. Ecopath with Ecosim 3. Time series regression 4. A simple biomass-based model such as one recently applied in eastern Canada. The exercise should be carried out preferably for two areas. Likely candidates include the Barents Sea and the region around Iceland. The projected investigation would require a funded multi-year project. Once funding is obtained, selection of appropriate area(s) should, if necessary, be decided by a working group of experts knowledgeable in the data requirements and availability. The tentative schedule provided for the work was articulated around 4 key-step meetings with a 2-year period as a realistic time-span for the whole process (NAMMCO/18).	
1.3.0	**By-catch**	
1.3.1	***Norway*:** The Management Committee supported the recommendation of the Working Group on by-catch that Norway provide the report of the March 2007 evaluation meeting to the NAMMCO Scientific Committee at their next meeting, and provide estimates of by-catch from fisheries to NAMMCO as soon as they become available (NAMMCO/16). *Faroes:* The WG supported the Faroes plan of conducting a questionnaire of fishermen to gather	Norway reported that it has a reference fleet as a trial for by-catch reporting. It is hoped that data will be available and analysed at the end of 2009. The findings should be available for reporting next year (NAMMCO 18). Efforts are being made to include mandatory reporting of marine mammal by-catch in all fishing vessel logbooks in the Faroe Islands. It should be noted that logbooks are already mandatory on all vessels

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	information about the magnitude of marine mammal by-catch as a useful first step (NAMMCO/16). *Iceland:* The Management Committee supported the advice of Working Group on by-catch that recommendations for improving the Icelandic monitoring program be accepted and implemented by Iceland in a timely fashion (NAMMCO/16). The Management Committee agreed in 2007 that the design of monitoring programs that will provide accurate and precise estimates of by-catch is in the main a scientific issue, and that such advice could therefore be provided by the Scientific Committee. The Management Committee agreed therefore to disband the standing Working Group on By-catch, as its role would now be fulfilled by the Scientific Committee (NAMMCO/16). The Management Committee agreed to the need for further guidance from Council in relation to priority of requests and workload of the Scientific Committee, before endorsing a review of by-catch systems (NAMMCO/17). The Management Committees **noted** the work undertaken by the Scientific Committee for organising a joint workshop with ICES, focussing on by-catch monitoring systems and reviewing the advantages and disadvantages of existing observation schemes for marine mammals, and **recommended** moving forward on this matter (NAMMCO 18). A Workshop on By-Catch Monitoring of marine mammals and seabirds, co-convened by NAMMCO and ICES was held successfully in Copenhagen in July 2010, and guidelines for best practices in monitoring by-catch are being developed and will be published (NAMMCO 19).	over 15 tonnes (NAMMCO 18). In Iceland there had been progress in monitoring but no results as yet (NAMMCO 18). There was still uncertainty whether by-catch in Greenland was reported as such or as catch (NAMMCO 18). Iceland reported new information on by-catch monitoring from 2009 (porpoise, harbour seal, bearded seal, grey seal and harp seal). Efforts are ongoing to improve reporting systems (NAMMCO 19). The Faroe Islands reported that a new electronic logbook system for vessels larger than 15 BRT is being developed and should be implemented in 2011 when reporting of marine mammal by-catch will become mandatory. (Conventional logbooks are already mandatory on vessels larger than 15 BRT.) (NAMMCO 19). Greenland reported that by-catches are reported as catches but a revised reporting system allowing discrimination of origin is underway (NAMMCO 19).
1.4.0	**Joint NAMMCO control scheme**	
1.4.1	The Management Committee agreed that the provisions of the Scheme should be amended to integrate requirements for observer training to ensure observer safety onboard vessels, and to take account of recent technological developments in automated monitoring. In addition the provisions should be modified to support it reporting to the Council rather than the Management Committee. (NAMMCO/16).	The revision of the provisions were finalised and adopted at NAMMCO 18.
1.5.0	**Enhancing ecosystem-based management**	

CODE	PROPOSAL FOR CONSERVATION AND MANAGEMENT	MANAGEMENT MEASURES/RESPONSE BY MEMBER COUNTRIES
1.5.1	The Management Committee recommended that the Working Group on Enhancing ecosystem-based management meet in 2007, and noted that it will be reporting to the Council henceforth. Nevertheless this item is of course of interest in a management context, and will remain on the agenda of the Management Committees. (NAMMCO/16). Noting the conclusion of the Scientific Committee that no further progress was likely in this area unless more resources were dedicated to modelling efforts already begun in Iceland and Norway, and to gathering the data necessary as model input, the Management Committee recommended that these activities be a priority for member countries (NAMMCO/16). Development of ecosystem models for use in management is a time-consuming process,. However enough progress has been made recently to warrant new consideration and a broader terms of reference in the Scientific Committee Working Group on marine mammal-fisheries interactions. Council therefore decided to discontinue the *ad hoc* Working Group on ecosystem-based management. Discussions of a general nature on the management level in recent years had been useful, and the efforts of the members of the *ad hoc* Working Group were appreciated. However, the continued scientific and management focus on these issues was more appropriate for detailed discussion in the respective Management Committees. It was however also agreed to keep this item on the Council agenda as an opportunity to follow developments in more general terms and to review how other relevant international bodies are addressing both the concepts and the practicalities of ecosystem-based management (NAMMCO 17).	
2.1.0	**Harp seals**	
2.1.1	The Management Committee requests that the Scientific Committee annually discusses the scientific information available on harp and hooded seals and advice on catch quotas for these species given by the ICES/NAFO Working Group on Harp and Hooded Seals. The advice by the Scientific Committee on catch quotas should not only be given as advice on replacement yields, but also levels of harvest that would be helpful in light of ecosystem management requirements For the Barents/White Sea and Greenland Sea stocks, in addition to the advice on replacement yields, advice should be provided on the levels of harvest that would result in varying degrees of stock reduction over a 10 year period (NAMMCO/13).	Greenland informed that a new executive order on seals will come into force in 2010 (NAMMCO 18).
2.1.2	*Northwest Atlantic* The Management Committee noted that a new abundance estimate for Northwest Atlantic harps seals of 4.8 million was available, based on a pup production estimate for 1994 of 702,900. The Management Committee also noted the conclusion that the Northwest Atlantic population of harp seals has been growing at a rate of 5% per year since 1990, and that the 1996 population was estimated to be 5.1 million, with a calculated replacement yield of	Canada brought to the attention of the Committee the recently completed Report of the Eminent Panel on Seal Management, which contains a full review of research and management of seals in Canada, with a primary focus on Northwest Atlantic harp and hooded seals. The Report is available at the following web site: http://www.dfo-mpo.gc.ca/seal-phoque/reports/index.htm. Canada also noted that an

CODE	PROPOSAL FOR CONSERVATION AND MANAGEMENT	MANAGEMENT MEASURES/RESPONSE BY MEMBER COUNTRIES
	287,000. The Management Committee concluded that catch levels of harp seals in Greenland and Canada from 1990 to 1995 were well below the calculated replacement yields in this period (NAMMCO/6). The Management Committee noted that combined estimated catches of harp seals in Canada and Greenland are in the order of 300,000 and that these catches are near, or at, the established replacement yields (NAMMCO/8). Noting that Canada has instituted a multi-year management plan with a 3- year allowable catch of harp seals totalling 975,000 (not including the catch by Greenland), the Management Committee requested the Scientific Committee to provide advice on the likely impact on stock size, age composition, and catches in West Greenland and Canada under the conditions of this plan (NAMMCO/13). The Management Committee noted that the request from advice from NAMMCO/14 "Evaluate how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland" was still open. The SC gave partial answer and had recommended again the request to be addressed to the ICES-NAFO WG. The Management Committee recommended that Greenland take the initiative of forwarding this request to ICES. (NAMMCO/16).	abundance survey of the Northwest Atlantic harp seals had been completed in 1999, and that published results were now available. (NAMMCO/11). Greenland commented that sustainable catches may be obtained at other catch levels than those that provide replacement yields. (NAMMCO/11). The Observer for Canada presented information on a multi-year management plan for the Atlantic seal hunt, which was announced in February 2003. For harp seals total allowable catch is set at 975,000 over a 3-year period. If the full quota were taken and Greenlandic harvests were as forecast, the total take should result in a slight population reduction over the period, while still maintaining the population well above the conservation reference points adopted (NAMMCO/12). Greenland informed the Management Committee that bilateral discussions with Canada on the Canadian Management Plan had taken place over the past year (NAMMCO/13). Greenland noted that there had still been no bilateral consultations with Canada on management of this stock, which is shared between the two countries. The Observer for Canada informed the Committee that a new multi-year management plan is in preparation, and that consultations with Greenland would be arranged in the near future (NAMMCO/15).
2.1.3	*North Atlantic, White/Barents Sea* The Management Committee noted the stock status and catch options presented by the Scientific Committee, and concluded that the catch level in 1998 was well below the calculated replacement yield. Catches at the same level in the future may result in population increase. From a resource management point of view, future quota levels approaching the replacement yield are advised. (NAMMCO/9).	Norway informed the Committee that measures were being considered to improve the efficiency of the seal harvest in this area. The possibility of introducing smaller vessels into the seal hunt is being pursued. The long-term goal will be to reduce the need for subsidising the hunt and increase the take of seals from this stock (NAMMCO/13, NAMMCO/14, NAMMCO/15).
2.1.4	*Greenland Sea* The Management Committee noted the stock status and catch options presented by the Scientific Committee, and concluded that the catch level in 1998 was well below the calculated replacement yield. Catches at the same level in the future may result in population increase. From a resource management point of view, future quota levels approaching the replacement yield are advised. (NAMMCO/6).	Norway informed the Committee that, similar to the situation for the White/Barents Sea stock, efforts are being made to improve the efficiency of harvesting. Recent harvests have been a small fraction of available quotas. Again the long-term goal will be to reduce the need for subsidising the hunt and increase the take of seals from this stock (NAMMCO/13). Norway reported that quotas for this stock have been roughly doubled

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		since 2005, based on advice from NAMMCO and ICES. However at present there is insufficient capacity to take higher quotas, so catches are expected to be much lower than the quotas (NAMMCO/15).
2.1.5	The Management Committee noted the conclusion of the Scientific Committee that the framework for the management of these species proposed by the ICES/NAFO Working Group would not be useful for NAMMCO for technical reasons and because the management objectives inherent in the framework were inflexible. In the case of harp and hooded seals, where management goals may in the future be defined in relation to ecosystem based objectives, more flexibility will be required than is allowed in this framework (NAMMCO/15). As suggested by the Scientific Committee in 2004, the Management Committee recommended that NAMMCO explore the possibility with ICES and NAFO of assuming a formal joint role in the Working Group on Harp and Hooded Seals. The Secretariat should contact ICES and NAFO in this regard. As a starting point, the Working Group, jointly with the NAMMCO Scientific Committee, should be asked to provide advice on outstanding requests (see NAMMCO Annual Report 2004, p. 27) (NAMMCO/15).	
2.1.6	The Management Committee also **endorsed** the WGHARP recommendation to implement the four-tiered management strategy which aligns with the Norwegian management strategy for Greenland Sea harp seals, once the population becomes data rich NAMMCO 18).	
2.2.0	**Hooded seals**	
2.2.1	*Northwest Atlantic* Noting the Scientific Committee's review of available analyses of hooded seal pup production, which recognised that calculations are dependent on the particular rate of pup mortality used, as well as the harvest regimes, the Management Committee concluded that present catches of hooded seals in the Northwest Atlantic (1990-1995) were below the estimated replacement yields of 22,900 calculated for a harvest of pups only, and 11,800 calculated for a harvest of 1-year and older animals only (NAMMCO/6).	
2.2.2	*Northwest Atlantic* The Management Committee noted that the total catch of hooded seals in the Northwest Atlantic in 1996 slightly exceeded the replacement yield while in 1997 the total number of seals taken was much lower (NAMMCO/8).	Greenland noted that this stock was shared with Canada and that the two countries hold regular bilateral discussions on management of this stock, including an exchange of information on harvest statistics, utilisation and stock assessment. (NAMMCO/11).
2.2.3	*Greenland Sea* The Management Committee noted the stock status and catch options presented by the Scientific Committee, and concluded that the catch level in 1998 was well below the calculated replacement yield. Catches at the same level in the future may result in population increase. From a resource management point of view, future quota levels approaching the	While supporting that catch levels for this stock are below replacement yield, Norway noted that the abundance estimate for this stock is dated and that it hoped that new information should soon be available from surveys planned for 2002. (NAMMCO/11).

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	replacement yield are advised (NAMMCO/9).	Norway informed the Committee that quotas in this area have been reduced on the advice of the ICES/NAFO Working Group on Harp and Hooded Seals, mainly because there is no recent abundance estimate for the stock. Consequently it is expected that the quota may be fully utilised this year (NAMMCO/13). Norway informed the Committee that a hooded seal survey covering all stocks will be carried out jointly with Canada and Greenland in 2005 (NAMMCO/14). A survey covering all stocks was carried out in 2005. Norway reported that, based on preliminary results from these surveys, quotas have been reduced for the Greenland Sea stock. A new survey will be carried out in the near future. Greenland noted that it had given Norway permission to take seals within the Greenland EEZ in 2006 (NAMMCO/15).
2.3.0	**Ringed seals**	
2.3.1	The Management Committee noted the conclusions of the Scientific Committee on the assessment of ringed seals in the North Atlantic, which had been carried out through the Scientific Committee Working Group on Ringed Seals. In particular, the Management Committee noted that three geographical areas had been identified for assessing the status of ringed seals, and that abundance estimates were only available for Area 1 (defined by Baffin Bay, Davis Strait, eastern Hudson Strait, Labrador Sea, Lancaster, Jones and Smith sounds (NAMMCO/6).	
2.3.2	While recognising the necessity for further monitoring of ringed seal removals in Area 1, the Management Committee endorsed the Scientific Committee's conclusions that present removals of ringed seals in Area 1 can be considered sustainable (NAMMCO/6).	Greenland: the government is presently undertaking a regulatory initiative which will deal with hunting of all seals in Greenland, rather than just harbour seals as at present (NAMMCO/11).
2.4.0	**Grey seals**	
2.4.1	The Management Committee noted the concern expressed by the Scientific Committee with regard to the observed decline in the grey seal stock around Iceland, where harvesting has been above sustainable levels for more than 10 years, with the apparent objective of reducing the size of the stock. The Management Committee agreed to recommend that Iceland should define clear management objectives for this stock. The Management Committee noted the conclusion of the Scientific Committee that the new quota levels implemented for Norwegian grey seals would, if filled, almost certainly lead to a rapid reduction in population in the area. The Management Committee agreed to recommend that Norway should define clear management objectives for this stock. For the Faroe Islands, the Management Committee supported the recommendation of the	Iceland: the management objective for grey seals would be to maintain the stock size close to the current level, and that protective measures would be taken should further declines continue. A precondition is careful monitoring of the stock size. Norway: a management plan for grey seals is presently under development. Recent catches have been lower than the quota levels in most areas (NAMMCO/14). Norway: a management plan for grey seals is still under development. In response to a query from Greenland, Norway informed the

CODE	PROPOSAL FOR CONSERVATION AND MANAGEMENT	MANAGEMENT MEASURES/RESPONSE BY MEMBER COUNTRIES
	Scientific Committee to obtain better information on the level of catch (NAMMCO/13). The Management Committee recommended Greenland to protect grey seals from hunting given the likely isolation of the small stock in southeast Greenland (NAMMCO 19).	Committee that grey seals are not managed in cooperation with other jurisdictions as there is believed to be little exchange among stocks (NAMMCO/15). The Faroes: a drastic decline in salmon aquaculture had likely led to a decline in killing of grey seals that were a nuisance to the industry (NAMMCO/15). The Faroes: there would be a satellite tracking programme for grey seals starting in the spring of 2007 to aid further studies on feeding ecology and abundance. (NAMMCO/16). Norway: a quota of 25% of the population has been established taking into consideration the estimated by-catch levels. A new population estimate for the period 2006-8 will soon be available, and a management plan, complemented by a genetic study, will be presented to the next Scientific Committee meeting in 2009 (NAMMCO 17). Norway: national management plans are presently ready to be fully implemented for both grey and harbour seals (NAMMCO 19). Norway: management plans for both grey and harbour seals have been implemented in Norway since late autumn 2010 (NAMMCO 20). Greenland: the recommendation of a total ban on hunting of grey seals has already been incorporated in a new Executive Order from 1st December 2010 (NAMMCO 19 and 20).
2.4.2	With regards to the present estimate of a harvest up til 40% of the population annually, the Scientific Committee **urged** the Faroe Islands to estimate their present removals and abundance off their coast. The Scientific Committee **strongly recommended** that all efforts be made in providing a proper estimate of population size and catch at its next meeting (NAMMCO 18). The Scientific Committee also **recommended** that the Faroe Islands define clear management objectives for grey seals, and that the reporting of grey seal catches in the Faroe Islands be made mandatory and enforced (NAMMCO 18). The Management Committee for Seals and Walruses **recommended** the convening of a WG on Coastal Seals to review the Norwegian Management plan in view of an assessment. The	The Faroese: efforts were underway to obtain better information on population, removals and breeding sites for this species, and satellite tagging of grey seals is in progress. Private companies possess data on this and other species Iceland: the management objective is to maintain the grey seal stock at the 2004 level of 4,100 animals. The latest estimate is 6,200 animals and well above the management objective (NAMMCO 19).

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	Management Committee for Seals and Walruses also **supported** the recommendations concerning the compilation and reporting of Faroese removal and abundance data, and the Icelandic research data (NAMMCO 18). The Management Committee urged the Faroe Islands to estimate removals and abundance of grey seals around their coast, and to provide proper estimates of population size snd catches for 2011 (NAMMCO 19).	
2.5.0	**Harbour seals**	
2.5.1	The Committee noted a request from NAMMCO 16: to define management objectives for harbour seals in Norway, Iceland and Greenland (NAMMCO 17). A total ban on hunting for this species in Greenland is **recommended**, and a formal assessment of the stocks in all areas and the establishment of clear management objectives should be undertaken (NAMMCO 18). The Management Committee **reiterated a recommendation** for a formal assessment of the Icelandic stock and the establishment of clear management objectives (NAMMCO 18). Concerning the new Norwegian Management plan, the Management Committee **recommended**, as for the grey seal management plan, that a better way of taking uncertainties into consideration be developed and that an expert working group make an in depth evaluation of the plan, including a comparison with existing management models for e.g. harp and hooded seals (NAMMCO 18).	Norway: currently working on a management plan for harbour seals (NAMMCO/16). The Faroe Islands: no priority for a specific management plan at this time because the species no longer occurs in the Faroes (NAMMCO/16). Greenland: working on management plans for a number of species, including harbour seal. The next priority will be given to harbour seals. Reported catches have been very high, probably due to misreporting. With new catch reporting system 24 animals were reported for 2006 (NAMMCO/16). Iceland: new abundance estimates available, but still insufficient information on by-catch. Norway: implemented a system for assessment of the two coastal seal species that secures updated information about abundance approximately every 5 yr. This system has provided two abundance estimates after 1996. As a third point estimate is needed for an assessment for harbour seals another survey is needed and will probably be performed by 2010 (NAMMCO 17). Greenland: a new executive order on protection and hunting of seals in Greenland is under construction and in this a ban on hunting of harbour seal is included (NAMMCO 17). Iceland: management objectives for harbour seals had been set to maintain the stock close to the 2006 level (NAMMCO 19). Norway: national management plans are presently ready to be fully implemented for both grey and harbor seals (NAMMCO 19). These were implemented in late fall 2010 (NAMMCO/20).

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2.6.0	**Atlantic walruses**	
2.6.1	The Management Committee examined the advice of the Scientific Committee on Atlantic Walrus and noted the apparent decline which the Scientific Committee identified in respect to "functional" stocks of walrus of Central West Greenland and Baffin Bay. While recognising the over all priority of further work to clarify and confirm the delineation and abundance of walrus stocks in the North Atlantic area, the Management Committee <u>recommends</u> that Greenland take appropriate steps to arrest the decline of walrus along its west coast. Taking into account the views of the Scientific Committee that the Baffin Bay walrus stock is jointly shared with Canada and that the West Greenland stock might be shared, the Management Committee encourages Canada to consider working co-operatively with Greenland to assist in the achievement of these objectives (*NAMMCO Annual Report 1995*: 49).	Greenland: new (1999) legislation for the conservation of the West Greenland stock include among other things restriction of who can hunt, a year-round ban on walrus hunting south of 66° N; and limitations on transport used in connection with walrus hunting to dog sleds and vessels of 19.99 GRT/31.99 GT or less. Municipal authorities now also have the possibility of implementing further restrictions if circumstances require. (NAMMCO/8). Greenland : a new regulatory proposal has been drafted introducing quotas on walrus. The final proposal will take public hearings into account. (NAMMCO/11). The regulatory initiative to introduce quotas and other hunting regulations for this species had been delayed, and comprehensive public hearings have been conducted. It is expected that a final decision on the initiative will be taken later in 2003 (NAMMCO/12). Greenland: the new regulation will go to the Greenlandic government for approval this year (NAMMCO/13). Greenland: the new regulation is awaiting the findings of the Scientific Committee in their assessment of walrus. (NAMMCO/14). Greenland: the regulatory initiative had been delayed but was expected to be introduced in 2006 (NAMMCO/15).
2.7.2	The Management Committee noted that there was an ongoing request for advice for an assessment of this stock. Present removals were likely not sustainable for the North Water and West Greenland stocks, and it was recommended that new assessments for these stocks be completed as soon as identified research recommendations were fulfilled (survey reanalysis, new surveys, stock structure, and complete corrected catch series) (NAMMCO/16). The Management Committee agreed that the relationship between JCNB and NAMMCO regarding walrus would be revisited next year. (NAMMCO/16). The Management Committee agreed that total removals for all areas should be set under consideration of a probability of sustainability that is higher than or equal to 70% (NAMMCO 19). The Management Committee also agreed that managers should consider establishing a more robust system for monitoring the sex and age composition of the catch. Furthermore it was agreed that a common management regime should be established between Greenland and Canada on shared stocks of walruses (NAMMCO 19).	Greenland: considerable progress in this area of assessment through implementation of hunting regulations and the Greenland Institute for Natural Resources (GINR) developing a Research Plan for 2007-10 (NAMMCO/16). Greenland: new Executive Order, finalised in 2006. 3-year quotas for the period 2007 – 2009 were introduced designed to allow for a gradual reduction of catches that by 2009 will result in removals that will be within the sustainable levels recommended by the Greenland Institute of Natural Resources (NAMMCO/16). Greenland: want to manage the species in NAMMCO, hence no initiative has been taken towards Canada to cooperate on management of walrus. Under the JCNB only exchange of information takes place (NAMMCO 22).

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2.7.3	The MC endorsed the updated assessment and quota advice for the Baffin Bay population, and recommended that no more than 85 walruses are taken annually in Qaanaaq from 2016 to 2020. Due to inconsistencies between the two reporting schemes (*Piniarneq* and *Særmeldingsskema*) in Greenland, it was recommeded to streamline the reporting system including to find out why the numbers are different between the reporting schemes. (NAMMCO24)	Greenland informed that there is still a lack of coordination with Canada. The catches in West Greenland was 53 animals (quota 69), the catches in North Water was 74 (quota 86) and in East Greenland 4 animals (quota 18). Greenland further informed that they were presently reviewing the reporting system. The Government has set the struck and lost (S&L) level in Qaanaaq to 3% not following the NAMMCO scientific advice on 11 % . For the rest of Greenland the scientific advice is followed. Greenland asked guidance from the Management Committee on how to handle and collect such data on S&L.(NAMMCO 24)
2.8.0	**Bearded seal**	
	The Management Committee **recommended** that the status of this species be assessed (NAMMCO 18).	
3.1.0	**North Atlantic fin whales**	
3.1.1	*East Greenland-Iceland Stock* The Management Committee accepted that for fin whales in the East Greenland – Iceland (EGI) stock area, removals of 200 animals per year would be unlikely to bring the population down below 70% of its pre-exploitation level in the next 10 years, even under the least optimistic scenarios. However, catches at this level should be spread throughout the EGI stock area, roughly in proportion to the abundance of fin whales observed in the NASS surveys. Furthermore, the utilization of this stock should be followed by regular monitoring of the trend in the stock size. The conservative nature of the advice from the Scientific Committee was noted (NAMMCO/9).	
3.1.2	*East Greenland-Iceland Stock* The Management Committee noted the conclusion of the Scientific Committee that projections under constant catch levels suggest that the inshore substock will maintain its present abundance (which is above MSY level) under an annual catch of about 150 whales. It is important to note that this result is based upon the assumption that catches are confined to the "inshore" substock, *i.e.* to the grounds from which fin whales have been taken traditionally. If catches were spread more widely, so that the "offshore" substock was also harvested, the level of overall sustainable annual catch possible would be higher than 150 whales. (NAMMCO/13). The Management Committee noted the conclusion of the Scientific Committee that there was no reason to change their previous conclusion that a catch of 150 whales from the West Iceland sub-stock would be sustainable, and considered that this should conclude the SC's	Greenland had qota adveice from IWc of 19 fin whales of which 11 were caught in 2015 (NAMMCO 24)

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	work on the EGI stock until new information becomes available (NAMMCO/16). It endorsed the plan to complete an assessment for the Northeast Atlantic stocks as a next step in the process of assessing the fin whale stocks in the areas of interest to NAMMCO countries (NAMMCO/16). The Management Committee noted the assessment performed by the SC and concluded that an annual strike of up to 154 fin whales from the WI Sub area is sustainable at least for the immediate 5 year period. (NAMMCO/19). The MC agreed to a catch level of 146 fin whales taken anywhere in the EG+WI area. The advice is valid for a maximum of 2 years (2016-2017). (NAMMCO 24)	
3.1.3	*Faroe Islands* The Management Committee noted that the conclusion of the Scientific Committee had not changed from the previous assessment, that the uncertainties about stock identity are so great as to preclude carrying out a reliable assessment of the status of fin whales in Faroese waters, and thus the Scientific Committee was not in a position to provide advice on the effects of various catches. It may also be necessary to obtain clearer guidance on the management objectives for harvesting from what is likely to be a recovering stock before specific advice can be given (NAMMCO/13).	Presently no plans for fin whale hunt in Faroes but would like to continue investigating this as a potential resourse for utilisation. (NAMMCO 24)
3.2.0	**Minke Whales - Central North Atlantic**	
3.2.1	The Management Committee accepted that for the Central Stock Area the minke whales are close to their carrying capacity and that removals and catches of 292 animals per year (corresponding to a mean of the catches between 1980-1984) are sustainable. The Management Committee noted the conservative nature of the advice from the Scientific Committee (NAMMCO/8).	
3.2.2	The Management Committee took note of the conclusions of the Scientific Committee with regard to the Central Atlantic Stock, that, under all scenarios considered, a catch of 200 minke whales per year would maintain the mature component of the population above 80% of its pre-exploitation level over that period. Similarly, a catch of 400 per year would maintain the population above 70% of this level. This constitutes precautionary advice, as these results hold even for the most pessimistic combination of the lowest MSYR and current abundance, and the highest extent of past catches considered plausible. The advice applies to either the CIC Small Area (coastal Iceland), or to the Central Stock as a whole (NAMMCO/13). Noting that a full assessment, including the 2009 estimate, will be conducted at the next meeting of the Large Whale Assessment WG in January 2010, the Management Committee	

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	for Cetaceans recommends that 200 minke whales per year be considered as the largest short-term catch that should be contemplated over the short-term, 2-5 years. This catch level refers to total removals from the CIC or CMA, both Icelandic and others (NAMMCO 18). The Management Committee agreed that annual removals of 216 minke whales from the CIC area are sustainable and precautionary and that annual removals of 121 minke whales from the CM area are sustainable and precautionary. Furthermore it was agreed that this management advice should apply for the next 5 years unless the Scientific Committee considers that new scientific evidence is likely to change the basis of the advice (NAMMCO 19). The Council took note of the Endorsement by the Management Committee for Cetaceans that annual removals of up to 229 minke whales from the CIC area are safe and precautionary for the next 5 years (NAMMCO 20). The MC agreed to a catch limit of 224 minke whales in the CIC area valid for a maximum of 3 years (2016-2018). (NAMMCO 24)	Norway have a carryover system, and from a quota of 1,286 common minke whales, 660 were caught by 21 vessels. Iceland have a carryover system, there was a quota of 275 common minke whales, and 29 were caught in 2015 by a single vessel. Greenland catches 2015: West Greenland of 164 common minke whales with a carry-over of 15 from 2014, 130 were caught. The quota for East Greenland was 12 minke whales with a carry-over of 3 from 2014, and 6 were caught. (NAMMCO 24)
	Minke Whales - West Greenland	
3.2.3		Greenland reported that a quota of 178 minke whales in West Greenland had been implemented from 2010 in response to the advice of the Scientific Committee of the IWC (NAMMCO 19).
3.3.0	**Narwhal - West Greenland**	
3.3.1	*Avanersuaq* The Management Committee noted that the present exploitation level in Avanersuaq of 150/yr seems to be sustainable, assuming that the same whales are not harvested in other areas. *Melville Bay – Upernavik* The Management Committee noted that the Scientific Committee could give no status for the Melville Bay – Upernavik summering stock. *Uummannaq* The Management Committee noted that the substantial catches (several hundreds) in some years do cause concern for the status of this aggregation. The Management Committee further noted that the abundance of narwhal in this area should be estimated. *Disko Bay* The Management Committee noted that present catches in this area are probably sustainable. *Catch Statistics*	Greenland: harvest quotas will be introduced for West Greenland narwhal in the near future (NAMMCO/11). Greenland: the regulatory initiative to introduce quotas and other hunting regulations for this species had been delayed, and comprehensive public hearings have been conducted. The draft regulations have now been submitted to the Council of Hunters. It is expected that a final decision on the initiative will be taken later in 2003 (NAMMCO/12).

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	The Management Committee noted that for both narwhal and beluga it is mandatory for future management that more reliable catch statistics (including loss rates) are collected from Canada and Greenland (NAMMCO/9*)*.	
3.3.2	The Management Committee accepted that the JCNB would provide management advice for this stock, which is shared by Canada and Greenland. The Management Committee therefore recommended that closer links be developed with the JCNB on this and other issues of mutual concern. (NAMMCO/10).	Greenland: the new regulations pertaining to beluga will also apply to narwhal, and that quotas will be introduced in July 2004 (NAMMCO/13).
3.3.3	The Management Committee noted the conclusions of the Scientific Committee, that the West Greenland narwhal have been depleted, and that a substantial reduction in harvest levels will be required to reverse the declining trend. These are preliminary conclusions, and more research and assessment work will be required. Nevertheless the Management Committee expressed its grave concern over the status of the West Greenland narwhal, and noted that the JCNB, which provides management advice for this stock, would be considering this information in the near future. The Management Committee also noted that it will be important for NAMMCO to monitor the situation closely and update the assessment as soon as more information is available (NAMMCO/13).	Greenland: quotas of 200 in West Greenland and 100 in Qaanaaq had been introduced in 2004, and the catch was lower than the quota level (NAMMCO/14). Greenland: the quota for 1 July 2004 to 30 June 2005 of 300 had been nearly fully taken. The quota for 2005/2006 of 260 raised to 310 during the hunting season, mainly because hunter observations suggested that narwhal numbers were larger than expected and because the original quota levels were exceeded (NAMMCO/15).
3.3.4	In 2005 the Scientific Committee provided similar advice to that given in 2004, that the total removal of narwhals in West Greenland should be reduced to no more than 135 individuals. This advice was provided with even greater emphasis due to the fact that all models reviewed suggested total annual removals even lower than this. This conclusion was reached in a joint meeting with the JCNB Scientific Working Group, using the best scientific advice available. It is apparent that there continues to be considerable disagreement between scientists and hunters on narwhal stock structure, life history, and especially abundance and trends. While recognising the existence of this disagreement, the Management Committee concluded that it is nevertheless necessary to manage narwhals in a precautionary manner in the face of uncertainty and apparently contradictory evidence. In this regard it was noted that the 2004/2005 quota was 300 and that the quota for 2005/2006 of 260 was raised to 310. These quotas are more than two times the level recommended by the Scientific Committee. While commending Greenland for the recent introduction of quotas and reduction in the harvest, the Management Committee expressed serious concern that present takes of narwhal in West Greenland, according to the advice of both the NAMMCO Scientific Committee and the JCNB Scientific Working Group, are not sustainable and will lead to further depletion of the stock. In 2000 NAMMCO accepted that the Canada/Greenland Joint Commission on Conservation	

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	and Management of Narwhal and Beluga (JCNB) would provide management advice for this stock. The Management Committee therefore strongly urged the JCNB and the Government of Greenland to take action to bring the removals of narwhals in West Greenland to sustainable levels (NAMMCO/15). In 2007, Norway, Iceland and the Faroes shared the concern expressed by the Scientific Committee, that the narwhal quota for West Greenland remained well above the recommended level of 135 and that the quota had increased since it was introduced in 2004. It was also noted in this respect that the JCNB in 2006 had expressed grave concern at the status of this stock, and recommended the development of a work plan with a time frame for the reduction in total removals of narwhal to the recommended level (NAMMCO/16). The Management Committee welcomed the development of a monitoring plan but reiterated the serious concern expressed in previous years that present takes of narwhal in West Greenland, according to the advice of both the NAMMCO Scientific Committee and the JCNB Scientific Working Group, are not sustainable and will lead to further depletion of the stock. While accepting that there remains considerable disagreement between scientists and hunters with regard to the status of the stocks, it was nevertheless considered advisable to manage in a precautionary manner in the face of such uncertainty. The Management Committee therefore once again strongly urged the JCNB and the Government of Greenland to take action to bring the removals of narwhals in West Greenland to sustainable levels as quickly as possible. (NAMMCO/16).	In 2007, the Minister of Fisheries for Greenland responded that decisions regarding catch limitations are taken with consideration of the views of scientists and hunters, and that in this case the two groups have a very different perception of the status of the stock. Narwhal are seasonally abundant in some areas and it has proven difficult up to now to reach a consensus between scientists and hunters on stock status. Hunting is very important to the culture and economy of Greenland. The minister also stated that belugas and narwhals consume Greenland halibut and disturb the fisheries. Jessen added that, in order to avoid inflicting undue hardship on hunting families, Greenland has opted for a gradual reduction of quotas, with the aim of reaching recommended sustainable levels. Greenland has also developed a monitoring and survey plan to obtain better information on the status of beluga, narwhal and walrus, for which funding is being sought. In addition Greenland is developing a multi-year management plan for narwhal (NAMMCO/16).
3.3.5	The Management Committee for Cetaceans **noted** that the quotas given for the period July 2008 - June 2009 of 260 narwhals in West Greenland (WG) and 130 narwhals in Melville Bay (MB), gave a lower probability of population increase than the 70% recommended for West Greenland narwhals (70% chance of increase corresponds to a total take of 229 and 81 narwhals in WG and MB) (NAMMCO 18). The Management Committee for Cetaceans, based on advice from the Scientific Committee, **recommended** that catches be set so that there is at least a 70% probability that management objectives will be met for West and East Greenland narwhals, i.e. maximum **total removals** of 310 and 85 narwhals in West and East Greenland respectively (NAMMCO 18). The Management Committee **noted** that NAMMCO is the competent body to advise on East Greenland, and that Greenland has followed the advice of the NAMMCO Scientific Committee, which is now endorsed. The Management Committee welcomed the fact that Greenland has followed the NAMMCO advice (NAMMCO 18).	Greenland stated that it would continue with its multi-year management plan for narwhals using 70% probability of increase – total 310 for W.Greenland and 85 narwhals for East Greenland. Greenland commented that collaboration between managers, hunters and scientists has improved (NAMMCO 18).
3.3.6	The Management Committee strongly **recommends** that “struck and lost” data be collected from all areas and types of hunt and that all “struck and lost” animals be included in the	In Greenland hunters are required to report on Struck and lost. Greenland requestd advice from the SC on collection of Struck and

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	advice (NAMMCO 19).	lost data. (NAMMCO 24)
3.3.7	The MC commends the work on developing the new catch-allocation model in NAMMCO-JCNB JWG and endorsed the use of the model in management procedures. (NAMMCO 24) The MC endorsed the new advice on total annual removals of narwhale in East Greenland (50 in Ittoqqortoormiit and 16 in Tasiilaq/kangerlussuaq) (NAMMCO 24).	Greenland has already implemented the procedure and quotas has increased in some areas and decreased in others. A revision to the Executive Order regulating hunt of Narwal and Beluga has been approved in Greenland. Greenland reported quotas and catches of narwhal in 2015 narwhal: West Greenland; quota, 144, catch 72. Inglefield Bredning; quota 85, caught 75; A technical 5 year quota block is given of 485 animals, first year starting in 2014. For Melville Bay the quota was 81, with a catch of 71. In East Greenland the quota was 88 plus an extra political allocated quota of 10, with a catch of 94. (NAMMCO 24)
3.4.0	**Beluga - West Greenland**	
3.4.1	*Maniitsoq – Disko* The Management Committee noted that a series of surveys conducted since 1981 indicate a decline of more than 60% in abundance in the area Maniitsoq to Disko. It further noted that with the present harvest levels (estimated at 400/yr) the aggregation of belugas in this area is likely declining due to overexploitation. *Avanersuaq – Upernavik* The present harvest in the area Avanersuaq - Upernavik is estimated to be more than 100/yr. The Management Committee noted that since this beluga occurrence must be considered part of those wintering in the area from Maniitsoq to Disko, it is considered to be declining due to overexploitation. Finally the Management Committee noted that with the observed decline a reduction in harvesting in both areas seems necessary to halt or reverse the trend (NAMMCO/9).	Greenland: in November 2000 the government made a decision to introduce harvest quotas for beluga and narwhal. Public hearings on a draft regulatory proposal were held in spring 2001. The results of these hearings are being taken into account in the drafting of a revised regulatory proposal, and a final set of regulations is expected to be introduced sometime in 2002 (NAMMCO/11). Greenlan: the regulatory proposal had been delayed, and comprehensive public hearings have been conducted. The draft regulations have now been submitted to the Council of Hunters. It is expected that a final decision on the initiative will be taken later in 2003 (NAMMCO/12).
3.4.2	It was accepted that the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB) would provide management advice for this stock, which is shared by Canada and Greenland. Closer links should be developed between NAMMCO and the JCNB on this and other issues of mutual concern. (NAMMCO/10).	
3.4.3	A joint meeting of the NAMMCO Scientific Working Group on the Population Status of North Atlantic Narwhal and Beluga and the JCNB Scientific Working Group had been held in May 2001. It was recommended that this co-operation at the scientific level should continue, and it was reiterated that closer links be developed between NAMMCO and the	Greenland: a regulatory framework allowing the government to set quotas and other limitations on hunting has now been passed. It is expected that quotas will be introduced for beluga and narwhal by July 2004. (NAMMCO/13).

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	JCNB on this and other issues of mutual concern. (NAMMCO/11).	Greenland: a quota of 320 had been introduced in West Greenland and Qaanaaq year-round from 1st July 2004. After implementation the catch was lower than the quota level, mainly due to poor weather conditions (NAMMCO/14). Greenland: the quota for 1 July 2004 to 30 June 2005 of 320 had not been fully harvested due mainly to poor weather conditions. The quota for 2005/2006 is 220 (NAMMCO/15).
3.4.4	The JCNB recommends reducing catches to 100 per year will have an 80% chance of halting the decline in beluga numbers by 2010. Similar advice was first provided in 2000 and has been confirmed and reiterated in meetings held in 2003 and 2004. Despite considerable disagreement between scientists and hunters on beluga, the Management Committee concluded that it is necessary to manage beluga in a precautionary manner in the face of uncertainty and apparently contradictory evidence. While commending Greenland for the recent improvements (quotas and reduction of harvest) serious concern was expressed that present quotas for beluga in West Greenland, are not sustainable and will lead to further reduction of the stock. The Management Committee therefore strongly urged the JCNB and Greenland to take action to bring the removal of belugas in West Greenland to sustainable levels (NAMMCO/15). The population is depleted and further action is needed to halt the decline. The quota is still above the recommended level of 100. However it was also noted that the quota has been reduced since its introduction in 2004. The Management Committee therefore commended Greenland for their management efforts to improve the conservation status of beluga in this area, and strongly urged Greenland to continue their efforts to bring the catch to sustainable levels. The Management Committee also welcomed the development of the monitoring plan mentioned above for narwhal which also applies to beluga (NAMMCO/16). The Management Committee for Cetaceans welcomed the multi-annual catch quotas recently introduced by Greenland for beluga stocks based on advice of the Scientific Committee that an annual take of 310 belugas over 5 years up to 2014 was sustainable, and **noted** that these are intended to rebuild the level of the stocks in coming years and therefore ensure the long-term sustainability of catches (NAMMCO 18).	
3.4.5	The MC agreed to a total annual removal of beluga in West Greenland to no more than 320 animals from 2016 to 2020. (NAMMCO 24)	Greenland reported that the quota in 2015 for beluga in West Greenland was 320, and 120 were caught. In Qaanaaq, the quota was 20 and 7 were caught. A technical 5 year quota block is given of 100

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		animals, with the first year starting in 2014. (NAMMCO 24) A revision to the Executive Order regulating hunt of Narwal and Beluga has been approved in Greenland. (NAMMCO 24)
3.5.0	**Northern bottlenose whales**	
3.5.1	The Management Committee discussed the advice of the Scientific Committee on the status of the northern bottlenose whale and noted that this was the first conclusive analysis on which management of the northern bottlenose whale could be based. The Management Committee <u>accepted</u> that the population trajectories indicated that the traditional coastal drive hunt in the Faroe Islands did not have any noticeable effect on the stock and that removals of fewer than 300 whales a year were not likely to lead to a decline in the stock (NAMMCO/5).	
3.6.0	**Long-finned pilot whales**	
3.6.1	The Management Committee noted the findings and conclusions of the Scientific Committee with respect to the status of long-finned pilot whales in the North Atlantic (Section 3.1, item 3.1), which confirmed that the best available abundance estimate of pilot whales in the Central and Northeast Atlantic is 778,000. Also that there is more than one stock throughout the entire North Atlantic, while the two extreme hypotheses of i) a single stock across the entire North Atlantic stock, and ii) a discrete, localised stock restricted to Faroese waters, had been ruled out. It further noted that the effects of the drive hunt of pilot whales in the Faroe Islands have had a negligible effect on the population, and that an annual catch of 2,000 individuals in the eastern Atlantic corresponds to an exploitation rate of 0.26%. The conclusion is that the drive hunt of pilot whales in the Faroe Islands is sustainable (NAMMCO/7). There is a comprehensive international scientific research sampling of all pilot whales caught in the Faroes from 1986 to 1988, and the Management Committee recognised the value of building on and updating this valuable information by ensuring ongoing sampling of pilot whales in the Faroes (NAMMCO/16).	In 1997 the Management Committee concluded that the Faroese drive hunt of pilot whales is sustainable. There have been no changes in annual take, new abundance estimates or other information that warrant any change in this conclusion. (NAMMCO/11). The Faroe Islands: plans are underway to implement a monitoring programme, the aim of which is to update the existing comprehensive biological data on pilot whales that was provided by the dedicated international research programme in the Faroe Islands in 1986-1988 (NAMMCO 18). Faores catched 501 pilot whales in 6 drives in 2015 (NAMMCO 24).
3.7.0	**Humpback whales**	
3.7.1	In 2006 new abundance estimates for West Greenland were available from surveys conducted in 2005. The Management Committee accepted the conclusion of the Scientific Committee that a removal (including by-catch) of up to 10 animals per year in West Greenland would not harm the stock in the short or medium term. The Management Committee therefore proposed that Greenland limit annual removals of humpback whales, including by-caught and struck and lost whales, to 10 off West Greenland. (NAMMCO/16).	Greenland informed that the current quota is 10 whales annually with a carry over of 2 whales. In 2015 6 animals were caught. This quota is IWC advice until 2018. (NAMMCO 24)

CODE	PROPOSAL FOR CONSERVATION AND MANAGEMENT	MANAGEMENT MEASURES/RESPONSE BY MEMBER COUNTRIES
	The Management Committee **noted** that in 2008, the Scientific Committee reconsidered its interim advice from 2006 for West Greenland humpbacks on the basis of the estimate of the survey conducted in 2007, noting that the abundance estimate was higher than that of the 2005 survey, on which the 2006 interim advice was based. The Management Committee **recommended** that the total quota of humpbacks in West Greenland in 2009, including by-catches, should not exceed 10 animals (NAMMCO 17; NAMMCO 18). The Management Committee **recommended** that a total removal of up to 20 humpback whales per year 2010-2015 would be sustainable (NAMMCO/19).	
3.8.0	**Harbour porpoises**	
3.8.1	The Management Committee noted in 2007 there was not a sufficient information base to provide advice on sustainable removals for this species for any of the NAMMCO member countries. Noting this, the Management Committee recommended that member countries conduct surveys to produce reliable estimates of abundance for harbour porpoises in their areas. In addition the Management Committee recommended that member countries provide reliable estimates of total removals, including by-catch, for this species. Once this information is available for any area, the sustainability of removals can be assessed by the Scientific Committee. This was considered particularly urgent for Greenland, where directed catches are in the low thousands annually (NAMMCO/16). The Management Committee **endorsed** the Scientific Committee recommendations that Iceland and Greenland co-ordinate their analyses of the 2007 data with regard to this species, that any survey undertaken in the Faroe Islands should be designed to be compatible with the SCANS surveys, and that there should be adequate monitoring of by-catches in all areas. (NAMMCO/17)	Iceland underlined that harbour porpoises were included in the 2007 survey and analyses will be presented to the next Scientific Committee meeting in 2009. This will provide the first reliable abundance estimate in the Icelandic coastal area. Greenland informed the Management Committee that a new executive government order on small cetaceans is being prepared that will include harbour porpoises, pilot whales and dolphins. Norway reported that porpoise by-catch data will be available after validation of their by-catch monitoring programme (NAMMCO 17).
3.9.0	**T-NASS**	
3.9.1	While recognizing national priorities, the Management Committee recommended that NAMMCO countries make every effort possible to ensure the coordination of the survey in terms of timing and coverage (spatial contiguity). The Management Committee also recommended that member countries assist the Committee in obtaining additional funding to support the T-NASS Extension and Acoustic subprojects. (NAMMCO/16). The Management Committee endorsed the Scientific Committee's recommendations for the next survey would be within the 2013-2015 time frame, and that a working group for planning of future surveys be set up as soon as possible, along with negotiations with all potential partners, and a consideration of extending the survey areas (NAMMCO 19).	

CODE	PROPOSAL FOR CONSERVATION AND MANAGEMENT	MANAGEMENT MEASURES/RESPONSE BY MEMBER COUNTRIES
4.0.0	**General Models**	
4.0.1	The Management Committee **endorsed** the Scientific Committee recommendation to use an "RMP implementation simulation process (IST)-like approach – as modified by Norway" as a general model for conservation and management of baleen whales in NAMMCO (NAMMCO 18).	
4.0.2	As background to the issue, the management advice for humpback whales in Greenland is based on the management procedure, the *Strike Limit Algorithm*, which was developed in the Aboriginal Whaling Management Procedure sub-committee of the IWC. This IWC procedure uses the *Needs Statement* in its calculations. The Needs Statement is a document that Greenland submits to the IWC stating how many whales they "require". The MC agreed that when management procedures from another organisation are used in formulating management advice, the SC should make sure that those procedures meet the NAMMCO management objectives before basing their advice on those procedures. (NAMMCO 24)	Greenland noted that they receive a limited number of humpback whales within the IWC system. The quota of 10 whales based on the Aboriginal Subsistence Whaling procedures and are not formed in a similar manner to how NAMMCO usually develops its management advice. Greenland plans to proposed a request to the SC "for advice on a sustainable catch level of humpbacks in WG". The proposed text of the request will be presented to MCC. (NAMMCO24)

ANNEX 2 - Summary of requests by Council to the Scientific Committee and responses

This table provides a summary of all active requests by the NAMMCO Council to the Scientific Committee, and notes the response of the Scientific Committee (SC) to these requests. Codes beginning with: 1 – relevant to all Management Committees; 2 – relevant to seals; 3 – relevant to whales.

Code	Meeting	Request	Response of the Scientific Committee	Status
1.1.0	**MARINE MAMMAL – FISHERIES INTERACTIONS**:			
1.1.5	NAMMCO/7 05-1997	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 SC recommends (this request) should remain as standing request and also takes the place of R-1.1.3 (SC21).	Standing
1.1.8	NAMMCO/17 09-2008	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. See also 1.1.6 and 1.4.6.	The SC convened in 2009 the WG on Marine Mammal Fisheries Interaction (MMFI) because it judged at its last meeting that the developments in modelling and other progress which had occurred in Norway, Canada and Japan warranted their review. SC has reviewed progress made in all areas and for all species. (SC/16). This request should be kept as ongoing until the results expected from Iceland are presented in the SC (SC21).	Ongoing
1.2.0	**MULTISPECIES APPROACHES TO MANAGEMENT:**			
1.2.1	NAMMCO/1 1992	To consider whether multispecies models for management purposes can be established for the North Atlantic ecosystems and whether such models could include the marine mammals compartment. If such models and the required data are not available then identify the knowledge lacking for such an enterprise to be beneficial to proper scientific management and suggest scientific projects which would be required for obtaining this knowledge.	Vikingsson updated the SC on the Ecosystem Modelling project for which funding was being sought. The initial NAMMCO research program has developed into a much broader project with modelling at the core, including more general fisheries management considerations and a socioeconomic component. The project has now been funded for 6 million Euros for the next 4 years. The funded project has been adapted for the call for research proposals from the EU, and now includes 29 institutes from 16 countries. It still contains parts of the original marine mammal components. Iceland is still a	Ongoing

			core area, and the project has been expanded to include many other areas, however multispecies modelling in the Barents Sea has been removed. The SC noted that the original NAMMCO project (coordinated by Lars Walløe) has been changed but the Icelandic component is still included. (SC/20) A large-scale ecosystem modelling project (MAREFRAME) is underway, which includes marine mammals in Icelandic and adjacent waters (SC/21).	
1.2.2	NAMMCO/5 02-1995	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.	It was clarified that the purpose of this request was to ensure that data on marine mammals was available for input into multi-species models for management. The Committee agreed that updated information on abundance and indications of trends in abundance of stocks of marine mammals in the North Atlantic should be clearly described in a new document for the internal reference of the Council, to replace the List of Priority Species. This document would be entitled Status of Marine Mammals in the North Atlantic and should include those cetacean and pinniped species already contained in the List of Priority Species, as well as other common cetacean species in the NAMMCO area for which distribution and abundance data is also available (fin, sei, humpback, blue, and sperm whales). (SC/5). This remains a standing request (SC/21).	Standing
1.3.0	**SEALWORM INFESTATION**:			
No active requests				
1.4.0	**ECONOMIC ASPECTS OF MARINE MAMMAL-FISHERIES INTERACTIONS:**			
1.4.7	NAMMCO/23 2015	The Scientific Committee is requested to review the results of the MAREFARAME 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 (R1.1.0) and multispecies approaches to management (R 1.2.0)	The European MAREFRAME project includes several components addressing marine mammal fisheries interactions. These include research on interactions between cod and common minke whales in Icelandic waters and between cod and seals off Scotland. The MAREFRAME project is scheduled to be concluded in 2017, after which the SC will review the result as requested by the Council (SC/22).	Ongoing

		[The MC] await(s) the SC's review of the MAREFRAME project (NAMMCO/24).		
1.5.0	**ENVIRONMENTAL ISSUES:**			
1.5.3	NAMMCO/24 2016	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.		**NEW**
1.6.0	**MANAGEMENT PROCEDURES:**			
1.6.4	NAMMCO/24 2016	The SC has recommended that catch statistics include correction for struck but lost animals for different seasons, areas, and catch operations. NAMMCO Council request the SC and the Hunting Committee to provide advice on the best methods for collection of the desired statistics on losses.		**NEW**
1.7.0	**MONITORING MARINE MAMMAL STOCK LEVELS AND TRENDS IN STOCKS /NORTH ATLANTIC SIGHTINGS SURVEYS (NASS)*:***			
1.7.11	NAMMCO/16 02-2007	Once the survey has been completed, the Committee requested the Scientific Committee to develop estimates of abundance and trends as soon as possible, with the primary target species (fin, minke and pilot whales) as a first priority, and secondary target species as a second priority.	This request is being addressed with the near completion of most of the analyses of T-NASS minke whale survey data. Abundance estimates for fin whales have been finalized (Icelandic-Faroese shipboard and Greenland aerial T-NASS surveys) or are on their way (Norway shipboard T-NASS survey). Some progress has been made in the analyses of pilot whale data, although further analyses are warranted, which will be presented to the next AE WG in October 2009. (SC/16). Estimates of abundance for some key species are available and referred to in the SC report (SC/17). Regarding **R-1.7.11**, the SC awaits results of NASS2015 and expects that these will allow for the development of an abundance estimate, and will be incorporated into the trend analysis. (SC/22)	Ongoing

1.7.12		Greenland requests the SC to give information on sustainable yield based on new abundance estimates expected from NASS2015 for all large baleen whales in West Greenland waters (NAMMCO 22).	The SC noted this new request, and will consider this again after T-NASS2015. (SC/21)	Ongoing
2.1.0	**HARP AND HOODED SEALS**			
2.1.4	NAMMCO/12 03-2003	The Management Committee noted that new information recently had become available on the abundance of harp seals in the Greenland Sea and the Northwest Atlantic. In addition new information is available on movements and stock delineation of harp seals in the Greenland, Barents and White seas. The Management Committee therefore reiterated its previous request to the Scientific Committee to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available. The Management Committee noted the likely impact of increasing abundance of these species on fish stocks. For harp seals in the Northwest Atlantic, the immediate management objective is to maintain the stocks at their present levels of abundance.	An update of the stock status of North Atlantic hooded seals had been made by the WGHARP at its 2008 meeting, which in turn had been endorsed by the Committee. The SC notes that this is a standing request that will be taken up again when new data become available. Considering that the population in the Greenland Sea in 2007 is still well below Nlim, and the results of the 2007 survey were similar to those in 2005, the SC reiterates its recommendation from SC 14 that the catches in the Greenland Sea be restricted to necessary scientific catches and to satisfy local needs at roughly current levels. (SC/16). Updates on harp & hooded seals from WGHARP were presented at SC/20.	Standing
2.1.9	NAMMCO/16 02-2007	The commission requested the SC to- investigate possible reasons for the apparent decline of Greenland Sea stock of hooded seals; and assess the status of the stock on basis of the results from the planned survey in 2007. The Management Committee recommended that Council ask the Secretariat to review its cooperation with ICES in light of the Scientific Committee work on harp and hooded seals. It further underlined the importance in getting answers to request R 2.1.9 (NAMMCO/22-2013).	This request was forwarded to the ICES-NAFO WG, which dealt with this request at its meeting in Tromsø in 2008. (SC/15). On the basis of the conclusion of this group, the SC concludes that the reasons for the decline of the stock are still not understood. A reduction in extent and concentration of drift ice has occurred in the Greenland Sea between Greenland and the Jan Mayen Island. These changes must have resulted in substantial changes in breeding habitat for the Greenland Sea populations of harp and hooded seals. The SC appreciates the efforts made by Norwegian and cooperating scientists to address the questions related to the apparent decline of hooded seals in the Greenland Sea. It **strongly recommends** that these activities are given high priority in the coming years. (SC/16) The SC advises the Council that a more formal cooperation between ICES and NAMMCO on harp and hooded seals such as through the	Ongoing

			ICES WGHARP would be desirable, and that a formal request to ICES for such cooperation could be sent (SC/20-2013). The SC was informed that ICES and the North Atlantic Fisheries Organization (NAFO) have accepted NAMMCO's request to join the WGHARP (SC/22-2015).	
2.1.10	NAMMCO/17 09-2008	The SC is requested to provide advice on Total Allowable Catches for the management of harp seals and the establishment of a quota system for the common stocks between Norway and the Russian Federation, leaving full freedom to the Committee to decide on the best methods to determine this parameter based on an ecosystem approach. For clarification, the Management Committee for Seals and Walruses wished to specify to the Scientific Committee that the "ecosystem approach" to management for one species involves the use of information about predation from or on other species when quotas are set, but multi-species modelling is not yet at a stage where this can be effected. The TAC are estimated by the Scientific Committee whereas quotas are traditionally set bilaterally by hunting nations (NAMMCO 18).	The Committee notes that in October 2008, ICES provided advice that was used to set the 2009 quotas for northeast Atlantic harp seals by the Joint Norwegian Russian Fisheries Commission. The SC endorses at its present meeting the advice provided. Dividing the total removals for each population into national allocations is traditionally carried out through bilateral negotiations in the Joint Norwegian Russian Fisheries Commission. Therefore the SC feels it needs clarification from the Council on the request of the establishment of a quota system. The SC also wishes a clarification from Council about the definition of "ecosystem approach" in the establishment of a quota system as stated in the request R-2.1.10. (SC/16).	Standing
2.3.0	**RINGED SEALS**:			
2.3.1	NAMMCO/5 02-1995	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. The Management Committee endorsed again this request as a standing request. (NAMMCO 19) The Management Committee took note of the report from the Scientific Committee and endorsed the idea of a Working	The Scientific Committee established a Working Group on Ringed Seals. The Scientific Committee considered the report of the Working Group and provided advice to Council. They also provided recommendations for future research. (SC/5). The SC noted that there is currently very little information on stock structure and stock size to consider in relation to both requests (2.3.1 and 2.3.2). Some movement information exists, but these do not give enough information to have understanding of population structure. The SC suggested that a Working Group be considered in the next few years (2015 or later). The WG could look into movements (from the available satellite tagging data) versus where catches are	Ongoing

		Group in 2015 or later when enough information is available (NAMMCO 22). The MC recommended that Greenland continue the genetic work and planned survey, and encouraged Greenland to take a precautionary stand and protect the Ilulissat population until more information is available. (NAMMCO 24)	occurring in relation to stock structure. It may also be important to assess this species in light of climate change and changing ice conditions. The SC notes that it is very difficult to obtain the desired information on this species. The Arctic Council recently held a meeting on ringed seals, and it was suggested that the SC considers, at its next meeting, the report from that meeting, and data availability, and considers then the need for a WG (SC/20). …still not enough information…The SC recommended research (genetics, surveys) that will help towards responding to R-2.3.1 (SC/22).	
2.3.2	NAMMCO/7 05-1997	The Scientific Committee was requested to advise on what scientific studies need to be completed to evaluate the effects of changed levels of removals of ringed seals in West and East Greenland. The Management Committee endorsed again this request as a standing request. (NAMMCO 19) See 2.3.1 for update from NAMMCO 22.	It was noted that the exploitation level of ringed seals in Greenland has shown considerable variability over decades in this century. The Scientific Committee chose to focus on scenarios where exploitation is raised by more than twice the level reported in recent years. The Scientific Committee then identified the main gaps in knowledge, and **recommended** research required to address them. (SC/6). See 2.3.1 for update from SC/20. The SC reiterated that data on this species is sparse and a full assessment is not possible. The SC recommends that a future WG should await results of ongoing tagging studies in central West Greenland, and future genetics studies to elucidate information on population structure (SC/21).	Ongoing
2.4.0	**GREY SEALS**:			
2.4.2	NAMMCO/11 02-2002	The Management Committee noted that there has been a decline in the numbers of grey seals around Iceland, possibly due to harvesting at rates that are not sustainable. The Scientific Committee had previously provided advice in response to a request to review and assess abundance and stock levels of grey seals in the North Atlantic, with an emphasis on their role in the marine ecosystem in general, and their significance as a source of nematodal infestations in fish in particular (NAMMCO 1995). Given the apparent stock decline in Iceland, an apparent increase in Southwest Norway and in the United Kingdom, and the fact that this species	The Working Group on Grey Seals met in April 2003 and completed an initial assessment of stocks around Norway, Iceland, Great Britain and the Baltic. (SC/11). The SC recommends: • Establishment and/or continuation of standardised and regular monitoring programmes for seal abundance in all countries, including the development of appropriate survey methods.	Ongoing

		interact with fisheries in three NAMMCO member countries, the Management Committee **recommended** that the Scientific Committee provide a new assessment of grey seal stocks throughout the North Atlantic. The Management Committee took note of the report from the Scientific Committee and endorsed that the Working Group on Grey and Harbour Seals meet in 2014/2015 in order to finalise requests 2.4.2 and 2.5.2. (NAMMCO 22).	• Securing catch records and associated data from hunted seals. • Quantification and standardisation of methods to estimate struck and lost and by-catch. • Population assessment of both species in *Russia*. • Survey of harbour seals along the coast of *Iceland.* • Studies to identify the population structure of *Norwegian* harbour seals. • Exploration of the south-eastern *Greenland* coast for the presence of harbour and grey seals. • Estimation of the stock identity, size, distribution and structure of the *Faroese* population of grey seals. • Completion of the ongoing genetic analyses of grey seal population structures for the north Atlantic including new samples from the *Faroe Islands.* The SC furthermore recommends • Development of common sampling protocols for all areas in the North Atlantic in preparation for epidemic disease outbreaks, including establishment of blood serum stores for seals sampled. • Compilation of a database of samples stored in the NAMMCO countries. (SC/18) The SC recommended that the Grey and Harbour Seals WG meet in 2014, reflecting the recommendations to finalise the **request 2.4.2**. (SC/19 and reiterated at SC/20) A Coastal Seals WG meeting has been tentatively scheduled for February 2016 to address R-2.4.2 and R-2.5.2. By February 2016, the CSWG will likely have by-catch estimates and a new complete grey seal estimate in Norway for consideration at the meeting (SC/21). The SC **recommended** that all of the available grey seal data from the Faroes is presented to the CSWG for review. The SC **recommends** that the CSWG develops specific plans for monitoring grey seals in the Faroes, e.g., obtaining a relative series of abundance (if a full abundance estimate is not possible at this time).	

			The 2015 abundance estimates from Norway will be available at CSWG. (SC/22-2015)	
2.5.0	**HARBOUR SEAL**			
2.5.2	NAMMCO/16 02-2007	The commission requested the Scientific Committee to conduct a formal assessment of the status of harbour seals around Iceland and Norway as soon as feasible.	At its meeting 2007 (SC/15), the SC **recommended** that an assessment be conducted in 2010 after the third Norwegian survey, leaving Iceland time for developing a management plan. However, the Norwegian survey will take place in mid-summer 2010, and the results of the survey will probably not be available before early 2011, therefore the SC **recommends** that an assessment be conducted early 2011. Data on removals are still needed both for Iceland and Norway. (SC/16). The SC reiterated the recommendation that a formal assessment of harbour seals in all areas be carried out by a WG meeting on coastal seals in 2011. SC **recommended** that a WG on coastal seals be held to review the ***Norwegian*** management plan for grey and harbour seals, to perform assessments for grey and harbour seals in all areas, and to develop a common management model for both species in all areas. The WG should also consider whether the age data from the catch of grey and harbour seals in ***Iceland*** would improve the assessment. If a meeting is planned for early 2011, another meeting is likely required to fulfil the task. (SC/17) The SC recommends: • Establishment and/or continuation of standardised and regular monitoring programmes for seal abundance in all countries, including the development of appropriate survey methods. • Securing catch records and associated data from hunted seals. • Quantification and standardisation of methods to estimate struck and lost and by-catch. • Population assessment of both species in *Russia.* • Survey of harbour seals along the coast of *Iceland.* • Studies to identify the population structure of *Norwegian* harbour seals.	Ongoing

		The Management Committee agreed to change the geographical focus of this request to entail ALL areas. (NAMMCO 19) See 2.4.2 for update from NAMMCO 22.	• Exploration of the south-eastern *Greenland* coast for the presence of harbour and grey seals. • Estimation of the stock identity, size, distribution and structure of the *Faroese* population of grey seals. • Completion of the ongoing genetic analyses of grey seal population structures for the north Atlantic including new samples from the *Faroe Islands.* The SC furthermore recommends • Development of common sampling protocols for all areas in the North Atlantic in preparation for epidemic disease outbreaks, including establishment of blood serum stores for seals sampled. • Compilation of a database of samples stored in the NAMMCO countries. (SC/18) The SC recommended that the Grey and Harbour Seals WG meet in 2014, reflecting the recommendations to finalise the **request 2.5.2**. (SC/19 and reiterated at SC/20) A Coastal Seals WG meeting has been tentatively scheduled for February 2016 to address R-2.4.2 and R-2.5.2. By February 2016, the CSWG will likely have by-catch estimates and a new complete grey seal estimate in Norway for consideration at the meeting (SC/21).	
2.6.0	**ATLANTIC WALRUS**:			
2.6.3	NAMMCO/15 03-2006	The Scientific Committee should 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. The MC supports the continued planning of the disturbance workshop for beluga and narwhal, and also recommends including walrus (NAMMCO 22; see also R-3.4.9).	With the current actual state of knowledge, the SC is unable to answer this question. The walrus disturbance study on Svalbard will help only in answering the problem of disturbance by tourists. The SC referred, however, to the answer to request 3.4.9. (SC/16). Owing to a lack of explicit studies, the SC is not in a strong position to provide advice on the effects of human disturbance on walrus. (SC/17) With regard to R-2.6.3, the SC noted that there is no new information available to consider this request (SC/20).	Ongoing

			Concerns were raised at both the Symposium and the SC meeting about a Canadian mining project currently under development in the Canadian Arctic, the Mary River Project operated by Baffinland Iron Mines Corp… It will have severe consequences for the large numbers of marine mammals [including] walruses, with unpredictable consequences for the populations themselves but also for the accessibility to hunting and/or its sustainability. Other industrial activities that were addressed at the symposium as being particularly important as disturbance factors for marine mammals were seismic exploration in Canada, and West and East Greenland. The SC draws the attention of the NAMMCO Council to the potentially severe consequences of these projects. The SC noted that these industrial activities will also likely have impacts on the hunting of these species, and could affect the advice that is given by this SC. (SC/22-2015)	
3.1.0	**FIN WHALE:**			
3.1.7 amend ed	NAMMCO 17 09-2008 amended NAMMCO/23 amended NAMMCO/24	The SC is requested to complete an assessment of fin whales in the North Atlantic and also to include an estimation of sustainable catch levels in the Central North Atlantic. This work should be initiated as soon as all estimates become available and before the meeting of the SC in 2009. Amended (NAMMCO/23) to include "While long-term advice based on the outcome of the RMP Implementation Reviews (with 0.60 tuning level) is desirable, shorter term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015." MC endorsed this recommendation for a Large Whale Assessment Working Group to convene in Fall 2014 (NAMMCO 22). Iceland noted that it is very important for the LWAWG to occur this autumn and proposed that the MC **amend** request R-3.1.7 to include the following additional text: "While long-term advice based on the outcome of the RMP	The fin whale assessment has been postponed to after the completion of the RMP Implementation Assessment of North Atlantic fin whales scheduled for June 2009. The WG on Large Whale Assessment is scheduled to meet 26-28 January 2010 in Copenhagen with fin whales on its agenda. (SC/16). The SC completed an assessment of North Atlantic fin whales at its 2010 meeting (SC/17). The SC considers that an annual strike of up to 154 fin whales from the WI sub-area is sustainable at least for the immediate 5-year period. It noted that the RMP-variant with a 60% tuning level has yet to be simulation-tested for trials involving stock structure uncertainty in the long term, thus it recommends that simulation trials be carried out as soon as possible and the long-term sustainability of the advice be reconsidered in the light of these results. As the present advice expires in 2015, the NAMMCO SC recommended convening a meeting of the working group on large whale assessments in the autumn of 2014 to provide further management advice on fin whales off Iceland (SC/20).	Ongoing

		Implementation Reviews (with 0.60 tuning level) is desirable, shorter term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015." The MC endorsed the amendment of R-3.1.7 to include this text (NAMMCO 23). At NAMMCO/24, R-3.1.7 was amended to read: The SC should complete an assessment of fin whales in the North Atlantic and also to include an estimation of sustainable catch levels in the Central North Atlantic. A long-term advice based on the new NASS-15 abundance estimate and the available results from the RMP Implementation Reviews (with 0.60 tuning level) is needed in 2016. (NAMMCO/24)	A Large Whale Assessment meeting was previously planned for Fall 2014. This was postponed to Fall 2015, awaiting work to be completed by the IWC on the fin and minke whale RMP Implementation Reviews. The IWC SC has proposed a workshop in January 2015, and plans to complete this work by the IWC SC 66a meeting in June. Therefore, the NAMMCO LWAWG will plan on meeting in the Fall of 2015 in hopes that the work on the IWC SC will be complete (SC21). The SC agreed with the advice of the Large Whale Assessment WG and **recommended** a catch limit of 146 fin whales for fin whales that can be taken anywhere in the EG+WI (East Greenland + West Iceland) region is safe and precautionary, and that this advice should be considered valid for a maximum of 2 years (2016 and 2017). This is interim advice because the most recent abundance estimate is almost 10 years old. A new abundance estimate is expected from the NASS2015 conducted this past summer. (SC/22)	
3.2.0	**HUMPBACK WHALE:**			
3.2.4	NAMMCO/15 03-2006	The Commission requested the Scientific Committee to 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. The MC recommends that the Large Whale Assessment working group should not consider humpback whales at the upcoming meeting in Fall 2014 (NAMMCO 22). The MC noted that at last year's MC meeting, it was recommended that humpback whales not be considered at the Large Whale Assessment WG. However, the advice for removals in West Greenland is for 2010-2015. Greenland noted that the situation regarding quotas in the IWC is not stable, and that they do not want to risk a situation where they	The SC **recommended** that the preliminary work to conclude such assessment be made in connection with the fin whale assessment meeting and that abundance estimate from all the surveys be made available to that meeting. (SC/15). ……………………………………………………. With reference to the pending request from NAMMCO 15 (R-3.2.4) to conduct a formal assessment of humpback whales following the completion of T-NASS 2007, the SC noted that it had completed the assessment for West Greenlandic waters. The SC has not yet initiated assessment in other areas and agreed to seek further guidance from the Council regarding that aspect of the request. If the Commission considers request 3.2.4 a priority, the SC will consider this request in conjunction with the fin whale meeting (SC/20).	Pending

		do not have advice from either the IWC or NAMMCO. Therefore Greenland would like to ask the SC whether there is sufficient data available to conduct an assessment of humpback whales at the upcoming Large Whale Assessment Working Group meeting in Fall 2015. Greenland referred to the end of SC advice of humpback whales 2009-2015 and the risk of postponement of the NASS. Greenland also noted that a new quota negotiation in the IWC will be in 2018 and due to the uncertainty in allocation of quotas, Greenland proposed that R-3.2.4 is **reiterated** and ask that the assessment of humpback whales is completed at the Large Whale Assessment Working Group in fall 2015. The MC **endorsed** this reiteration of the request (NAMMCO/23). At NAMMCO/24, Council amended this request: "The SC is 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."	The SC agreed with the advice of the Large Whale Assessment WG and **recommended** that the IWC's *Strike Limit Algorithm* (SLA) that has been developed within the Aboriginal Whaling Management Procedure (AWMP) as the best current basis for providing management advice for West Greenland humpback whales. SC **endorsed** the advice of 10 strikes per year based on the SLA that was accepted by the IWC. The SC also noted that a higher number may be sustainable because the SLA calculations take into account the Greenlandic *Needs Statement* provided to the IWC of 10 whales. This advice applies up to and including 2017, and with an expected new abundance estimate from the NASS2015, a new calculation by the IWC SLA to provide advice should be straightforward. (SC/22)	
3.3.0	**MINKE WHALE:**			
3.3.4 amended	NAMMCO/17 09-2008	The SC is requested to conduct a full assessment, including long-term sustainability of catches, of common minke whales in the Central North Atlantic once results from the 2009 survey become available. In the meantime the SC is requested to assess the short-term (2-5 year) effects of the following total annual catches: 0, 100, 200 and 400. The MC noted that there was no new information regarding this request, and reiterates that the SC should address this request when new information becomes available. (NAMMCO/22) Council agreed to **amend** the request to read "The SC is requested to complete assessments of common minke whales in the North Atlantic and include estimation of sustainable	The Assessment WG was convened to help answer with temporary advice. The SC **recommends** that 200 minke whales per year be considered as the largest short-term catch that should be contemplated over the short-term, 2-5 years. This catch level refers to total removals from the CIC or Central Medium areas, both Icelandic and others. A full assessment, including the 2009 estimate, will be conducted at the next meeting of the Assessment WG in January 2010. (SC/16). The SC considered that annual removals of up to 216 minke whales from the CIC area are safe and precautionary. The advice is conservative in the sense that it is based on the uncorrected, downward biased 2009 abundance estimate as well as the lower of the two accepted abundance estimates from 2007. Similarly, an	Ongoing

		catch levels in the Central North Atlantic. While long-term advice based on the outcome of the RMP Implementation Reviews (with 0.60 tuning levels) is desirable, a shorter-term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015." (NAMMCO 23). At NAMMCO/24, the request was **amended** to read: The SC is requested to complete assessments of common minke whales in the North Atlantic and include estimation of sustainable catch levels in the Central North Atlantic. (NAMMCO 24)	annual removal of 121 minke whales from the CM area is a safe and precautionary management advice. (SC/17) Response to this request is awaiting the conclusion of IWC Implementation Review (see above), and will be considered at the LWAWG planned for Fall 2015 (SC/21). The SC **endorsed** the advice provided by the WG that a catch limit of 224 common minke whales in the CIC sub-area is safe and precautionary, and that this advice should be considered valid for a maximum of 3 years (2016 – 2018). This is interim advice because the most recent abundance estimate is from 2009, which will then be approaching 10 years old. (SC/22)	
3.4.0	**NARWHAL AND BELUGA:**			
3.4.9	NAMMCO/14 03-2005	The Scientific Committee should provide advice on the effects of human disturbance, including noise and shipping activities, on the distribution, behaviour and conservation status of belugas, particularly in West Greenland.	The SC conveyed this request to the JCNB/NAMMCO Joint Working Group to consider at their next meeting, probably in late 2007 or 2008 (SC/14). The SC recommended that this item be on the agenda of the meeting of the JCNB/NAMMCO Joint WG, recommended to meet before March 2009. (SC/15). The SC is not in the position to progress on this issue at this point and **recommends** that habitat-related concerns becomes a standing item on the JCNB/NAMMCO JWG agenda. It may be difficult, if not impossible, to answer the specific request for beluga for several years to come. The SC notes that many of the habitat concerns apply to other marine mammals besides beluga and therefore it may be appropriate to treat all species together in addressing this topic. As a way forward, the SC **recommends** that the Council consider extending the scope for a more general request with the SC establishing a WG on the impacts of human activities other than hunting on marine mammals in the North Atlantic. Ugarte is suggested as Chair. Terms of Reference for the first meeting would be the evaluation of impact of seismic, shipping and tourist activities	Ongoing

		The MC supports the continued planning of the disturbance workshop for beluga and narwhal, and also recommends including walrus (NAMMCO 22).	on the distribution, behaviour and conservation of marine mammals. (SC/16). The JWG and the SC (SC/19) recommended holding an international symposium on the effect of seismic and other development activities on arctic marine mammals with a focus on beluga and narwhal. Relating to **Request 3.4.9:** In 2011, the SC proposed a symposium on beluga and narwhals in relation to disturbance and industrial activities. The SC **recommends** this symposium to be held in 2015 and awaits further guidance from Council before proceeding with the planning (SC/20). The SC **recommended** broadening the scope of the Symposium and include presentations from other species/research. A number of external experts will be required for this meeting (SC/21). The Disturbance Symposium was held October 2015…the report will be considered at SC/23. Based on preliminary presentations of the results, the SC **draws the attention** of the NAMMCO Council to the potentially severe consequences of these projects. The SC noted that these industrial activities will also likely have impacts on the hunting of these species, and could affect the advice that is given by this SC. (SC/22)	
3.4.11	NAMMCO/17 09-2008	The Scientific Committee is requested to update the assessment of both narwhal and beluga, noting that new data warrant such an exercise.	The SC endorses the assessment performed by the JWG. Narwhal: noted that the conclusion reached differed from those reached in 2005. It **recommends** that catches be set so that there is at least a 70% probability that management objectives (population increase) will be met for West and East Greenland narwhals, i.e. maximum total removals of 310 and 85 narwhals in West and East Greenland respectively. Narwhal update: The JWG and the SC (SC/19) agreed that narwhals in Scoresby Sound (Ittoqqortormiit) and Kangerlussuaq-Sermilik (Tasiilaq) should be treated as two separate stocks. The age structure from animals collected between 2007 and 2010 in Ittoqqortormiit was applied to both areas, and the harvest was found to select older animals. It was estimated that narwhals in the Ittoqqortormiit area have increased slightly, while narwhals in the	Standing

			Tasiilaq/Kangerlussuaq area might be stable. The current growth rate in the absence of harvest was estimated to lie between 1.2% (95% CI:0–3.5) and 3.7% (95% CI:1.6–5.9), depending upon model and area. Proposed quotas ranged from 17-70% (Ittoqqortormiit) with probability of 95-70% increase in population and 0-18 (Tasiilaq) with probability of 95-70% increase. Beluga: the catch of belugas in West Greenland has been reduced in response to previous advice. These reduced takes already seem to be having a positive effect on population size. The modelling for belugas rests on a more solid background than that of narwhals because of simpler stock structure, however since there is still uncertainty in the assessment, the SC **strongly recommends** that future catches be set according to the probability of population increase of at least 70%. Annual takes between 180 to 310 individuals over the next 5 years will leave the population an 70% to 95% probability of a continued increase until 2014. (SC/16). Beluga update: The JWG considered, and SC agreed (SC/19), that the revised assessment models, which incorporate the age structure data but no new abundance estimate, confirmed that the current removals based on the 2009 advice are sustainable. Based on a 70% probability of population increase, it is concluded that a total annual removal of 310 beluga in West Greenland (excluding Qaanaaq) is sustainable. A new and updated advice is expected at the next meeting based on a new abundance estimates from the spring survey in 2012, and the SC noted that new abundance estimates for assessments should be available at least every 10th year. No specific advice was given on the North Water (Qaanaaq), since the current removals remain at a low level relative to the population size. No advice was given for the harvest in Canada. Results from different scenarios of the age structured population dynamic model were presented, providing annual growth rate estimates from 3.2% to 5%, in the absence of harvest. The depletion ratio for 2012 was estimated to 44% (95% CI: 16%–88%), with a yearly replacement of 510 (95% CI:170–780) individuals. (SC/19)	

3.4.14	NAMMCO/24 2016	The Council requests the SC to examine the data existing on beluga in East Greenland (sightings, strandings, by-catch, catch) and examine how these material can be used in an assessment process and advice on how this data can be improved.		**NEW**
3.5.0	**SEI WHALES**:			
3.5.3 amended	NAMMCO/19 09-2010	The Scientific Committee is requested to assess the status of sei whales in West Greenland waters and the Central North Atlantic and provide minimum estimates of sustainable yield. MC endorses the suggestion from the SC to wait for the outcome of the IWC SC review before conducting their own review (NAMMCO 22). The MC noted that the IWC has been considering whether they will conduct an assessment on sei whales for many years. Most previous sightings surveys have not included sei whales as a priority species, and therefore the survey areas did not cover far enough south to obtain complete abundance estimates. Iceland noted that they were hoping to conduct a separate sightings survey with the primary focus on sei whales in the future. It was suggested that the previous estimates from 1989 and 1995, while acknowledged that they are likely underestimates, could be used as a minimum estimate to base some advice. The MC suggested that request R-3.5.3 remains a pending request, and notes that this work will not be completed by the SC in 2015. The MC also notes that there may be future work in the IWC (NAMMCO 23).	The Scientific Committee notes that the RMP could be applied using existing data. The resulting catch limits would consequently be lower than the stock could sustain. A prerequisite for initial assessment work is the recalculation (including considerations of extrapolation) of abundance estimates for a comparable area and assessing the extent of negative bias for the reasons mentioned above. Advice based on an RMP approach would require an initial assessment and likely the development of implementation trials. (SC/18) There is no new information available with regards to this request. The SC noted that the SC of the IWC has initiated a review of available data on North Atlantic sei whales with the view conducting an RMP implementation. Given the busy schedule of the IWC RMP sub-committee, such an implementation is not expected to be completed until 2017 or later. To avoid double work, the NAMMCO SC agreed to monitor the outcome of the IWC SC review of available data scheduled in 2014 before proceeding with an assessment. (SC/20).	Ongoing
3.6.0	**NORTHERN BOTTLENOSE WHALES**:			
No active requests				
3.7.0	**KILLER WHALES**:			

3.7.2	NAMMCO/13 03-2004	The Management Committee requested the Scientific Committee to review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, and to provide advice on research needs to improve this knowledge. Priority should be given to killer whales in the West Greenland – Eastern Canada area. MC **notes** the SC report that there is no new information available for R-3.7.2 (NAMMCO 22). Greenland informed the MC that validation of these catches is expected to be completed in 2016, going back to 2010. The Ministry have received reports of catches in 2014 and 2015. (NAMMCO/24)	The Scientific Committee concluded that there was not enough information to carry out the assessment at this time, particularly for the West Greenland area. The Scientific Committee will review new information on killer whales annually with the aim of completing the assessment once sufficient information becomes available for a particular area. Not enough information still. (SC/15). Situation unchanged (SC/16). The SC again noted that there is not sufficient new information to answer this request at this time (SC/20). There is still not enough information to answer the request. Unfortunately catch information in Greenland was not available for review by the SC at this meeting (SC/21). At SC20, the SC noted higher levels of annual catches (19 on average per year from 2010 and 2012) in West Greenland. The SC was then informed that the recent catch statistics on killer whales in West Greenland have not been validated, and at this meeting the SC noted that these catch statistics still have not been validated. The SC **reiterates the recommendation** that all catch data on killer whales are validated before the next SC meeting, so that it is possible for the SC to monitor the development of the hunt. …at [SC/22] the SC noted that these catch statistics still have not been validated. The SC **reiterates the recommendation** that all catch data on killer whales are validated before the next SC meeting, so that it is possible for the SC to monitor the development of the hunt. (SC/22)	Ongoing
3.8.0	**LONG-FINNED PILOT WHALES**:			
3.8.6	NAMMCO 20 09 2011	The Scientific Committee is **requested** to continue work to complete a full assessment of pilot whales in the North Atlantic and provide advice on the sustainability of catches, as soon as necessary further information becomes available, with particular emphasis on the Faroese area and East and West Greenland. In the short term, the Scientific Committee	The SC (SC/19) agreed that it was unlikely that a full assessment could be attempted in the near future. Regarding a short term advice, the SC noted that both the AWMPc procedure (which has been used for preliminary advice for baleen whales in West Greenland by NAMMCO and the IWC), as well as the PBR approach, could be	Ongoing

		was requested to provide a general indication of the level of abundance of pilot whales required to sustain an annual catch equivalent to the annual average of the Faroese catch in the years since 1997. MC awaits the results of NASS2015 and hopes that these will help address R-3.8.6.	used for an inverse advice calculation of the minimum abundance required to sustain the average take by the Faroese. With the average annual catch by the Faroese since 1997 being 678, and the CV of the latest abundance estimate being 0.27, the AWMPc procedure estimates that an abundance estimate around 50,000 pilot whales and a similar precision is required to sustain the catch. In comparison, the PBR approach (rmax of 3% and recovery factor of 1) calculates an abundance estimate around 80,000 whales. These calculations reflect precautionary estimates of the minimum abundance estimates required to sustain the Faroese hunt. However, the geographical range of the stock(s) that supply the Faroese hunt is unknown, and it is unresolved how the calculated estimates compare with the accepted estimate of 128,000 (95% CI: 75,700-217,000) pilot whales from the Icelandic and Faroe Islands area of T-NASS. The next assessment will not occur until after the next sightings survey (SC/21). The remaining unanswered portions of **R-3.8.6** awaits new data from NASS2015. The West Greenland part was dealt with during SC/19 and the SC refers Council to that report.	
3.9.0	**DOLPHIN SPECIES *(Tursiops* and *Lagenoryhncus spp.):***			
3.9.6	NAMMCO/13 03-2004	The Management Committee has asked the Scientific Committee to carry out assessments of these species, but to date insufficient information has been available on stock delineation, distribution, abundance and biological parameters to initiate the work. The Committee was pleased to note that considerable progress has been made in the Faroes in describing the ecology and life history of white-sided dolphins and that information on white-beaked dolphins should be available from Iceland and Norway in about 2 years time. Abundance estimates are lacking in all areas except Icelandic coastal waters, and no information on stock delineation or pod structure is yet available. The SCANS survey planned for 2005/6 and coastal surveys planned for Norway (see 9.3) should provide information on distribution and abundance in some areas. The Committee endorsed the	There is still insufficient data on these species to conduct an assessment, but the SC **recommended** that abundance be estimated for white-sided and white-beaked dolphins from the 2007 T-NASS survey as soon as possible. An assessment of the species could be attempted in 2009 at the earliest. (SC/15). The Committee notes that there are still not enough data (life history and abundance) for any of the three species to complete an assessment. The Faroes have samples for diet and life history parameters from 350 white-sided dolphins, but the analysis is not completed yet. (SC/16). The SC **noted** that the data on life history and abundance for any of the three species is still not sufficient for an assessment and **recommended** that Faroese samples for diet and life history parameters from 350 white-sided dolphins be finalised and at the	Pending

		plan of the Scientific Committee to proceed with the assessments once the above-mentioned studies have been completed, probably by 2007. The MC notes the report of the SC, awaits the publication from the previous sampling. (NAMMCO/24)	same time that an abundance estimate from the 2007 survey be attempted. (SC/17) The SC noted that there is no new data available to answer this request. Mikkelsen informed that the data collected from the drive hunt of white sided dolphins in the Faroes will be published before the next SC meeting (SC/20). The SC noted that there is no new information for tursiops bottlenose dolphins from the Faroes and the analysis from previous studies of white sided dolphins have not been completed (SC/21). Some sampling has been occurring in the Faroes previously, however no new samples have been collected recently because there have been very few catches in recent years. The results from the previous sample collections have yet to be published. (SC/22)	
3.10.0	**HARBOUR PORPOISES**:			
3.10.1	NAMMCO/7 05-1997	The Council noted that the harbour porpoise is common to all NAMMCO member countries, and that the extent of current research activities and expertise in member countries and elsewhere across the North Atlantic would provide an excellent basis for undertaking a comprehensive assessment of the species throughout its range. The Council therefore requested the Scientific Committee to perform such an assessment, which might include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals. The Management Committee recommends that total removal estimates are made for all areas, and that abundance estimates from the 2007 survey in Iceland and the 2010 survey in the Faroe Islands are available before a WG meeting. (NAMMCO 19).	The Scientific Committee decided that the matter could best be dealt with by convening an international workshop / symposium on harbour porpoises ...including: distribution, abundance and stock identity; biological parameters; ecological interactions; pollutants; removals and sustainability of removals. (SC/6). The Scientific Committee utilised the report of the Symposium to develop its own assessment advice to the Council.…The Scientific Committee developed research recommendations to address some of the information needs for management of this species. (SC/8). The SC considered that formal assessments for this species were warranted for Greenland, Iceland and Norway, but that there was insufficient information on abundance in all areas and removals in Iceland and Norway to conduct assessment at this time. (SC/ 14). Estimates of abundance and removals are still needed in all areas. (SC/15).	Ongoing

		The MC **endorses** the recommendations of the SC (NAMMCO 22).	Information was still lacking on abundance in all areas and removals in Faroes, Iceland and Norway in order to conduct an assessment. (SC/16). The SC recommended that an assessment meeting for harbour porpoises in all areas be held during the winter 2011/12. (SC/18) Update: A total annual by-catch estimate of 6,900 harbour porpoises in Norway was reported. This estimate is substantial, and it raises concerns that the by-catch of harbour porpoises in Norway may not be sustainable. Therefore the SC recommended initiating an assessment of harbour porpoises in Norway. Greenland reported that they had sufficient data for an assessment of harbour porpoises in West Greenland. The SC also noted the existence of abundance estimates from both Iceland and the Faroe Islands, as well as some estimates of by-catch in Iceland. (SC/19) The NAMMCO Working Group on Harbour Porpoises met in Copenhagen 4-6 November 2013. Taking into consideration the work of the HP WG, the SC provided a list of recommendations for Greenland and Norway. A future harbour porpoise WG will be scheduled after a report from the By-catch WG, new data from NASS2015, and progress on research requests from the 2013 HPWG (SC/21).	

SECTION 3 COUNCIL

REPORT OF THE COMMITTEE ON HUNTING METHODS

The Committee on Hunting Methods held its annual meeting on 6 February 2016 back to back with NAMMCO 24. In addition, a meeting was held on 6 February 2015. Reports from both meetings are found below.

The Committee also held four telephone meetings; 17 April, 28 May, 7 October and 29 October. These meetings were exclusively dealing with the organising of the Expert Group Meeting on assessing TTD data from large whales hunts that was held 4 – 6 November in Copenhagen. The report from the Expert Group meeting is found in Annex 1 to this report.

Members of the Committee in 2015 were Amalie Jessen and Nette Levermann (Greenland), Ulla Svarre Wang replaced by Signar Petersen in February 2016 (Faroe Islands), Hild Ynnesdal, Kathrine Ryeng and Egil Ole Øen (Norway), Guðni Magnus Eriksson and Kristján Loftsson(Iceland). Nette Levermann chaired the Committee.

REPORT OF THE 6th FEBRUARY 2016 MEETING

The Committee on Hunting Methods met on 6 February 2016 at the Ministry of Fisheries, in Oslo, Norway. Present were Guðni Magnus Eiriksson and Kristjan Loftsson (Iceland), Alessandro Tøvik Astroza, Kathrine Ryeng and Hild Ynnesdal (Norway), Amalie Jessen and Nette Levermann (Greenland), Signar Petersen (Faroe Islands) and Charlotte Winsnes from the Secretariat.

1. INTRODUCTORY REMARKS AND ADOPTION OF AGENDA

The Chair of the Committee, Nette Levermann, welcomed the Committee members to the meeting, especially the new member Signar Petersen. The draft agenda was adopted, and meeting documents were reviewed. Charlotte Winsnes acted as rapporteur.

2. UPDATE ON HUNTING METHODS IN MEMBER COUNTRIES

Greenland

Levermann informed the meeting that there is a revision to the Executive Order regulating the hunt on large whales (2014) pertaining to the hunting period for minke whales. The new hunting period is March to November. The change in period is reflecting change in observed behavior of the minke whales.

Also a revision of the two executive orders on hunting licenses (2014) has been made because a change in the price of a hunting license has been approved.

Finally a revision to the Executive Order regulating the hunt on narwhal and beluga (2016) is recently approved. It is based on the newest scientific information of stock status, area and hunting grounds.

One new reference on reporting of catch data of large whales have come in 2015.

Whaling

The national quotas for large whales in 2015-2016 is based on the advice from the IWC Scientific Committee and approved by the IWC Commission in 2014.

Quota 2015-2016: West Greenland: 164 minke whales, 19 fin whales, 10 humpback whales and 2 bowhead whales. East Greenland: 12 minke whales. Carry-over numbers have been added for both years.
Active hunting boats: There were 32 approved whaling boats with harpoon guns and 425 smaller boats were active in whaling activities in Greenland in 2015.

Catch including struck and lost: West Greenland: 11 fin whales, 130 minke whales including 3 struck and lost, 6 humpback whales and 1 bowhead whale. East Greenland: 6 minke whales.

Hunting period: The hunting period for 2015-2016 is for fin whale and humpback whale from 1. January to 31. December and for minke whale and bowhead whale 1. March to 31. December.

Entanglements: 10 humpback whales was reported entangle in fisheries gear in 2015. 9 along the coast of West Greenland and 1 in East Greenland. 5 died of which 4 were permitted euthanized and one drowned.

Strandings: No reported strandings.

Irregularities: Quality control is ongoing. In 2015, there were 2 reported infractions of national legislation on large whales. The infractions were related to the use of rifle as secondary weapon for the humpback whales.

<u>Hunt of small cetaceans, narwhal and beluga</u>
Quota 2015 beluga: West Greenland: 330. Qaanaaq: 20; technical 5 year quota block is given of 100 animals, first year starting in 2014.
Quota 2015 narwhal: West Greenland: 144. Inglefield Bredning: 85; technical 5 year quota block is given of 485 animals, first year starting in 2014. Melvin Bay: quota 81. East Greenland: 88 plus an extra political allocated quota of 10.

Catch including struck and lost 2015 beluga: West Greenland: 120. Qaanaaq: 7.
Catch including struck and lost 2015 narwhal: West Greenland: 72. Inglefield Bredning: 75. Melvin Bay: 71. East Greenland: 94.

The catch numbers for beluga and narwhal includes struck and lost without specifying the actual numbers of struck and lost.

Hunting period: The hunting periods for 2015 for all small cetaceans are from 1 January to 31. December.

No stranding, entanglements or irregularities have been reported.

There are no quota regulations on other small cetaceans in Greenland. For catch numbers please referrer to the national progress reports.

<u>Hunt of pinnipeds, walrus</u>
Quota 2015 walrus: West Greenland: 69. Northwater: 86. East Greenland: 18.

Catch including struck and lost 2015 walrus: West Greenland: 53. Northwater: 74. East Greenland: 4.

The catch numbers for walrus includes struck and lost without specifying the actual numbers of struck and lost.

Hunting period: The hunting period for walrus in West Greenland is from 1. March to 30. April and in Northwater and East Greenland it is from 1. October to 30. June. The hunting period for harp seal, ringed seal, hooded seal and bearded seal are from 1. January to 31. December.

No stranding, entanglements or irregularities have been reported.

There are no quota regulations on other legally hunted pinnipeds in Greenland. For catch numbers please referrer to the national progress reports.

Norway
Ynnesdal informed the meeting of the following:

<u>Whaling</u>
Quota: 1286 minke whales
Active hunting boats: 21
Catch including struck and lost: 660
Hunting period: 1. April – 28. September

Strandings: Norway do not record strandings
Irregularities: Quality control is ongoing.

Sealing
Quota: 21.270 harp seals
Catches of harp seals: 1165 harp seals including 8 taken for research
Catches of hooded seals: no commercial hunt allowed, 11 hooded seals taken for research
Hunting period: 1. April – 30. June
Active hunting boats: 1 vessel
No irregularities reported.

Norway stopped to subsidise the seal hunt in 2014 resulting in only one vessel going out. Previously it used to be 3 – 4 vessels each season. For the season 2016 no decision has been taken on either sealing or whaling pending upcoming meetings between the authorities and the industry.

Faroe Islands
Petersen informed the meeting of the following:

There are no regular quota system in the pilot whale hunt, but the Sysselmann has the authority to decide if the hunting should be stopped. The hunt can take place around the year and there is therefore no particular season.

In 2015 there were 6 drives and 501 pilot whales were taken. In addition two bottlenose whales were also caught. No irregularities were reported.

A new whaling regulation was introduced in 2015 " Løgtingslóg um grind og annan smáhval, sum seinast broytt vi¨løgtingslóg nr. 93 frá 22. juni 2015”, on pilot whales and other small cetaceans. The law enables the authorities to prosecute persons exhibiting disruptive behaviour and interference in the hunt and also making training courses on the use of the spinal lace.

There will be made a slight improvement to the design of the spinal lance based on experiences with this new equipment. There was a minor problem with the curving of the blade that did not prolong TTD but damaged the equipment. However the overall evaluation is that the lance is working as intended and has improved the killing technique. All hunters are obliged to undertake a training course built on the NAMMCO manual, and so far around 2 700 hunters have completed this course.

Iceland
Eiriksson informed the meeting of the following:

Minke whaling
Quota: 275 minke whales – incl. carry over from 2014
Catch: 29 taken by 1 vessel. No struck and lost
Hunting period: 9 May – 30 August
No irregularities have been reported.

Fin whaling
Quota 171 fin whales – incl. carry over from 2014
Catch 155 incl. 1 struck and lost. 2 active hunting vessels.
Hunting period: 29 June – 28 September
No irregularities have been reported.

Two new references on timr to death (TTD) on minke and fin whale hunt have come in 2015.

Eiriksson informed the meeting that the Directorate has advised the Ministry that more TTD data should be collect in order to complete the TTD assessment of minke whales. The collection of TTD in 2014 and 2015 represents too few animals to draw firm conclusions.

The Committee took note of the presented information, and agreed that for future meetings it would be beneficial to present the information on quota, catch and scientific advice in a table format. The Secretariat was also tasked to look into ways of improving the List of references.

The Committee furthermore discussed at length problems related to by-catch, strandings and entanglement of whales. It recognised that its terms of reference was focused on direct takes but at the same time the mentioned issues have great animal welfare consequences something that is of concern for the Committee. It therefore agreed to ask the advice of Council on how best to address these questions.

3. TTD EXPERT GROUP MEETING 6 – 8 NOVEMBER 2015

The report from the expert group meeting on assessment of whale killing methods for large whales held in November 2015 was presented under this agenda item.

Council, at NAMMCO 23, had tasked the Committee to organise an expert group meeting for the presentation of TTD data on large whales with the terms of reference:

The expert group meeting shall undertake a review and evaluate the whale killing data submitted to NAMMCO by member countries and associated hunting nations, as well as data and information on recent and ongoing research on improvements and technical innovations in hunting methods and gears used for the hunting of large whales.

The meeting had assessed information on hunting methods and TTD data from NAMMCO member countries (Iceland, Norway and Greenland) in addition to Japan, Canada and USA. All members of the EWG were invited as experts in fields related to the issue of killing mammals.

The meeting was successful with indebt and informed discussions, and resulted in specific conclusions and recommendations.

In its evaluation of the expert group meeting the Committee on Hunting Methods agreed to that next time more time should be set aside for discussion of recommendations in plenum and also for the committee drafting the recommendations.

The Committee endorsed the report with its conclusions and recommendations and agreed to in particular to draw the attention of the Council to the following issues:

- The Expert groups concern that the rifle hunt in Greenland seems to be increasing as a result of demand for meat that is not being met by the harpoon cannon hunt.
- In general, to recognise the importance of increasing hunters awareness through training, of the angle of the shot relative to the animals body position in order to reduce TTD.
- To monitor TTD at 10 years intervals.
- To organise a Workshop on alternatives for collecting standardised TTD data that is more economical and also makes it possible to compare TTD between countries.
- To review underlying reasons for struck and lost with the aim of decreasing it.

4. NEXT MEETING

The Committee agreed to get back to the date for the next meeting after Council had met. The Committee also agreed to hold skype meetings. However, the Committee will evaluate a need of face to face meeting in relation to topics to be discussed and solved.

5. ADOPTION OF THE REPORT

The report was adopted by correspondence on 8 February 2016.

REPORT OF THE 6th FEBRUARY 2015 MEETING

The Committee on Hunting Methods met on 6 February 2015 at the Fisheries Directorate in Havnafjordur, Iceland. Present were Guðni Magnus Eriksson and Kristjan Loftsson (Iceland), Kathrine Ryeng and Hild Ynnesdal (Norway), Nette Levermann (Greenland), and Christina Lockyer and Charlotte Winsnes from the Secretariat.

1. ADOPTION OF AGENDA AND APPOINTMENT OF RAPPORTEUR

The Chair of the Committee, Nette Levermann, welcomed the Committee members to the meeting. The draft agenda was adopted with the addition of one information item under any other business. Charlotte Winsnes acted as rapporteur.

2. EXPERT GROUP MEETING FOR PRESENTATION OF TTD DATA

The report from the expert group meeting on assessment of whale killing methods for large whales from 2010 was presented as a background document.

Council, at NAMMCO 23, had endorsed the idea of organising an expert group meeting for the presentation of TTD data on large whales with the terms of reference:

The expert group meeting shall undertake a review and evaluate the whale killing data submitted to NAMMCO by member countries and associated hunting nations, as well as data and information on recent and ongoing research on improvements and technical innovations in hunting methods and gears used for the hunting of large whales.

NAMMCO member countries (Iceland, Norway and Greenland) and hunting nations like Japan, Canada, USA and Russia will be invited to participate and to inform about their hunting practises and present their data.

The Committee discussed and agreed upon the agenda as described in Appendix 1.

Anticipated duration of the meeting is two days and suggested venue is either in Copenhagen or in Reykjavik, in week 45 (2 – 6 November) 2015.

The Committee also reconfirmed the list of experts to be invited agreed on at the last meeting, and included two more persons. The present list of experts consists of 10 persons. One of these were added by correspondence after the meeting. Furthermore, the Committee identified a possible chair.

The Secretariat was tasked to proceed with invitations of both hunting nations and experts.

3. INTERNAL SEMINAR ON DATA COLLECTION, PROCESSING, ANALYSING AND PRESENTATION OF TTD DATA

After the last meeting in the Committee it became clear that members had different understandings of what the practical seminar on TTD data should entail. An intersessional meeting was therefore held during NAMMOC 23 to clear up misunderstandings. This meeting was followed by a planning meeting between the Chair, the Secretariat and Lars Walløe, where the following was agreed to:

- To organise a two-day seminar just prior to the planned TTD expert Group meeting.
- One day will deal with the Greenlandic data and the other with Icelandic and Norwegian data.
- These seminars will NOT deal with the collection of data, but will focus on the analysing process of data already collected.
- Lars Walløe has agreed to produce three different analyse protocols prior to the seminar; one for Greenlandic data, one for fin whale and one for minke whale.
- Greenland will supply Lars Walløe with data from 30 – 50 individuals so that he can evaluate how to best analyse and present this data.

- Participants to the seminar must be people with a relevant background (mathematicians, statisticians) so that they will be able to undertake these analyses in the future. It is up to Greenland and Iceland to find these people. In addition members of the Committee may participate.
- The period suggested for both expert group meeting on TTD and the seminar is the first week of November, so that it lies back to back with the annual Scientific Committee meeting.

Iceland emphasised that their primary interest in this seminar is to understand and get a description of the process of how these particular data analysis are carried out.

The Committee welcomed the update and was especially pleased to hear that Walløe will produce written protocols. Documentation is essential to ensure the transfer of knowledge from the present to new generations. The Committee also agreed that for 2016 the next project could be to produce a protocol for data collection.

4. UPDATE ON TAJII WORKSHOP

Prior to NAMMCO 23 the Japanese representatives to the meeting had asked for a meeting to discuss the plans for a workshop on small cetaceans hunting in Tajii. The Chair and the Secretariat met on Sunday 1 February and prepared a possible programme and a list of budget items that were distributed to all members of the Committee for comments. This was later sent to the Japanese as an input to the meeting, together with the handbook on pilot whaling.

The meeting was held Thursday 5 February after the close of NAMMCO 23. It was attended by Mr Sakamoto and Mr Iino from Japan, The Chair and Charlotte Winsnes from NAMMCO.

Sakamoto expressed appreciation for the programme and budget, and informed that he had forwarded these to Tokyo. Levermann expressed that NAMMCO was pleased to be of help and that we would be happy to continue to do so. It was also emphasised that NAMMCO would not be in a position to contribute economically or personnel wise without a formal request being sent and approved by the NAMMCO Council. It was furthermore advised that Justines Olsen from the Faroe Islands and Egil Ole Øen from Norway would be important experts should such a workshop take place.

The Committee took note of the information.

5. FOLLOW UP FROM NAMMCO 23

Agenda items 3 and 4 above were the two follow up issues from NAMMCO 23.

6. FOLLOW UP FROM THE LAST COMMITTEE MEETING

At the last meeting the Committee raised the idea of reviving the workshop on handling, processing and utilisation of hunted marine mammals that had been on the agenda in 2009. There was no new information or ideas presented at the meeting. The Committee agreed to ask the Secretariat to keep this in mind in relation to the project on marine mammals and food security.

7. NEXT MEETING

The next meeting will be a telephone meeting before Easter.

8. ANY OTHER BUSINESS

Iceland informed the meeting that there were discussion internally pertaining to when and how the report of the TTD should be published.

9. ADOPTION OF THE REPORT

The report was adopted by correspondence on 13 March 2015.

Appendix 1 - List of laws and regulations for marine mammal hunting

(Updated NAMMCO 24)

FAROE ISLANDS

Parliamentary Act	No 57 of 5 June 1984 on whale hunting No 54 of 20 May 1996 amending Parliamentary Act on whale hunting No 9 of 14 March 1985 on the protection of animals, as last amended by Parliamentary Act No 60 of 30 May 1990 No 43 of 22 May 1969 on weapons etc. as amended by Parliamentary Act No 54 of 12 May 1980 No 56 of 19 May 2015 on pilot whale and other small whale, with later amendments.
Executive order	No 57 of 12 September 1969 on weapons etc. No 19 of 1 March 1996 on exemption from protection of whales No 126 of 23 June 1997 on protection of whales No 87 of 20 September 2007 on protections of whales No 100 of 5 July 2013 on pilot whaling.

GREENLAND

Greenland Home Rule Act	No 12 of 29 October 1999 on hunting No 11 of 12 November 2001 on revisions to Greenland Home Rule Act No 12 of 29 October 1999 on hunting No 9 of 15 April 2003 on revisions to Greenland Home Rule Act No 12 of 29 October 1999 on hunting No 1 of 16 Mai 2008 on revisions to Greenland Home Rule Act No 12 of 29 October 1999 on hunting No 25 of 18 December 2003 on animal welfare No 29 of 18 December 2003 on nature protection
Executive Order	No 26 of 24 October 1997 on extraordinary check and approval of harpoon canons No 22 of 19 August 2002 on trophy-hunting and fishing No 13 of 30. December 2014 on hunting licenses for full time hunters No 14 of 30. December 2014 on hunting licenses for part-time hunters No 1 of 15. January 2016 on protection and hunting of beluga and narwhal No 21 of 22 September 2005 on protection and hunt of polar bears No 20 of 27 October 2006 on protection and hunting of walrus No 12 of 22. December 2014 on protection and hunting of large whales No 12 of 16 July 2010 on reporting from hunting and strike of large whales No 16 of 12 November 2010 on protection and hunting of seals

Catch registration form (1993-present) "*Piniarneq"*

ICELAND

Law	No 26, May 3, 1949 on whaling No 40, June 1, 1979 on amendments to Law No 26/1949 on whaling No 23, April 17, 1991 on amendments to Law No 26/1949 on whaling (cf. Law No 40/1979) No 92, July 1, 1991 on amendments to Law 26/1949 on whaling (cf. Law No 40/1979 and 23/1991)
Regulation	No 163, May 30, 1973 on whaling No 304, May 9, 1983 on amendments to Regulation No 163 of May 30, 1973 on whaling No 239, May 10, 1984 on amendments to Regulation No 163 of May 30, 1973 on whaling (cf. Regulation No 304/1983) No 862, October 17, 2006 on amendments to Regulation No 163 of May 30, 1973 on whaling (cf. Regulation No 304/1983 and 239/1984) No 822, September 14, 2007, on amendments to Regulation No 163 of May 30, 1973 on whaling (cf. Regulation No 304/1983, 239/1984 and 862/2006) No 456, May 19, 2008, on amendments to Regulation No 163 of May 30, 1973 on whaling (cf. Regulation No 304/1983, 239/1984, 862/2006 and 822/2007) No 58, January 27, 2009, on amendments to Regulation No 163 of May 30, 1973 on whaling (cf. Regulation No 304/1983, 239/1984, 862/2006, 822/2007 and 456/2008) No 263, Mars 9, 2009 on amendments to Regulation No 163 of May 30, 1973 on whaling (cf. Regulation No 304/1983, 239/1984, 862/2006, 822/2007, 456/2008 and 58/2009) No 359, April 6, 2009 on amendments to Regulation No 163 of May 30, 1973 on whaling (cf. Regulation No 304/1983, 239/1984, 862/2006, 822/2007, 456/2008 58/2009 and 263/2009) No 414, April 29, 2009 on the ban on whale hunting in specific areas.
Minke waling licenses	Rules in the licenses for minke whaling.

NORWAY

Act of 29 May 1981 No 38	Relating to Wildlife and Wildlife Habitats (the Wildlife act)
Act of 27 March 1999 No 15	Relating to the Right to Participate in Fisheries and Hunting
Act of 6 June 2008 No 37	The Marine Resources Act
Act of 19 June 2009 No 97	Animal Welfare

Executive Orders from the Department of Fisheries and Coastal Affairs:

31 March 2000	Regulation of the practice of hunting minke whales.
11 March 2003	Regulation of the practice of hunting seals in the West Ice and the East Ice

The Ministry of Fisheries and Coastal Affairs and the Directorate of Fisheries issues each year executive orders relating to the participation and governing of the hunt of Whales and Seals.

Appendix 2 - List of references on hunting methods

(Updated NAMMCO 24)

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ANNEX 1 - Report from the TTD expert group meeting

INTRODUCTION

NAMMCO Council in February 2015 tasked its Committee on Hunting Methods to organise the second Expert Group meeting to assess large whale killing data. The first assessment meeting was held in 2010 (NAMMCO 2010).

People's right to hunt and utilise the marine mammal resources is one of the founding principles of NAMMCO. Embedded in this right is the obligation to ensure that the hunt is sustainable and that it is conducted responsibly with respect to killing efficiency, hunter's safety and animal welfare. To facilitate NAMMCO's work in this field, the Committee on Hunting Methods was established in 1994. The Committee gives advice on hunting methods and practices to the NAMMCO Council and the member countries. The advice should be based upon the best scientific findings, technological developments and user knowledge with due considerations to hunters' safety and efficiency of utilisation.

TERMS OF REFERENCE of the Expert Group **(EG)** as provided by the NAMMCO Council:

The expert group meeting shall undertake a review and evaluate the whale killing data submitted to NAMMCO by member countries and associated hunting nations, as well as data and information on recent and ongoing research on improvements and technical innovations in hunting methods and gears used for the hunting of large whales.

The aim of the Expert Group was to assess the presented whale killing data and give recommendations with respect to possible improvements. Data and information were presented from Greenland, Iceland, Norway, Japan, USA (Alaska and Makah hunts) and Canada.

In setting up the Expert Group, the Committee on Hunting Methods identified a small group of qualified persons with extended experience and knowledge in general and/or marine mammal specific biology, physiology, anatomy, pathology and statistics. All members of the Expert Group (Appendix 1) were invited in a personal capacity, without affiliation to country or organisation, as experts in fields related to the issue of killing mammals.

The meeting agreed on the agenda (Appendix 2) and established a drafting group with the responsibility to formulate conclusions and recommendations. Based on the discussions and deliberations of the meeting they presented some draft recommendations on the last day. These recommendations were discussed in plenary point by point and adopted by consensus. The finalising of the full report was done afterwards by correspondence.

The Expert Group met under the chairmanship of Dr Christina Lockyer on 4 – 6 November 2015 in Copenhagen, Denmark. Charlotte Winsnes acted as rapporteur. The present report summarises the discussions of the Expert Group and gives the conclusions and recommendations.

BACKGROUND

Time to death (TTD) or Survival time (ST) and the Instantaneous death rate (IDR) are terms used to measure and quantify killing efficiency and the state of art of killing methods and practices. Standardised collection and analysis of TTD/ST and IDR data with covariates that may influence these make it possible to compare how rapidly whales are killed using different techniques and gears. It also makes it possible to calculate effects of new developments, modifications or changes in hunting practices and of systematic training of hunters.

CRITERIA OF DEATH

Definition of death has changed over the centuries depending on cultural views as well as technological and biomedical advances. In biology, death was traditionally determined by behavioural signs such as termination of movement and respiration, and for a long period of time it was widely accepted that death equalled the absence of pulse and breathing *i.e.* the classical cardio-respiratory criteria of death (Knudsen 2005[2]).

No official criteria of death have been formulated for animals except for whales. A definition was adopted by the International Whaling Commission (IWC) in 1980 and reiterated in 1992 (IWC 1980; 1992) to make a standard ruling to compare the efficiency of different hunting and killing procedures in the field as well as evaluation of research into new methods. As the exact time of death might be difficult to observe for animals dying in or under water the time of death was defined as "… the moment the mouth (was) slackened, the flippers (were) slackened (along the sides) and/or all movements (had) ceased". However, neuropathological investigations of minke whale brains from whales hunted and killed with penthrite grenades showed that the IWC criteria were not always met as whales with permanent brain damage of sufficient severity to account for instant or very rapid loss of sensibility and death still (like terrestrial mammals) could show uncoordinated movements (reflex movements) for several minutes after they were dead (Knudsen 2005).

Knudsen in her doctoral thesis "Assessment of insensibility and death in hunted whales – a study of trauma and its consequences caused by the currently used weapons and ammunition in the Norwegian hunt for minke whales, with emphasis on the central nervous system" (Knudsen 2004, p. 100) concluded that "...when times to death (TTD) are solely determined on the basis of the IWC criteria which in practice is immobility, a significant portion of animals will be recorded as being sensible or alive when they actually are unconscious or dead." Hence one may conclude that TTD based on the IWC criteria is biased negatively *i.e.* overestimated.

<u>Discussion</u>
The Expert Group (EG) acknowledged that no clear definition of death exists for animals. It can therefore be argued that by definition measuring time to death (TTD) is not feasible. However, for the purpose of comparison both between and within hunts the IWC criteria has proven to be an adequate and internationally agreed upon tool to measure efficiency and to assess improvements. Furthermore the EG emphasised that the IWC criteria is applicable not only for veterinarians but also for hunters, a not insignificant point since hunters often are the ones reporting TTD with their watch as the only available technical measuring tool.

The EG agreed that the IWC criteria was not an exact criteria of death but that it was a working criteria that for all practical purposes functioned as a measuring tool.

COLLECTION OF TTD DATA

The NAMMCO Expert Group Meeting on Assessment of Large Whale Killing Data in 2010 emphasised the importance of recording TTD/ST/IDR. The meeting recommended that all hunts use the Norwegian method of collecting and analysing TTD data in order to identify needs for improvements.

In Norway, TTD data were collected for more than 5,000 minke whales killed in the period 1981 to 2012. During this period, the hunting equipment and methods changed primarily because of research and development work done to improve killing efficiency and reduce animal suffering. The IDR increased by 65% from 17% to 82% and the average TTD was reduced from 11.5 min to 1 min.

The standardised collection and analysis of TTD, ST and IDR data from hunts using different techniques were instrumental in improving the hunting methods and gears. The data were analysed with covariates like animal size, shooting distance and angle of harpoon gun shot, hit region and detonation area. The results of the analysis not only documented the need to develop better weapons and improved hunting techniques and practices, but also gave indications as to which factors might be of special significance for improvement. It also highlighted the importance of organising training courses for hunters.

How to collect TTD data the "Norwegian Way" – Appendix 3
The data collectors should be independent, designated, competent persons that do not have other tasks to attend to in the killing and flensing (butchering) phase. Qualification requirements are veterinarians, large mammal biologists and large whale physiologists and hunting- and fisheries inspectors, in that order.

The profession of the veterinarians enables them to better understand and assess the behaviour of the animal

[2] Knudsen SK, 2005. A review of the criteria used to assess insensibility and death in hunted whales compared to other species. The Veterinary Journal 169 (2005) 42 – 59.

when hit, and relate the animal's reaction to the death criteria, and it is assumed that large mammal biologists and physiologist also have this understanding. For example when the question is whether an animal is dead or unconscious it is important to understand the concept of reflex movements and to be able to distinguish between these as uncoordinated movements and movements made by a conscious and living animal. Typically, a hit whale swimming on its back shows that the whale is unconscious or dead and what one sees are reflex movements.

Ideally, every kill should be followed by post mortem examinations, and thus anatomical and pathological knowledge is important when assessing damage to organs and gross (macroscopic) changes in vital organs. Pathological findings are especially important when verifying differences between reflex and conscious movements.

A specially designed reporting form has been developed covering primary observations of the animal during the hunt and kill, such as, among others, reaction pattern, hit area and estimated TTD, and secondary observations typically related to variables like animal size, shooting distance and angle, *etc.* Prior to collecting TTD data all personnel should receive special training covering *inter alia*: general introduction to national laws and equipment used in the hunt, and a thorough review of the reporting form.

Quality control of data

Each separate reporting form must be examined closely to make sure that errors or possible misrepresentations of facts are taken out or corrected before the data are analysed. Inconsistencies must be explainable for the data to be included in the dataset that will be analysed. The more knowledge and experience a person has of the hunting methods and practices, the more capable he or she will be to undertake this quality control of the collected data.

When doubt exists concerning reports, it is required that supplementary information be acquired by interviewing the inspector and hunters, and/or by checking catch data or other data from other existing reporting systems. In Norway, an additional source of information for a person specifically trained in Norwegian minke whale hunt is the electronic recording system "the blue box". The electronic system does not record TTD but it records time and position of every whale shot and taken on board for flensing through various movement sensors placed in strategical places on the boat connected to a GPS. This means that data from this system may give an indication as to whether the whale died quickly or slowly.

To be able to carry out this kind of quality control satisfactorily it is a prerequisite to have the necessary biological knowledge in addition to detailed knowledge of, and experience from, whaling.

Discussion

The EG underlined the importance of collecting data in a standardised manner. It also noted the importance of doing a quality control of individual datum to ensure that the data used is "true" in the sense that it is not a product of misinterpretation or obvious errors.

The person measuring TTD might not be one of the above-mentioned professions. Sometimes hunters will collect TTD. It was noted that as long as the person collecting the data is trained in what to look for it is better to record TTD than not recording TTD at all.

ANALYSIS AND PRESENTATION OF TTD DATA

From the early 1980s the IWC started to question whaling member countries about statistical data on TTD. At that time the results were usually presented as mean TTD (perhaps with either the corresponding standard deviation (SD) or standard error (SE)). Usually the maximum TTD was also presented as well as the number of whales behind the calculations. As long as only a few whales died instantaneously this was a fair way to present the TTD results. These measures could be compared *e.g.* between different years or between different types of harpoon guns to investigate whether there were improvements in the hunt. Already at that time it was obvious that both mean and the SD were strongly influenced by one or a few whales with very long TTD, but an advantage was that the measures were easy to calculate.

Today statisticians advise the use of more robust measures of location and spread in situations where there are possibilities of outlying observations. The Norwegian method is based on Professor Walløe's advice to use the simplest of these robust alternatives: the median and the 0.25 and the 0.75 fractiles in the distribution. However, since a large fraction of the whales die instantaneously today in many whaling operations the analysis should be divided in two parts.

First the Instantaneous Death Rate (IDR) should be analysed by methods for estimating a binomial probability, usually combined with methods to estimate a 95% Confidence Interval (CI). These IDRs can then be compared between years or between hunting methods, if necessary by such statistical tests as Fisher-Irwin test or Campbell's chi-square (n-1) method. If covariates such as shooting distance, shooting angle or length of the whale are recorded, the analysis can be extended by logistic regression to investigate whether any of these covariates influences the IDR.

The whales that survive the first hit by the harpoon should then be analysed by the methods described in the second paragraph above. The median and the two quartiles in the distribution should be presented, for the median also the nonparametric 95% CI. A Kaplan-Meier plot of the results is usually very informative. If covariates are available, Kaplan-Meier plots could be made for different sub-groups, or the possible influence of the covariates could be investigated by a Cox regression. If some of the survival times are censored *e.g.* because a secondary killing method is applied, the median and fractiles should be estimated by methods from 'survival analysis'.

Discussion

The EG noted the presentation and agreed with the statistical advice, especially to divide the data into 2 parts: the IDR group and the remaining survivors.

DESCRIPTION OF KILLING METHODS – REVIEW OF TTD DATA

Norwegian minke whaling

Norwegian fishermen are hunting minke whales from small (50 feet) or medium sized (60-120 feet) fishing boats that are rigged for whaling in the spring and summer season. The weapons are 50 mm and 60 mm harpoon guns. The harpoon is equipped with a penthrite grenade (Whale grenade-99) developed in Norway in 1997-1999. The grenade is loaded with 30g pressed penthrite as explosive. The back-up weapon is a rifle of calibre .375 or .458, using full metal jacket, round-nosed bullets. The vessels usually search for whales at slow speed (4-6 knots/h) and the whales are often shot from a relatively short range (< 30m). No sonar or similar instruments are used during the hunt as such instruments are considered to scare the whales off.

Starting in 1984 all gunners and licence holders have been required to attend obligatory training courses. The recommendation is to fire the grenade at the whale from a side position (45°-135° - relative to the animal's long axis) and aim at the thorax (chest). The rifle is usually fired at close range and when the whale's head is over water. The shot is directed to the brain.

Research programmes

From 1981 to 2005 several research programmes and studies to assess and improve the hunting and killing methods for minke whales were conducted in Norway.

1981- 86: Research programme I: Project manager E.O. Øen.

Development of improved killing methods in the Norwegian minke whaling, improvements of weapons and hunting methods and training of hunters.

The research programme aimed to find alternatives to the "cold" harpoon (harpoon without explosives). The programme included collection of TTD data from the "cold" harpoon hunt for comparison with other killing methods, field trials with high velocity projectiles (HVP), alternative designed harpoons, the use of explosives and rifles and ammunition used for back-up. The trials with HVP showed that such projectiles under certain conditions had abilities to kill minke whales fast, but since minke whales sink when dead HVP had to be combined with simultaneous harpooning to retrieve shot whales. The studies also included the possible use of high-pressure gases, drugs and electric harpoons. After reviewing the possible use of gases, drugs and electricity to kill whales no trials to test such methods were found necessary. The work resulted in the development and implementation of a harpoon grenade (Raufoss) with 22 g of penthrite fuse as explosive implemented in the hunt from 1984-85 onwards. The data sampled during the research period showed that while the "cold harpoon" killed only a maximum of 17% of the whales instantly or within a minute the new penthrite grenade killed 45% of the whales instantaneously.

1992- 96: Research programme II: Project manager E.O. Øen.
Further developments of alternative hunting gears and hunting methods in Norwegian minke whaling.
The studies included development of methods for *in situ* fixation of whale brains and histological examination of brain tissues, ballistic studies and further trials with harpoons, ballistic studies of rifle bullets, harpoon gun sights and marksmanship contra shooting ranges, improvements of catching gears and routines. In addition to the development of a method for *in situ* fixation of whale brains the studies resulted in implementation of obligatory shooting tests for gunners with harpoon guns and rifles prior to the hunt and new regulations in the hunt. After implementation of the shooting tests and the new regulations the IDR was elevated from 45% to about 60%.

1996- 2004: Research programme III: Project manager E.O. Øen.
Further developments of explosives and weapons in Norwegian minke whaling: Development and field testing of a new and improved harpoon grenade for minke whales (Whale grenade-99).
A relatively high rate of malfunction of the Raufoss harpoon grenade in the 1990s initiated studies that resulted in a new, safer and more reliable penthrite grenade for Norwegian minke whaling. The Whale grenade-99 was implemented in the hunt from 2000 and data sampled during the hunt in 2000-2002 for 1667 minke whales showed an IDR of 80%.

1998-2004: Research programme IV: Project manager S.K. Knudsen and E.O. Øen
Assessment of insensibility and death in hunted minke whales; study of trauma and its consequences caused by the currently used weapons in the Norwegian minke whale hunt.
The aims of the study were to: (1) investigate lesions caused by penthrite grenade detonation in minke whales, with special emphasis on the central nervous system (CNS); (2) confirm that the rifle ammunitions used in the Norwegian hunt were capable of penetrating the skull of minke whales and causing sufficient damage to the CNS to account for an instantaneous loss of sensibility; and (3) find out if the "IWC criteria" of death were valid to determine TTD in whales.

The results of post mortem examination of minke whale brains fixed *in situ* proved the deadly effect of penthrite grenades detonating in the whale body. They confirmed that unconscious whales show agonal reflex movements, an issue that had been under discussion for years in IWC. They also confirmed that the "IWC-criteria" were not fully adequate to determine exactly when a whale loses consciousness or dies when TTD are solely determined on the basis of the "immobilisation" criteria; and that a significant proportion of animals will be recorded as being sensible or alive when they most likely are unconscious or dead. However, if the IWC criteria are used in conjunction with a post mortem examination, the estimated TTD will be close to the real TTD for the majority of the whales. The method can therefore be used to compare different hunting techniques and methods provided that competent personnel collect the data and the same protocol is used for data collection and analysing. If the pathological examination does not include investigations of the brain, it is likely that the TTD of some animals still will be overestimated.

Collection of TTD data and results from the 2011 and 2012 seasons

Data collection
Data was collected and recorded on specific reporting forms by fisheries inspectors trained in a two-day course. In addition to TTD, the behaviour of the whale after being shot, whale length, estimated range of shooting, the angle between the shot direction and the whale's long axis, the impact point on the whale, the detonation site, necropsy findings, grenade function and re-shootings were recorded. The time from a strike to the animal's death was recorded by using stop-watch. The IWC criteria were used to decide TTD.

Results
TTD data were collected for 271 minke whales. Instantaneous death was recorded for 222 whales (82 %). The median TTD for the 49 whales not registered instantly dead was 6 min. One whale that had only been wounded was re-shot and died after 20-25 minutes.

The shooting position/angle is registered for 94% (255) of the whales. Of these 62% were shot from the recommended side position (45°-135° - relative to the animal's long axis), 22% in a narrower angle from behind

(135°-180° - relative to the animal's long axis), 16% were shot from the front (0°) or from behind (180°). 92% of the whales shot from the recommended side position (45°-135°) were registered instantly dead while only 70% of whales shot in the narrower angle either from front or behind positions (0°- 45° and 135°-180°) died instantly. The result for the other 16% of whales which were shot from the front (0°) or from behind (180°) was 63%. No misfire of grenades due to technical errors was reported during the two seasons. The instantaneous death rate of 82% is the highest IDR ever recorded in the Norwegian minke whale hunt (see Figure 1 next page).

Detonation in the thoracic cavity, detonation near the spinal column in the thoracic part and rostral to the thorax (neck and brain) resulted in 100% instant death. The detonation caused massive bleedings, damages and injuries to vital organs like heart, lungs, major blood vessels and central nervous system (CNS). Former studies of minke whale brains from whales killed with penthrite grenades (Knudsen 2005) show that the detonation in thorax and neighbouring regions like the rostral part of the abdomen creates fatal haemorrhages (bleedings) in the spinal column and the basis and cortex of the brain, probably due to concussion and the extremely high, undulating pressure/shock waves that spread out through the body to the brain through natural openings like the spinal column, large vessels and other openings in the skull.

The angle of the shot relative to the animal's long axis influences the TTD significantly. Shots directed at the thorax from the recommended side position of about 45°-135° relative to the animal's long axis resulted in 92% instant kills while shots directed in narrower angles from front or from behind resulted in 70% and 63% instant kills, respectively.

The results from this study are concurrent with earlier studies. Shots from a narrow angle to the body of a moving target will significantly increase the risk of stray shots or hits and detonation outside vital areas and seem to be the main reason for the longer survival times.

Presently, due to continuous modification of components that have showed weaknesses, and close surveillance and quality control of the production process, malfunction or misfire of the Norwegian penthrite grenade is very unusual. The high quality of the grenade together with the introduction and use of the NAMMCO handbook "NAMMCO Instruction manual for the maintenance and use of weaponry and equipment deployed in hunting of baleen whales in NAMMCO member countries" should potentially increase further improvements of IDR and TTD if all gunners become patient and wait until the animal is in the recommended side position before the gun is fired.

Discussion

The EG acknowledged the extensive research and developmental work undertaken by Norway since the early 1980s. The EG further noted that the TTD data collected in 2011 and 2012 confirmed and gave a slightly improved result to the last survey undertaken in 2000-2002. Presently the IDR was 82 % as compared to 80% the last time. The survey covered all hunting boats over a period of 2 years.

The EG reiterated and emphasised the conclusion from the 2010 meeting of the importance of the angle of the shot relative to the animal's long axis in harpoon gun hunts. The recommended angle is from 45 to 135 degrees relative to the animal's long axis and the shot should be aimed at the thorax.

The EG acknowledged that all 2010 recommendations had been followed up. It further recommended that Norway continue to monitor the hunt with regard to TTD and IDR at 10-year intervals unless important issues arise that require more frequent monitoring.

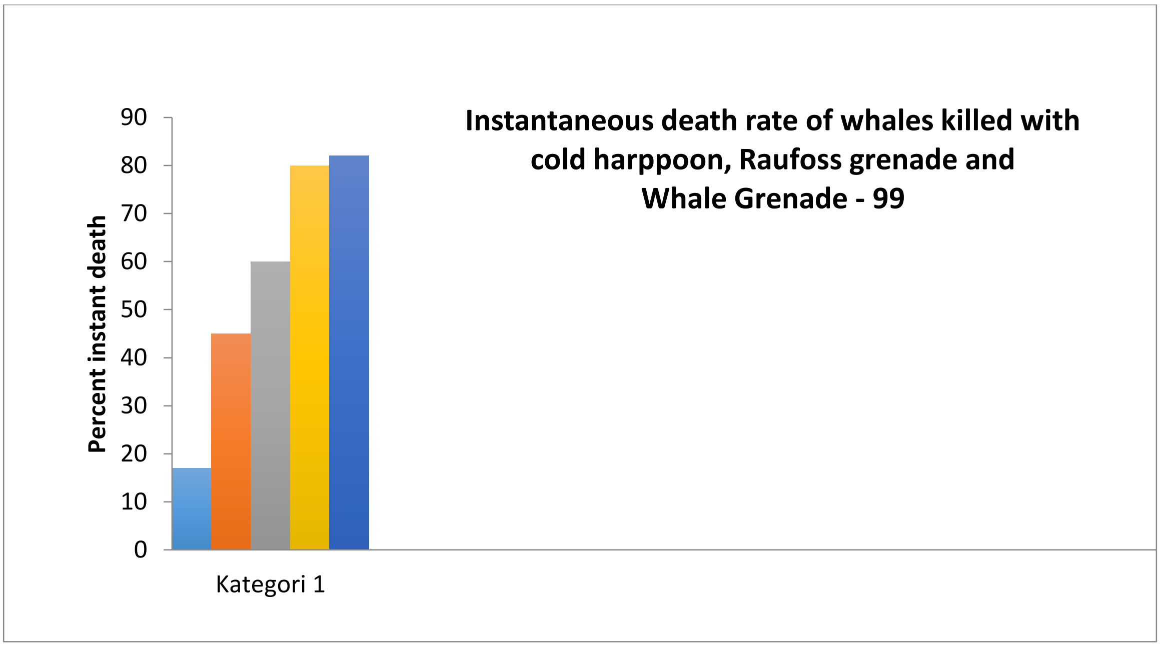

***Figure 1:** IDR of whales killed with different weapons*
Light blue: cold harpoon 1981-83, Orange: Raufoss harpoon grenade 1984-86, Grey: 1994-96, Yellow: Whale Grenade-99 2000-02. Blue: Whale Grenade-99: 2011-12.

Iceland – minke whaling

The minke whale hunt in Iceland is carried out with similar weapons and boats as are described for the Norwegian minke whaling above. Minke whales are hunted in Icelandic coastal waters from small or medium sized (60-70 feet) fishing boats that are rigged for whaling in the spring and summer season. The weapons are deck mounted 50 mm Kongsberg harpoon guns equipped with the penthrite grenade (Whale grenade-99) developed in Norway in 1997-1999. The grenade is loaded with 30g pressed penthrite as explosive. Back-up rifles of calibres .375 or .458 using full metal jacket, round-nosed bullets are used if the whale is not instantly dead by the grenade detonation. The vessels usually search for whales at slow speed (4-6 knots/h) and the whales are often shot from a relative short range (< 30m). No sonar or similar instruments are used during the hunt as such instruments are regarded to scare the whales off.

Collection of TTD data in the 2014 and 2015 seasons

An experienced veterinary officer well-trained for TTD data collection was engaged to collect the TTD data using the data-collection form that is used for collection of TTD data for minke whales in Norway. In addition to TTD data, supplementary information like the behaviour of the whale after being shot, whale length, estimated range of shooting, the angle between the shot direction and the whale's long axis, the impact point on the whale, the detonation site, necropsy findings, grenade function and possible re-shooting was recorded. The post mortem examinations of the whales were carried out when the whales were processed on board. On board examinations do not include examination of the brain.

The time from a strike to the animal's death was recorded by using a stop-watch. The time of death was recorded as recommended by IWC in 1980. In addition to these behaviour signs of death the recorded TTD was verified through the findings of organ damage demonstrated at the autopsy. Shooting range and angle of the shot relative to the animal's long axis were estimated without instrumental aid.

Nine (69%) of the 13 minke whales were reported instantly dead after detonation of the grenade in the thoracic region. Eight of these were shot from the recommended side position (45°-135° - relative to the animal's long axis) and one from a narrower angle from behind (135° - 180° - relative to the animal's long axis). The median survival time for the four whales that did not die instantly was 4 min. The longest survival time was 13 min. The size of the whales varied from 6.2 to 8.1m. Shooting distance varied from 20 to 60 m with an average shooting distance of 45m.

Discussion

The EG acknowledged that Iceland had followed up on the 2010 recommendation (NAMMCO 2010) to collect TTD data. The presented data had been collected and analysed with covariates (animal size, shooting distance and angle of harpoon cannon shot, hit region and detonation area) in line with the Norwegian methods like it had been done in Norway during 1981-2002.

The weapons used in Iceland are identical to the ones used in Norway for minke whales and the results show an IDR of 69% which is lower than the IDR registered in the Norwegian hunt (82%). The EG did not find that they could draw any firm and strong conclusions regarding killing efficiency due to the very limited set of data from the two seasons. In such a small sample each unit will represent 7-8% of the result making it possible for one single whale to tip the balance considerably in a positive or negative direction.

The EG noted that these results were somewhat inconclusive. The EG recommended that Iceland should work towards future collection of data for minke whales, for improved assessment of TTD. As was the case with Norway, the EG recommended that as a general rule, the hunt be monitored with regard to TTD and IDR at 10-year intervals unless important issues arise that require more frequent monitoring.

Iceland – fin whaling

Fin whale hunting is conducted from medium-sized boats that are exclusively used for whaling. Hunting grounds are within Iceland’s 200 miles exclusive economic zone and the whales are towed to a land station for flensing and processing. The whales are killed using 90 mm Kongsberg harpoon guns and a modified Whale Grenade-99 designed to trigger the detonation of 100 g of the explosive penthrite at a depth of 110 cm after penetration into the whale. The back-up weapon is a new grenade.

Hvalur hf., the company hunting fin whales in Iceland, has since 1985 worked to improve the killing efficiency in the hunt. Whale Grenade-99 replaced the former “Black Powder Grenade” (filled with 650 g of black powder as explosive) that had been used for large whales for at least 70-80 years. The killing by the “Black Powder Grenade” is a combination of the concussion from the blow and the wounds and tissue lacerations caused by the heavy splinters from the cast iron grenade. However, the wounding and killing efficiency of such splinters is highly unpredictable.

When black powder was used, some TTD data were collected for 16 sperm whales and three fin whales during butchering of large whales in 1979. Based on organ damages it was concluded that onset of unconsciousness was rapid in eight whales, while onset of unconsciousness was slow in seven whales. In 1983 observations were made of the kill and butchering of 19 fin whales. The median TTD was estimated to three minutes. No whales were recorded instantly dead but six whales were recorded unconscious instantly or within 10 seconds. The median time to unconsciousness was two minutes. The longest survival time recorded was 16 minutes.

Development work to improve killing efficiency

1985-1989

Experiments on 90 mm harpoon grenade technology started in Iceland in 1985 and continued to 1989 in conjunction with the Icelandic programme on whale research. A prototype penthrite grenade was made using the core of the contemporary Norwegian minke whale grenade in 1986. Based on information from the gunner on behaviour of the whales after being hit and observations from flensing, the IDR was estimated as approx. 70-80%. However, no systematic necropsy of the hunted whales or any statistical analyse of killing data were undertaken. The conclusion that could be drawn was that detonation of 100 g of penthrite fuse in the chest or near the spinal column in the chest or neck resulted in instant death.

2009-2014

A second prototype of penthrite grenade was tested with some success in 2009 and 2010 and finally a third grenade was developed and tested in 2013. This grenade is made of stainless steel, has a new trigger line and trigger hooks. Gunners and crews were trained how to handle and use the new grenade. The training course was repeated in 2014 and the gunners were instructed to aim the harpoon grenade at the chest and to hold the shot until they could fire at the whale from the side (45°-135° relative to the animal's long axis).

Electronic sights for 90 mm Kongsberg harpoon canon
Harpoon guns are traditionally equipped with fixed simple open sights that cannot be easily adjusted. After studies of telescopic sights, Red Ring Holosight® (RRH) were used in the last half of the 2014 hunt. The trial took place too late to be included in the sampling of TTD data in 2014. However, the gunners claim that the new sights were successful and that they did not want to go back to use traditional open iron sights.

Collection of TTD data and results from the 2014 season
The data-collection that had been used for minke whales in Norway was adapted to fin whales and an experienced and well trained veterinary officer from Norway collected data during the 2014 season. In addition to TTD data, supplementary information like the behaviour of the whale after being shot, whale length, estimated range of shooting, the angle between the shot direction and the whale's long axis, the impact point on the whale, the detonation site, necropsy findings, grenade function and possible re-shooting was recorded. The post mortem examinations of the whales were carried out at the land station.

The time from a strike to the animal's death was recorded by using a stop-watch. The time of death was recorded as recommended by IWC in 1980. In addition to these behavioural signs of death the recorded TTD was verified through the findings of organ damage demonstrated at the autopsy. Shooting range and angle of the shot relative to the animal's long axis were estimated without instrumental aid. Reports were received for 50 fin whales. No whales were reported lost.

IDR was recorded for 42 whales (84 %). The whales not instantly killed (8) were re-shot with penthrite grenade. The median survival time for those whales was 8 min with the shortest survival time of 6.5 min and the longest survival time of 15 min. The recorded size/length of the whales varied from 50 to 69 feet.

Shots directed at the thorax from side position of about 45°-135° relative to the animal’s long axis resulted in 92% instant kills while shots directed in narrower angles gave poorer results. The gunners shot several whales slightly more from behind (about 135°-180° - relative to the animal's long axis) than recommended, but the analysis showed that most of these whales also had high IDR. Of the eight fin whales that survived the first shot five had been shot from behind or from the front.

Detonation in the chest, in or at the thoracic spine, neck or brain resulted in 100% instant death. Detonation inside the chest caused bleedings and severe damage and injuries to vital organs like heart, lungs and major blood vessels.

Discussion
The EG noted the work that had been undertaken to improve hunting methods through modifications of the penthrite grenade, and acknowledged that an IDR of 84% was very good. Although the data presented on the use of the black powder grenades were incomplete and limited, the killing efficiency of the penthrite grenades used in 2014 was seen as clearly superior.

In 2010 it was recommended to look into the potential use of acoustic monitoring of grenade detonation in order to enhance human safety during flensing. Hvalur hf. contracted a consultant in Iceland, who is an expert in this field. Today both their catcher boats are equipped with underwater hydrophone sensors and an accelerator meter situated on the gun.

The system works such that when the gun is fired then the accelerator meter triggers a signal to the computer that records the shot from the gun and a very short time later records the blast from the grenade. This can then be printed out and handed to the flensing crew on land. They will then know better whether the grenade has exploded or not and will then take special care when handling the harpoon and the grenade during flensing operation, if the printed document from the catcher boat does not show that the grenade has exploded.

The EG noted that all the recommendations from 2010 were fully completed.

Japan
Japanese whaling for common minke whale in the western North Pacific is carried out in two very different operations. One is carried out offshore from one large catcher boat. This operation uses a rifle or a cold harpoon as a secondary weapon if the grenade harpoon does not kill the whale. The coastal whaling operation is carried out close to the coast from a number of small catcher boats. A lance or a cold harpoon is used as the secondary

killing weapon, and the flensing of the whale takes place on the shore. Data from the offshore operation is available from 1994, and from the coastal operation from 2002. Data from both operations were available for analysis. The data included information about TTD and the covariates whale body length (BL), whale sex (SEX) and body hit point (HP; three levels), but not shooting distance.

For a detailed description of hunting methods with primary and secondary killing devices see NAMMCO Expert group meeting 2010.

The analyses were carried out as recommended by the NAMMCO Expert Group in 2010: "*The EG recommended logistic regression analysis on IDR from Japanese minke whale catches, both coastal and offshore, to try to identify the reasons for the differences between Japanese and Norwegian IDR, and to use Cox's regression methods on TTD for whales not killed instantaneously, to study the efficiency both of the harpoon method itself on these whales and the efficiency of the secondary killing methods.*"

First the IDR was analysed by logistic regression with the two types of whaling operations as the only independent variable. The results showed that the IDR was higher in the offshore operation than in the coastal and that the difference was statistically significant at the 5% level ($p=0.003$).

Then IDR for each of the two whaling operations were analysed by logistic regression with covariates and interaction terms. The best models were selected by Akaike Information Criteria (AIC). For the coastal operation the best model included HP, BL and an interaction term between HP and BL. For the offshore operation the best model included HP and BL. For both operations HP in the thorax or abdomen resulted in higher IDR, and the IDR decreased with increased BL of the whale. There were no statistically significant sex differences.

For the surviving whales TTD was estimated by the Kaplan-Meier method and the influence of the covariates was explored by Cox regression. The Kaplan-Meier plots show that the killing of surviving whales is more rapid in the offshore hunt than in the coastal, especially the secondary killing method used in the coastal whaling is less efficient than the method used in the offshore whaling. For the Cox regression the starting model for the explanatory variables of HP, BL and Sex and their first order interactions. Again AIC was used as the selection criterion.

For the coastal whaling the resulting best model included HP and SEX. For the offshore whaling the best model only included SEX. No interactions were selected in either of the models. For both operations surviving female whales die faster than males, but the difference is only statistically significant at the 5% level in the coastal operations ($p=0.006$). In coastal operations, TTD is longer compared to the offshore operations. This is probably explained by type (or size) of harpoon, which is smaller in coastal operations. In both whaling operations, surviving whales die faster if they are hit in the thorax or abdomen, but again the difference is only statistically significant in the coastal whaling ($p<0.001$).

The efficiency of the secondary killing methods rifle, cold harpoon and lance have not been analysed by logistic regression or survival analysis.

Discussion

The EG focused its discussion on the presented material for common minke whales.

The EG noted that IDR continues to be substantially lower than in other comparable hunts (Norway, Iceland) where the penthrite grenade is used as the primary weapon. The EG reiterated the advice given in 2010 that the use of sonar and high speed boats to chase the whales has effects on behaviour of whales. It is probably counterproductive in relation to achieving a high IDR. Chasing the whales usually results in shots at too narrow an angle from behind and the tail instead of from the side, and it is well documented that this reduces the efficiency of the grenade detonation and hence reduces the IDR and increases TTD. It was further noted that the logistical regression analysis on IDR showed that the difference in IDR between coastal and offshore operations can be explained by both body length and hit point.

When asked why the shooting distance differed between the coastal and the offshore hunts it was explained that this was linked to the amount of propellant charge and the weight of the harpoon. In the offshore operations 75mm harpoon guns and harpoons are used while the smaller 50mm harpoon guns and harpoons are used in the coastal operation.

The EG acknowledged the work that has been done since 2010 in relation to statistical analysis of data, in particular the number of parameters that have been considered.

Based on survival analysis it is clear that the lance is not as effective in the coastal hunt as the rifle used in the offshore hunt. In this connection it was noted that rifle was not used in the coastal hunt due to relative proximity of humans. The EG recommends that Japan develops and uses a more effective back-up weapon than the lance for the coastal hunt.

The EG notes that the 2010 recommendations included a study of the efficiency of the back-up (secondary) killing methods but that this does not appear to have been addressed.

Acknowledging that a rifle shot through the brain kills an animal instantaneously while a bleeding out caused by one or several stabs from a lance may take several minutes, the use of the lance as a back-up killing method should be evaluated.

Greenland

Minke whales, fin whales, bowhead whales and humpback whales with harpoon gun

The hunt is conducted opportunistically and seasonally, *i.e.* the hunters are not full-time whalers but also fishermen and they can also have other seasonal employment. Fin whales and humpback whales are caught in West Greenland, south of Uummannaq. Fin whales are caught either by two boats of a minimum length of 30 ft working together, or by one boat of a minimum length of 36 ft. One boat with a minimum length of 36 ft is required for the humpback whale. Bowhead whales are caught in West Greenland in the Disko Bay area. They are caught by three boats of a minimum length of 36 ft working together. The majority of the minke whales are also taken by this method by one boat with a length of 30-70 ft. Each boat should be equipped with one certified 50mm Kongsberg cannon, which is checked every second year.

The primary weapon is a harpoon with the Norwegian penthrite "Whale Grenade 99". This whale-grenade was produced for minke whales, but has been modified to accommodate the hunt of the larger whales (triggering cord extended from 40 cm to 90 cm, and explosive increased from 30 g to 45 g of penthrite). Primary and secondary weapons for the three larger whale species are the modified "Whale Grenade 99". Gunners shoot in the heart and lung region by aiming at an area close to the pectoral fins.

The secondary weapon for the minke whale is either a new grenade or rifle of a minimum calibre of 7.62 mm (30.06) employing full mantled bullets. Some hunters use solid round- nosed bullets together with rifles with higher calibre (.375), due to its better penetration. Rifle shots are aimed at the neck, in the back of the animal's head.

Hunting generally occurs in good sea conditions only (<Beaufort 3) as the main method of hunting is stealth. Trips generally last less than 24 hours and once a vessel has caught a whale it tows it to the nearest suitable flensing site. Hunting usually occurs within 60 nmi of the home port of the vessel and depending on conditions up to 10 nmi offshore.

Killing methods are continuously being improved, with a focus on hunters' safety and animal welfare. Data are collected for each hunt by the hunters and reported to the Ministry of Fisheries, Hunting and Agriculture.

Collective minke whale hunt

The collective minke whale hunt is carried out in settlements that do not have boats with a harpoon gun. The collective minke whale hunt takes place also to supplement the food products when the supply from the harpoon gun boats is not sufficient for the community. The collective minke whale hunt is the only hunt of large whales in areas with little infrastructure, such as East Greenland and West Greenland north of Disko Bay.

A minimum of five skiffs are required to carry out a hunt, but normally it will be around 8 -10 small (usually around 19 ft and never more than 29 ft) boats equipped with outboard motors. Each boat generally contains around 2-4 people. Boats of larger size without harpoon gun can also take part, but not as the leading boat. These are usually small fishing boats. Each skiff has to be equipped with at least one hand harpoon with line and buoys. This harpoon is attached to the whale at the first opportunity, to prevent the animal from sinking. During the course of the hunt, hunters attempt to herd the whale towards shallow and inshore waters.

The weapons of the collective minke whale hunt are rifles of a calibre of 7.62 mm. (30.06) or larger using full mantled bullets. As a rule, the whales are first wounded and then secured with the hand harpoons. When possible, the hand harpoon is used before wounding the animal. One hunter is the designated leader and it is his task to secure the animal with the hand harpoon. Once a whale has been secured, it is killed by shots aimed at the neck. Round-nosed solid bullets together with rifles of higher calibre, such as .375, are often used to kill the whale.

TTD and IDR

The criteria used to indicate unconsciousness and death are when the whale does not move and the flippers are motionless. This includes when the whale has sunk and there is no movement in the harpoon line or floats. Number of whales killed instantly means whales reported killed within 1 minute. TTD is measured from the first impact regardless of if this is a handheld harpoon or grenade.

The TTD were scheduled to be analysed according to the 2010 recommendation, but due to unforeseen, external circumstances, this did not happen before the present EG meeting. The plan is now to do this in February 2016. Greenland has gathered data on hitting point, body length, sex and TTD.

The presented TTD data are biased high because the TTD are estimated by the hunters and are not corrected by post-mortem examinations. It was noted by the hunters that there is a clear difference in efficiency of killing between different geographical regions in Greenland.

Data were presented for all hunts and can be found in Appendix 4.

Discussion

The EG acknowledged that Greenland had strived to follow up the recommendations from 2010, and that the recommendation to present data and analysis in a statistically more informative way will be fulfilled in the near future.

The EG acknowledges that Greenland has gathered data pertaining to the body position where the whale is hit and TTD, and looks forward to analysis and interpretation of these data to be made available.

The EG recognised that there had been a clear improvement and movement towards an IDR of more than 50% for the harpoon gun minke hunt. The IDR and TTD is still not as good as in the Norwegian hunt and it was suggested to do analysis of strike location as this might give indicators as to why this discrepancy exists. This information should then be part of future training of hunters.

The EG reiterated the recommendation from 2010 that debriefing meetings are organised for hunters at the end of each season to exchange information and experiences. It was noted by the hunters that there is a clear difference in efficiency of killing between different geographical regions in Greenland, and experienced hunters should meet with less experienced hunters to exchange information.

The EG expressed concern that the rifle hunt seems to be increasing as this hunt will seldom have an IDR above 0%. The character of the hunt is such that if the whale died immediately the risk of losing the animal is very high. In the rifle hunt the whale is first shot, then harpooned and then killed. The first shot is to slow the whale down in order to be able to get so close as to harpoon it and then kill it. It is not possible to get near enough to harpoon it first. The EG emphasised the importance of hitting above water as water will change the trajectory of the bullet. The EG encourages Greenland to evaluate the current sequence of the use of rifle and harpoon to catch the animals and also the efficiency of the harpoon in this sequence. It also encourages review of other types of harpoons.

The EG noted that the TTD is shorter and IDR higher in the minke whale hunt conducted by harpoon gun as compared to the rifle hunt. In addition Greenland documented a very low struck and lost rate for minke whales killed with harpoon gun, and a higher struck and lost rate for the rifle hunt.

Fin whale
The EG acknowledges Greenland for the change in the charge of the grenade that has resulted in a higher IDR for the fin whale hunt. The IDR is lower and the TTD greater than in the Icelandic fin whale hunt and the aim should be to improve the efficiency bearing in mind the differences in equipment used.

Data are needed with reference to the body position where the whale is hit in relation to TTD, and the EG looks forward to analysis and interpretation of these data to be made available.

Humpback
The EG noted that the increased penthrite charge deployed in the humpback whale hunt had not had the same positive effect on IDR as in the fin whale hunt, probably as a consequence of poor shooting angle.

Data are needed with reference to the body position where the whale is hit in relation to TTD, and the EG looks forward to analysis and interpretation of these data to be made available.

Bowhead
The EG acknowledges that shooting trials to study the trajectory of the harpoon through the water have been performed.
Data are needed with reference to the body position where the whale is hit in relation to TTD, and the EG looks forward to analysis and interpretation of these data being made available.

Fin, humpback and bowhead
The EG recommends that hunters be trained to measure and report on strike location and detonation location, and the distance between the two in order to evaluate the efficiency of the hunts.

Generally in relation to the recommendations from the 2010 meeting the EG noted that the only outstanding items to follow up were:

- Statistically analysing TTD data
- Debriefing after the end of the season

It was further noted that Greenland will do the analysis in February 2016 and that the intention is to hold a debriefing meetings after the end of the current season.

Alaska
Bowhead whales are hunted there during spring (April – May) and fall (September – October) when the whales migrate between the Bering and Beaufort seas. In the spring hunt the hunting crews go out to leads in the pack-ice with their skin boats waiting for the whales to pass by. In the fall the hunt is carried out in open sea from larger outboard motor boats. The whales are killed with penthrite grenades developed in cooperation with a Norwegian scientist and charged with 22 g of penthrite or with traditional old black powder grenades. The grenades are fired from a “darting gun”. In addition, as back-up, shoulder guns are used to fire black powder grenades. The darting gun, which best can be characterized as a multi purpose weapon, is attached to a strong wooden pole. The gun has a trigger rod in front that fires the gun when it hits the skin. A harpoon with line connected to a buoy is attached to the top of the darting gun. When a whale is spotted the skin boat is paddled up to the whale or in the fall motored up to the whale and the darting gun is thrown at the whale aiming at the neck or the thorax (chest). The harpoon hits the skin/blubber and attaches to the whale the moment before the trigger rod hits the skin and fires the grenade into the whale. The penthrite grenade has a built-in delayer, which detonates the grenade 4.5 sec after penetration into the whale. The delay time of the black powder grenade is a little bit longer. When the whale is dead the carcass is towed to the beach where it is butchered. The bowhead hunt is subjected to considerable environmental interference from weather (wind speed and direction, fog, and temperature), stability of land fast ice, and sea ice concentration and type. The success of each hunt is greatly affected by these factors and shows considerable annual and regional variation.

Each Alaska Eskimo whaling vessel holds a captain and harpooner plus other hunters. The Alaska Eskimo

Whaling Commission's weapons improvement programme has been working for several years to improve the hunting efficiency as well as providing a more humane method of taking the whales. Manuals and training courses are made and set up to teach the hunters how to safely and effectively use the penthrite grenade. The introduction of the penthrite grenade in the darting gun combined with training programmes organised by the AEWC has resulted in a significant reduction in whales struck and lost from around 50% to less than 10%. Up to now AEWC has only recorded struck and lost data as part of their reporting to the federal government and there has been no collection of TTD data.

Discussion

The EG noted the presentation and acknowledged that struck and lost had been dramatically reduced from around 50% to less than 10% and that this was accredited to the introduction of the penthrite grenade in the darting gun and also the training programmes organised by AEWC.

The EG encourages the AEWC to start collecting TTD and IDR data from the bowhead hunt and present the results at the next EG meeting to allow comparison of bowhead hunt effectiveness with other nations. Also the EG thanked for presenting the training manual and program and would appreciate a future presentation on other aspects from the hunt or of training in the AEWC hunt.

Canada

After many decades of being prohibited because of an estimated low population of bowhead whales in the Canadian eastern Arctic, the hunt for this species by Inuit communities was reinstated in 1994 under the Nunavut Land Claim Agreement. In 2006, a new evaluation of the size of the bowhead whale population in the eastern Arctic gave a much higher estimate, thus supporting existing Inuit claims that numbers of bowhead whales have increased noticeably over the past decades. The hunt for bowhead whales in Canada continues to be on a small scale, with 13 animals landed and 3 animals struck and lost between 1996 and 2010. This is the only communal hunt in Nunavut. It is also the only subsistence hunt for which Inuit hunters require a permit from Fisheries and Oceans Canada. In recent past, this hunt has been conducted between late July and late September. The current annual quota for the whole of Nunavut is three animals, with a goal to extend this number to five.

The hunt is truly a community event in which members of the hunting and flensing crews and their families establish camp at a good distance from the community itself, near waters that are propitious for the hunt. Before a community can obtain a permit to conduct a hunt, it must submit a plan that identifies the captain, the hunting crew (which consists of four to seven small vessels with outboard motors), and the flensing crew. This plan must also demonstrate the acquisition of necessary equipment, including harpoons with floats (typically two to four of which are deployed on a whale during a hunt), lances (anguvigaq) as secondary weapons, and flensing equipment. Two grenades, each containing 20 g of penthrite, are provided as the primary weapon by Nunavut Tunngavik Incorporated (NTI) to a community that is successful in its bid to conduct a hunt. For a grenade to be deployed, the 'designated' harpooner needs to depress the tip of a metal rod extending from a modified darting gun on the whale's back, thus discharging a 'pusher' charge (.458 calibre) which propels the grenade into the body.

The presentation given during the meeting reported on detailed observations of five hunts conducted in different communities between 2010 and 2014. Each of these observations spanned the whole operation, from the very beginning of the chase to completion of the flensing process. Regarding the hunt itself, criteria used to identify death of the animal included cessation of all movements and the fact that the animal was floating upside down. Based on data available, the average time to death (TTD) was 54.1 min (range, 34-90 min; 5 animals) from deployment of the first harpoon and 32.4 min (range, 14.5-61 min; 4 animals) from deployment of the first grenade. No instantaneous death after the first strike was observed. The average time to tow the carcass to the flensing site was 4 hr (range, 2.75-5.5 hrs; 4 animals), and the average interval between death and the start of flensing was 7 hr (range, 4-10.5 hr; 4 animals).

Nine grenades were deployed in the course of the five hunts. One grenade did not explode for unknown reasons. One grenade penetrated only superficially in the animal (possibly because it had not fitted snugly enough into the barrel of the dart gun), and most of the energy of the explosion appeared to have dissipated on the outside. Four grenades exploded in the epaxial muscle mass (along the animal's back); in two of these cases, the grenade may have been delivered at too much an angle relative to the surface of the animal, and in another case the grenade struck and fractured two ribs. One grenade exploded in the chest cavity; one exploded in the abdomen (or possibly the lower region of the abdominal wall); and one exploded near the junction between the skull and vertebral column, killing the animal instantly (although a first grenade had already been deployed in this animal).

In three of the five hunts observed, profuse bleeding in the chest cavity caused by strikes from lances appeared to have been the primary cause of death, as the grenades had failed to reach this cavity. The very abundant blood supply normally found in muscles of the dorsal part of the chest wall, between ribs, could explain this massive bleeding resulting from the strikes.

In conclusion:
1) the penthrite grenade and lance (anguvigaq) are complementary tools for hunting and killing bowhead whales; 2) both require close proximity to the whale for their application, thus involving a major risk, although it is faster to deploy a grenade than to strike with a lance; 3) even if not lethal, explosion of the first grenade weakens the whale, making it easier to use the lance and/or the second grenade; and 4) explosion of a single grenade can kill a bowhead whale instantly if the strike is applied to the 'neck' area, but this is difficult and risky to do.

Discussion
The EG acknowledges the effort that has been made in recent years to gather data on the bowhead whale hunt by Canadian Inuit. Observations of the hunt have been few but detailed, and have offered a welcomed veterinary aspect. The EG encourages continuation of these observations.

The EG noted long TTD values in the hunts observed. It believes that these values could be substantially reduced through further training of hunters, including exchange of information with other bowhead-hunting nations in order to benefit from their expertise and experience with other hunting techniques. The hunting of bowheads with darting gun and penthrite grenades in Canada deviates considerably from the way bowheads are successfully hunted in Alaska. In the Canadian hunt harpoons are not attached to the darting gun. Instead one or several harpoons are being attached to the whale first to slow down the animal. It was reported that after harpooning the whales often would show evasive reactions to the boats, which prevented the boats to get close enough or in position to hit with the darting gun and fire the grenade into the most vulnerable areas of the animal. It was also reported that some of the grenades did not penetrate deep enough to wound the animal sufficiently serious to get a rapid death.

In discussions some held the view that this way of hunting would never result in rapid death. The whole idea with the darting gun, which was developed in the 1870ies, was that the harpooning and the killing should be carried out in one single operation to avoid reactions of dangerous evasiveness and reduce the risk of lost whales. Canada was encouraged to adopt the Alaskan way of hunting bowheads, which has become very successful regarding rapid killing and reduction of losses of whales. In the discussion, also the efficiency of the lance to kill large whales was questioned and debated. Some held the view that the killing by bleeding out caused by one or several stabs from a lance may be both painful and prolong the killing time compared to reshooting with grenades. The EG encouraged Canada to do research on the efficiency of the lance (anguvigaq) as a back-up weapon to kill bowhead whales.

Makah whaling
The Makah are currently prohibited from hunting whales, but are involved at this time in the US legal process working towards resuming the hunt. Their plans for when the hunt is resumed were presented at this meeting.

The Makah gray whale hunt will include a mix of traditional hunting methods with modern tools and weapons to ensure a quick and humane death for the hunted whale. The hunt method used will be the same method used during hunts in 1999 and 2000. A video of the Makah's 1999 whale hunt can be seen at https://www.youtube.com/watch?v=cGmc1-fbs5U.

The hunt will include a team of eight crew members in a 10 m long canoe and a team of at least three in a motorized chase boat of at least 6.5 m. The crew in the canoe will be the first to approach and harpoon a whale.

The gray whale sinks on death and it is therefore imperative to have at least one or two lines attached. The crew of eight works together to paddle into position to harpoon the whale. The goal is to approach the whale to harpoon from the right side of the canoe. After the harpoon is deployed the crew member immediately behind the harpooner ties on floats and additional line. In 1999, the crew in the canoe held the harpoon line. In the future the whalers will either again hold the line or will let go of line and leave the buoys to retard the swimming speed of the whale. After the harpoon is deployed the chase boat will approach and harpoon the whale a second time.

After the whale is securely harpooned the chase boat will approach with a rifleman. The rifleman will shoot a .50 caliber or larger ammunition targeting the base of the brain stem and the first couple of vertebrae to cause the immediate death of the whale. Research by Dr. Allen Ingling[3] has shown that rifles of .460 caliber and larger are more than capable of firing shots that will sufficiently penetrate and damage the central nervous system to immediately kill a whale. A safety officer will work with the rifleman and keep track of other boats on the water and other potential hazards for a shot. When the rifleman has a clear and safe shot the safety officer will signal through oral and physical communication that the rifleman is safe to shoot.

This approach was used by the Makah Tribe in its successful 1999 gray whale hunt. As shown in the video, the time to death of the whale from when it was first struck with a harpoon until it was dead was around 8 minutes. It is hoped with appropriate training and certifications that future hunts have similar or quicker time to death.

After the whale is dead a crew member will secure a line to the whale's tail or will dive in and attach a line through the lower jaw and upper lip of the whale. The whale will then be towed to shore by a larger support boat. On shore there will be crews to conduct the spiritual and cultural practices for the whale and a team to butcher the whale.

In 2007 some young hunters took one whale that took very long to kill. They shot the whale in the wrong spot due to lack of training and knowledge of whale anatomy.

Discussion

The EG appreciated the presentation. The video documents that it is problematic to use traditional methods like harpooning first and then shooting (see above – Canada). When the whale is first harpooned it will try to get away from the hunters. Grey whales are also known to attack boats if they are threatened.

COMPARISON OF HUNTS

The EG was asked to compare the hunting methods of different regions presented to the meeting, and also when applicable to make comparisons of different years within one hunt. To facilitate this exercise the EG developed an overview (Appendix 4) of the following data:

species, region and year of collecting data, primary and secondary weapons, TTD in minutes, mean, median of survivors, maximum survival time in minutes, IDR and sample size.

The EG agreed that it was not possible to make comparisons of TTD of different hunts as these data had been collected and analyzed using different analyzing methods and also were a result of very incompatible hunting methods.

For instance the Greenlandic data on TTD had not (for reasons explained above) been analysed in the same manner as the Norwegian and Icelandic, and data collection differed. Likewise, with the Japanese TTD numbers; the median includes the whole sample size, not only the survivors like it does in the Norwegian and Icelandic data.

The EG therefore agreed to review and comment on the IDR and sample size only.

[3] Ingling, Allen L., VMD: Ballistic Testing of Large-Calibre Rifles for the Makah Tribal Gray Whale Subsistence Hunt. Presented to IWC in 1999. Document IWC/51/WK14 APPENDIX

Norway
Significant increase in IDR from 17% in 1981-83 to 82% in 2011-12. The primary weapon in 1981-83 was the cold harpoon and in 2011-12 the penthrite grenade. However, comparison of IDR's using the same weapon also show a significant increase in IDR. The sample size in 2011-12 was less than in the last few survey years but the EG acknowledged that it was adequate to detect statistical significance.

Iceland – minke whale
The sample size is too small to draw any strong conclusions, but the EG agreed that an IDR of 69% is looking favourable.

Greenland – minke whale caught with harpoon grenade
The sample sizes are adequate and the EG acknowledged that there is a general movement towards IDR of 50%

Greenland – minke whale rifle hunt
The sample sizes are adequate. The IDR is practically 0 with three years out of eight having positive IDRs of 3%, 3%, and 8%. The EG noted that the IDR might be related to the increasing quota allocations recruiting new, less experienced hunters into the hunt.

Japan – common minke whale, offshore operations (Pacific)
The 2013 sample size was so small that it should ideally have been statistically added to the previous year. Excluding 2013 the EG acknowledged that the IDRs are stable above 50% and increasing.

Japan – Antarctic minke whale
The sample sizes are adequate and the IDRs are stable at between 57% and 63%.

Japan – common minke whale, coastal operations
The sample sizes are adequate. The EG did not find obvious improvements in the IDR (majority of years below 50%), and noted that this probably was due to the use of sonar.

Greenland – fin whale
The sample size is too small to draw any strong conclusions, but the EG acknowledged that there was a 1% increase in IDR after introduction of a higher penthrite charge in 2013 and 2014.

Iceland – fin whale
The sample size is adequate and the EG acknowledged that an IDR of 84 % is very good.

Japan – fin whale
The sample sizes are too small to draw any conclusions.

Japan – sei whale
The sample sizes are adequate and the EG noted that the IDR was fairly stable around 41% - 60% with the majority from 52 % and above.

Japan – Bryde's whale
The sample sizes are adequate but the EG could not see any trend in the IDRs.

Japan – sperm whale
The sample sizes are too small to draw any conclusions.

Canada – bowhead whale
The sample sizes are too small to draw any conclusions.

Greenland – humpback whale
No IDR was presented.

Alaska – bowhead whale
No IDR was presented.

Greenland – bowhead whale
The sample sizes are too small to draw any conclusions

EDUCATION AND TRAINING

NAMMCO member countries
NAMMCO has developed instruction manuals on weaponry and killing for all whale hunts in the member countries. The manuals give basic and vital information on the use and maintenance of weapons and ammunition deployed in whale hunting. The text is descriptive, sometimes giving step by step instructions with corresponding illustrations.

The aim is to

- Improve the safety for hunters and hunting crew
- Improve the hunters' knowledge and skill regarding use and maintenance of weapons
- Improve animal welfare

Target groups are whalers, gunners, riflemen, whaling inspectors, wildlife officers and international observers, and administrators and others engaged in whaling. See document 18 which contains the full manual on baleen whales.

Regulation
Whaling in all three member countries is subject to strict and detailed regulations concerning all aspects of the hunting activities. There are rules pertaining to hunting season, quotas, equipment and monitoring. The permission to go whaling is given on an annual basis, and certain requirements must be met in order to get a licence.

Norway
Training courses
It is a requirement for licence holders and gunners to have passed the obligatory training courses arranged by the Directorate of Fisheries.

In these courses, professional and technical personnel lecture on laws and regulations governing the hunt. Thorough information is given on all aspects of the hunting activity such as weapon maintenance and correct use (rifle, harpoons, harpoon guns), hunters' safety and animal welfare, anatomy and physiology of relevance for the killing and the understanding of the behaviour of the whales, and slaughtering and processing of the products from the whale. In addition, hunters are trained in how to report to the authorities and how to take biological samples of the catch for the DNA-register.

The courses are arranged whenever there are new regulations concerning the hunt or new licence holders. However, on a yearly basis prior to the beginning of each hunting season, the hunters (the gunners) are required to pass obligatory shooting tests, both with rifle and harpoon guns. The shooting tests with the harpoon guns take place from the boat at sea and are overseen and approved by inspectors from the Directorate of Fisheries. The rifle test (identical to ordinary tests required for big game hunters) is performed at a shooting range and must be approved by authorised personnel from a gun club.

From 2014, all whaling vessels have received the NAMMCO manual with a request that it is made available on board and that all hunters familiarise themselves with the manual prior to the actual hunting.

Iceland
Training courses
Traditionally, education and training of minke whalers took place informally by transfer of knowledge from one generation to the next. Formal courses in the use of harpoon guns and grenades were first held in 1983 and the most recent course to teach hunters to use Whale Grenade-99 was held for minke whalers in 2003.

In order to get a licence for minke whaling, Icelandic regulations require that the gunner undertake a course on handling of harpoons and grenades as well as holding a general licence for firearms. No training requirements exist on an annual basis.

In the fin whale hunt the gunners have been trained in separate courses in 2009 and 2010. Annual courses have been held in 2013, 2014 and 2015.

Greenland

Training courses

In Greenland, only full-time hunters can apply for a licence to hunt large whales. There are no regulatory training courses or tests on how to shoot and where to aim at the animal. Knowledge is passed down from generation to generation and between captain and crew. However when hunting of new whale species starts up, pilot projects including shooting practice and theoretical courses are held by the responsible Ministry (Ministry of Fisheries, Hunting and Agriculture) with mandatory participation of the relevant hunters and vessel crew.
As in Iceland, there are obligatory special courses in how to handle the grenades in order to buy, handle and use harpoon grenades. The use of penthrite grenades became mandatory for boats equipped with harpoon cannons in 1991. The grenades may only be bought after presenting the certificate from this course together with the licence for whaling.

Licences for whaling with harpoons are only given to captains who have taken the course or have at least one crew member who has passed the course. It is special technical staff at the Hunters Organisation KONFIFA-KNAPK who organise the courses in cooperation with the Ministry of Fisheries, Hunting and Agriculture. The courses are held one or more times a year depending on demand. The programme of the course includes the mechanics of the Whale grenade 99, security aspects, mounting of the harpoon, storage and handling of the grenade, as well as operations of the harpoon cannon.

KONFIFA and the Ministry also organise courses in mounting and renovating of the harpoon guns. These courses are taken by people who have a technical education on welding and who are working with metal and are employed in a shipyard approved for the mounting and checking of harpoon cannons. The harpoon cannons are, by regulation, examined and approved every other year by a person certified through the above-mentioned course.

Japan

Gunners, crew members and the persons concerned always have a meeting before the start of a research cruise to discuss experiences and results of data analysis from the previous season with respect to improving TTD. During the season, necropsy records obtained by a researcher on the mother ship are also sent to the gunners on the sampling vessels as soon as possible so that the gunners may review the results of their shots while their memories are still fresh. Gunners are responsible for handling any equipment problems that arise during the offshore hunt and are therefore also trained in harpoon maintenance.

Alaska

AEWC has put strong emphasis on training programmes related to the introduction of the penthrite grenade and also to ensure that hunters understand the importance of the hitting point or target areas. Already in 2004 they produced the first user's manual for the penthrite projectile and the darting gun. This manual has recently been updated. The meeting was presented with the latest video produced that showed the assembly and disassembly of the darting gun with the penthrite projectile. The AEWC also organises training sessions on dissection to teach hunters about the whale anatomy with focus on target areas.

Canada

The hunting takes place in communities that are located far away from each other. Probably as a consequence of the geographical spread of whaling communities, formal training or possibility of learning from each other are limited for Inuit Hunters. Prior to each hunt, training by a representative from NTI and potential transfer of knowledge by hunters from other communities are given during a half-day or whole-day introduction to hunting and flensing methods.

Makah training programme
The Makah Tribe provided their draft training programme to the EG for review. The training programme includes training requirements and certifications specified for each team member of the hunt. The training programme will be implemented through lectures, hands-on training, and certification tests for key personnel. The emphasis of the training is to ensure that the hunt is safe for the whaling team and bystanders and to ensure that the hunt is as effective and humane as possible.

Discussion
The EG recognizes that whaling takes place under very different circumstances in different places and that this will have an impact on education and training. However regular training and exchange of information are very important to achieve more efficient hunts and to improve animal welfare.

The EG emphasizes the importance of combining theoretical information with actual meetings in order to exchange information and experiences, including sampling and recording of data.

The EG emphasizes the importance of the angle of the shot relative to the animal's long axis in the harpoon cannon hunts. The recommended angle, based on the Norwegian data, is from 45 to 135 degrees relative to the animal's long axis and aiming the shot at the thorax. This information should be included in training programmes for gunners.

The EG thanked AEWC for the training material presented on the darting gun. The EG would appreciate a future presentation on other aspects of training in the AEWC hunt.

The EG thanked the Makah Tribe for sharing their whale training programme and description of their planned hunt methodology.

The EG noted that the whale training programme educates Makah whalers on the general biology of gray whales, aspects of gray whale behaviour relevant to a hunt, gray whale anatomy, and hunt safety. One strength of the training programme is that it helps hunters learn key landmarks to locate the brain of gray whales.

The EG endorsed the Makah training programme noting that with the portion of the training programme presented to the EG, and the other planned training activities, future Makah whale hunts should be safe and efficient.

The EG encourages the Makah to benefit from the expertise and experience from other hunts.

MONITORING

NAMMCO has an international observation scheme hunting whereby activities in the member countries are monitored on an annual, random basis. The scheme is a mechanism to monitor the hunting activities and control that hunting activities follow national law and regulations and also that national inspections are carried out according to their intentions. Provisions and more information can be found at www.nammco.no.

Norway

Responsible authority
The responsibility for whaling lies with the Ministry of Trade, Industry and Fisheries and is regulated, administrated and supervised by the Directorate of Fisheries.

Monitoring system
Norway has since 2006 an automated monitoring system that verifies when and where a shot has been fired and when a whale has been taken on board. Consequently, struck and lost whales are also recorded. All licensed whaling boats are equipped with an Electronic Trip Recorder (the Blue Box). The system cannot be manipulated and consists of a control and data logger box (Blue Box) designed to independently monitor and log hunting activity data. An independent GPS and different sensors deployed in certain areas and structures of the boat collect the data, and the programmes are designed for continuous operation and logging of data for at least 4 months. It is equipped with back-up batteries and automatic restart functions if system interruption occurs.

After the hunting season, the encrypted data from the Blue Box are decrypted and analysed by authorised personnel in the Directorate of Fisheries. For more reading see document Øen, E.O.: electronic monitoring of Norwegian minke whaling, IWC 2005

Inspection

There are also random inspections occurring carried out by inspectors from the Directorate of Fisheries. These inspectors have attended the same training courses.

Reporting system

There is no mandatory reporting of TTD or IDR.

The reporting system in Norway is a combination of a self-reporting system and the automated blue box. The automatic monitoring system is a supplement to the electronic catch reporting system. The hunters are obliged to electronically report the catch (or no catch) on a daily basis. This report includes information on catch, position of catch, sex, length, circumference, blubber dimension, foetus/size of foetus and number of grenades used in the catch.

Iceland

Responsible authority

The responsibility for whaling lies with the Ministry of Trade, Industry and Fisheries and is regulated, administrated and supervised by the Directorate of Fisheries.

Monitoring and inspection system

There are random inspections carried out by inspectors from the Directorate of Fisheries.

Reporting system

In Iceland there is a self-reporting system where all catches are reported to the Directorate of Fisheries. Hunters are obliged to report the position, sex and length, presence and size of foetus, for caught animals.

Greenland

Responsible authority

The responsibility for whaling lies with the Ministry of Fisheries, Hunting and Agriculture. They regulate and administer the hunt, while the Fisheries Licence Control Authority, through their wildlife officers, supervises and controls the activities.

Monitoring and inspection system

The wildlife officers work in close cooperation with the municipality authority, the police, Arctic Command and the Government of Greenland. The wildlife officers monitor the whaling activity itself by inspections of some of the hunts at sea and / or by controlling permits, licenses and equipment used on-board the vessels and skiffs and at the open markets where the hunters can sell their products. In 2015, 8 wildlife officers and 4 assisting wildlife officers were employed nationally.

Reporting system

The reporting system in Greenland is a self-reporting system where all catches are reported to the Ministry of Fisheries, Hunting and Agriculture. For every large whale taken, the responsible person (captain of the harpoon boat or the chosen leader in the collective hunt) is required to fill out a reporting form that is submitted to the Ministry shortly after the hunt.

The information given includes information about the hunter, his licence and boat, description of the weapon used to kill the animal, serial number of the grenade, etc. Furthermore it gives information on species, catch area and flensing place, body length, sex, reproductive state of females, stomach contents, weight of edible products and estimated time to death (TTD). Cases of “struck and lost” are also reported.

No edible products from a whale may be sold before the catch is reported to the municipality. Through this reporting the hunter will obtain a stamp on their licence. To get a stamp it is required that a filled out reporting scheme is handed in; and for whalers with a harpoon boat licence, the receipt for the purchase of the whale grenade as well as the used grenade with serial number must also be presented.

For more information see document Greenland: White paper on management and utilisation of large whales in Greenland, 2012.

Japan
The hunting is monitored closely mainly for research reasons. A researcher(s) is/are allocated to all whaling vessels and also a national inspector(s) is present at a mother ship (offshore operation) or a land base (coastal operation).

Alaska
There are regular reporting requirements initiated by the federal government. The whaling captains are obliged to report on sex, location of strike and damage to the animal and take certain biological samples that are reported to NOAA. The biomonitoring sampling programme respond to food health and safety concerns.

Canada
Permits for each of the bowhead whale hunts by Inuit communities are issued by Fisheries and Oceans Canada (DFO). DFO officers and, on occasions, officers of the Nunavut Department of Environment attend some, but not all, of the hunts. Catches and struck-and-lost are reported to DFO by Hunters and Trappers Organisations of individual communities.

Makah
There are presently no monitoring programmes in place. In the 1999 hunt NOAA monitored and it is anticipated that NOAA will continue to do so when the hunt resumes.

<u>Discussion</u>
The EG recommends that all hunts are monitored with regard to TTD and IDR at 10-year intervals unless other important issues arises that require more frequent monitoring.

The EG recommends a workshop to look into alternative, and if possible, more economical methods for collecting standard TTD data that may also facilitate more frequent collection of data.

CONCLUSIONS AND RECOMMENDATIONS

Norway
The EG acknowledges the completion of data gathering that has been done since 2010 and also the improvement in the quality of the hunt over the past few decades.

The EG recommends that Norway repeat monitoring of the hunt with regard to TTD and IDR at 10-year intervals unless important issues arise that require more frequent monitoring.

Iceland
<u>Minke whale</u>
The EG acknowledges the work that has been done since 2010.

The EG encourages Iceland to try again to gather data on TTD and IDR and increase the sample size in order to obtain more robust information. A sample size of 25-30 animals should be adequate to obtain statistically reliable data for some types of comparisons.

There has been no training course arranged since 2003. A new course for the hunters should be arranged.

<u>Fin whale</u>
Recommendations from 2010 are fully completed and the EG acknowledges this.

The EG recommends that Iceland repeat monitoring of the hunt with regard to TTD and IDR at 10-year intervals unless important issues arise that require more frequent monitoring.

Greenland

Minke whale - Harpoon cannon hunt

There has been an improvement of the grenade hunt of minke whales. The EG acknowledges this, and also the low struck and lost rate. The IDR is lower, and the TTD greater than in Norway, and the aim should be to improve the hunt efficiency. The recommendations from 2010 to present the data and analysis in a statistically more informative way will be fulfilled in the near future. Analysis of strike location should be informative of why Greenlandic hunts have lower IDR than Norwegian hunts and the EG recommends that the result of this analysis be presented to hunters in future trainings.

It was furthermore recommended to organise a practical training course for gunners. There should, as stated by the hunters, be a debriefing at the end of the season in order to exchange information and experiences from the season.

Minke whale - Rifle hunt

Data show that there is a longer TTD and higher struck and lost rate in the rifle hunt than in the harpoon hunt.

The EG learned that the proportion of minke whales hunted in the collective hunt has been increasing in recent years as compared to the number of whales hunted with deck-mounted harpoon cannon. Noting that rifle hunts are increasing, the EG encourages Greenland to evaluate the current sequence of the use of rifle and harpoon to catch the animals and also the efficiency of the harpoon in this sequence. It also encourages review of other types of harpoons.

The Greenlandic hunters stated that there is a clear difference in efficiency of killing between different geographical regions in Greenland. The EG reiterates the recommendations that experienced hunters should meet with less experienced hunters to exchange information.

The EG acknowledges that Greenland has gathered data pertaining to the body position where the whale is hit and TTD, and looks forward to analysis and interpretation of these data to be made available.

Fin whale

The EG acknowledges Greenland for the change in the charge of the grenade that has resulted in a higher IDR for the fin whale hunt. The IDR is lower and the TTD greater than in the Icelandic fin whale hunt and the aim should be to improve the efficiency bearing in mind the differences in equipment used.

Data are needed with reference to the body position where the whale is hit in relation to TTD, and the EG looks forward to analysis and interpretation of these data to be made available.

Bowhead

The EG acknowledges that shooting trials to study the trajectory of the harpoon through the water have been performed.

Data are needed with reference to the body position where the whale is hit in relation to TTD, and the EG looks forward to analysis and interpretation of these data to be made available.

Fin, humpback and bowhead

The EG recommends that hunters be trained to measure and report on strike location, detonation location and distance between the two in order to evaluate the efficiency of the hunts.

Japan

The use of sonar during the hunt has effects on the behaviour of whales. It also appears to be counterproductive in relation to TTD since the animal will need to be chased and will be shot at too narrow an angle from behind. These two factors have important implications in terms of animal welfare since they are bound to increase TTD and decrease IDR.

Minke whale

The EG acknowledges the work that has been done since 2010 in relation to statistical analysis of the data, in particular the number of parameters that have been considered.

Based on survival analysis it is clear that the lance is not as effective for the coastal hunt as the rifle used in the offshore hunt. The EG recommends that Japan develops and uses a more effective back up weapon for the coastal hunt.

The EG notes that the 2010 recommendations included a study of the efficiency of the back up (secondary) killing methods but that this does not appear to have been addressed.

Acknowledging that a rifle shot through the brain kills an animal instantaneously and faster than bleeding out caused by the use of the lance, the actual efficiency of the lance as a killing method should be evaluated.

Alaska

The EG encourages the Alaska Eskimo Whaling Commission (AEWC) to collect and present TTD and IDR data on their hunts at the next EG meeting to allow comparison of bowhead hunt effectiveness with other nations. The EG thanks AEWC for the training material presented on the darting gun. The EG would appreciate a future presentation on other aspects of training in the AEWC hunt.

Canada

The EG acknowledges the effort that has been made in recent years to gather data on the bowhead whale hunt by Canadian Inuit. Observations of the hunt have been few but detailed, and have offered a welcomed veterinary aspect. The EG encourages continuation of these observations.

The EG noted long TTD values in the hunts observed. It believes that these values could be substantially reduced through further training of hunters, including exchange of information with other bowhead-hunting nations in order to benefit from their expertise and experience with other hunting techniques.

The EG encourages research on the efficiency of the lance (anguvigaq) as a back up weapon to kill bowhead whales.

Makah

The EG thanked the Makah Tribe for sharing their whale training programme and description of their planned hunt methodology.

The EG noted that the whale training programme educates Makah whalers on the general biology of gray whales, aspects of gray whale behaviour relevant to a hunt, gray whale anatomy, and hunt safety. One strength of the training programme is that it helps hunters learn key landmarks to locate the brain of gray whales.

The EG endorsed the training programme noting that with the portion of the training programme presented to the EG, and the other planned training activities, future Makah whale hunts should be safe and efficient.

The EG encourages the Makah to benefit from the expertise and experience from other hunts.

GENERAL

Accepting that struck and lost is an inevitable part of all whaling operations the EG recommends that there be a review of the underlying reasons for struck and lost with the aim of decreasing it.

The EG recommends that the data be analysed by the statistical methods recommended in 2010. These analyses should include analysis of the efficiency of the backup (secondary) killing methods.

Monitoring

The EG recommends that all hunts be monitored with regard to TTD and IDR at 10-year intervals unless other important issues arises that require more frequent monitoring.

The EG recommends a workshop to look into alternative, and if possible, more economical methods for collecting standard TTD data that may also facilitate more frequent collection of data.

Education and training

The EG emphasizes the importance of the angle of the shot relative to the animal's long axis in the harpoon cannon hunts. The recommended angle, based on the Norwegian data, is from 45 to 135 degrees relative to the animal's long axis and aiming the shot at the thorax. This information should be considered in training programmes for gunners.

Regular training and exchange of information is very important to achieve more efficient hunts and to improve animal welfare.

The EG emphasizes the importance of combining theoretical information with actual meetings in order to exchange information and experiences, including sampling and recording of data.

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Bolethe PAPIS - interpreter

Appendix 2 – Agenda

1. INTRODUCTORY ITEMS
2. TERMS OF REFERENCE AND BACKGROUND TO THE WORKSHOP
3. ADOPTION OF THE AGENDA
4. PRINCIPLES OF COLLECTION, QUALITY CONTROL, ANALYSING AND PRESENTATION OF TTD DATA
5. DESCRIPTION OF KILLING METHODS IN USE AND/OR UNDER DEVELOPMENT, CRITERIA FOR DEATH AND REVIEW OF TTD DATA
    - 5.1 Norway
        - 5.1.1 Minke whales
    - 5.2 Iceland
        - 5.2.1 Minke whales
        - 5.2.2 Fin whales
    - 5.3 Japan
        - 5.3.1 Minke whales in Antarctic and N. Pacific
        - 5.3.2 Minke whales, coastal
        - 5.3.3 Fin whales
        - 5.3.4 Sei whales
        - 5.3.5 Bryde's whales
        - 5.3.6 Other species
    - 5.4 Greenland
        - 5.4.1 Minke whales
        - 5.4.2 Fin whales
        - 5.4.3 Bowhead whales
        - 5.4.4 Humpback whales
    - 5.5 Canada
        - 5.5.1 Bowhead whales
    - 5.6 The US
        - 5.6.1 Bowhead whales
        - 5.6.2 Gray whales
6. FOLLOW UP ON THE RECOMMENDATIONS FROM THE NAMMCO EXPERT GROUP MEETING ON ASSESSMENT OF LARGE WHALE KILLING DATA IN 2010
7. COMPARISON OF METHODS AND EFFICACY
8. EDUCATION AND TRAINING OF HUNTERS
9. MONITORING SCHEMES
10. CONCLUSIONS AND RECOMMENDATIONS
11. OTHER MATTERS
12. ADOPTION OF CONCLUSION AND RECOMMENDATIONS

Appendix 3 - Protocol for TTD data collection and analyses

PROTOCOL FOR COLLECTION OF TTD DATA IN WHALE HUNTS WITH DECK MOUNTED HARPOON GUN

Dr Egil Ole Øen, Wildlife Management Service-Sweden

COLLECTING TTD DATA IN WHALING

Background

Time to death (TTD) or Survival time (ST) and the Instantaneous death rate (IDR) are terms that are used to measure and to quantify the killing efficiency and the state of art of current killing methods and practices used in whaling operations. Collection and analysis of TTD/ST and IDR data in a standardised manner with covariates that may influence TTD/ST and IDR make it possible to compare how rapidly whales are killed using different techniques and gears. Standardised collection methods and analyses of TTD make it possible to calculate impacts on TTD and IDR of new developments, modifications or changes in hunting practices and the impact also on efficiency of systematic training of hunters.

In Norway (1981-2012) TTD of more than 5000 minke whales killed using different types of hunting gears were collected and analysed with the covariates animal size, shooting distance and angle of harpoon gun shot, hit region and detonation area. The results were used to document the need for innovations like development of new and improved weapons, consecutive modifications and testing of gears and hunting techniques and practices, training of hunters etc. During these 21 years IDR increased by 65% from 17% to 82% and the average TTD was reduced from 11.5 min to 1 min.

The NAMMCO Expert Group Meeting on Assessment of Large Whale Killing Data in 2010 underscored the importance of recording TTD/ST/IDR and recommended the use of the Norwegian way of collecting and analysing for all hunts to identify needs for improvements.

Why record TTD

To document killing efficiency
To discover potential ways to improve the killing
To follow improvements or other issues relevant for killing over time

How to sample TTD data – "the Norwegian Way"

It is very important that the personnel collecting data are independent and are able to concentrate on data collection and not have other tasks to attend to in the killing and flensing (butchering) phase.

<u>Who should sample/collect – required qualifications prioritised</u>

1. Veterinarians
2. Large mammal biologist and large whale physiologist
3. Hunt- and fisheries inspectors

The profession of the veterinarians makes them able to better understand and assess the behaviour of the animal when hit, and relate the animal's reaction to the death criteria. Large mammal biologists and physiologist may also have this understanding. Anatomical and pathological knowledge is important when assessing damage to organs and gross (macroscopic) changes in vital organs, which can be studied during flensing.

If it is not possible to have dedicated personnel that only collect TTD data, scientists/hunt-fisheries inspectors (preferably with biological background) carrying out research/inspection on board but with necessary time off from his/her own research/inspection during killing and flensing may be used.

Generally, all personnel should receive special training PRIOR to collecting TTD data for whales – category 3 above will generally need more training than categories 1 and 2. Such training course should cover *inter alia*:

A general introduction on whales, whaling and management of whales (abundance estimates, quota setting, national and international management systems)

National laws and regulations – implications for the hunting practise with respect to
- equipment (review of gear and equipment – functions and correct use and maintenance)
- the hunt itself (searching for whales, shot, hauling, flensing and correct treatment of edible products)
- criteria of death

Description of why data is collected and how it is collected
Utensils: watch for measuring TTD
- anatomy and physiology relevant for estimating TTD
- examination of detonation area
- reporting: how to fill out the forms and how to deliver them

Reporting form
The attached form with guidelines is the one used in the Norwegian minke whale hunt.

For practical reasons the form should be limited to one page. To the extent possible the form should be designed with only "yes/no/unknown" options to tick off.

Comments or circumstances not covered by the form and which the inspector wants to inform about may be written either on the back of the form or on a separate sheet.

It is a prerequisite to fill out the report immediately after the kill has taken place and observations of organ damages have been identified. It is very easy to forget details after a short while.

The form shall cover information on I. Primary observations/findings and II. Secondary observations/findings.

I. Primary observations/finding are factors that are used directly to determine or that upon review may be used to support, nuance or disprove the given TTD estimate in the report.

Important primary observations are (but not excluding other):

a. Reaction patterns in whales in connection when struck/hit (whale dives, sinks, turns over on its back, swims, etc.)
b. Slackening or movements in mouth, flipper or tail
c. Hit area (harpoon)
d. Detonation site (grenade)
e. Gross organ damages - bleedings
f. Estimated TTD

II. Secondary observations/findings are related to aspects of the hunt that may impact the TTD (like but not excluding other):

g. Animal size
h. Weapon type
i. Shooting distance
j. Shooting angle

<u>Criteria of death</u>
The International Whaling Commission in 1980 recognized that it is difficult to decide exactly the moment of death of a whale as it is more or less under water when it happens. It therefore recommended the use of behavioural cues as indicators of death. These diagnostic criteria of death in whales, known as the "IWC criteria", were set to "…the time taken for the mouth to slacken, the flipper to slacken or all movements to cease". These signs, which can be observed during practical whaling, are to be used in conjunctions with pathological findings made during necropsy. It has been recognized that when TTD are solely determined on the basis of IWC criteria, a significant portion of animals will be recorded as being sensible or alive when they are actually unconscious or dead.

Quality control of data
The importance of filling out the form *immediately* during the hunt cannot be stressed enough. The likelihood of remembering details and circumstances correctly after time has passed is low and may normally result in invalid and incorrect information.

Before statistically analysing the data each separate reporting form must be examined closely with respect to errors and possible falsifications of facts.

When in doubt it may be necessary to acquire additional information through interviewing the inspector and hunters, or checking catch data from the existing reporting systems.

To be able to carry out this kind of quality control satisfactorily it is a prerequisite to have the necessary biological knowledge in addition to detailed knowledge of, and experience from, whaling.

GUIDELINES FOR THE COMPLETION OF THE CATCH FORM

Fill out all questions as thoroughly as possible.

If uncertain what to write or if information is missing, note this down. Likewise, give additional comments of any kind.

Death criteria are slackened mouth, flippers slackened (along the sides) and that whales are at rest. It is not always that all of these criteria are present even though the whale is dead. For example, the jaw will not be open when the animal is on its back. Currents and waves can provide movements of the tail. Flippers will not immediately lie completely along the side when the whale dies.

If the whale is conscious or waking up again, it will try to straighten up, move the flippers outwards, close the jaw and give blow and try to dive. Movements in the tail will be clear and coordinated with the other signs of consciousness.

Survival time/ TTD: The time it takes from firing the shot to the whale's death. Instantaneous kill is specified as 0 or instantaneous in the form. If one is unsure of the time, for example if not all criteria are fulfilled, indicate why and what kind of uncertainty in the form.

In order to verify stated survival time in retrospect, it is very important that the following information is noted as accurately as possible:
- did the grenade work normally?,
- place for recoveries of any grenade remnants,
- shot reactions,
- organ damages,
- mark the harpoon hit area in the figure
- shot angle information.

Shot direction indicates the direction where the harpoon comes from in relation to the whale's long axis. The direction is indicated by the numbers 1-5:

1 = directly from the front (0°)
2 = diagonally from the front (above 0° to 45°)
3 = sideways (45° to 135°)
4 = diagonally from the back (135° to 180°)
5 = directly from the back (180°)
Shot Distance is estimated without any technical aid.

Grenade detonated: It is very rare that the grenade does not detonate due to technical error. If the grenade did not detonate this may be because the harpoon has not penetrated far enough into the whale body (65-70 cm in minke whale) or because the trigger line is cut off. In the case of malfunctioning, indicate probable cause for the malfunction, grenade production number and year.

Loss notes loss of struck and dead or hurt whale. The cause(s) are described under comments. If possible note where the harpoon hit the whale and if the grenade detonated or not.

Reaction harpoon hit/detonation: This information is important for the assessment of the effects of shot/detonation, and is used when evaluating the survival time.

Visible organ damages after the detonation
This is important information when assessing final survival time.

The grenade detonates approximately 65-70 cm inside the whale (minke whale). Often there will be remains of the grenade on the detonation site such as residual from the aluminium capsule and one or more pieces of black polyethylene. Damages to organs are observed during flensing or when organs are removed. In the area where the grenade exploded, the tissues and organs will be torn up and there is substantial accumulation of blood in the area. Detonation in the musculature causes massive injuries to muscle tissue and transforms it into a jellylike mass without normal tissue structure up to 20 – 30 cm from the detonation site.

REPORTING FORM NORWEGIAN MINKE WHALING (YEAR)

Date: Vessel: Whale no in hunting logbook:

Survival time:

Harpoon in (Figure 1-9): Harpoon out (Figure 1-9): Shot through: Yes/No

Shot direction (1-5): Shot distance: Grenade detonated: Yes/No

Lost animal: Yes/No

Reshot canon: Yes/No Gunshot: Yes/No Alongside of boat (time):

Reaction from harpoon shot (mark X):

Turned over/ sank Dived and sank Swimming movements in tail: Yes/No

Mouth: open/closed Flippers: laying by the side/stood partly out/completely out .

Visible grenade damages to organs taken when flensing :

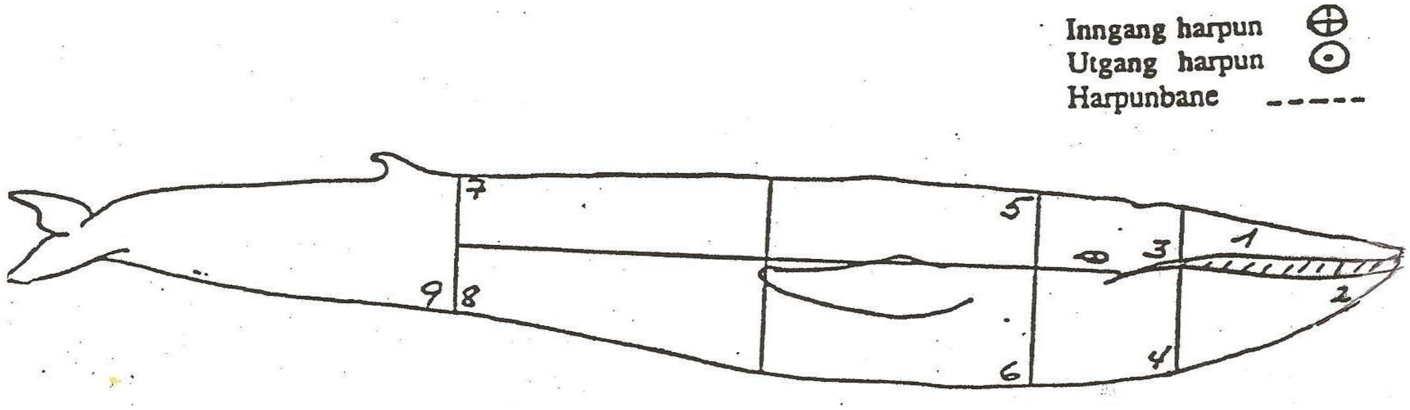
Hearth: Yes/No Lung(s): One lung Yes/No /both lungs: Yes/No
Large veins in chest cavity: Yes/No Large veins in abdominal cavity: Yes/No

Spine/neck/skull: Yes/No Indicate damage area:

Organs in abdominal cavity: Yes/No Indicate organ(s) damaged:

Blubber/muscles: Yes/No Indicate damaged area (Figure 1-9):

Remains of grenade: Yes/No Indicate area of discovery:



Comments (use back of form or separate sheet)

PROTOCOL FOR STATISTICAL ANALYSES OF TTD IN WHALING OPERATIONS

Professor Lars Walløe, University of Oslo, Norway

WHICH AND HOW MANY KILLINGS SHOULD BE RECORDED

1. The ideal is to record TTD for all animals killed.
2. Nearly equally good is to record TTD for a random (in the statistical sense) sample of the killings (or boats or hunters).
3. A non-random sample may provide valuable information, especially if explanatory variables are recorded, but a small random sample is better than a large non-random sample.
4. If the sample has to be non-random, try to include all possible types of boats or hunters.
5. If the sample has to be non-random, try to include the same boats or hunters (or similar boats and hunters) in the following years.
6. Even a very small sample (less than 10) is better than no sample.

Advice on the organisation of the data matrix

a) Each whale should be represented by one line (row) in the matrix
b) The first column should contain a whale identifier (e.g. a number)
c) An early column should contain a binary value indicating instantaneous death (e.g. 1: instantaneous dead, 0: alive after the first hit)
d) One column should contain time to event
e) The next column should contain a variable indicating type of event (1: death, 2: censoring)
f) The next columns should contain covariates which could be binary, categorical or scale, one column for each variable
g) If a secondary weapon is used, the columns c), d), e) and f) should be repeated for the secondary weapon. If there are alternative secondary weapons, one column should indicate which secondary weapon is used.

A) Instantaneous death

a) binomial p with confidence interval
b) comparing two binomial p's with chi-square (n-1) or Fisher-Irwin test
c) logistic regression with covariates

B) Time to death for whales that are not instantaneous dead

a) Kaplan-Meier plots
b) Cox-regression with covariates
c) survival analysis with censoring
d) survival with use of secondary weapon

Appendix 4 – Overview of TTD and IDR

Note that comparisons can only be made between years within each hunt due to differences in sampling, analysing and hunting methods.
TTD: time to death, **IDR**: instant death rate **ST**: Survival time

Species	Country	Hunting methods		TTD in minutes		Max ST in minutes	IDR %	Sample size *1*2
Minke whales	Year	Primary weapon	Secondary weapon	Mean	Median of survivors			
	Norway							
	1981-83	cold harpoon	rifle 30.06	11	11	62	17	353
	1984-86	grenade 22 g penthrite	rifle 9.3	6	8	57	45	257
	1993-99	grenade 22 g penthrite	rifle .375 and .458	4	7	90	60	2687
	2000-02	grenade 30 g penthrite	rifle .375 and .458	2	10	90	80	1667
	2011-12	grenade 30 g penthrite	rifle .375 and .458	1	6	20	82	271
	Iceland							
	2014-15	grenade 30 g penethrite	rifle .458	1	4	13	69	13
	Greenland				**Median all inc. survivors**			
	2007	grenade 30 g penthrite	375 and larger	7	3	45	31	123
	2008	grenade 30 g penthrite	rifle 30.06 and .375 or larger	6	5	25	27	77
	2009	grenade 30 g penthrite	rifle 30.06 and .375 or larger	5	2	30	41	68
	2010	grenade 30 g penthrite	rifle 30.06 and .375 or larger	5	2	30	44	95
	2011	grenade 30 g penthrite	rifle 30.06 and .375 or larger	4	1	60	34	108
	2012	grenade 30 g penthrite	rifle 30.06 and .375 or larger	4	2	40	48	89
	2013	grenade 30 g penthrite	rifle 30.06 and .375 or larger	4	2	20	51	79
	2014	grenade 30 g penthrite	rifle 30.06 and .375 or larger	4	1	25	53	78
	2007	rifle 30.06 and .375	rifle 30.06 and .375 or larger	24	20	120	3	29
	2008	rifle 30.06 and .376	rifle 30.06 and .375 or larger	23	20	120	8	38
	2009	rifle 30.06 and .377	rifle 30.06 and .375 or larger	29	20	120	0	59
	2010	rifle 30.06 and .378	rifle 30.06 and .375 or larger	25	25	90	0	57

	2011	rifle 30.06 and .379	rifle 30.06 and .375 or larger	26	21	120	0	56
	2012	rifle 30.06 and .380	rifle 30.06 and .375 or larger	27	20	120	0	50
	2013	rifle 30.06 and .381	rifle 30.06 and .375 or larger	34	20	720	0	91
	2014	rifle 30.06 and .382	rifle 30.06 and .375 or larger	27	20	210	3	70
	Japan*3				**Median all inc. survivors**			
C.minke whale offshore	2010	grenade 30 g penthrite	grenade/ rifle .375 or .458	2	1		50	14
	2011	grenade 30 g penthrite	grenade/ rifle .375 or .458	2	0		59	49
	2012	grenade 30 g penthrite	grenade/ rifle .375 or .458	1	0		62	74
	2013	grenade 30 g penthrite	grenade/ rifle .375 or .458	3	3		33	3
C.minke whale coastal	2009	grenade 27 g penthrite	cold harpoon/lance	4	1		48	119
	2010	grenade 27 g penthrite	cold harpoon/lance	4	0		57	105
	2011	grenade 27 g penthrite	cold harpoon/lance	7	4		35	77
	2012	grenade 27 g penthrite	cold harpoon/lance	4	2		44	108
	2013	grenade 27 g penthrite	cold harpoon/lance	5	2		47	92
	2014	grenade 27 g penthrite	cold harpoon/lance	6	2		40	81
	2015	grenade 27 g penthrite	cold harpoon/lance	6	3		37	19*4
A.minke whale	2009	grenade 30 g penthrite	grenade/ cold harpoon/rifle .375/.458	2	0		57	506
	2010	grenade 30 g penthrite	grenade/ rifle	2	0		62	170
	2011	grenade 30 g penthrite	grenade/ rifle	2	0		59	266
	2012	grenade 30 g penthrite	grenade/ rifle	1	0		63	103
	2013	grenade 30 g penthrite	grenade/ rifle	2	0		57	251

Notes:

***1**: In the Greenlandic and Japanese hunts TTD is calculated from the whole sample size not only the survivors.

***2:** In the Greenland data sample size and catch size is different, i.e. in 2007 grenade hunt sample size is 123 animals which represent 95% of total catch.

***3:** The grenade is a cast iron grenade unlike the aluminium Whalegranade 99.

***4:** In 2015 Japan sampled 70 common minke whales; 19 (Sanriku survey) and 51(Kushiro survey). Only the Sanriku survey analysed at the time of meeting.

Note that comparisons can only be made between years within each hunt due to differences in sampling, analysing and hunting methods.
TTD: time to death, IDR: instant death rate ST: Survival time

Species Fin whales	Country Year	Hunting method: Primary weapon	Hunting method: Secondary weapon	TTD in minutes: Mean	TTD in minutes: Median of survivors	Max ST in minutes	IDR %	Sample size
	Iceland							
	2014-15	grenade 100 g penthrite	grenade 100 g penthrite	1.5	8	15	84	50
	Greenland*1*2				**Median all inc. survivors**			
	2007	grenade 30 g penthrite	grenade 30 g penthrite	15	13	60	30	10
	2008	grenade 30 g penthrite	grenade 30 g penthrite	11	10	25	20	10
	2009	grenade 30 g penthrite	grenade 30 g penthrite	23	25	45	14	7
	2010	grenade 30 g penthrite	grenade 30 g penthrite	22	4	60	33	3
	2011	grenade 30 g penthrite	grenade 30 g penthrite	21	15	60	20	5
	2012	grenade 30 g penthrite	grenade 30 g penthrite	8	8	15	25	4
	2013	grenade 45 g penthrite	grenade 45 g penthrite	12	10	25	44	9
	2014	grenade 45 g penthrite	grenade 45 g penthrite	22	10	120	36	11
	Japan*2				**Median all inc. survivors**			
	2009	grenade 60 g penthrite	grenade 60 g penthrite		0		100	1
	2010	grenade 60 g penthrite	grenade 60 g penthrite	12	12		50	2
	2012	grenade 60 g penthrite	grenade 60 g penthrite		0		100	1

Notes:
***1:** For the Greenland data sample size and catch size is different, i.e. in 2008 hunt sample size is 10 animals which represent 71% of total catch.
***2** In the Greenlandic and Japanese hunts TTD is calculated from the whole sample size not only the survivors

Note that comparisons can only be made between years within each hunt due to differences in sampling, analysing and hunting methods.
TTD: time to death, **IDR:** instant death rate. In the Japanese hunt TTD is calculated from the whole sample size not only the survivors

Species Sei whales	Country Year	Hunting method Primary weapon *1	Secondary weapon	TTD in minutes Mean	Median	IDR %	Sample size
	Japan						
	2010	grenade 60g/50g penthrite	grenade/cold harpoon/ rifle .458	3	0	52	100
	2011	grenade 60g/50g penthrite	grenade/cold harpoon/ rifle .458	4	3	41	95
	2012	grenade 60g/50g penthrite	grenade/cold harpoon/ rifle .458	3	0	52	100
	2013	grenade 60g/50g penthrite	grenade/cold harpoon/ rifle .458	2	0	60	100
	2014	grenade 60g/50g penthrite	grenade/cold harpoon/ rifle .458	3	2	48	90
	2015	grenade 60g/50g penthrite	grenade/cold harpoon/ rifle .458	3	0	53	90

Species Bryde's whale	Country Year	Hunting method Primary weapon *1	Secondary weapon	TTD in minutes Mean	Median		Sample size
	Japan						
	2010	grenade 50g/30g penthrite	grenade/cold harpoon/ rifle .375/.458	3	0	58	50
	2011	grenade 50g/30g penthrite	grenade/cold harpoon/ rifle .375/.458	2	1	50	50
	2012	grenade 50g/30g penthrite	grenade/cold harpoon/ rifle .375/.458	2	0	71	34
	2013	grenade 50g/30g penthrite	grenade/cold harpoon/ rifle .375/.458	5	3	47	28
	2014	grenade 50g/30g penthrite	grenade/cold harpoon/ rifle .375/.458	3	0	60	25
	2015	grenade 50g/30g penthrite	grenade/cold harpoon/ rifle .375/.458	3	0	52	25

Species Sperm whale	Country Year	Hunting method Primary weapon *1	Secondary weapon	TTD in minutes Mean	Median		Sample size
	Japan						
	2010	grenade 60g/50g penthrite	grenade 60g/50g penthrite	0	0	100	3
	2011	grenade 60g/50g penthrite	grenade 60g/50g penthrite		6	0	1
	2012	grenade 60g/50g penthrite	grenade 60g/50g penthrite	4	3	33	3
	2013	grenade 60g/50g penthrite	grenade 60g/50g penthrite		11	0	1

***1: Penthrite charge depend on body length**

Note that comparisons can only be made between years within each hunt due to differences in sampling, analysing and hunting methods.

TTD: time to death, **IDR**: instant death rate, **ST**: Survival time

Species	Country	Hunting method		TTD in minutes		Max ST in minutes	IDR %	Sample size
Humpback whales	Year	Primary weapon	Secondary weapon	Mean	Median			
	Greenland							
	2010	grenade 30 g penthrite	grenade 30 g penthrite	23	7	90	17	6
	2011	grenade 30 g penthrite	grenade 30 g penthrite	9	3	30	50	6
	2012	grenade 45 g penthrite	grenade 45 g penthrite	12	13	25	25	8
	2013	grenade 45 g penthrite	grenade 45 g penthrite	30	15	120	17	6
	2014	grenade 45 g penthrite	grenade 45 g penthrite	21	10	75	17	6

Note humpback whales:

Sample size and catch size is different, i.e. in 2010 hunt sample size is 6 animals which represent 67% of total catch.

TTD is calculated from the whole sample size not only the survivors.

Species	Country	Hunting method		TTD in minutes		Max ST in minutes	IDR %	Sample size
Bowhead whales	Year	Primary weapon	Secondary weapon	Mean	Median			
	Canada							
	1996-2010	n/a*1	n/a	n/a	n/a	n/a	n/a	16
	2010-2014	grenade 20 g penthrite	lance	54.1*2	62	90	0	5
				32.4*3	37.75	61		4

Notes bowhead whales:

***1:** 13 whales landed, 3 struck and lost, no information on TTD

***2:** time from first harpoon to death

***3**: time from first grenade to death

SECTION 4

REPORT OF THE COMMITTEE ON INSPECTION AND OBSERVATION

The Committee on Inspection and Observation held a telephone meeting 12 January 2016 from 14:00 to 15:00 hrs. Online were: Ulla Svarrer Wang, Chair (Faroe Islands), Nette Levermann (Greenland), and Hild Ynnesdal and Kathrine Ryeng (Norway), Charlotte Winsnes attended from the NAMMCO Secretariat. Guðni Magnus Eriksson (Iceland) did not participate in the meeting but gave his input after the meeting.

1. OPENING PROCEDURE

The Chair, Ulla Svarrer Wang, welcomed the Committee members to the meeting. The draft agenda was adopted and the list of documents reviewed (Appendix 1). Charlotte Winsnes acted as rapporteur.

2. THE 2015 SEASON

Presented under this agenda item were documents NAMMCO/IO-January/2016/2 containing the report from the Secretariat of the implementation of the NAMMCO International Observation Scheme for 2015 and NAMMCO/I&O-January /2016/3 containing the reports from the NAMMCO observers active in 2015.

Pilot whaling in the Faroe Islands had been the focus of the observation scheme in 2015. Two observers were contracted from 3 – 24 August and 7 – 28 September respectively. During the total observation period of 44 days one pilot whale hunt took place and was observed. No violations had been observed, and observer reports had been submitted to the Secretariat. In 2015 there were 6 pilot whale drives and catches in the Faroe Islands, and these drives were in the period from 6 June to 30 November.

The Committee commented on the fact that only one pilot whale hunt took place during the time period where observers had been in the Faroe Islands. Since the only occurring pilot whale drive had been observed it was pointed out that it was a 100% overage in that specific time period. In general it was agreed to ask the Secretariat to expand its reporting of the implementation of the observation scheme to cover the activities of the focus hunt(s) for the whole calendar year where applicable.

3. THE 2016 SEASON

Presented under this agenda item was document NAMMCO/IO-January/2016/4 containing the scope of Observation activities of the NAMMCO International Observation Scheme for 2016.

The Committee reiterated the importance of documenting the efficiency and rationale behind the chosen focus of the observation scheme in a given year. Economy and human (personnel) resources are the main constraints of the range of the observation scheme. Limitless resources would in theory accomplish a coverage of the observation scheme near a 100%. However, the activities observed will presently and for the foreseeable future cover only a very small percentage of the total hunting activities any given year, something that underscores the importance of random sampling and a kind of unpredictability of when and perhaps where an observer is active.

The Committee reiterated its advice to the Secretariat to presents the plans for coming observation activities with information on geographical area, planned effort compared to the total fleet/hunt when applicable and a more detailed budget.

The suggested scope for observation activities in 2016 is whaling in Norway contracting up to three observers, one from Greenland and two from Iceland/Faroes Islands. Observation periods from two weeks up to 1 month depending on the hunting grounds of the boats in question. Observing on a boat that hunts in the Spitsbergen region involves three to four weeks at sea.

The total hunting season starts 1 April with varying ending dates. Last year it closed 28 September, and the majority of the boats started around middle of May. Based on the 2015 season where 21 vessels participated the total season counted 546 weeks. The effort that is suggested for 2016 (maximum 10 weeks) represents a coverage of less than 2% of the total activity. The suggested budget was noted to be around NOK 225 000. The Secretariat will develop a detailed budget based on the discussion of scope and range that will be presented to FAC and Council for approval.

The whaling fleet in Norway can be divided into three main categories based on the length of the vessels. An observer can observe on one boat or several boats. The Committee discussed selection criteria and agreed to pick one vessel from each of the described categories at random.

4. UPDATE ON NATIONAL MONITORING DATA

The Faroe Islands reiterated the information submitted last year that they do not have national inspectors to monitor whaling. However, the manner in which the pilot whale hunt is regulated by law ensures the control and monitoring of the pilot whale drive hunts trough the district administrator (“Sysselman”) and the whaling foremen leading each hunt.

Greenland informed that the wildlife officers as part of the regular national control have followed and controlled large whale hunts, beluga and narwhale hunts, seal and walrus hunts. These are done by random control at sea, so it is mainly hunting permits and products that are controlled when coming to the harbor and later when the hunter is selling the products. In 2014, there were 2 reported infractions of national legislation on large whales. The infractions were related to the use of riffle for humpback whale as secondary weapon. No infraction was reported for 2015.

In Norwegian whaling at sea monitoring is carried out by the Electronic trip Recorder (Blue Box). In addition inspectors from the Directorate of Fisheries are conducting periodic and random checks of hunting activities. No inspectors have been active on the whaling vessels in 2015.

22 licenses were issued for the 2015 season, of which 21 vessels participated. The hunting period was from 1 April to 28 September. No infringements were reported.

With respect to sealing in Norway, there is a 100 % control and monitoring effort as it is mandatory to have inspectors on all vessels. As previous years, the inspector was a veterinarian, who also carried out quality control of the meat on behalf of the Food Security Authorities. Only one vessel participated in the hunt in the West Ice in 2015. The hunting season was from 1 April to 30 June. No infringements were reported.

Iceland reported that there had been two inspectors on the fin whale hunt during 7 trips over a 7 days period. Two inspectors were also monitoring the minke whale hunt for 3 days. No infraction was reported. Iceland collected TTD data in the 2015 season including post-mortem examinations for the minke whale hunt. In total TTD was collected for 12 minke whales in 2015 and one in 2014 season, making the total of 13 minke whale.

5. FOLLOW UP FROM THE LAST MEETING

Webpage

The Committee was informed that the NAMMCO webpage is a priority and focus of the Secretariat. The information displayed on the Inspection and Observation Committee and the Joint NAMMCO Control Scheme is thus continuously updated by the Secretariat. Members of the Committee are welcome to comment and make proposals for improvements to increase the visibility and usefulness of the webpage.

Competence requirement for national inspectors

Qualifications requirements for observers; the general rule is that an observer shall have at least the same level of professional competence as that required of inspectors in the country where the observations are to take place. The Committee reiterated its recommendation that information on competence requirements for inspectors must be circulated to all members as part of the nomination process. Duties of national inspectors vary between member countries due to differences in the activities which they control and it is essential that the qualification requirements are known to all member countries so that they are able to nominate competent people.

The Secretariat had only received the requested information from Norway and Greenland. The Faroe Islands informed that they do not have national inspectors to monitor pilot whale drive hunts, and therefore no information on competence requirements for whaling inspectors is available.

The Committee asked the Secretariat to circulate the information received both with respect to competence requirement and also the control/check lists in relation to national legislation developed by member countries to aid the observers in the execution of their duties.

6. NEXT MEETING

The Committee agreed to schedule the next meeting for November 2016 in order to comment on the 2017 scope and range of the activities. The exact date will be confirmed later.

9. REPORT OF THE MEETING

The report was approved by correspondence on 18 January 2016.

Appendix 1 - Agenda and List of documents

Agenda:

1. OPENING PROCEDURE
   1.1 Introductory remarks
   1.2 Adoption of agenda and review of documents
2. THE 2015 SEASON
3. THE 2016 SEASON
4. UPDATE ON NATIONAL MONITORING DATA
5. FOLLOW UP FROM LAST MEETING
6. NEXT MEETING
7. ANY OTHER BUSINESS

List of documents:

NAMMCO/IO-January/2016-2: Secretariat's report from the 2015 season
NAMMCO/IO-January/2016-3: Observer reports
NAMMCO/IO-January/2016/4: Observation season 2016 – plans and budget

SECTION 5 SCIENTIFIC COMMITTEE

REPORT OF THE 22nd SCIENTIFIC COMMITTEE MEETING

EXECUTIVE SUMMARY

The 22nd meeting of the Scientific Committee was held in Tórshavn, Faroe Islands from 9-12 November, 2015. The SC remembered Dorete Bloch from the Faroe Islands, an SC member from 1992-2009, who passed away this year—she will be missed by all.

Reports from 3 working groups (WGs) were presented: Large Whale Assessment WG (ANNEX 1), NAMMCO-JCNB Joint WG (ANNEX 2), and the Survey Planning WG (ANNEX 3). The SC also discussed the NASS Steering Committee's post-survey report to the FAC (ANNEX 4). National Progress Reports were received by member countries and observers. The SC also heard special presentations on whale research projects in Japan.

Cooperation with other organisations

In the IWC SC in recent years, there has been movement for more funding to be allocated to conservation issues rather than management related issues, which has gained some support in the Commission. This could create further delays completing work relevant to NAMMCO such as assessment of whale stocks. However, this may also allow more flexibility to survey on 10 year cycles rather than 6 years, which is not of concern from a conservation perspective and would allow funding to be used for surveys of other species.

In ASCOBANS, one area of potential cooperation is on the assessment of harbour porpoises since it is a shared stock. Several ASCOBANS participants expressed interest in working with NAMMCO on exploring the idea of convening a joint meeting reviewing the status of harbour porpoises.

Several ICES WGs have work of relevance to NAMMCO: Working Group on Marine Mammal Ecology (WGMME), the Working Group on By-catch of Protected Species (WGBYC), and the Joint ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHARP). NAMMCO's request to join the WGHARP was accepted by ICES and NAFO this year, which will hopefully help facilitate requests being submitted to the WG.

The NAMMCO-JCNB Joint Working Group agreed on Rules of Procedure, which were also accepted by the NAMMCO SC.

Several Arctic Council WGs have work of relevance to NAMMCO, including the CAFF and PAME.

Environmental/Ecosystem Issues

In the Barents and Norwegian Seas, cod abundance has increased, and its range has extended northwards in recent years. One implication of this is a new overlap of feeding grounds with harp seals and minke whales, two other important top predators in the area. Both these mammal species have exhibited declines in body condition in recent years, and competition for food with the increasing cod stock is suggested as a possible explanation.

In Iceland during the last two decades, substantial increases in sea temperature and salinity have been reported in Icelandic waters. Concurrently, pronounced changes have occurred in the distribution and abundance of several cetacean species and their prey since regular monitoring began in 1987. A northward shift in summer distribution of capelin and a crash in the abundance of sand eel are suspected to be the primary cause of the recent shift in distribution of common minke whales away from Icelandic coastal waters. Continued monitoring of the distribution and abundance of cetaceans is essential for conservation and management of the cetacean populations and as a part of wider studies of ongoing changes in the ecosystem.

By-catch
By-catch remains an issue of importance, not only in NAMMCO countries, but in many other areas. The SC recommended holding a By-catch WG (BYCWG) that includes participants from outside the marine mammals sphere and the SC (e.g. fishery experts) and outside NAMMCO.

Impacts of Human Disturbance in the Arctic
The Symposium organised by NAMMCO "Impacts of Human Disturbance on Arctic Marine Mammals" was held 13-15 October 2015. Concerns were raised at both the Symposium and the SC meeting about a Canadian mining project currently under development in the Canadian Arctic, the *Mary River Project* operated by *Baffinland Iron Mines Corp,* a project that continues expanding, currently with the prospect of year-round shipping through the heavy pack ice in Baffin Bay. It will have severe consequences for the large numbers of marine mammals using the area in summer and winter, not only narwhals but also belugas, bowheads, ringed seals and walruses, with unpredictable consequences for the populations themselves but also for the accessibility to hunting and/or its sustainability.

Other industrial activities that were addressed at the symposium as being particularly important as disturbance factors for marine mammals were seismic exploration in Canada, and West and East Greenland. The SC **draws the attention** of the NAMMCO Council to the potentially severe consequences of these projects. The SC noted that these industrial activities will also likely have impacts on the hunting of these species, and could affect the advice that is given by this SC.

SEALS AND WALRUS

Harp seals
Russia (PINRO) have been conducting surveys in the White Sea for pup production since 1998. Surveys since 2004 have indicated a significant reduction in pup production. The reasons for the decline are not known, although one hypothesis is that there was a decline in reproduction in adult females, and an increase in the age of maturity. Results from an aerial survey flown in 2013 gave an estimated pup production of 128,786 (95% CI 98,188 to 159,364).

Although the population assessment model used for the White Sea/Barents Sea harp seal population provided a poor fit to the pup production survey data, ICES has decided to continue to use the model which estimated a total 2015 abundance of 1,368,200 (95% C.I. 1,266,300 – 1,509,378). Despite the fact that this population is now classified as data poor, ICES expressed concerns over the high removals and declining population resulting from the PBR estimations, and concluded that the estimated equilibrium catches were the most preferred option. The equilibrium catch level is 19 200 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), in 2015 and subsequent years.

The use of traditional photo aircrafts to assess seal populations in remote areas, such as the West Ice, is expensive and becoming more difficult to operate. IMR (Norway), with funding from the Norwegian Research Council (NRC), has now started experiments with alternative (and cheaper) methods to perform photo-based aerial surveys of seals in the West Ice. Two research surveys have been carried out to the West Ice with the aim to test the usefulness of UAVs (Unmanned Aerial Vehicles), operated by the Northern Research Institute (Norut), to perform aerial photographic surveys of harp and hooded seal whelping patches on the drift ice. Experience obtained from using the UAVs, and the quality of the images taken, were promising. Both harp and hooded seals, including pups, were easily identified on the images taken at an altitude of 300 m (the usual altitude for photographing during traditional surveys).

A new population model is being developed for harp seals in the Barents and White Seas that is more flexible in capturing the dynamics of the observed pup production data. The current management model predicted that the pup abundance will have a slight increase over the next 15 years, whereas the new (state-space) model predicted that the pup abundance will increase substantially. The state-space model show some promising results and might be a step forward towards more realistic modelling of the population dynamics of the Barents Sea/White Sea harp seal population.

A recent paper using a new genetic analysis supports the hypothesis that harp seals comprise three genetically distinguishable breeding populations, in the White Sea, Greenland Sea, and Northwest Atlantic.

An analysis of the effects of potential increases in Canadian catches on Greenlandic catches indicates that if catches of young of the year in Canada increase (e.g. if sealskin prices increase), this will significantly reduce the availability of young harp seals for Greenland hunters. Although it is unlikely that Canadian catches will increase in the near future, the situation should be monitored.

The Joint ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals will meet again in August 2016 at the ICES HQ in Copenhagen, Denmark, to review the status and assess the catch potential of harp and hooded seals in the North Atlantic.

Ringed seals

Ringed seals from the Ilulissat Icefjord (Kangia) in Greenland show differences in size, pelage pattern, and behaviour (e.g., movements and diving patterns) than other ringed seals. The SC **recommended** that a separate management plan be developed for the ringed seal in the Ilulissat Icefjord, to protect this potential separate population from overharvest. The SC also **recommended** genetic sampling work and a new survey for abundance estimate be conducted.

Research in Svalbard has shown dramatic shifts in movement patterns and foraging behaviour of ringed seals before and after a major collapse in sea-ice in Svalbard. These behavioural changes suggest increased foraging effort and thus likely increases in the energetic costs of finding food. Continued declines in sea-ice are likely to result in distributional changes, range reductions and population declines in this keystone arctic species.

The SC noted that there is still not enough information to warrant convening a NAMMCO Ringed Seal WG and recommends that this should occur after new surveys and genetics studies are completed.

Grey Seals

Boat-based visual surveys aimed obtaining a new abundance estimate in Norway were conducted from 2013–2015. Some of the new estimates obtained in mid Norway were much lower than in the previous survey, and quotas were immediately reduced in these areas as a result.

A reporting system has been implemented in the Faroes to obtain estimates of removals at salmon farms, and reports indicate that the removals about 100+ seals per year. The SC is pleased that the Faroes have developed and implemented this system of reporting but noted that removal numbers are high, which is concerning, especially because the population size is unknown. The SC **recommended** that all of the available grey seal data from the Faroes is presented to the Coastal Seals Working Group for review. The SC **recommends** that the CSWG develops specific plans for monitoring grey seals in the Faroes, e.g., obtaining a relative series of abundance (if a full abundance estimate is not possible at this time).

Harbour Seals

Surveys aimed to obtain a new abundance estimate in Norway were conducted from 2011–2015. This has yielded a new point estimate of 7,594 for the species for the entire Norwegian coast. This new estimate is implemented in current management of the species – this management now follows the management plan reviewed by NAMMCO SC in 2011.

In Iceland, results from the partial survey of harbour seals in 2014 shows an appreciable decrease in abundance in the most important haul-out areas. Aerial surveys of harbour seals are planned for 2016, if funds are available. Large uncertainties in abundance and catch statistics, both direct catches and by-catches, make assessments of the present status and sustainability of removals problematic. MRI’s 2015 advice to the government declared that in the absence of new abundance estimates, it was unable to evaluate whether the existing management objectives of grey seals and harbour seals are being met.

Coastal Seals Working Group

The SC recommended continuing with the plan for the CSWG to be held in February 2016, where they will assess the status of all populations, address by-catch issues, and review the Norwegian management plans.

Walrus

The assessment and quota advice was updated for the Baffin Bay population. The SC **recommended** that no more than 85 walruses are landed annually in Qaanaaq from 2016 to 2020.

Due to inconsistencies between the two reporting schemes (*Piniarneq* and *Særmeldingsskema*) in Greenland, the SC **recommended** that Greenland should streamline their reporting system, and also conduct a study to investigate why the numbers are different between the reporting schemes.

The SC noted that although this is a shared stock, there is no formal agreement on sharing of information between Canada and Greenland for walruses. SC **recommended** that NAMMCO request the Canadian catch data.

The SC also **recommended** a new survey in the North Water Polyna (NOW; Baffin Bay stock) area as a means of monitoring this population. The SC also **recommends** that new age data and struck and lost data be obtained from both Canada and Greenland.

Satellite tagging of walruses continues in Svalbard, and the researchers are training Russian scientists so that they can use these techniques in the Pechora Sea. Genetics studies on walruses in the Pechora Sea indicate that they are similar to the Svalbard-Franz Josef Land walruses. This would mean that the abundance of the Svalbard-Franz Josef Land walrus population is larger than previously thought.

CETACEANS

Fin whale

The SC agreed with the advice of the Large Whale Assessment WG and **recommended** a catch limit of 146 fin whales for fin whales that can be taken anywhere in the EG+WI (East Greenland + West Iceland) region is safe and precautionary, and that this advice should be considered valid for a maximum of 2 years (2016 and 2017). This is interim advice because the most recent abundance estimate is almost 10 years old. A new abundance estimate is expected from the NASS2015 conducted this past summer.

In addition, this is also an interim advice in accordance with the Council's request necessitated by delays in the IWC RMP *Implementation Review*. This *Review* is scheduled to be completed in June 2016 after which the NAMMCO SC will provide a long-term advice as requested by the Council.

The SC **encouraged** collaborative genetic research led by Iceland aimed at identifying close kin relationships within the North Atlantic and urged member nations to participate by supplying samples.

Humpback whale

The SC agreed with the advice of the Large Whale Assessment WG and **recommended** that the IWC's *Strike Limit Algorithm* (SLA) that has been developed within the Aboriginal Whaling Management Procedure (AWMP) as the best current basis for providing management advice for West Greenland humpback whales. Based on the work of the WG, the SC **endorsed** the advice of 10 strikes per year based on the SLA that was accepted by the IWC. The SC also noted that a higher number may be sustainable because the SLA calculations take into account the Greenlandic *Needs Statement* provided to the IWC of 10 whales.

This advice applies up to and including 2017, and with an expected new abundance estimate from the NASS2015, a new calculation by the IWC SLA to provide advice should be straightforward.

Common minke whale

The SC **endorsed** the advice provided by the WG that a catch limit of 224 common minke whales in the CIC sub-area is safe and precautionary, and that this advice should be considered valid for a maximum of 3 years (2016 – 2018). This is interim advice because the most recent abundance estimate is from 2009, which will then be approaching 10 years old. In addition, this is interim advice due to delays in the IWC RMP implementation review of North Atlantic common minke whales. This review is scheduled to be completed in June 2016 after which the NAMMCO SC will provide a long-term advice as requested by the Council.

New abundance estimates will be developed from the shipboard survey from the results of NASS2015. However, unusually unfavourable weather conditions seriously affected the aerial survey in coastal Icelandic waters and it is clear that the data collected are insufficient for any realistic abundance estimation for the Icelandic continental shelf area (CIC) as a whole. A funding proposal has been submitted for a repeat of this aerial survey in the summer of 2016, and the outcome of this funding request is expected in early 2016.

Beluga and Narwhal

The NAMMCO-JCNB Joint Working Group (JWG) met in Ottawa, Canada, 11-13 March 2015 to update the assessment and advice for belugas and narwhals in Greenland and Canada.

Belugas in West Greenland

The SC **agreed** with the advice and recommendations of the JWG that the total annual removal of beluga in West Greenland is no more than 320 over period from 2016 to 2020.

Narwhals in West Greenland and Canada

A sub-group of the JWG completed their work of developing a catch-allocation model that allows managers to assign catches from the narwhal metapopulation that is shared by Canada and Greenland to the appropriate summering aggregation, by different hunting grounds and seasons. The model includes all information that is available on narwhal movements including telemetry data, all abundance estimates, seasonal occurrence and historical catch data. The NAMMCO SC welcomed this new methodological development for this complex assessment situation. The advancement of the allocation model is considered a step forward and could potentially be applied in many situations where migratory populations are exploited in several areas under various jurisdictions.

The JWG provided an example (see Table 4 in the main report) of the how the catches can be distributed for the period 2015-2020 according to the allocation model.

East Greenland narwhals

The assessments of narwhals in the two stocks in East Greenland (Ittoqqortormiit and Tasiilaq/Kangerlussuaq areas) were updated with recent catch information. The updated assessment estimates a slightly smaller sustainable catch (Table 6 in the main report) than the previous assessment, reflecting that we are further away in time from the available abundance estimate. The total annual removal was estimated to be no more than 50 for the Ittoqqortormiit area and 16 for the Tasiilaq/Kangerlussuaq. The SC **agreed** with the advice of the JWG and noted that the quota for Tasiilaq was recently increased by 10 narwhals above the previous management advice.

Next NAMMCO-JCNB JWG Meeting

Greenland will likely not have any new information to present to the JWG until 2017, and it will be important for the Canadians to provide new abundance estimates and catch history information before the next meeting. From the NAMMCO perspective, the SC recommends waiting until 2017, but recognizes that scheduling a meeting is up to the discretion of the NAMMCO and JCNB Chairs.

Global Review of Monodontids

Prewitt informed the SC that the planning for the NAMMCO organised *Global Review of Monodontids* meeting is continuing. The meeting will be held in conjunction (either immediately before or after) with the Marine Mammals of the Holarctic, which recently announced the location and dates of the meeting: 17-26 October 2016 in Astrakhan, Russia.

Killer whale

At the SC meeting in 2013, the SC noted higher levels of annual catches (19 on average per year from 2010 and 2012) in West Greenland. The SC was then informed that the recent catch statistics on killer whales in West Greenland have not been validated, and at this meeting the SC noted that these catch statistics still have not been validated. The SC **reiterates the recommendation** that all catch data on killer whales are validated before the next SC meeting, so that it is possible for the SC to monitor the development of the hunt.

Pilot whale

The Faroes have developed a scientific monitoring programme to update biological parameters. A number of samples have been collected including samples for ageing, reproductive information, and stomach samples for diet. The plan is to continue to collect samples from every drive and deliver results to the next assessment meeting. The SC commended the Faroes for the work on the sampling programme.

Harbour porpoise

Tagging of harbour porpoises continues in Greenland, and some of the 2014 tags are still operating. Tissue samples are being collected for various analyses for comparison with previous sampling programs.

In response to the recommendations from the 2013 Harbour Porpoise WG, the Institute of Marine Research (IMR; Norway) is seeking external funding for initiating work on harbour porpoises in cooperation with other research groups.

Sperm whale
A study in Norway using a whale safari company as a platform from which to conduct a photo-identification study of male sperm whales confirmed the presence of both transient and resident male sperm whales in the Bleik Canyon. The results suggest that the sperm whale group(s) found there are a loose feeding aggregation and not a closed population. No trend in the number of sighted whales was found. The estimated size of the feeding aggregation in the Bleik Canyon also fluctuated between years, from 11 to 116 individuals, with no trend evident.

Bowhead whale
A strip-width survey estimated 100 (95% CI: 32-329) bowhead whales in the North East Water Polynya off Northeast Greenland in 2009 (Boertmann et al. 2015). This estimate is considerably higher than observations in the past.

A survey was conducted using a ship and helicopter in Svalbard on the ice-edge for polar bears and ice-associated whales including bowhead whales. The helicopter provided 27 of the 28 bowhead whale sightings.

A tourist vessel also reported a sighting of about 100 whales in the Jan Mayen area and photos confirmed that at least some of the whales were bowheads. A paper from these observations are expected next year.

Blue whale
Iceland reported that they had tagged 2 blue whales during 2014.

An increasing number of blue whales are reported in the waters around Svalbard including in inner parts of the fiord systems especially on the west coast. As reported for fin whales, the Norwegian Polar Institute has started instrumenting animals with satellite tracking devices and collect biopsies for studies of genetics diet and ecotoxicology. In 2015, 3 whales were tagged. Blue whales were also detected on the passive acoustic listening devices that have been deployed at various sites around Svalbard and thus collecting data on the phenology of arrival and departures to the area.

NASS2015
The NASS2015 Steering Committee informed the SC on the three extension surveys that comprised NASS2015, which included an intensive survey with the purpose of estimating the abundance of pilot whales around the Faroe Isles, an aerial survey of the coastal waters in East Greenland and a ship-based survey around Jan Mayen following methods developed for the Norwegian minke whale surveys. All the surveys were successfully completed and resulted in valuable data useful for abundance estimation of the target species.

In addition to these surveys, national surveys covered the West Greenland shelf, areas around Iceland, the Faroes and the Norwegian Sea, providing satisfactory coverage of these waters. With the exception of the Icelandic aerial survey that was hampered by unusually bad weather conditions, all the national surveys were successfully completed and resulted in valuable data useful for abundance estimation of the target species. Details of the survey effort and number of sightings are provided in the report from the Steering Committee (ANNEX 4 of the main report).

The recommendations from the Steering Committee include a plan for the analysis and presentation of the results. It is also recommended that the Steering Committee has now completed its task and that further development of the results from the survey should be transferred to NAMMCO SC and its Abundance Estimation Working Group.

NAMMCO SCIENTIFIC PUBLICATIONS
The current volume, *Volume 11: Age estimation of marine mammals with a focus on monodontids*, is still underway, with a scheduled completion date of early 2016.

The SC discussed possible future volumes. One possibility is to publish a volume with papers from the planned Global Review of Monodontids meeting. Of particular interest are papers from Russian scientists that will present their projects at this meeting. This would be especially helpful because these scientists usually do not publish in English, and therefore their information is usually not accessible.

FUTURE WORK PLANS

Coastal Seals Working Group

The CSWG will meet late February 2016. The likely location is either Copenhagen/Reykjavik/Oslo, to be decided by the Chair in consultation with the Secretariat. The decision will be based on the final participant list. Invited participants (not including SC members) will include 1 person each from the UK, USA, Canada, Sweden and Denmark, and 2-3 Norwegians. (Chair: Kjell Tormod Nilssen)

The WG will mainly address **R-2.4.2** and **R-2.5.2**.

The Terms of Reference for the meeting will be for the WG to:

1) assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway.
2) address by-catch issues in Norway, Iceland, and the Faroe Islands
3) re-evaluate the Norwegian management plans (which have been already implemented) for grey and harbour seals.

The SC **recommended** that all of the available grey seal data from the Faroes is presented to the CSWG for review. The SC **recommends** that the CSWG develops specific plans for monitoring grey seals in the Faroes, e.g., obtaining a relative series of abundance (if a full abundance estimate is not possible at this time).

NAMMCO-JCNB Joint Working Group on Narwhal and Beluga

The Secretariat (Scientific Secretary) will liaise with the JCNB and NAMMCO co-chairs about whether to postpone until 2017. The next meeting (2016 or 2017) will be hosted by Greenland. (Chair: Rod Hobbs, Convenor: Mads Peter Heide-Jørgensen)

ICES/NAFO/NAMMCO WGHARP (Working group on Harp and Hooded Seals)

The WGHARP will meet again in August 2016 at the ICES HQ in Copenhagen, Denmark, to review the status and assess the catch potential of harp and hooded seals in the North Atlantic. Norway has forwarded a request to ICES requesting an assessment of status and harvest potential of the harp seal stocks in the Greenland Sea and the White Sea/Barents Sea, and of the hooded seal stock in the Greenland Sea. This request will form the basis for the next WGHARP meeting. (Chair: Mike Hammill, Convenor: Tore Haug)

By-catch Working Group

The SC recommended convening a one-day meeting of the NAMMCO BYCWG before the CSWG. This WG should include Mikkelsen and Gunnlaugsson from the SC, and Arne Bjørge (Norway), and should incorporate members from outside the marine mammals sphere and the SC (e.g. fishery experts) and outside NAMMCO. (Chair: *to be determined*, Convenor: Geneviève Desportes)

By including external expertise from fisheries and marine mammal science, the WG would

1. Identify all fisheries with potential by-catch of marine mammals
2. Review and evaluate current by-catch estimates for marine mammals in NAMMCO countries.
3. If necessary, provide advice on improved data collection and estimation methods to obtain best estimates of total by-catch over time.

Abundance Estimates Working Group

A small AEWG will be scheduled for May 2016, with only NAMMCO participants. The location will be Copenhagen or Bergen. A second meeting may be scheduled in October 2016, depending on progress with the analyses, and could be held back to back with a LWAWG meeting in October 2016. (Chair: Daniel Pike, Convenor: Geneviève Desportes)

Large Whale Assessment Working Group

A Large Whale Assessment WG may be scheduled before the next SC meeting, after the abundance estimates from NASS2015 are available. The SC recommended inviting Doug Butterworth, but also additional experts to establish additional expertise within the WG, possibly someone from the Butterworth lab. Additional participants (outside of the SC) may include Bjarki Elvarsson and Hiroko Svolvang. (Chair: Lars Walløe, Convenor: Gisli Vikingsson)

Global Review of Monodontids

This workshop will be held in conjunction (either immediately before or after) with the Marine Mammals of the Holarctic, which recently announced the location and dates of the meeting: 17-26 October 2016 in Astrakhan, Russia. (Chair: Arne Bjørge, Organising Committee: Jill Prewitt, Randall Reeves, Robert Suydam, Steve Ferguson, Rikke Hansen, Olga Shpak)

Next SC meeting

The SC suggested that it would be a considerable cost and time saving to have the next SC meeting in Copenhagen rather than Greenland. If the meeting is held in Copenhagen, the SC **urged** all countries to send all of their SC members to the next meeting to take advantage of the cost saving.

ELECTION OF OFFICERS

Tore Haug (Norway) was elected as Chair and Bjarni Mikkelsen (Faroes) was elected as Vice Chair of the SC. The SC **welcomed** the incoming officers and look forward to their terms in office.

MAIN REPORT

1. CHAIRMAN'S WELCOME AND OPENING REMARKS

The Chair of the NAMMCO Scientific Committee (SC), Thorvaldur Gunnlaugsson, welcomed the participants (Appendix 2.) to the meeting. The group welcomed two participants that were new to the NAMMCO SC meetings, Louis A. Pastene from the Institute of Cetacean Research in Japan, and Luis Ridao Cruz from the Faroe Marine Research Institute.

Gunnlaugsson noted the passing of a significant past member of the NAMMCO SC, Dorete Bloch. Dorete passed away on 28 February this year, and her loss was felt by all members of the SC. Dorete was a member of the SC from 1992 to 2009. Geneviève Desportes remembered Dorete as a warm person and quite a character, who welcomed her to the Faroe Islands in 1984. Desportes commended the invaluable input Dorete made to NAMMCO and the Scientific Committee, both scientifically and certainly on the social side. Her open and strong personality meant a lot to the SC.

Bjarni Mikkelsen welcomed the group to the Faroe Islands and especially to the Museum of Natural History. He informed the group on the plans for a trip to see the old whaling station, and on arrangements for a dinner hosted by the Faroe Islands.

2. ADOPTION OF AGENDA

The agenda was adopted with minor revisions (Appendix 1).

3. APPOINTMENT OF RAPPORTEUR

Prewitt (Scientific Secretary) was appointed as rapporteur. The participants were reminded to provide summaries of their presentations, including citations.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

The list of available documents is available in Appendix 3.

4.1. National Progress Reports

National Progress Reports (NPRs) were received by the member countries (minus catch data from Greenland), and the observers from Canada and Russia. The NPR from Japan was received shortly after the meeting. Information in the NPRs from member countries is presented under the individual agenda items.

Russia

Zabavnikov gave a presentation on Russian research in the Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO), primarily survey activities in the Barents Sea. The plan is for Russian sealing to resume for the White Sea harp seal population in 2016 if ice conditions are favourable.

Japan

This year the SC heard special presentations from Japan on JARPAII and NEWREP-A.

Pastene updated the SC on marine mammal research activities in Japan in 2014-15. Three main research institutions were involved in cetacean research, the National Research Institute of Far Seas Fisheries, the Tokyo University of Marine Science and Technology and the Institute of Cetacean Research. There were 3 main sources of information on cetacean, 1) Whale Research Program under Special Permit in the western North Pacific (JARPNII). Coastal surveys, focused on common minke whales, were carried out in spring and fall in Sanriku and Kushiro regions, respectively. Data and samples for feeding ecology, pollutant, and stock structure studies were collected; an offshore survey, focused on sei and Bryde's whales, was carried in summer. Information for feeding ecology and ecosystem, pollutant and stock structure studies were collected; 2) Dedicated sightings surveys in the North Pacific (summer) and Antarctic Area IV (austral summer 2014/15) by Japan. The formal survey was focused mainly to obtain sighting data for abundance estimation of Bryde's whale while the Antarctic survey was focused mainly on Antarctic minke whale. Photo ID and biopsy sampling experiments were conducted during these sighting surveys on right, humpback, and blue whales.;3) IWC-POWER sighting survey- in the North Pacific (summer) organized by the IWC SC, focused on sighting, photo-id and biopsy sampling of large whales, particularly Bryde's whale. Other activities involved the update of the DNA registers for large whales based on whales taken by JARPNII and by-catches (setnets, mainly common minke whales but also some few other large whales) , and recording strandings. The National Research Institute of Far Seas Fisheries was involved in research of several species of small cetaceans. See details in the Japan NPR.

Pastene and Kitakado presented the research objectives and scientific outputs of the Japanese Whale Research Program in the Antarctic (JARPAII). JARPAII had four objectives, 1) monitoring of the Antarctic ecosystem, 2) modelling competition among whale species, 3) elucidation of temporal and spatial changes in stock structure, and 4) improving the management procedure for Antarctic minke whales. During the presentation, the following outputs of the research were highlighted: i) genetic analyses of samples collected by JARPAII contributed to understand the phylogenetic relationship and taxonomy of minke whales worldwide; ii) two stocks of Antarctic minke whale distribute in the research area and mix spatially in a transition area; iii) several biological parameters, including age-specific mortality rates, were estimated for the Antarctic minke whale on a stock basis; iv) demographic changes occurred in the Antarctic minke whale between the 1940's and 1970's are consistent with the pattern expected under the 'krill surplus hypothesis'; v) nutritional conditions have been deteriorating for Antarctic minke whale since the 1980's, which is coincident with the recovery of other krill-eater large whale species such as humpback and fin whales, after severe exploitation by commercial whaling. It was noted that the attainment of information on krill biomass series in the research area is important for explaining the reasons for the biological changes observed. Pastene noted that his group was interested in cooperating with NAMMCO scientists regarding different aspect of their programs, in particular genetics and satellite tagging.

Kitakado and Pastene presented an outline of the Japanese Research Plan for New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A). The outline included some explanations on technical aspects of the plan. Japan had terminated its previous whale research program in the Antarctic (JARPAII) following the International Court of Justice (ICJ) Judgment, and subsequently announced the development of a new research program that takes into consideration the objectives of JARPAII (considered reasonable by the Court) and the reasoning and conclusions contained in the Judgment. The NEWREP-A has two main objectives; i) improvement in the precision of biological and ecological information for the application of the RMP to the Antarctic minke whales; and ii) investigation of the structure and dynamics of the Antarctic marine ecosystem through building ecosystem models. Each main objective is composed of several objectives and sub-objectives. The NEWREP-A proposal was submitted to the IWC and reviewed during an Expert Panel Review workshop held in February 2015, and subsequently by the IWC Scientific Committee in June 2015. Several recommendations were offered by the Review Workshop and the Scientific Committee. Japanese scientists have considered all the recommendations, and they have designed a detailed timeline for carrying out the relevant work on these recommendations. Work progress on some recommendations considered of high priority was presented to the meeting.

Discussion

The SC thanked Pastene and Kitakado for their interesting presentations and commended the work being carried out and the results obtained under the JARPA II project. During the following discussion, they were asked whether the same kind of trend studies had been carried out for other species which may also have benefited from the krill surplus, such as several penguins species, crabeater and fur seals. Within JARPA II, there were no analyses that addressed this. It was noted that the focus of the data collection was the Antarctic minke whale and data and samples on the dwarf minke whale were very limited, so it was not possible to see whether that species exhibited the same trends in abundance, life history parameters and body condition. One problem in the modelling exercise was the poor krill trend data in Eastern Antarctica.

For NEWREP-A, the SC thanked Pastene and Kitakado for their presentation of this ambitious and well-founded programme. Pastene explained that main method for age determination would be earplug, but that the project would also examine the possibility a non-lethal technique, the rate of DNA methylation. They also plan to investigate the aspartic racemisation method using eye lenses.

4.2. Working Group (WG) Reports

Reports were available from three working groups in 2015.

4.2.1. Large Whale Assessment
The Large Whale Assessment WG met 5-7 October 2015 in Copenhagen, Denmark and discussed fin whales, common minke whales, and humpback whales. The results from this meeting will be discussed under these individual species' agenda items (8.1, 8.2 and 8.3). The full report is available in ANNEX 1.

4.2.2. NAMMCO-JCNB JWG
The results and recommendations from the NAMMCO–Canada/Greenland Joint Commission on the Conservation and Management of Narwhal and Beluga (JCNB) Joint Scientific WG (JWG) specific to belugas and narwhals were reported under those species' agenda items. The full report is available in ANNEX 2. The new Rules of Procedure for the JCNB-NAMMCO JWG were discussed under Item 5.4.

4.2.3. Survey Planning WG (SPWG)
The SC noted that this Survey Planning WG meeting was a preparation meeting for NASS, and therefore was now outdated. The report full report is available in ANNEX 3. Further discussions of NASS will be taken under agenda Item 9.

5. COOPERATION WITH OTHER ORGANISATIONS

The full observer's reports are available in Appendix 4, and only major points of direct interest are presented below.

5.1. International Whaling Commission (IWC)
Several points regarding cooperation with the IWC were discussed under the relevant species (fin whale: 8.1, humpback whale: 8.2, common minke whale: 8.3 and sei whale: 8.6).

In recent years, there has been movement in IWC SC to change the working procedures of the SC, with more funding allocations to conservation issues rather than management related issues. This movement has gained some support in the Commission. It was noted that this could create further delays completing work relevant to NAMMCO such as *Implementation Reviews* and work in the Aboriginal Whaling Management Procedure (AWMP). Norway has indicated that this delay is not necessarily a problem, which may allow more flexibility to survey on 10 year cycles rather than 6 years. This is not of concern from a conservation perspective and would allow funding to be used for surveys of other species.

5.2. Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
Desportes drew the attention of the NAMMCO SC to a system of by-catch monitoring using remote electronic video monitoring on ships that observe by-catch as the net is being brought on board. The system is reliable and more and more widely used for monitoring by-catch in European waters. A report of the special Workshop held by ASCOBANS back to back with the AC meeting would become available shortly.

A main area of potential cooperation with ASCOBANS is on the assessment of harbour porpoises, as this is a shared stock with the ASCOBANS area and neither group can make a full assessment without information from the other. Several ASCOBANS participants expressed interest in working with NAMMCO on exploring the idea of convening a joint meeting reviewing the status of harbour porpoises.

5.3. International Council on the Exploration of the Seas (ICES)
Haug reviewed the 2014 and 2015 activities in ICES which have some relevance to the work in NAMMCO SC. This included work in the ICES Working Group on Marine Mammal Ecology (WGMME), the Working Group on Bycatch of Protected Species (WGBYC), and the Joint ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHARP). The ICES Annual Science Conference (ASC) generally include sessions with marine mammals included as an integral part, occasionally also sessions entirely devoted to marine mammals.

5.3.1. Joint ICES/NAFO/NAMMCO Working Group Harp and Hooded Seals (WGHARP)
Species-specific information from this working group is presented under the relevant agenda items (7.1 and 7.2).

The SC was informed that ICES and the North Atlantic Fisheries Organization (NAFO) have accepted NAMMCO's request to join the WGHARP. The Secretariat will communicate with the ICES Secretariat before the next WGHARP meeting (scheduled for August 2016) to clarify the procedures in WGHARP, in particular how requests should be forwarded for review. It was noted that a previous request from Greenland to the WGHARP chair was not discussed at the meeting because it had not followed proper procedure. The hope is that NAMMCO can facilitate processes such as this.

5.4. JCNB

The SC reviewed the Rules of Procedure that were agreed by the NAMMCO-JCNB Joint Scientific Working Group, and **agreed** on them as well.

5.5. Arctic Council

Desportes informed the SC that NAMMCO's aim is to become more active within the Arctic Council. Towards this aim, Desportes attended various Arctic Council meetings this year including the Conservation of Arctic Flora and Fauna (CAFF) and Protection of the Arctic Marine Environment (PAME) WGs in September and the CAFF Marine Expert Network Meeting in November. The Marine Expert Network is working on developing a "State of Arctic Marine Ecosystem Report" and NAMMCO is seeking involvement in the development of this report. Fernando Ugarte from the NAMMCO SC also attended this meeting.

5.6. Other

There were no other reports available.

6. ENVIRONMENTAL / ECOSYSTEM ISSUES

6.1. Marine mammals-fisheries interactions (R-1.1.5, 1.1.8)

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.*

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. See also 1.1.6 and 1.4.6.*

Discussion

R-1.1.8 was discussed under agenda item 9.

6.1.1. By-catch

As has been presented previously at the 2013 HPWG and SC meetings, Bjørge et al (2013) estimated that a substantial number of harbour porpoises are being bycaught in Norwegian fisheries. However, it has been recently discovered that recalculations are needed in this analysis due to errors that were found in the data. A new extrapolation will be developed, and the numbers will likely be lower.

Norway is also performing mitigation studies in Lofoten; this work is in progress.

In response to the recommendations from the 2013 Harbour Porpoise WG, the Institute of Marine Research (IMR; Norway) is seeking external funding for initiating work on harbour porpoises in cooperation with other research groups.

The SC also discussed a recent letter from USA to Norway informing them that the USA is implementing rules potentially banning import of marine products from countries with fisheries with high by-catch (gillnets). It was noted that the letter is unclear whether the USA is planning on banning all marine products or just products from the problematic fishery. This is a potentially significant economic issue for all NAMMCO countries, which is another reason for the increased emphasis on future work on harbour porpoises and by-catch in general.

The SC also noted that by-catch is also an issue for coastal seals in Norway. The final by-catch estimations are not yet available but they are believed to be in the 100s of seals. Norway will bring updated estimates next year at Coastal Seals Working Group (CSWG).

Iceland has included by-catch data in the NPR. It was noted that effort in the cod gillnet fishery in 2014 was the lowest on record.

For the Faroes, it is thought that there is usually low levels of by-catch, because of the absence of gillnet fisheries in shallow waters. In 2014 there was one incident in the pelagic mackerel fishery where 15 pilot whales were caught in a trawl. Mikkelsen also reported that single cases have been reported where minke and killer whales were bycaught in pelagic trawl fisheries. Mandatory reporting has been implemented in the Faroes for all vessels above 15 GRT, but not vessels below that size. The SC also noted that fishery effort for mackerel has increased in recent years.

Zabavnikov reported that there is some by-catch of marine mammals from crab fisheries in the Barents Sea, with entanglements of large whales in the gear. Finalised estimates are not yet available, but PINRO plans to organize monitoring effort for next year in the Barents Sea.

6.1.1.1. Update on plans for WG

At last year's meeting, the SC discussed organizing a By-catch WG to look at all by-catch information available in NAMMCO.

The ICES WGBYC (Working Group on By-catch of Protected Species) considers several methods for collecting by-catch data as being reliable, although those have not been implemented at an effort level sufficient to produce reliable data for the assessment of the by-catch pressure in European waters (e.g., ICES 2010ab, 2012). The SC noted that the Norwegian reference fleet method is one of the methods for obtaining by-catch estimates. Others are using observers and remote electronic monitoring.

The SC agreed that the by-catch issue should not be fully handed over to the ICES WGBYC, and that the NAMMCO SC By-catch WG should have an initial meeting soon, then consider a joint meeting with the ICES WGBYC. The NAMMCO SC By-catch WG should include Mikkelsen and Gunnlaugsson from the SC, and Arne Bjørge (from Norway), and should incorporate members from outside the marine mammals sphere and the SC (e.g. fishery experts) and outside NAMMCO.

6.2. Multispecies approaches to management (R- 1.2.1, 1.2.2)

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

6.3. Economic aspects of marine mammal-fisheries interactions (*New Request- R-1.4.7*)

R-1.4.7 (NEW): *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 European MAREFRAME project includes several components addressing marine mammal fisheries interactions. These include research on interactions between cod and common minke whales in Icelandic waters and between cod and seals off Scotland. The MAREFRAME project is scheduled to be concluded in 2017, after which the SC will review the result as requested by the Council.

6.4. Environmental issues (*no active requests*)

Barents and Norwegian Seas

Haug and Vikingsson reported from recent research on whales and seals in the North Atlantic: Climate warming may both enhance northward expansion of temperate species from lower latitudes and change the distribution of resident species at higher latitudes. This may present challenges both for newcomers and residents. Cod abundance has increased, and its range has extended northwards in the Barents Sea in recent years. One implication of this is a new overlap of feeding grounds with harp seals and minke whales, two other important top predators in the area. Bogstad et al. (2015) demonstrate that both these mammal species have exhibited declines in body condition in recent years, and competition for food with the increasing cod stock is suggested as a possible explanation. Significant changes in the distribution and abundance of several cetacean species during recent decades has been shown both in Icelandic and adjacent waters (Víkingsson et al. 2015) and in the Norwegian Sea (Nøttestad et al. 2015). Both papers illustrate that whale species have the capability to rapidly perform shifts in distribution and abundance patterns strongly associated with adaptive search behaviour in relation to both changing levels of abundance of their prey and increased sea surface temperatures.

Furthermore, Haug reported on a study based on data from the joint Norwegian-Russian ecosystem surveys in the Barents Sea (Ressler et al. 2015). In comparing acoustic surveys of krill with observed distribution of minke, fin and humpback whales, the authors tested the hypothesis that these animals aggregated where krill were abundant. Fin whale densities were positively and linearly associated with krill abundance, and higher than average densities of humpback whales were found in areas with high krill abundance. No association was found between minke whales and krill. Densities of all 3 whale species were also positively associated with capelin, another target species of the ecosystem surveys. For fin and humpback whales, the effects of capelin and krill on whale densities appeared to be principally separate and additive, although there was some evidence for a stronger effect of krill at low capelin densities. In terms of their preference for krill and capelin, these whale species appeared to be flexible, opportunistic predators.

Changes in Icelandic waters

Vikingsson et al. (2015) was discussed by the SC. During the last two decades, substantial increases in sea temperature and salinity have been reported in Icelandic waters. Concurrently, pronounced changes have occurred in the distribution of several fish species and euphausiids. The distribution and abundance of cetaceans in the Central and Eastern North Atlantic have been monitored regularly since 1987. Significant changes in the distribution and abundance of several cetacean species have occurred in this time period. The abundance of Central North Atlantic humpback and fin whales has increased from around 2,000 to 12,000 and 15,000 to 21,000, respectively, in the period 1987-2007. In contrast, the abundance of minke whales on the Icelandic continental shelf decreased from around 44,000 in 2001 to 20,000 in 2007 and 10,000 in 2009. The increase in fin whale abundance was accompanied by expansion of distribution into the deep waters of the Irminger Sea. In 2014 there was a prominent shift in catch distribution of fin whales compared to all previous years. The distribution of the endangered blue whale has shifted northwards in this period. The habitat selection of fin whales was analysed with respect to physical variables (temperature, depth, salinity) using a generalized additive model, and the results suggest that abundance was influenced by an interaction between the physical variables depth and distance to the 2000m isobaths, but also by sea surface temperature (SST) and sea surface height (SSH). However, environmental data generally act as proxies of other variables, to which the whales respond directly.

Overall, these changes in cetacean distribution and abundance may be a functional feeding response of the cetacean species to physical and biological changes in the marine environment, including decreased abundance of euphausiids, a northward shift in summer distribution of capelin and a crash in the abundance of sand eel. The latter two are suspected to be the primary cause of the recent shift in distribution of common minke whales away from Icelandic coastal waters. Continued monitoring of the distribution and abundance of cetaceans is essential for conservation and management of the cetacean populations and as a part of wider studies of ongoing changes in the ecosystem.

Future work

Haug and Zabavnikov reported that a high priority part of the planned Joint Norwegian-Russian Research Program on Harp Seal Ecology is to deploy satellite transmitters on harp seals in the White Sea. In all the years 2007-2011 it was planned to do this in a joint Russian-Norwegian effort just after the moulting period (in late May), or, alternatively, in late March – early April if ice conditions turns out to be unfavourable in early May. Unfortunately, the Federal Technical Committee (FTC) did not permit satellite tagging using non-Russian tags in Russian waters in all years. In 2012-2015, however, permission to tag harp seals in the White Sea was given by the Russian Authorities, but a lack of funding (2012-2014) and lack of ice (2015) prevented tagging of seals. In 2016 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 2016. IMR, Norway will, as before, be responsible for the satellite tags, including providing all necessary technical details, as well as for providing experienced personnel and equipment for anaesthetizing seals and tag deployment. For proper planning and budgeting on both institutes, PINRO scientist must obtain the necessary permissions from Russian authorities before December 2015. 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 2016 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.

Discussion

Haug noted that Norway and Russia had planned to tag harp seals this year but ice conditions in the White Sea were not good and they will attempt tagging again in 2016. They have also applied for money to tag harp seals in the Greenland Sea. One main aim of the planned tagging experiments is to explore potential explanations for the observed decreases in blubber thickness, feeding areas and migration routes.

The SC discussed whether any change in female reproductive rates in minke whales had been observed. Øien noted that the data might be available as pregnancies and size of whales are reported by the whalers in the logbook, but age class of whales are not available.

Sandeels used to be main prey item minke whales, and the segment of the population that remains in Iceland is now feeding mainly on gadoids and herring. There is some indication in decrease in body condition for minke whales, but no data is available after 2007. The minke whalers are sampling but the total catch in recent years has been low (about 20) and from a single location near Reykjavik.

6.5. Other (*no active requests*)

Disturbance Symposium

The Symposium organized by NAMMCO, *Impacts of Human Disturbance on Arctic Marine Mammals, with a focus on narwhal, beluga, and walrus*, was held 13-15 October in Copenhagen. The Symposium was attended by about 45 people and there were 25 presentations on narwhal, belugas, walrus, bowhead whales, harbour seals and humpback whales.

The full report from the Symposium is not available yet, as the time between the Symposium and the SC meeting was short. Prewitt will work on finalising the report with the Chair, Kit Kovacs, and SC Convenor, Mads Peter Heide-Jørgensen, which will be available to Council at the meeting in February, and for the SC to fully discuss at next year's SC meeting. However, Heide-Jørgensen informed the SC about a few key issues of concern.

A mining project – the *Mary River Project* operated by *Baffinland Iron Mines Corp.* – currently under development in the Canadian Arctic attracted special interest at the symposium. The mining will take place on land and is by itself not a concern for the marine environment; however the plan to ship up to 12 million tons of iron ore from Northern Baffin Island to European processing facilities is of concern.

Initial approval was obtained in December 2012 for shipping 18 million tons of iron ore from a port in northern Foxe Basin through Hudson Strait. But due to the high costs of this operation approval was obtained in 2014 for shipping a smaller amount (4.2 mill tons) of iron ore from Milne Inlet on the east coast of Baffin Island through Baffin Bay during the open water season. A new alternative proposal has been prepared involving shipment of 12 million tons iron ore through Eclipse Sound and Baffin Bay for 10 months including winter icebreaking in the Baffin Bay.

The area in Milne Inlet that is planned to be the port of the ore shipping activity is located at one of the most important summering grounds for narwhals. Narwhals are known to be skittish, highly sensitive to human activities and easily disturbed by approaching boats, even in areas without hunting. Studies at the ice edge in Lancaster Sound have demonstrated that narwhals react at long distances to underwater noise from vessels, with and without icebreaking (Finley et al. 1990). The risk is that the narwhals may abandon the summering ground in Milne Inlet with unpredictable consequences for the population.

Of even larger concern is the prospect of year-round shipping through the heavy pack ice in Baffin Bay. Large numbers of marine mammals rely on the quiet pack-ice environment during winter. Bowhead whales are crossing Baffin Bay both in early winter and in spring where they congregate just outside the entrance to Eclipse Sound, the main shipping area for the iron ore transportation. Belugas also seasonally cross Baffin Bay and in winter they are found in large numbers in West Greenland precisely in the shipping lane. Narwhals from all of the Baffin Bay populations winter in various areas of Baffin Bay over deep water or along the West Greenland where they forage for most of their annual food intake. Shipping in these areas will not only create unprecedented underwater noise in otherwise very quiet environments, but it will also create artificial ice-free channels that may be used by several species of marine mammals with likely detrimental consequences. Among the seals, the ringed seal is perhaps the most abundant species in the pack ice and they are suspected to have a large numbers breeding population in the pack ice.

Other industrial activities that were addressed at the symposium as being particularly important as disturbance factors for marine mammals were seismic exploration in Canada, and West and East Greenland. Migrating narwhals were identified as being particularly sensitive to these activities, but it was also noted that information was missing about safe operational distances to narwhal congregations and how conflicts with narwhal populations could be avoided by areal and seasonal closure of seismic operations.

The SC **draws the attention** of the NAMMCO Council to the potentially severe consequences of these projects. The SC noted that these industrial activities will also likely have impacts on the hunting of these species, and could affect the advice that is given by this SC.

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

7.1. Harp Seal

7.1.1. Review 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*

7.1.2. Update

New advice for the White Sea / Barents Sea stock

Haug and Zabavnikov reported from the recent WGHARP meeting (ICES 2014) that PINRO had been assessing the White Sea pup production using multi-spectral aerial surveys since 1998. Surveys flown during 1998-2003 produced pup production estimates that ranged from 287,000 to 340,000. Subsequent surveys indicated a significant reduction in pup production. The reasons for the decline starting in 2004 are not known, although one hypothesis is that there was a decline in fecundity as a result of an increase in percentage of barren females and/or increase in the age of maturity. Results from an aerial survey flown in 2013 gave an estimated pup production of 128,786 (95% CI 98,188 to 159,364).

The population assessment model used for the White Sea/Barents Sea harp seal population provided a poor fit to the pup production survey data. Nevertheless, ICES has decided to continue to use the model which estimated a total 2015 abundance of 1,368,200 (95% C.I. 1,266,300 – 1,509,378). The modelled total population indicates that the abundance decreased from 1946 to the early 1960s, but has generally increased since then. Based on current data availability, the Barents Sea / White Sea harp seal population is considered to be "data poor" (fertility data used in modelling is older than 5 years). The equilibrium catch level is 19 200 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), in 2015 and subsequent years. The PBR removals are estimated to be 33,500 (14% pups) seals. This catch option indicates a 23% reduction of the 1+ population over the next 15 year period. Despite the fact that this population is now classified as data poor, ICES expressed concerns over the high removals and declining population resulting from the PBR estimations, and concluded that the estimated equilibrium catches were the most preferred option.

Use of drones in pup production surveys
The use of traditional photo aircrafts to assess seal populations in remote areas, such as the West Ice, is expensive, and has also become more difficult to operate during recent years. Haug reported that IMR, with funding from the Norwegian Research Council (NRC), has now started experiments with alternative (and cheaper) methods to perform photo-based aerial surveys of seals in the West Ice. Two research surveys have been carried out to the West Ice, the first in March 2014 using KV *Svalbard*, the second in March 2015 using MS *Bjørkhaug*. The aim of the surveys was to test the usefulness of UAVs (Unmanned Aerial Vehicles), operated by the Northern Research Institute (Norut), to perform aerial photographic surveys of harp and hooded seal whelping patches on the drift ice. Two drones were tested: One small (wingspan 2.10 m) with electromotor and one larger (wingspan 3.80 m) petrol-driven UAV. Digital cameras were used, and the largest UAV was also instrumented with thermal infrared (IR) camera. Both aircrafts were launched by a mechanical launcher from the ship deck. The smaller UAV could be landed on KV Svalbard's helicopter platform, while the larger had to be landed on ice floes, preferably at least 80 m long and 20 m wide. Both UAVs fly along predefined transects and altitudes, but changes can be implemented throughout the flight using satellite-based communication. The UAVs are landed manually. The main aim of the investigations in 2014 was to explore various survey altitudes and camera settings to obtain an optimal altitude and camera set up for photographing seal pups. Simultaneous use of digital and IR cameras enabled exploration of combinations of those to detect and classify seals. Experience obtained from using the UAVs, and the quality of the images taken, were promising. Both harp and hooded seals, including pups, were easily identified on the images taken at an altitude of 300 m (the usual altitude for photographing during traditional surveys). Images from the IR camera did not improve the photo analyses. In 2015, we aimed also to test UV-cameras. Unfortunately, however, the largest UAV (including the equipment) was lost due to technical problems. The experience obtained during the two surveys show that it is necessary to develop a system that enables us to land a relative large UAV on the helicopter platform. The ice conditions in the West Ice seal whelping patches usually implies small and uneven ice floes which make it difficult to land the UAV. It is important to improve the range of the largest UAV. Also, technical improvements on the UAV and equipment are necessary in order to be able to operate in cold and windy conditions.

Manual analysis of images obtained in aerial photographic surveys is extremely time consuming and costly, and involves subjective human interpretation by trained experts. For this reason, the UAV project, also aims at developing methodology for automating the process of counting seals from aerial images. This will be achieved through the development of new image analysis and pattern recognition techniques tailored to detect seals in digital colour images. This part of the work occurs in close cooperation with the Norwegian Computing Center, Oslo.

New population model for harp seals
Haug presented Øigård and Skaug (2015) who had explored a new population model for harp seals. The population model used in current management of the Barents Sea/White Sea harp seal populations is a deterministic age-structured population dynamics model. Available fecundity data are included in the model as a known quantity and no uncertainty around the measurements has been accounted for. The scarce available data on fecundity makes the model stiff and unable to fit to variations in the observed data, and the resulting confidence intervals are likely to be underestimated. Norwegian scientists have suggested an improvement to the population model to make it more flexible in capturing the dynamics of the observed pup production data. They accounted for the temporal variation in fecundity using a state-space approach, and assumed the fecundity to be a stochastic process that was integrated with the age-structured population dynamics of the current management model. Due to the limited availability of fecundity data for the Barents Sea / White Sea population, fecundity information from the Northwest Atlantic harp seal population was used. Summary statistics for the Northwest Atlantic time-series, such as autocorrelation and variance in fecundity, were used as prior distributions in the state-space model. The state-space model was more flexible than the deterministic model and provided a tight fit to the survey pup production estimates as it captured the sudden drop in the survey estimates from 2004 and 2005. The state-space model provided a higher estimate of current population size but also a much higher associated uncertainty. The current management model predicted that the pup abundance will have a slight increase over the next 15 years, whereas the state-space model predicted that the pup abundance will increase substantially. The state-space model show some promising results and might be a step forward towards more realistic modelling of the population dynamics of the Barents Sea/White Sea harp seal population.

Harp seal population identities
Haug reported of a recent paper by Carr et al. (2015) who had studied the phylogeographic structure among the discrete transatlantic breeding areas (the White Sea, Greenland Sea, the Labrador ice Front, and Southern Gulf of St Lawrence) of harp seals. The study was based on phylogenomic analysis of highly-resolved intraspecific phylogenies obtained from complete mitochondrial DNA genomes. Analyses performed indicated that the Greenland Sea population has a markedly younger phylogenetic structure than either the White Sea population or the two Northwest Atlantic populations, which are of intermediate age and homogeneous structure. This is the first study to indicate that the White Sea and Greenland Sea populations have different population genetic histories. The analysis supports the hypothesis that harp seals comprise three genetically distinguishable breeding populations, in the White Sea, Greenland Sea, and Northwest Atlantic.

Impacts of increasing Canadian catches on Greenlandic hunt
The west Atlantic harp seal population is now estimated to be close to 8 million seals and considered to be close to the maximum population size. It is a "data-rich population" and can therefore be managed based upon ecosystem or economic considerations as long as population is above 70% of its present size. Canada had submitted a request to NAFO for WGHARP, in its 2014 meeting, to explore possible management options to reduce the Northwest Atlantic harp seal population. WGHARP examined how different scenarios of reductions of the NW Atlantic population to 5.4 million animals (from the current 7.4 million) over period of 5 or 10 years will affect the abundance of young of the year, juvenile seals and adult seals in Greenland waters and how this might affect the potential number of seals available for the Greenland hunt. To illustrate this, simulations using the NW Atlantic stock assessment model were performed.

The skin industry in Greenland is presently heavily based on young harp seals, especially young of the year (skins from adult seals are not purchased). However, with the planned management options, the Canadians may be allowed to catch close to all pups for a long period and that would exclude Greenland hunters and the Greenland skin industry from this resource.

Greenland had therefore requested the WGHARP to examine how different scenarios of reductions of the population to the N70 level, by Canadian catches, could affect the abundance of young harp seals in Greenland waters.

To answer the request the group first estimated the average number of YOY harp seals that leave the breeding area and thereby potentially can become available to Greenland hunters. The number of pups are reduced by early natural mortality and the Canadian hunt before they leave the breeding area. Taking this into account it was estimated that an average of 449,634 young of the year were leaving the breeding area annually over this 10 year period (2003–2012). This number is an average number of what potentially can be available to the Greenland hunters.

The analysis showed that if the Canadians want to reduce the population to the N70 level over a 10 year period with YOY being 90% of the catch (and if there is a density dependant regulation of the population) it can be done with a catch 900,000 seals for 5 year and 800,000 for the next 5 years. This would reduce the number of YOY for Greenland hunters to zero the first year and the runs give an availability between 18-40% of the 2003-2012 availability for the next nine years. So, a Canadian catch that reduces the population will have significant influence on the availability of YOY by Greenland hunters (and young seals in general), if the catch include a high fraction of pups. If a reduction of the population to N70 is done with YOY only consisting of 50% it will, according to the model, increase the availability of YOY for Greenland hunters. This is because a reduction of adult seals is likely to increase the number of pups born. There might be many harp seals now, but the fraction of the females that gives birth is low, but will increase with a lowering of the adult population.

This means that if sealskin prices increase, Canada can legally start a catch of YOY, which significantly will reduce the availability of young harp seals for Greenland hunters.

<u>Discussion</u>
The SC noted the results from the analysis of the effects of potential increases in Canadian catches on Greenlandic catches, and agreed that although it is unlikely that Canadian catches will increase in the near future, the situation should be monitored.

The SC discussed that the pupping patch that has been observed in south Greenland is likely part of the Greenland Sea population based on the timing of pupping.

7.1.3. <u>Future work</u>

Haug reported that the Joint ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals will meet again in August 2016 at the ICES HQ in Copenhagen, Denmark, to review the status and assess the catch potential of harp seals in the North Atlantic.

7.2. Hooded seal

7.2.1. <u>Review of active requests (R-2.1.4 , 2.1.9)</u>

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*

7.2.2. <u>Update</u>

The joint analyses of the Norwegian and Russian data on female hooded seal reproductive biology in the Greenland Sea are currently being prepared for publication.

7.2.3. <u>Future work</u>

Haug reported that the WGHARP will meet again in August 2016 at the ICES HQ in Copenhagen, Denmark, to review the status and assess the catch potential of hooded seals in the North Atlantic.

7.3. Ringed seal

7.3.1. <u>Review of active requests (R-2.3.1, 2.3.2)</u>

R-2.3.1 (ongoing): *stock identity, abundance estimate, etc.*
R-2.3.2 (ongoing): *effects of removals of ringed seals in Greenland*

7.3.2. <u>Update</u>

Greenland

Arctic Ringed seals are presently believed all to be the same subspecies (*Pusa hispida hispida*). Ongoing studies of size differences between ringed seals from different parts of the Arctic show that the ringed seals from the Ilulissat Icefjord (Kangia) in Greenland are significantly larger than other Arctic ringed seals. Ongoing telemetry studies also show that 11 out of 12 seals tagged in this fjord have been stationary (staying in the fjord). These seals also differ from other ringed seals by a somewhat different pelage pattern and significantly deeper dives than other ringed seals. It is possible that they should be regarded as a different subspecies and that they therefore should be managed separately from the other Arctic ringed seals. The plan for 2016 is to investigate possibly genetic differences from other Arctic ringed seals and survey the area for abundance of these seals in the Ilulissat Icefjord. It cannot be ruled out that this kind of ringed seal also exist in other parts of the Arctic.

<u>Discussion</u>

The SC noted that it is important that morphs/ecotypes/subspecies that are so different (and probably highly specialized to certain environmental conditions) are protected from overharvest, because a replacement by the more common ringed seals will be a great loss of diversity. A separate management plan should therefore be developed for the ringed seal in the Ilulissat Icefjord, as soon as a survey has been conducted.

The SC **recommends** that genetics sampling work continues and looks forward to seeing these results. The SC also **recommends** that a survey be conducted to obtain an abundance estimate for this population. The SC noted that with the increasing number of hunters, and with little known about this population, the hunt could have a large impact on the population quickly and Greenland should consider protection of this small population until more information is known. SC **recommends** wider research to look at whether these types of seals are more widely geographically spread.

This work will help towards responding to **R-2.3.1**.

Norway (Svalbard)

Lydersen reported from a newly published article (Hamilton et al 2015) from Svalbard on ringed seal behaviour in relation to changes in the sea ice distribution in the area. Since the first documentation of climate-warming induced declines in Arctic sea-ice, predictions have been made regarding the expected negative consequences for endemic marine mammals. But, several decades later, little hard evidence exists regarding the responses of these animals to the ongoing changes in their environment. Herein, we report the first empirical evidence of a dramatic shift in movement patterns and foraging behaviour of a keystone arctic species, the ringed seal (*Pusa hispida*), before and after a major collapse in sea-ice in Svalbard, Norway, which has shifted the summer position of the marginal ice zone from a position over the continental shelf, northward to the deep Arctic Ocean Basin. Following this change, which is thought to be a "tipping point", subadult ringed seals swam greater distances, searched more continuously showing less area-restricted search, dove for longer periods, exhibited shorter surface intervals, rested less on the sea-ice and did less sympagic diving during post-moulting foraging excursions. In combination, these behavioural changes suggest increased foraging effort and thus also likely increases in the energetic costs of finding food. Continued declines in sea-ice are likely to result in distributional changes, range reductions and population declines in this keystone arctic species.

7.3.3. <u>Future work</u>

There is continuing work in Greenland (see above).

7.3.3.1. Possible WG

In previous SC meetings, the SC suggested that a ringed seal working group could potentially be convened in the next few years, and that the SC should review the CAFF Ringed Seal report from 2014. Desportes reported that the CAFF ringed seal group is currently not active. Norway is the current co-chair of the CAFF Marine WG, and the Norwegian Polar Institute has also proposed research projects together with Americans on ice seals (including ringed seals).

The SC noted that there is still not enough information to warrant convening a NAMMCO Ringed Seal WG and recommends that this should occur after new surveys and genetics studies are completed.

7.4. Grey seal

7.4.1. <u>Review of active requests (R-2.4.2)</u>

R-2.4.2 (ongoing): *abundance estimates all areas*

7.4.2. <u>Update</u>

Norway

Haug informed that the most recent pup production estimate of grey seals in Norway is based on data obtained in 2006-2008. The management plan for coastal seals now implemented in Norway require that data used in assessments should be updated every 5 years. A boat-based visual survey aimed to obtain a new abundance estimate for the species in Norway was, therefore, started in November 2013 (covering the northernmost parts of Norway) and continued in 2014 (covering parts of mid Norway) and 2015 (covering North Norway). Some of the new estimates obtained in mid Norway were much lower than in the previous survey, and quotas were immediately reduced in these areas as a result.

<u>Discussion</u>

The quota that is given in Norway for the Tromsø/Finnmark area is higher than the usual 5% of current abundance estimate for the area because it is assumed that some animals in this area are likely from the Murman Coast. Grey seals are protected in Russia from directed catches, and there is likely no by-catches in Russia because they do not use gillnets.

Faroe Islands

Mikkelsen informed the SC that a reporting system has been implemented in the Faroes to obtain estimates of removals of grey seals in connection with salmon farming. The reportings indicated that the removals are at the level of about 100+ seals per year. The removals mainly occur in November-December and are primarily young animals.

A small amount of by-catch was previously reported in the halibut fishery, however the halibut fishery has now almost stopped.

Some seals tagged seals in Scotland (especially from the northern islands) do come to the Faroes, but they do not stay long.

Discussion

The SC is pleased that the Faroes have developed and implemented this system of reporting. The SC asked about the reliability of the reporting and Mikkelsen said that the Faroes are confident in the reporting. The SC **noted** that removal numbers are high, which is concerning, especially because the population size is unknown.

7.4.3. Future work

Norway

The current surveys, aimed to obtain a new pup production estimate for the entire Norwegian coast, will be completed in 2015. If possible, Russia and Norway will conduct a joint survey of grey seals on the Murman Coast — these grey seal colonies have not been surveyed since 1991.

Faroes

The SC commented that pup counts of grey seals are challenging because they pup in caves, however direct counts at haulout sites, perhaps using drones, should be considered for surveys. These surveys could aim to obtain, at the least, information on relative abundance.

Mikkelsen informed the SC that he would like to continue the tagging study that began in 2007/2008 with 10 tagged animals. He will look into the possibility of cooperation and funding with the aquaculture industry.

Iceland

An abundance estimate from 2012 is available, and there is a plan for a new grey seal survey in 2016 pending funding.

7.4.3.1. Coastal Seals WG (CSWG)

The CSWG (Chair: Kjell Tormod Nilssen) will meet in early March 2016. The WG will mainly address R-2.4.2 and R-2.5.2.

By February 2016, the CSWG will likely have by-catch estimates and a new complete grey seal estimate in Norway for consideration at the meeting.

The Terms of Reference for the meeting of the WG are:

1) assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway.
2) address by-catch issues in Norway, Iceland, and the Faroe Islands
3) re-evaluate the Norwegian management plans (which have been already implemented) for grey and harbour seals.

The SC **recommended** that all of the available grey seal data from the Faroes is presented to the CSWG for review. The SC **recommends** that the CSWG develops specific plans for monitoring grey seals in the Faroes, e.g., obtaining a relative series of abundance (if a full abundance estimate is not possible at this time).

The 2015 abundance estimates from Norway will be available at CSWG. The Norwegian by-catch data is being worked on currently and they hope to have the data validated in time for the CSWG.

7.5. Harbour seal

7.5.1. Review of active requests (R-2.5.2)

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

7.5.2. Update

Norway

Haug reported that aerial and boat based visual surveys aimed to obtain a new abundance estimate for harbour seals in Norway were started in 2011 and continued in 2012-2015. This has yielded a new point estimate of

7,594 for the species for the entire Norwegian coast. This new estimate is implemented in current management of the species – this management now follows the management plan reviewed by NAMMCO SC in 2011.

IMR, in collaboration with the Swedish Natural History Museum, are considering tagging harbour seals in Sweden to see if they visit Norwegian coast.

Iceland
Results from the partial survey of harbour seals in 2014 shows an appreciable decrease in abundance in the most important haul-out areas. Aerial surveys of harbour seals are planned for 2016, if funds are available.

Greenland
In Greenland a new small group of harbour seals (three mothers with pups) was documented. Only four regularly used haul-out places (with a total of less than100 seals) is presently known in Greenland. All hunting on this species was banned in 2010 and it is believed that several small remnant populations still exist, but live undetected.

Discussion
Norwegian catch is reported by hunters and is considered reliable. The quotas are precautionary so some underreporting is not considered problematic.

In Iceland, the large uncertainties in abundance and catch statistics, both direct catches and by-catches, make assessments of the present status and sustainability of removals problematic. Hence, in its advice to the government in 2015 the Marine Research Institute (MRI) declared that in the absence of new abundance estimates it was unable to evaluate whether the existing management objectives of grey seals and harbour seals are being met.

7.5.2.1. Presentation from Japan
Kitakado updated his on-going works on risk-assessment for the Kuril harbour seals in Japan and reported the current discussion process for conservation and management. The population of Kuril harbour seals off Cape Erimo in northern Japan had dramatically declined by the 1970s due to overhunting, and it had once faced with a risk of extinction. Since then, owing to protection measures, the population size has shown a steady recovery while the damage to set net fishery by the seals has also increased. Conservation of the population should of course be prioritized, but it is also necessary to develop a resource management strategy focused to achieve a balanced objective between the conservation of population and mitigation of the damage to the fishery. For this purpose, assessment works were required to know the carrying capacity and the current level of depletion of the population. Fortunately, surveys of the harbour seal population have been continuously conducted during both the breeding and moulting seasons, over a long period. Based on the observations for population indices as well as partial information on the extent of past by-catch, density-dependent age-structured production models were constructed and then the parameters were estimated through maximizing a joint likelihood function from multiple series of observations. In addition, simulation studies were conducted to evaluate possible management procedures for the population. Results of the maximum likelihood estimation showed that the models used in the analyses fitted well to the data. As the estimation result, it was found that the population level has exceeded at least 60% of the carrying capacity though the extent of recovery slightly depends on the model assumption. Regarding the future projection in the simulation study under the assumption of a stochastic stock-recruitment relationship, the population size will still increase at the rate of current level of by-catch. Also, results of risk-assessment showed that the extinction risk of the population is negligibly small unless high mass mortality events frequently happen. Given these results, the Ministry of Environment in Japan decided to remove the population from the "Threatened Category" and will develop some interim approaches, possibly including culling of animals to achieve the balance objective for the conservation and management of the Kuril harbour seals off Cape Erimo. At this moment, some simulation results showed that some future management procedures involving culling adults while avoiding unintentional by-catch of yearling animals would be effective.

The SC thanked Kitakado for this interesting presentation. In discussion the SC noted the promising and interesting use of the infrared camera for counting seals.

7.5.3. Future work

Haug reported that biopsy sampling of tissue from pups for genetic studies had been carried out on the Norwegian coast in recent years, and that genetic studies were now in progress. The aim of such studies is to assess the population structure of the species using DNA analyses.

7.5.3.1. Coastal Seals WG

As discussed above, the CSWG (Chair: Kjell Tormod Nilssen) will meet in early March 2016. The WG will mainly address R-2.4.2 and R-2.5.2.

By February 2016, the CSWG will likely have by-catch estimates and a new complete grey seal estimate in Norway for consideration at the meeting.

The Terms of Reference for the meeting will be for the WG to:

1) assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway.
2) address by-catch issues in Norway, Iceland, and the Faroe Islands
3) re-evaluate the Norwegian management plans (which have been already implemented) for grey and harbour seals.

The SC also recommended additional work for grey seals to be completed by the WG (see item 7.4.3.1).

7.6. Bearded seal

7.6.1. Update

No current work was reported.

7.6.2. Future work

No future work was noted.

7.7. Walrus

7.7.1. Review of active requests (R-2.6.3)

R-2.6.3 (ongoing): *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.*

7.7.2. Disturbance Symposium

A preliminary discussion on the results from the Symposium were discussed under item 6.5. The final report will be available to the SC for discussion at next year’s meeting.

7.7.3. Assessment Baffin Bay

Stock structure

The Greenland Institute of Natural Resources (GINR) continued the tagging of walruses in the Qaanaaq area (Baffin Bay stock) in 2015. Open water early in the season allowed for transportation to the Wolstenholme Fjord where large numbers of walruses have been detected during aerial surveys. No tagging has been attempted before in this area due to difficult logistical conditions after closure of the hamlet of Moriussaq. A total of 21 walruses were tagged with satellite transmitters in June 2015 in a collaboration with local hunters from Qaanaaq. The tracking of the walruses showed that they left the Wolstenholme Fjord during June and moved west across the North Water to the east coast of Ellesmere Island. Some walruses moved north along Ellesmere Island, some went far west into Jones Sound and 3 walruses went south of Devon Island into Lancaster Sound where they headed west to Cornwallis Island.

These new tracking data confirm that the Baffin Bay population of walruses extend far west into the Canadian high Arctic.

Abundance

The importance of the North Water polynya in Smith Sound as an overwintering area for marine mammals has been questioned. One way to address the issue is to assess the abundance of selected marine mammals that are present during winter in the North Water. Visual aerial surveys involving double observer platforms were conducted over the eastern part of the North Water polynya in April 2014. Four species of marine mammals were included in strip census estimation of abundance. Perception bias was addressed using a double-platform survey protocol, a Chapman mark-recapture estimator for whales, seals and walruses on ice, and a Mark Recapture Distance Sampling estimation technique for walruses in water. Availability bias was addressed by correcting abundance estimates by the percentage of time animals detected in water were available for detection at the surface. The resulting estimates suggested that 2,544 walruses (95% CI 1,513-4,279) wintered in the eastern part of the North Water polynya in April 2014. The walrus estimate is larger than previous summer estimates and it emphasizes the importance of the habitat along the Greenland coast as a walrus wintering ground.

Discussion of the SC
The SC **adopted** this abundance estimate for use in the updated assessment.

Catch Statistics
SC/22/18 presents data on the catch of walrus for the Baffin Bay population. Since 2007, when quotas were introduced in Greenland, catches of walrus have been reduced considerably. Throughout the years, more males than females have been caught. October is the month when most walruses are caught with almost 1/3 (32%) of total catches from the years 1993–2014. The Baffin Bay population is also harvested in the Canadian High Arctic and it is recommended that catches from these areas are included in the catch history.

In this catch history, catches from Upernavik were separated out from the Baffin Bay stock.

Discussion of the SC
The catches in this paper are not corrected for struck and lost. The SC **reiterated the previous recommendation** that Greenland provide information on struck and lost in walruses.

The SC **noted** that in Greenland there are 2 different reporting schemes for quota versus no-quota animals (*Piniarneq* and *Særmeldingsskema*). There are inconsistencies between the numbers that are reported, which creates problems when attempting to determine which numbers are accurate. For any assessment, the SC noted that it is important to obtain accurate removals. It is important to know whether the smaller numbers in *Piniarneq* reflects a general underreporting for all species in this system, as some marine mammal species are only reported under this system. The SC therefore **recommended** that Greenland should streamline their reporting system, and also conduct a study to investigate why the numbers are different between the reporting schemes.

There are Canadian catches included for up until 2011. The SC **noted** that although this is a shared stock, there is no formal agreement on sharing of information between Canada and Greenland for walruses.

Assessment
SC/22/16 used the new abundance estimate and the updated catch history to update the assessment for Baffin Bay walruses. It used the Bayesian model that has been used by NAMMCO WGs in past assessments of walrus, beluga and narwhal, with the prior distributions on the biological parameters being those of the 2013 assessment of walrus.

Estimates of animals that were struck and loss were added to the catch history of landed catches. A field study in the area in 1977/78 estimated loss rates between 15% and 25% from 34 hunts with a total of 112 landed animals (Born and Kristensen 1981), and more recent estimates by hunters indicate much lower loss rates of no more than five percent (APNN 2014; Born unpublished). The assessment used the span of these estimates as a uniform prior from a low catch history with a loss rate of 5%, to a high catch history with a loss rate of 25%. The sex ratio in the major part of the catch history was assumed to be even, except for catches after 2007 where gender identification by hunters estimated an average fraction of 34% females.

The analysis included also age estimates for 376 animals that were landed in Qaanaaq from 1987 to 1991. The fit of models to the age data showed an under-representation of animals younger than ten years, in agreement with a hunt that takes mainly adult animals.

The magnitude of the decline in the Baffin Bay stock caused by historical catches is unclear due to incomplete catch reporting, but four different models showed an initial decline until around 2005, and an increasing population thereafter, reflecting a decline in the annual landed catches from about 150 from 1999 to 2003, to about 80 from 2004 to 2008.

An exponential model estimated a stock that declined from 3,120 (90% CI: 2,640-3,730) animals in 1960, to 1,410 (90% CI: 1,220-1,670) in 2006, and then increased to 1,820 (90% CI: 1,420-2,330) in 2015. The models that were fitted to the age data showed a relatively precise estimate of the annual growth rate to about 7.9% (90% CI: 6.5-9.3%), while an exponential model with no age data had a much less precise estimate of the growth rate (7.1%; 90% CI: 3.9-10%).

While there are no reasons to question the growth rate estimate from the age data, the SC noted that these data are almost 30 years old, and the growth may thus no longer apply. It was therefore decided to use the exponential model with no age data for the management advice. This model that relied only on the trend in the three estimates of spring abundance from 2009 to 2014, provided a better reflection of the uncertainty on the present growth in the population.

The SC noted also that the Greenlandic quota for the area is given in terms of landed animals, assuming a loss rate of no more than 3%. But with the upper end of the loss rate in the assessment being based on data from the area, the SC found that an assumed loss rate of 3% was unrealistically low. It was therefore decided to give the advice in terms of landed animals with the point estimate of the loss rate (14.4%) from the assessment subtracted from the total removal. This provides the estimated trade-off in Table 1 between the annual landed catches and the probability of an increase in the population from 2016 to 2020, with an annual catch of 92 walruses being recommended as the maximum take that will allow a 70% chance of increase during this time period.

The recommended annual take of 92 walruses includes the Canadian catches in the high arctic. With the average annual take in three locations in Canada (Grise Fjord, Craig Harbour and Resolute Bay) being seven from 2007 to 2011, and the SC therefore **recommended** that no more than 85 walruses are landed annually in Qaanaaq from 2016 to 2020.

Table 1: The estimated probabilities of increase in the Baffin Bay stock of walrus from 2016 to 2020 given a range of annual landed catches (total landings in Qaanaaq and the Canadian High Arctic).

Probability	0.70	0.75	0.80	0.85	0.90	0.95
Catch	92	86	80	73	66	57

Discussion of SC

SC **recommended** that NAMMCO request the Canadian catch data. The SC also **recommended** a new survey in the North Water Polyna (NOW; Baffin Bay stock) area as a means of monitoring this population. The SC also **recommends** that new age data and struck and lost data be obtained from both Canada and Greenland.

7.7.4. Update

The SC **noted** that the abandoned village in Greenland used as a field camp in the tagging study (Moriussaq) did not have many walruses present when it was habited. However, after it was abandoned, walruses are moving into the area, suggesting that the presence of humans affects walrus distribution.

Lydersen presented information on tagging walruses in Svalbard. Their research group have also trained Russian researchers on their tagging techniques and they conducted similar tagging work in the Pechora Sea.

Genetics studies on walruses in the Pechora Sea indicate that they are similar to the Svalbard-Franz Josef Land walruses. This would mean that the abundance of the Svalbard-Franz Josef Land walrus population is larger than previously thought.

8. CETACEANS STOCKS - STATUS AND ADVICE TO THE COUNCIL

8.1. Fin whale

8.1.1. Review of active requests (R-3.1.7, 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 NASS2015 for all large baleen whales in West Greenland waters*

R-3.1.7 amended (ongoing): *complete an assessment of fin whales in the North Atlantic and also to include an estimation of sustainable catch levels in the Central North Atlantic.* ***NEW AMENDMENT****:* "While long-term advice based on the outcome of the RMP Implementation Reviews (with 0.60 tuning level) is desirable, shorter term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015."

8.1.2. Large Whale Assessment WG (see ANNEX 1)

In 2008 the NAMMCO SC was requested to complete an assessment of fin whales in the North Atlantic, and also to include an estimation of sustainable catch levels in the Central North Atlantic. In 2014 the Council endorsed an amendment to the request to include the following additional text: "While long-term advice based on the outcome of the RMP *Implementation Reviews* (with 0.60 tuning level) is desirable, shorter term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015."

The relevant areas for the current management advice are EG (East Greenland) and WI (West Iceland), since all Icelandic whaling for fin whales takes place in these areas. The WG received in its meeting results from calculations based on the IWC RMP with 0.60 tuning, and which provides catch limits for North Atlantic fin whaling in these areas. Based on these calculations the WG **recommends** that a catch limit of 146 fin whales for fin whales that can be taken anywhere in the EG+WI region is safe and precautionary, and that this advice should be considered valid for a maximum of 2 years (2016 and 2017). This is interim advice because the most recent abundance estimate is from 2007, and the WG reiterated its previous recommendation that 10 years was the longest period the approach applied could be used without a new abundance estimate becoming available. The WG also recognized that a survey had been carried out this past summer (2015), and by this time next year a further agreed abundance estimate should be available.

The IWC *Implementation Simulation Trials* for North Atlantic fin whales are ongoing and an IWC workshop has been tentatively scheduled for February 2016 to complete these trials. Completion of the IWC's work will be informative for long-term advice; however the WG recognizes that this IWC work has been postponed in the past, and issues may yet arise that again delay completion of this work.

Discussion

The SC **agreed** with the conclusions of the WG that a catch limit of 146 fin whales for fin whales that can be taken anywhere in the EG+WI region is safe and precautionary, and that this advice should be considered valid for a maximum of 2 years (2016 and 2017).

In addition to the abundance estimate being close to 10 years old, this is also an interim advice in accordance with the Council's request due to delays in the IWC RMP *Implementation Review* of North Atlantic fin whales. This review is scheduled to be completed in June 2016 after which the NAMMCO SC will provide a long-term advice as requested by the Council.

8.1.3. Update

Lydersen reported from a new program on fin and blue whales in the Svalbard area, which involved satellite tracking and collection of biopsies for studies of genetics, diet, and ecotoxicology.

8.1.4. Future work

The SC **encouraged** collaborative genetic research led by Iceland aimed at identifying close kin relationships within the North Atlantic and urged member nations to participate by supplying samples.

8.2. Humpback whale

8.2.1. Review 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 NASS2015 for all large baleen whales in West Greenland waters*

R-3.2.4 (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.*

8.2.2. Update

Large Whale Assessment WG (see ANNEX 1)

The NAMMCO SC last reviewed the status of the West Greenland humpback whales in 2010. At that time, the SC applied the "interim SLA" to the most recent abundance estimate from 2007 to conclude that an annual catch of 20 whales was safe, and that this level of catch would allow the population to increase. Management advice for humpback whales off West Greenland has been provided by the IWC SC, which agreed on a final AWMP *SLA* for this stock in 2014. The NAMMCO WG endorsed this *SLA* as the best current basis for providing management advice for West Greenland humpback whales, as well as the current advice of up to 10 strikes per year requested by Greenland (within the IWC system) as being safe. The WG discussed but did not come to a conclusion on whether NAMMCO should consider the impact that the IWC's *Needs Statement* has on the quotas given by the *SLA*, considering that it is a component of the *SLA* procedure.

This advice applies up to and including 2017, and with an expected new abundance estimate from the NASS2015, a new calculation by the IWC *SLA* to provide advice should be straightforward.

Discussion of the SC

Based on the work of the WG, the SC **endorsed** the advice of 10 strikes per year based on the SLA that was accepted by the IWC, and noted that a higher number may be sustainable.

The SC noted that **R-1.7.12** was not considered yet as the abundance estimate from NASS2015 is not yet available.

Satellite Tagging in Iceland

Víkingsson presented a summary of satellite tagging of humpback whales by the MRI. Since 2007, 21 humpback whales have been instrumented with satellite tags in Icelandic waters. These experiments have revealed local movements in Icelandic coastal waters and information on migration patterns during autumn and winter. Five humpback whales were tracked southwards out of Icelandic waters. One of these started migration in late November and the other four in January and February. Four of these tracks represent only partial migration routes. However, in 2014/2015 the migration of one humpback whale was followed between North Icelandic waters and Silver Bank off the coast of the Dominican Republic. This is the first documentation of a complete migration track of a baleen whale between feeding and breeding grounds in the North Atlantic.

The SC complemented Vikingsson on this work.

8.2.3. Future work

A new humpback whale abundance estimate is expected for Greenland from the NASS2015.

8.3. Minke whale

8.3.1. Review of active requests (R-3.3.4, 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 NASS2015 for all large baleen whales in West Greenland waters*

R-3.3.4 amended(ongoing): *full assessment, including long-term sustainability of catches, of common minke whales in the Central North Atlantic… assess the short-term (2-5 year) effects of the following total annual catches: 0, 100, 200 and 400*

8.3.2. Update

Large Whale Assessment Working Group (see ANNEX 1)

At NAMMCO/23, Council adopted an amendment to **R-3.3.4**: "The SC is requested to complete assessments of common minke whales in the North Atlantic and include estimation of sustainable catch levels in the Central North Atlantic. While long-term advice based on the outcome of the RMP *Implementation Reviews* (with 0.60 tuning levels) is desirable, a shorter-term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015."

The IWC *Implementation Review* is not formally completed, but both the stock structure and the abundances in the central and north-east Atlantic were agreed in the IWC SC meeting in 2014. The genetic work suggests a single oceanwide stock with incomplete mixing. In a management context in the IWC SC it has been decided to operate with three stocks at a *Medium Area* level, i.e., a Western (W), Central (C) and Eastern (E) stock (Fig. 1). The IWC SC also decided to merge many of the *Small Areas* within each of these *Medium Areas*. The NAMMCO WG endorses the single-stock hypothesis and the use of the W, C and E Management Areas in the future.

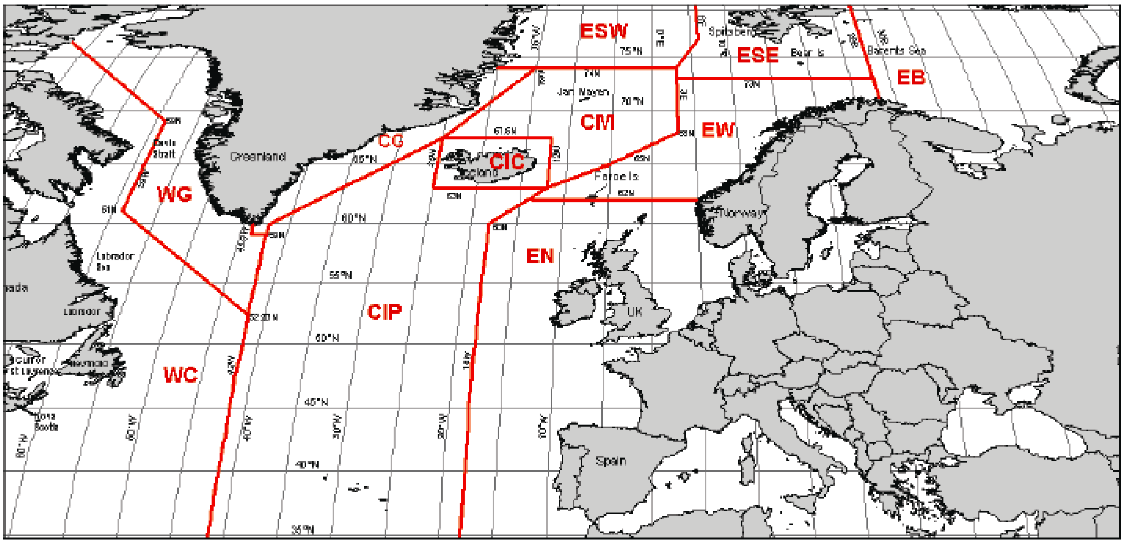


Fig. 1. Map of the North Atlantic showing the *sub-areas* defined for the North Atlantic common minke whales.

However, for the present assessment and interim management advice the WG have decided to give separate advice for the CIC (Iceland coast), CM (Jan Mayen), and CG (East Greenland) IWC *Small Areas*. The main reasons for this decision are that different information on abundance is available for each of these *Small Areas*, and that each supports a separate whaling operation. Icelandic minke whaling takes place in the CIC, Greenlandic minke whaling off East Greenland takes place in CG, and some Norwegian whaling for minke whales previously used to take place in CM.

The WG considered that the existing results from the IWC *Implementation Simulation Trials* provide an up-to-date and reasonably robust indication of the current status of common minke whales in the North Atlantic. The results indicate that these populations have either:

i) never been substantially reduced below their pre-exploitation levels, or
ii) been earlier reduced by no more than about 50%, but recently have been increasing.

Hence these assessments do not indicate any reason for concern about the status of common any reason for concern about the status of common minke whales in the North Atlantic.

<u>Management advice</u>

West "Medium area"

The current IWC management advice for West Greenland common minke whales (164 per year) is based on the interim AWMP procedure applied to the 2007 estimate of 16,100 (CV: 0.43) common minke whales off West Greenland. The IWC advice for the next block quota starting in 2018 is planned to be based a management procedure that has not yet been established, but is planned to be developed from the trial structure of the ongoing RMP *Implementation Review*.

Central "Medium Area"
The NAMMCO SC previously agreed that implementation of the IWC RMP to calculate catch limits provided an appropriate basis to address the Council's requests for assessments and advice. This year the WG received calculations for the CIC *Small Area*, based on the RMP CLA with tuning level of 0.60. Based on these results the WG recommended that a catch limit of 224 common minke whales in the CIC *sub-area* is safe and precautionary, and that this advice should be considered valid for a maximum of 3 years (2016 – 2018). This is interim advice because the most recent abundance estimate is from 2009, and the WG reiterated its previous recommendation that 10 years is the longest period the approach applied could be used without a new abundance estimate becoming available. The WG would prefer to apply the CLA to the whole Central *Medium Area*, but the most recent abundance survey was that in 2009 which covered only the CIC *sub-area*. To apply the RMP at the *Medium Area* level would mean that the most recent abundance estimate for that whole region is from 2007, and so already almost 10 years old.

It should be noted that the catches in the CIC *sub-area* have in recent years been a small fraction of the total allowable catch, and although catch limits have been allocated to the CM *Small Area* using the IWC RMP with 0.60 tuning, no whales have been taken there in recent years (since 2011).

The management advice for East Greenland has been developed in the IWC SC standing WG on the AWMP.

The WG noted that a new abundance estimate is needed for the whole Central *Medium Area*.

East "Medium Area"
For the IWC East *Medium Area the* IWC-SC agreed the abundance estimates (mid time point 2011) in 2014, and agreed that the genetic data showed that all common minke whales in this *Medium Area* could be regarded as belonging to one stock. For precautionary reasons the IWC-SC agreed that the EN *Small Area* should continue to be regarded as a *Small Area*, but that the *Small Areas* EW, EB and ES should be combined in a new *Small Area*. The IWC-SC *Implementation Simulation Trials* for the North Atlantic Central and East *Medium Areas* showed acceptable performance for this structure. For these reasons management advice for common minke whales in the next six year period from 2016 for the East *Medium Area* should be based on the 2011 abundance estimates using RMP with tuning level 0.60 and with *catch cascading* between the two remaining *sub-areas*.

Discussion
The SC **agreed** with conclusions and **endorsed** the advice provided by the WG that a catch limit of 224 common minke whales in the CIC *sub-area* is safe and precautionary, and that this advice should be considered valid for a maximum of 3 years (2016 – 2018). In addition to the abundance estimate being close to 10 years old, the advice provided for the Icelandic minke whale operation is interim in accordance with the Council's request necessitated by delays in the IWC RMP implementation review of North Atlantic common minke whales. This review is scheduled to be completed in June 2016 after which the NAMMCO SC will provide a long-term advice as requested by the Council.

The SC noted that since the resumption of commercial whaling in 2006, catches have been much lower than the issued quota levels. While the size of the domestic market is likely the largest causative factor, unusually low catches in the most recent years is mainly due to a combination of low densities of common minke whales off southwest Iceland, unfavourable weather conditions and logistical constraints for distance from whaling grounds to the single processing plant.

8.3.3. Future work
New abundance estimates will be developed from the shipboard survey from the results of NASS2015. However, unusually unfavourable weather conditions seriously affected the aerial survey in coastal Icelandic waters. Thus, only 37% of the planned survey coverage was realized, the lowest of the 6 surveys attempted since 1987. The realized survey effort was almost confined to the western and southern parts of the survey area. Therefore, it is clear that the data collected are insufficient for any realistic abundance estimation for the

Icelandic continental shelf area (CIC) as a whole. A funding proposal has been submitted for a repeat of this aerial survey in the summer of 2016. The outcome of this funding request is expected in early 2016.

8.4. Beluga

8.4.1. Review 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 22*

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

8.4.2. JCNB/NAMMCO WG report

The JCNB/NAMMCO Joint WG (JWG) met in Ottawa, Canada, 11-13 March 2015 (ANNEX 2).

Catches

The historical catches of beluga in West Greenland from 1954 to 1998 were updated for underreporting and animals struck and lost, with the estimated total historical takes being on average 28% larger than the reported catches. All catches are assumed taken from the Somerset Island summering stock and all the catches in West Greenland are presumably taken from the fraction of that stock that winters in West Greenland. The exception is the winter catches in Qaanaaq (approx. 5% of annual catches in Qaanaaq) that likely are taken from the fraction that winter in the North Water. It is unknown which stock is supplying the summer hunt in Qaanaaq (approx. 15% of annual catches in Qaanaaq). A few confirmed catches (and sightings) of belugas have been recently been report from East Greenland.

In 2013 there were higher catches than usual in Upernavik. The reason for this is not known, but one potential cause could be seismic activities in 2013. Seismic activities could have driven the whales closer to shore, making them more susceptible to hunting. It is known that belugas are easily scared into the coast, and also that the migration patterns of belugas are potentially affected by seismic activities.

Under-reporting of catches remains a potential problem, and this is problematic as no straightforward correction is possible.

Abundance

The JWG agreed on a new abundance estimate of 9,072 (CV=0.32, CI: 4,895-16,450) beluga off West Greenland in March-April 2012.

The largest abundance of whales was found at the northern part of Store Hellefiske Bank, at the eastern edge of the Baffin Bay pack ice, a pattern similar to that found in nine systematic surveys conducted since 1981. A clear relationship between decreasing sea-ice cover and increasing offshore distance of beluga sightings was established from all previous surveys, suggesting that belugas expand their distribution westward as new open water areas on the banks of West Greenland open up earlier in spring with reduced sea-ice coverage or early annual ice recession.

Assessment update

The assessment of the winter aggregation off West Greenland was updated with the new abundance estimate and the updated catch history. It estimated a decline (Fig. 2) from 19,140 (90% CI:12,680-28,260) individuals in 1970 to a maximal depletion of 8,130 (90% CI:5,740-11,440) in 2004, and an increase to 11,420 (90% CI:6,370-17,850) in 2020 (assuming yearly post 2014 catches of 294). The predicted change from a declining to an increasing population was caused by the introduction of quotas in Greenland, with annual catches in the order of 500 to 700 reduced to less than 200 after 2004.

Advice

Reiteration of Past Advice

The JWG **reiterate**d the previous advice from 2005 and 2012 about seasonal closures. The following seasonal closures are **recommended**:

- Northern (Uummannaq, Upernavik and Qaanaaq): June through August

- Central (Disko Bay): June through October
- Southern (South of Kangaatsiaq): May through October.
- For the area south of 65°N, it is recommended that no harvesting of beluga be allowed at any time.

The function of these closures is to protect the few animals that may remain from historical summer aggregations in Greenland, and to allow for the possibility of reestablishment of the aggregations.

No specific advice was given on the North Water, noting that the removals remain at a low level relative to the population size derived from the 2009-2010 and 2014 surveys in the North Water and around Somerset Island in 1996, and assuming that future catches remain at low levels.

New Advice

With the new abundance estimate for 2012, the JWG **recommends** that the total annual removal of beluga in West Greenland in no more than 320 over period from 2016 to 2020 (Table 2).

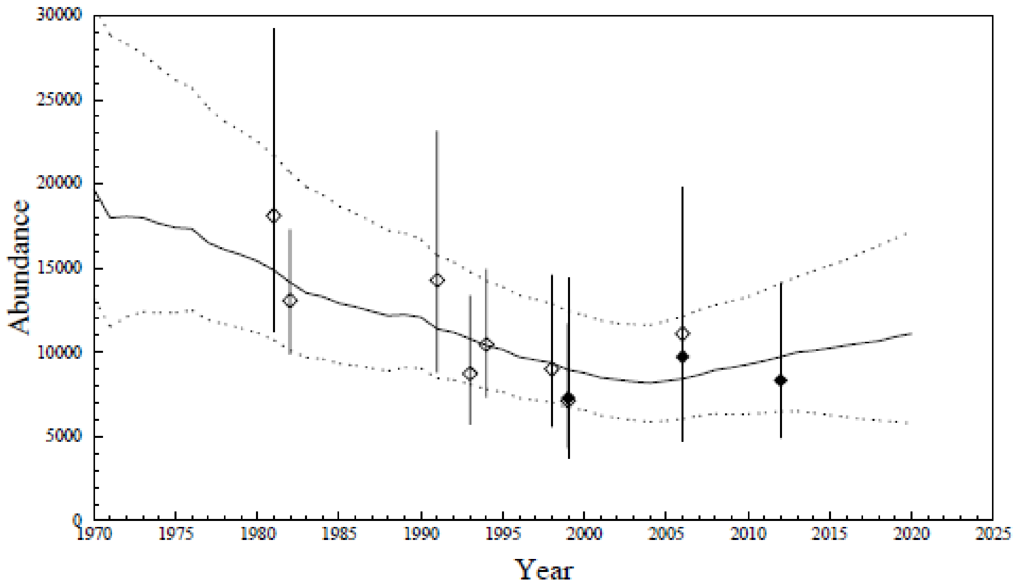
Discussion

The SC **agreed** with the advice and recommendations of the JWG.

Table 2. Beluga in West Greenland. The estimated trade-off between the total annual removal and the probability (P) of an increase in the number of beluga that winters off West Greenland over the period from 2016 to 2020.

P	**0.70**	**0.75**	**0.80**	**0.85**	**0.90**	**0.95**
West Greenland	320	290	260	225	195	145

Fig 2. The estimated dynamics (curves) of the aggregation of belugas that winter off West Greenland, together with the abundance estimates from aerial surveys (absolute estimates solid diamonds; relative estimates open diamonds). The bars and dotted curves show the 90% confidence interval.



8.4.3. **Disturbance Symposium**

The preliminary findings from the Disturbance Symposium were discussed under agenda item 6.5. The finalized report will be available for discussion at the next SC meeting in 2016.

8.4.4. <u>Update</u>

Studies of beluga whales in Svalbard continue, and have received new funding for three more years. It involves satellite tracking and collection of skin, blubber and blood samples for a large suite of studies. In 2015, only two animals were caught and instrumented.

8.4.5. <u>Future work</u>

No future work was discussed.

8.4.5.1. JCNB/NAMMCO JWG meeting- spring 2016

Greenland will likely not have any new information to present to the JWG until 2017, and it will be important for the Canadians to provide new abundance estimates and catch history information before the next meeting. From the NAMMCO perspective, the SC **recommends** waiting until 2017, but recognizes that scheduling a meeting is up to the discretion of the NAMMCO and JCNB JWG Chairs.

8.4.5.2. Global review of monodontids

Prewitt informed the SC that the planning for the NAMMCO organised *Global Review of Monodontids* meeting is continuing. The meeting will be held in conjunction (either immediately before or after) with the Marine Mammals of the Holarctic, which recently announced the location and dates of the meeting: 17-21 October 2016 in Astrakhan, Russia.

The organising committee consists of Arne Bjørge (Chair, Norway), Jill Prewitt (NAMMCO), Robert Suydam (North Slope Borough, Alaska, USA), Roderick Hobbs (USA), Steve Ferguson (Canada), Randy Reeves (Canada), Rikke Hansen (Greenland), and Olga Shpak (Russia).

The SC suggested that the organizers inquire whether the Arctic Council's CAFF WG would be interested in joining NAMMCO as co-sponsors for this meeting.

8.5. Narwhal

8.5.1. <u>Review of active requests</u> (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 22*

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

8.5.2. <u>Updates</u>

8.5.2.1. NAMMCO-JCNB JWG report (see ANNEX 2)

New information on abundance and catches were presented as well as new methodological developments of the allocation model for catches between Greenland and Canada that has been underway for some years.

Catch statistics

Greenland presented a time series of catch statistics from West Greenland during 1862-2014, which was constructed with catches split into hunting grounds and corrected for under-reporting detected from purchases of mattak (low option), for periods without catch records (medium option) and from rates of killed-but-lost whales (high option). Struck and lost rates have been estimated using factors such as community, season, hunting method, and these estimates are included in the catch history that is used in the assessment model.

Canada presented catch statistics and a summary of the process of management advice in Canada. The catch statistics provided by Canada have not been split by summering stocks or struck and lost rates by communities and the JWG reiterated the **recommendation** for Canada to provide corrected catch statistics to include in the assessments.

Abundance estimates

Abundance estimates were presented from the Canadian High Arctic narwhal survey that was conducted in Canada in August 2013, however, they survey was not presented in full detail and it could therefore not be approved for use in assessments. Details of the final analysis of the survey will be presented at a later JWG meeting.

New abundance estimates for narwhals in Melville Bay (one of the two summering areas in West Greenland) based on aerial surveys were presented and these estimates of 2,983 narwhals (cv=0.39; 95% CI 1,452-6,127) and 3,091 (cv=0.50; 95% CI 1,228-7,783) in 2012 and 2014 were accepted by the JWG for use in the assessment.

Catch Allocation Model

Studies applying satellite-tracking techniques have during the past 20 yrs revealed information on seasonal movements, site fidelity to summering grounds and migratory corridors of some stocks of narwhals in Baffin Bay and adjacent waters. This is also known as the Baffin Bay narwhal metapopulation. Without information on movements, narwhals that are hunted in different regions cannot be attributed to their summering aggregation. In order to assign catches in different hunting grounds and seasons to the appropriate summering grounds, where abundance estimates usually are developed, a so-called allocation model has been under development for several years. It includes all information that is available on narwhal movements including telemetry data, all abundance estimates, seasonal occurrence and historical catch data.

A total of 8 distinct summering stocks of narwhals have been identified and whales from these stocks are hunted at 11 hunting. Different fractions of the migrating stocks of narwhals are available at 11 hunting grounds, during different seasons giving a total of 24 hunts. The allocation model that is developed to mirror these seasonal patterns of occurrence consists of a matrix with 24 rows and 8 columns. The eight columns are the individual summer aggregations of Smith Sound, Jones Sound, Inglefield Bredning, Melville Bay, Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island.

Thus for each summer aggregation and hunt there is a cell in the matrix, and the matrix is devised so that when multiplied by a number of removals, the resulting number will determine the total removals from each summer aggregation. The cells in the matrix were determined using the tag data, or when no tag data was available, then expert opinion and the relative abundance of each summer aggregation. The tag data determined the fraction of the summer aggregation that was available to a hunt, which was multiplied by the size of the stock to determine the numbers from each summer aggregation exposed to each hunt. The total number of whales available to a hunt to determine the proportion of the hunt that came from the summer aggregation then divided these. The catch allocation model allocates the catches in different hunting areas and seasons to the different summer aggregations. Further refinement of the model included testing of the sensitivity of the allocation to data uncertainty as well as stochastic variation of the matrix from year to year.

In order to develop assessment based on the catch allocation model a Bayesian population modelling of the eight summer aggregations of narwhals in the region was conducted to estimate the impact of the catches on the population dynamics of the eight narwhal aggregations. The assessment model uses population trajectories and catches histories from 1970 to 2014, abundance estimates and data on reproduction to estimate the catches taken from the different summer aggregations during this period. Assessment of the sustainable catch levels from each of the 8 summering stocks are presented in Fig. 3 and Table 3, however, the take of narwhals from the different summering aggregations cannot be managed by consideration of summering grounds exclusively because many narwhals are caught in other hunting areas at other times of the year (e.g., during migration). Instead, management limits for different hunts and season must be considered together.

The difference between current catch levels (C0) distributed by stock and an example of sustainable catch levels developed from the allocation model (C1) is shown in Table 4. The example of a distribution of the sustainable catch levels estimated from the allocation model to the hunting grounds and seasons is shown in Table 5 where the average catch option (C0) uses the average annual take (including struck and loss) in the different hunts over the five year period from 2009 to 2013. The C1 column in Table 4 is an example of the how the catches can be distributed for the period 2015-2020 according to the allocation model.

Some of the summer aggregations, like those in Smith and Jones Sound, have very low catches that have little effect on the dynamics, while the narwhal aggregation in Melville Bay is clearly influenced by the historical takes. The narwhal aggregation around Somerset Island may have an increasing trend, and those in Inglefield Bredning, Admiralty Inlet, Eclipse Sound and East Baffin Island appears relatively stable. The model estimates that nearly all the aggregations are above the maximum sustainable yield level where slightly decreasing trends usually are of no concern (Fig. 3).

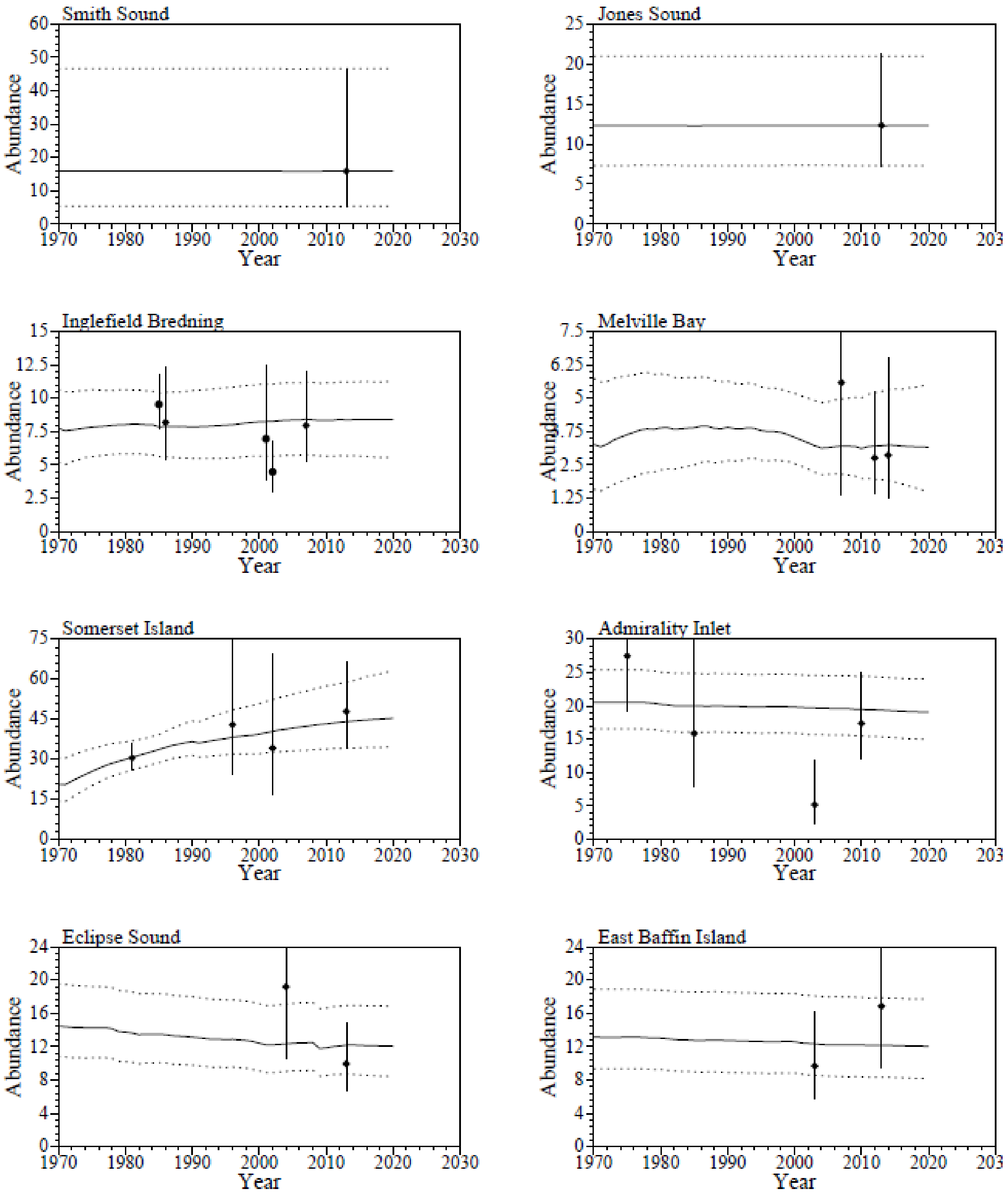


Fig 3. The population trajectories from the assessment model by summering aggregation. The medians (black) and 90% confidence intervals (dotted) of the estimated population dynamics from the eight summer aggregations of narwhals in East Canada and West Greenland, together with abundance estimates from aerial surveys (dots).

Table 3. The total annual removals per stock that meet given probabilities (P) of management objectives. The simulated period is from 2015 to 2020, and this assumes a 50% catch of females.

P	Smith Sound	Jones Sound	Inglefield Bredning	Melville Bay	Somerset Island	Admiralty Inlet	Eclipse Sound	East Baffin Island
0.5	284	231	147	108	914	394	398	192
0.55	259	215	135	102	871	371	377	180
0.6	231	200	123	97	828	347	354	169
0.65	206	186	111	90	780	325	332	158
0.7	185	171	98	82	732	301	310	147
0.75	165	156	83	72	684	273	287	135
0.8	144	141	68	63	635	243	262	123
0.85	123	126	52	53	580	213	234	110
0.9	100	106	33	40	512	177	198	94
0.95	67	78	5	21	403	124	151	72

The NAMMCO SC **agreed** with the recommendations of the JWG and **welcomed** this new methodological development of the complex assessment situation for the narwhal metapopulation that is shared between Canada and Greenland. The advancement of the allocation model is considered a step forward and could potentially be applied in many situations where migratory populations are exploited in several areas under various jurisdictions.

East Greenland

<u>Assessment and updated advice</u>

The assessments of narwhals in the two stocks in East Greenland (Ittoqqortormiit and Tasiilaq/Kangerlussuaq areas) were updated with recent catch information. Population models were fitted to the abundance estimate from 2008 for each stock and an age-distribution sampled from animals caught around Ittoqqortormiit between 2007 and 2010.

The updated assessment estimates a slightly smaller sustainable catch (Table 6) than the previous assessment, reflecting that we are further away in time from the available abundance estimate. The total annual removal was estimated to be no more than 50 for the Ittoqqortormiit area and 16 for the Tasiilaq/Kangerlussuaq.

SC **agreed** with the advice of the JWG. The SC noted that the quota for Tasiilaq was recently increased by 10 narwhals above the previous management advice.

8.5.3. Future work

SC **recommended** that future research includes

3) New surveys of narwhals in the two stocks where recommended catch levels has decreased, i.e. East Greenland and Melville Bay
4) More satellite tag and dive data from the stocks in West Greenland and Eastern Canada to obtain more information about movement between summer aggregations and information for availability bias for survey correction factors

Table 4. Two potential scenarios of takes of narwhal in the 24 different hunts. C0 represents the current situation with average catches during 2009-2015. C1 represents an example of a projection through 2020.

		Catch Options	
Hunt	**Season**	**C0 (Average)**	**C1**
Etah	Spring	4	5
Qaanaaq	Summer	98	98
Grise Fiord	Spring	7	9
Grise Fiord	Summer	11	15
Grise Fiord	Fall	0	0
Upernavik	Summer	100	70
Ummannaaq	Fall	86	154
Disko Bay	Winter	73	97
Central Canadian Arctic	Spring	4	6
Central Canadian Arctic	Summer	74	118
Central Canadian Arctic	Fall	2	3
Arctic Bay	Spring	31	41
Arctic Bay	Summer	141	188
Arctic Bay	Fall	0	0
Pond Inlet	Spring	58	77
Pond Inlet	Summer	55	73
Pond Inlet	Fall	4	5
Baffin Island Central	Spring	12	11
Baffin Island Central	Summer	100	91
Baffin Island Central	Fall	44	40
Baffin Island South	Spring	5	5
Baffin Island South	Summer	9	8
Baffin Island South	Fall	12	11
Baffin Island South	Winter	0	0

Table 5. Examples of future annual removals (C) through 2020 per summer aggregation, with associated probabilities (P) of fulfilling management objectives. The C0 and C1 removals follow from the catch options in Table 4 above, and the 90% confidence intervals of the estimates are given by the sub and super scripts.

	Smith Sound	Jones Sound	Inglefield Bredning	Melville Bay	Somerset Island	Admiralty Inlet	Eclipse Sound	Baffin Island
C0	4_{4}^{4}	18_{18}^{18}	98_{98}^{98}	109_{101}^{141}	219_{175}^{265}	185_{161}^{226}	155_{104}^{207}	134_{120}^{152}
P0	$1.00_{1.00}^{1.00}$	$1.00_{1.00}^{1.00}$	$0.7_{0.7}^{0.7}$	$0.49_{0.26}^{0.56}$	$0.99_{0.99}^{0.99}$	$0.89_{0.83}^{0.92}$	$0.95_{0.89}^{0.98}$	$0.76_{0.68}^{0.81}$
C1	5_{5}^{5}	24_{24}^{24}	98_{98}^{98}	83_{72}^{126}	343_{283}^{399}	243_{212}^{296}	198_{134}^{262}	122_{110}^{138}
P1	$1.00_{1.00}^{1.00}$	$1.00_{1.00}^{1.00}$	$0.7_{0.7}^{0.7}$	$0.7_{0.36}^{0.75}$	$0.97_{0.95}^{0.98}$	$0.8_{0.71}^{0.85}$	$0.9_{0.8}^{0.96}$	$0.8_{0.74}^{0.85}$

Table 6. Narwhal in East Greenland. The estimated trade-off between the total annual removal and the probability (P) of an increasing stock from 2015 to 2020, for Ittoqqortormiit and Tasiilaq in East Greenland.

P	**0.70**	**0.75**	**0.80**	**0.85**	**0.90**	**0.95**
Ittoqqortormiit	50	40	30	20	10	4
Tasilaq	16	13	9	4	1	0

8.5.3.1. Planning JCNB/NAMMCO JWG meeting (taken above in 8.5.3.1)
As noted above, the SC recommends scheduling the next meeting sometime in 2017. See 8.4.5.1 for more details.

8.5.3.2. Global review of monodontids
This item was discussed under item 8.4.5.2.

8.5.3.3. Disturbance symposium
This item was discussed under item 8.4.3.

8.6. Sei whale
8.6.1. Review 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 NASS2015 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*

8.6.2. Update
Iceland reported that there were not very many sightings during NASS2015 but that this was not unexpected as the timing and coverage of the survey was not appropriate for estimation of sei whale abundance.

Iceland informed the SC that they have been requesting a RMP *Implementation Review* in the SC of the IWC, however it was decided at this year's IWC SC meeting to postpone this work.

8.7. Bottlenose whale
8.7.1. Update
The Faroese NPR reported that 5 animals stranded in 2014. The Museum received tissue samples from these animals for analysis of diet, reproduction, etc. and these will be archived.

8.7.2. Future work
No future work was reported.

8.7.3. Abundance estimate
The Faroese data from T-NASS 2007 has been integrated into a model-based assessment of deep diving species being done in the UK. Mikkelsen informed the SC that the manuscript is planned to be submitted within a few months.

8.8. Killer whale
8.8.1. Review 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.*

8.8.2. Update
The SC noted that there is still not enough information to answer **R-3.7.2**.

At SC20, the SC noted higher levels of annual catches (19 on average per year from 2010 and 2012) in West Greenland. The SC was then informed that the recent catch statistics on killer whales in West Greenland have not been validated, and at this meeting the SC noted that these catch statistics still have not been validated. The SC **reiterates the recommendation** that all catch data on killer whales are validated before the next SC meeting, so that it is possible for the SC to monitor the development of the hunt.

Iceland informed the SC that there is an ongoing project in MRI on the behaviour, migration, and feeding ecology of killer whales. This work will be finalized by the end of this year. The SC awaits presentation of these results at the next meeting.

8.9. Pilot whale

8.9.1. <u>Review of active requests</u> (R-3.8.3, 3.8.4, 3.8.5, 3.8.6, 1.7.11)

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

R-3.8.3 (ongoing): *to develop a proposal for the details of a cost-effective scientific monitoring programme for pilot whales in the Faroes*

R-3.8.4 (ongoing): *methodology and the coverage of T-NASS take into account the need for reliable estimates for pilot whales. In addition, priority should be given to the analysis of data on pilot whales after the completion of T-NASS*

R-3.8.5 (ongoing): *assess the status of long-finned pilot whales in West Greenland waters and provide minimum estimates of sustainable yield*

R-3.8.6 (ongoing): *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. 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*

<u>Discussion</u>

Regarding **R-1.7.11**, the SC awaits results of NASS2015 and expects that these will allow for the development of an abundance estimate, and will be incorporated into the trend analysis.

Regarding **R-3.8.3**, taking into account the recommendations made by the 2008 Pilot Whale WG (Qeqertarsuaq, Greenland) that were organized in response to this request, the Faroes has developed a scientific monitoring programme to update biological parameters. As reported in the NPR, a number of samples have been collected including samples for ageing, reproductive information, and stomach samples for diet. The plan is to continue to collect samples from every drive and deliver results to the next assessment meeting. Based on this information, the SC considers **R-3.8.3 completed** and awaits further guidance from Council.

R-3.8.4 refers to T-NASS 2007, and the SC considers this request now **completed**.

Regarding **R-3.8.5**, the SC considers this request replaced by **R-3.8.6**. The remaining unanswered portions of **R-3.8.6** awaits new data from NASS2015. The West Greenland part was dealt with during SC/19 and the SC refers Council to that report.

8.9.2. <u>Update</u>

The Faroes have been attempting satellite tagging to obtain information on distribution of whales susceptible to catches. Mikkelsen informed that they were not able to tag during the sightings survey activities because of poor weather and difficulties in approaching whale groups. However, they were able to tag 5 whales from one group on 24 August after the survey was completed. One of the 5 tags is collecting dive data. The SC noted that the preliminary results from these animals suggest that pilot whales move widely around in the North Atlantic (Fig. 4).

The SC commended the Faroes for the work on the sampling programme.

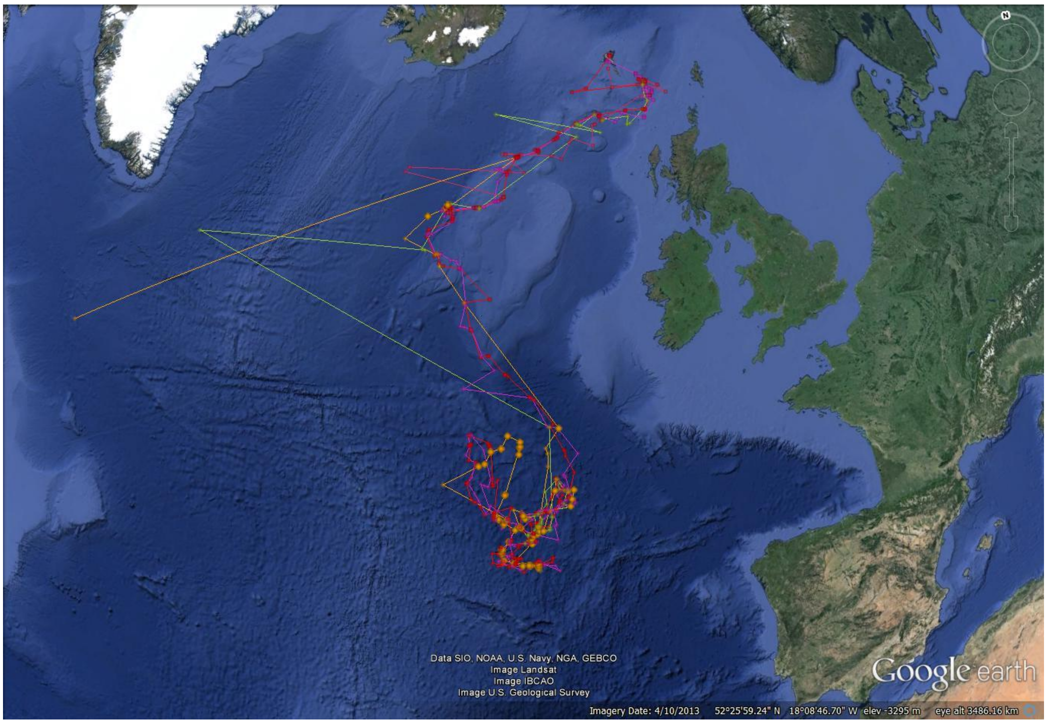


Fig. 4. Movement (unfiltered ARGOS positions) of a group of pilot whales that was tagged in the Faroe Islands 24 August 2015.

8.9.3. <u>Future work</u>

The goal is to have an approved pilot whale abundance estimate in 2016.

In preparation for a new assessment, the Faroes are re-establishing the competence for age and reproduction analysis.

8.10. Dolphins

8.10.1. <u>Review of active requests</u> (R-3.9.6)

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

8.10.2. <u>Update</u>

Some sampling has been occurring in the Faroes previously, however no new samples have been collected recently because there have been very few catches in recent years. The results from the previous sample collections have yet to be published.

Zabavnikov informed the SC that a wider distribution and higher numbers of white-beaked dolphins in comparison previous years had been recorded during the annual Russian-Norwegian ecosystem survey in the Barents Sea in August-September 2014 in the Russian (PINRO) research area (east of 33°E). All recorded animals were observed close to capelin and juvenile cod aggregations.

Lydersen noted the recent observations of polar bears feeding on ice-entrapped white beaked dolphins in Svalbard.

8.10.3. <u>Future work</u>

There are no plans to collect more samples.

8.11. Harbour porpoise

8.11.1. <u>Review of active requests</u> (R-3.10.1)

R-3.10.1 (ongoing): *comprehensive assessment of the species throughout its range*

8.11.2. <u>Update</u>

Tagging of harbour porpoises continues in Greenland, and some of the 2014 tags are still operating. Tissue samples are being collected for various analyses for comparison with previous sampling programs.

8.11.2.1. Status of recommendations from 2013 HPWG

As discussed under item 6.1.1, Norway informed the SC that they are seeking funding and planning studies in response to the recommendations from the 2013 HPWG.

8.11.2.2. *Updates on catch/by-catch reporting and numbers*

This was discussed under agenda item 6.1

8.11.3. Future work

See above under 8.11.2.1.

8.12. Sperm whale

8.12.1. Update

Sperm whales feeding aggregations occur in the Bleik Canyon, close to shore in North Norway. Haug reported of a study using a whale safari company as a platform from which to conduct a photo-identification study of male sperm whales in the area (Rødland & Bjørge 2015). Data was collected over 22 seasons (1987–2010) of whale-watching tours. The study confirm the presence of both transient and resident male sperm whales in the Bleik Canyon. The results suggest that the sperm whale group(s) found there are a loose feeding aggregation and not a closed population. Total residence time varied between one day and 14 years, although most individuals were only seen in one or two years. The number of sighted whales fluctuated between years, from eight to 77 individuals. No trend in the number of sighted whales was found. The estimated size of the feeding aggregation in the Bleik Canyon also fluctuated between years, from 11 to 116 individuals, with no trend evident.

8.12.2. Future work

No future work was discussed.

8.13. Bowhead whale

8.13.1 Review of active requests (R-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 NASS2015 for all large baleen whales in West Greenland waters*

8.13.2. Update

A strip-width survey estimated 100 (95% CI: 32-329) bowhead whales in the North East Water Polynya off Northeast Greenland in 2009 (Boertmann et al. 2015). This estimate is considerably higher than observations in the past.

A survey was conducted using a ship and helicopter in Svalbard on the ice-edge for polar bears and ice-associated whales including bowhead whales. The helicopter provided 27 of the 28 bowhead whale sightings.

A tourist vessel also reported a sighting of about 100 whales in the Jan Mayen area and photos confirmed that at least some of the whales were bowheads. A paper from these observations are expected next year.

8.13.3. Future work

No future work was discussed.

8.14. Blue Whale

8.14.1 Update

Iceland reported that they had tagged 2 blue whales during 2014.

An increasing number of blue whales are reported in the waters around Svalbard including in inner parts of the fiord systems especially on the west coast. As reported for fin whales, the Norwegian Polar Institute has started instrumenting animals with satellite tracking devices and collect biopsies for studies of genetics diet and ecotoxicology. In 2015, 3 whales were tagged. Blue whales were also detected on the passive acoustic listening devices that have been deployed at various sites around Svalbard and thus collecting data on the phenology of arrival and departures to the area.

8.14.2. Future work

Iceland reported that they did not have any immediate plans for more tagging.

9. SURVEY PLANNING (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 NASS2015 for all large baleen whales in West Greenland waters*

Survey Planning WG

The SC WG on Survey Planning met in Reykjavík on 14-15 April 2015 (ANNEX 3) under the Chairmanship of Desportes and preceded by a day of survey equipment training. The aim of the meeting was to review the plan of the Icelandic aerial surveys and to facilitate the completion of the planning for the Icelandic-Faroese shipboard surveys. At this late stage, with two vessels departing less than two months later, survey protocols and data collection systems (Faroese and Iceland) were not decided upon yet, and one vessel and some observers (Faroese) still needed to be chartered/hired. The meeting was therefore very practically oriented in order to complete the planning of the survey. At the time of the meeting, it was unknown whether the NAMMCO proposal to the Norwegian Ministry of Foreign Affairs for the Extension surveys (which include the survey of the Jan Mayen area) would be funded.

Resources per area were reviewed. Survey modes and procedures, sighting protocols, stratification, effort allocation and transect design were agreed upon for both the aerial and shipboard surveys. Survey guidelines for observer had not been finalised yet and it was uncertain at that point which data recording equipment and software would be used, both for the aerial and shipboard surveys. NAMMCO funds were used to develop a prototype of a new device to electronically measure and log angles and possible improvement to the device were discussed and agreed upon.

9.1. NASS Debrief

Heide-Jørgensen reported on the post-NASS meeting of the Steering Committee (ANNEX 4). Three surveys constituted extensions of the national surveys were conducted in the four NAMMCO countries in 2015. The three surveys were funded by NAMMCO and were after an application prepared by a Steering Committee established by NAMMCO’s FAC.

The three extension surveys included an intensive survey with the purpose of estimating the abundance of pilot whales around the Faroe Islands, an aerial survey of the coastal waters in East Greenland and a ship-based survey around Jan Mayen following methods developed for the Norwegian minke whale surveys.

All the surveys were successfully completed and resulted in valuable data useful for abundance estimation of the target species.

In addition to these surveys, national surveys covered the West Greenland shelf, areas around Iceland and the Norwegian Sea, providing a satisfactory coverage of these waters. Details of the survey effort and number of sightings are provided in the report from the Steering Committee (ANNEX 4).

The recommendations from the Steering Committee include a plan for the analysis and presentation of the results. It is also recommended that the Steering Committee has now completed its task and that further development of the results from the survey should be transferred to NAMMCO SC and its Abundance Estimation Working Group.

Iceland

A PhD student from St Andrews University is planning to perform a spatial analysis of distribution from NASS2015 and previous surveys. Other countries with old NASS data are welcomed to collaborate.
SC **noted** that the Icelandic aerial survey for minke whales was hampered by poor weather conditions and will likely not produce an abundance estimates.

SC **noted** the recommendations of the NASS Steering Committee but recognizes that this group reports to the FAC.

9.2. Plans for analysis/presentation of abundance estimates (WG)

The Steering Committee recommends that a small AEWG with only NAMMCO national participants meet in May.

9.3. Plans for future surveys

9.3.1. <u>Timing</u>

The Icelandic aerial survey in 2015 was hampered by poor weather and the preliminary indications are that an abundance estimate will not be possible from this survey. Iceland is currently seeking funding for a new aerial survey planned for 2016.

The SC noted that Canada, USA and SCANS-III will likely survey in 2016.

9.3.2. <u>Coordination</u>

The SC noted that it is too early to make a decision on coordination of the next NASS.

9.3.3. <u>Ideas for improving planning for next NASS</u>

The SC noted that it may be of interest for NAMMCO scientists to have observers on the SCANS-III survey to benefit from their experience and expertise.

9.4. <u>Issues regarding trends/abundance/distribution of marine mammals in the North Atlantic</u>

It is too early to discuss this item, but after the results of the NASS2015 are available, the SC will discuss this again. The results of the project with the PhD student in St Andrews University discussed above may be of interest for this issue.

9.5. <u>Publications from TNASS-07</u>

The plan is for the TNASS-07 pilot whale data will be combined with both past results and the NASS2015 data in a trend analysis.

The SC noted that it is unfortunate that not all of the TNASS-07 data has been published, but at this point there may be results forthcoming from the NASS2015 survey and therefore it makes sense to wait for the analyses from the recent survey and publish them together.

9.6. <u>Future work</u>

As discussed above, the SC recommends that the AEWG will meet in May. There will be a very short pre-meeting (via teleconference) to determine whether the analyses are on track for a May meeting.

10. NAMMCO SCIENTIFIC PUBLICATIONS

10.1. Monodontid age estimation

The Monodontid volume is still ongoing and will hopefully be finalized in early 2016.

10.2. Next volume

The SC discussed plans for future volumes in the series. One idea is a survey volume which contains any previously unpublished NASS papers, and the new results from NASS2015.

Another possible future volume would be papers from the planned Global Review of Monodontids. Of particular interest are papers from Russian scientists that will present their projects at this meeting. This would be especially helpful because these scientists usually do not publish in English, and therefore their information is usually not accessible.

The SC recommended continuing with themed volumes due to the increase in the workload that is likely to occur if the journal was to accept individual papers.

11. DATABASES ON ABUNDANCE AND CATCHES

11.1. Abundance

The Secretariat is working on compiling a table of the abundance estimates that are used in the assessments. The draft table was provided for the SC's input on the data that is being compiled.

11.2. Catches

The Secretariat is also working on compiling the catch data from the NPRs. This table is mainly for information to managers and the public and is not necessarily the catch histories that are used in the assessments.

12. WORK PROCEDURES IN THE SC

12.1. Involvement of the Vice-Chair

The Vice-Chair has been involved in the presentation of the SC report at the last few Council meetings, and this is the first year that the Vice-Chair has been involved in the preparation and running of the SC meeting. The SC noted that this is a good way to continue.

12.2. Guidelines for chairing the SC

The SC discussed two main issues with respect to the Guidelines:

1) Election of chair and vice chair. The normal practice has been that it follows the rotation of member countries, however this set of guidelines notes that it is not necessary to follow the rotation of countries.

2) Involvement of the Vice chair. The SC noted that the Vice Chair can and should be involved before the meeting, during the SC meeting and also during the Council meeting.

The SC **agreed** that the Secretariat shall prepare a draft of an Executive Summary of the SC Report for a review by the Chair (and Vice Chair). The Chair has the responsibility for the final version of the Executive Summary.

12.3. New meeting procedures

The SC discussed ideas for future meetings to make them as efficient and effective as possible, and to strengthen the SC overall. Some suggestions were to:

1) Strengthening scientific collaborations between the scientists in the SC. Among other options for joint projects of interest to all NAMMCO countries, one example is to resurrect the idea of developing satellite-tagging expertise within the SC. This could be done by requesting funds from NAMMCO. Another idea is where SC members could form stronger collaborations is a genetics study.
2) Add a new agenda item on "Collaborative work within the SC". The SC agreed that this item would come at the beginning of the meeting so that it can be discussed throughout the meeting.
3) Hold the SC meeting every other year, with the alternative year being a tele/video conference. This is in response to the financial concerns related to sending the full complement of SC members to the meetings. This suggestion will be discussed further at the next meeting.
4) Encourage SC could members bring presentations (e.g., powerpoint, videos) hightlighting research projects.

These and any new suggestions will be discussed further at the next SC meeting.

12.4. Other suggestions

There was a suggestion that the incoming Chair should present their vision for the SC at next year's meeting.

Participants were reminded that the Rules of Procedure details a 10 day deadline for meeting documents to be submitted to the Secretariat, and that everyone should strive to follow these deadlines in order to give everyone sufficient time to read and prepare for the meeting.

12.5. Use of NAMMCO documents

It was noted that use of NAMMCO documents at external meetings should credit NAMMCO.

13. FUTURE WORK PLANS

13.1. Scientific Committee

13.1.1. 2016 Meeting (Greenland)

The SC suggested that it would be a considerable cost and time saving to have the next SC meeting in Copenhagen rather than Greenland. If the meeting is held in Copenhagen, the SC **urged** all countries to send all of their SC members to the next meeting to take advantage of the cost saving.

The timing of the meeting will be during the first or second week of November 2016.

13.2. Working groups

13.2.1. Coastal Seals WG

The CSWG (Chair: Kjell Tormod Nilssen) will meet late February 2016. The likely location is either Copenhagen/Reykjavik/Oslo, to be decided by the Chair in consultation with the Secretariat. The decision will be based on the final participant list. Invited participants (not including SC members) will include 1 person each from the UK, USA, Canada, Sweden and Denmark, and 2-3 Norwegians.

The WG will mainly address **R-2.4.2** and **R-2.5.2**.

The Terms of Reference for the meeting will be for the WG to:

1) assess the status of all populations, particularly using new abundance estimate data that are available from Iceland and Norway.
2) address by-catch issues in Norway, Iceland, and the Faroe Islands
3) re-evaluate the Norwegian management plans (which have been already implemented) for grey and harbour seals.

The SC **recommended** that all of the available grey seal data from the Faroes is presented to the CSWG for review. The SC **recommends** that the CSWG develops specific plans for monitoring grey seals in the Faroes, e.g., obtaining a relative series of abundance (if a full abundance estimate is not possible at this time).

13.2.2. JCNB/NAMMCO Joint WG

Greenland will likely not have any new information to present to the JWG until 2017, and it will be important for the Canadians to provide new abundance estimates and catch history information before the next meeting. From the NAMMCO perspective, the SC **recommends** waiting until 2017, but recognizes that scheduling a meeting is up to the discretion of the NAMMCO and JCNB JWG Chairs.

The Secretariat (Scientific Secretary) will liase with the JCNB and NAMMCO co-chairs about whether to postpone until 2017.

The next meeting (2016 or 2017) will be hosted by Greenland.

13.2.3. ICES/NAFO/NAMMCO WGHARP

The WGHARP will meet again in August 2016 at the ICES HQ in Copenhagen, Denmark, to review the status and assess the catch potential of harp and hooded seals in the North Atlantic.

Norway has forwarded a request to ICES, which will form the basis for the next WGHARP meeting. The text of the request is below.

> "We understand that new information is now available on both the harp and hooded seal stocks. Therefore we would request an assessment of status and harvest potential of the harp seal stocks in the Greenland Sea and the White Sea/Barents Sea, and of the hooded seal stock in the Greenland Sea.

ICES should also assess the impact on the harp seal stocks in the Greenland Sea and the White Sea/Barents Sea of an annual harvest of:

1. current harvest levels,
2. sustainable catches (defined as the fixed annual catches that stabilizes the future 1 + population),
3. catches that would reduce the population over a 15-years period in such a manner that it would remain above a level of 70% of the maximum population size, determined from population modeling, with 80% probability."

The NAMMCO SC will request 2 experts to be invited.

13.2.4. NAMMCO BYCWG

The SC **recommended** convening a one-day meeting before the CSWG for planning a future meeting and work of the NAMMCO BYCWG. The participants at this meeting should include Mikkelsen and Gunnlaugsson from the SC, Arne Bjørge (Norway) and Desportes from the Secretariat.

The full WG should also incorporate members from outside the marine mammals sphere and the SC (e.g. fishery experts) and outside NAMMCO.
The TOR developed at SC21 for the WG are:

1. Identify all fisheries with potential by-catch of marine mammals
2. Review and evaluate current by-catch estimates for marine mammals in NAMMCO countries.
3. If necessary, provide advice on improved data collection and estimation methods to obtain best estimates of total by-catch over time.

13.2.5. Abundance Estimates WG

A small AEWG will be scheduled for May 2016, with only NAMMCO participants. The location will be Copenhagen or Bergen.

A second meeting may be scheduled in October 2016, depending on progress with the analyses, and could be held back to back with a potential LWAWG meeting in October 2016

13.2.6. Large Whale Assessment WG

A Large Whale Assessment WG may be scheduled before the next SC meeting, after the abundance estimates from NASS2015 are available. The SC recommended inviting Doug Butterworth, but also additional experts to establish additional expertise within the WG, possibly someone from the Butterworth lab. Additional participants (outside of the SC) may include Bjarki Elvarsson and Hiroko Svolvang.

14. BUDGET

14.1. Spending in 2015

Once the 2015 budget is finalised, this will be circulated to the SC for information.

14.2. Budget for 2016/2017

The SC discussed the 2016 budget in relation to the number of invited experts to the WGs.

15. ANY OTHER BUSINESS

15.1. Election of officers

Tore Haug (Norway) was elected as Chair and Bjarni Mikkelsen (Faroes) was elected as Vice Chair of the SC. The SC **welcomed** the incoming officers and look forward to their terms in office.

15.2. New GS vision for NAMMCO

Desportes, as recently appointed General Secretary of NAMMCO, presented her view and visions concerning the future of NAMMCO and specifically the Scientific Committee, as the body generating the management advice and therefore one key feature in the organisation. NAMMCO has established itself as an effective regional management body that ensures effective conservation and sustainable utilisation of marine resources, with several management success-stories. It has effectively improved hunting methods, with increased animal welfare and hunters' security. Desportes saw the organisation, and the SC, as having reached a cruising speed and a point where one can choose to continue business as usual or secure development and improvement. Focus areas and goals for different terms period, combined to enhanced transparency and increased visibility were key words. Several good stories emanating from the SC in particular deserved awareness that is much more public. She underlined the importance for the SC to be the watchdog, rending the Council aware of any arising conservation issue. She provided ideas for enhancing and widening the competence of the SC and the visibility and transparency of its work. She mentioned the use of external expert/observer as a key factor in this process.

The SC welcomed the positive nature of this presentation. A number of ideas for strengthening the operation of the SC, and the SC meetings, were discussed after this presentation, and are discussed in items 12.3 and 12.4.

16. MEETING CLOSURE

16.1. Acceptance of report

The report was accepted by correspondence on 26 November 2015.

16.2. Closing remarks

The Chair thanked the participants for their contributions. The SC thanked the Chair Gunnlaugsson for his efforts over the last three years, and thanked Bjarni Mikkelsen for very nice meeting facilities and a pleasant excursion to the old whaling station.

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Appendix 1 - Agenda

1. CHAIRMAN'S WELCOME AND OPENING REMARKS
2. ADOPTION OF AGENDA
3. APPOINTMENT OF RAPPORTEUR
4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS
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   - 4.2 Working Group Reports
     - 4.2.1 Large Whale Assessment
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     - 4.2.3 SPWG
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5. COOPERATION WITH OTHER ORGANISATIONS
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   - 5.2 ASCOBANS
   - 5.3 ICES
     - 5.3.1 Joint ICES/NAFO/NAMMCO WGHARP
   - 5.4 JCNB
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   - 5.6 Other
6. ENVIRONMENTAL / ECOSYSTEM ISSUES
   - 6.1 Marine mammals-fisheries interactions
     - 6.1.1 Bycatch Update on plans for WG Multispecies approaches to management
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   - 7.1 Harp Seal
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     - 7.2.1 Review of active requests
     - 7.2.2 UpdateFuture work
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     - 7.3.1 Review of active requests
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   - 7.5 Harbour seal
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     - 7.5.3 Future work
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   - 7.6 Bearded seal Update
     - 7.6.2 Future work
   - 7.7 Walrus
     - 7.7.1 Review of active requests
     - 7.7.2 Disturbance Symposium
     - 7.7.3 Assessment Baffin BayUpdate
       - 7.7.4.1 Status of recommendations from 2013 Walrus WG
       - 7.7.4.2

8 CETACEANS STOCKS - STATUS AND ADVICE TO THE COUNCIL
- 8.1 Fin whale
  - 8.1.1 Review of active requests
  - 8.1.2 Large Whale Assessment WG
  - 8.1.3 Update
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- 8.2 Humpback whale
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- 8.3 Minke whale
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    - 8.4.5.1 JCNB/NAMMCO JWG meeting- spring 2016
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    - 8.4.5.3 Other
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    - 8.5.2.1 NAMMCO-JCNB JWG report
  - 8.5.3 Future work
    - 8.5.3.1 Planning JCNB/NAMMCO JWG meeting (taken above in 8.5.3.1)
    - 8.5.3.2 Global review of monodontids (taken above in 8.5.3.2)
    - 8.5.3.3 Disturbance symposium (taken above in 8.5.3.3)
    - 8.5.3.4 Other
- 8.6 Sei whale
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- 8.7 Bottlenose whale
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- 8.8 Killer whale
  - 8.8.1 Review of active requests
  - 8.8.2 Update
  - 8.8.3 Future work
- 8.9 Pilot whale
  - 8.9.1 Review of active requests
  - 8.9.2 Update
  - 8.9.3 Future work
- 8.10 Dolphins
  - 8.10.1 Review of active requests
  - 8.10.2 Update
  - 8.10.3 Future work
- 8.11 Harbour porpoise
  - 8.11.1 Review of active requests
  - 8.11.2 Update
    - 8.11.2.1 Updates on catch/by-catch reporting and numbers
  - 8.11.3 Future work

8.12 Sperm whale
8.12.1 Update
8.12.2 Future work
8.13 Bowhead whale
8.13.1 Review of active requests
8.13.2 Update
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8.14 Blue Whales
8.14.1 Update
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9 SURVEY PLANNING
9.1 NASS Debrief [Cruise reports & Debriefing report]
9.2 Plans for analysis/presentation of abundance estimates (WG)
9.3 Plans for future surveys
9.3.1 Timing
9.3.2 Coordination
9.3.3 Ideas for improving planning for next NASS
9.4 Issues regarding trends/abundance/distribution of marine mammals in the North Atlantic
9.5 Publications from TNASS-07
9.6 Other updates
9.7 Future work
10 NAMMCO SCIENTIFIC PUBLICATIONS
10.1 Monodontid age estimation
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11 DATABASES ON ABUNDANCE AND CATCHES
11.1 Abundance
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12 WORK PROCEDURES IN THE SC
12.1 Involvement of the Vice-Chair
12.2 Guidelines for chairing the SC
12.3 New meeting procedures
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12.5 Use of NAMMCO documents
13 FUTURE WORK PLANS
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13.1.1 2016 Meeting (Greenland)
13.2 Working groups
13.2.1 Coastal Seals
13.2.2 JCNB/NAMMCO
13.2.3 ICES/NAFO/NAMMCO WGHARP
13.2.4 By-catch- data reviewed in ICES WGBYC or NAMMCO WG?
13.2.5 Others?
13.3 Other matters
14 BUDGET
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15.2 Vision for NAMMCO from the new General Secretary
16 MEETING CLOSURE
16.1 Acceptance of report
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Appendix 3 – List of documents

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SC/22/01b	Draft ANNOTATED Agenda	1
SC/22/02	Draft List of Documents	2
SC/22/03	Draft List of Participants	4
SC/22/NPR-F	National Progress Report – Faroe Islands	4.1
SC/22/NPR-G	National Progress Report – Greenland	4.1
SC/22/NPR-I	National Progress Report – Iceland	4.1
SC/22/NPR-N	National Progress Report – Norway	4.1
SC/22/NPR-C	National Progress Report – Canada	4.1
SC/22/NPR-J-1	National Progress Report – Japan – Large cetaceans	4.1
SC/22/NPR-J-2	National Progress Report – Japan – Small cetaceans	4.1
SC/22/NPR-R	National Progress Report – Russian Federation	4.1
SC/22/04	Annex 2- Active Requests from Council	many
SC/22/05	Table of Accepted Abundance Estimates	11.1
SC/22/06	Observer’s report: ASCOBANS	5.2
SC/22/07	NAMMCO-JCNB Joint Scientific Working Group report	5.4, 8.4, 8.5
SC/22/08	*No document*	
SC/22/09	Survey Planning Working Group (April 2015)	9
SC/22/10	Recommendations from 2013 WGs	7.7 and 8.11
SC/22/11	*No document*	14
SC/22/12	Observer’s report on activities in ICES (Haug)	5.3
SC/22/13	Observer’s report: 66th meeting of the IWC Scientific Committee	5.1
SC/22/14	Observer's report: Arctic Council	5.5
SC/22/15	Large Whale Assessment WG Report	8.1, 8.2, 8.3
SC/22/16	Witting. Assessment runs for Baffin-Bay walrus - 2015	7.7.3
SC/22/17	Heide-Jørgensen et al. Large numbers of marine mammals winter in the North Water polynya	7.7.3
SC/22/18	Garde and Heide-Jørgensen. Catches of Atlantic walrus in Northwest Greenland (Baffin Bay population) 1993-2014	7.7.3
SC/22/19	Guidelines for chairing the SC	12.2
SC/22/20	Faroes NASS Cruise report	9
SC/22/21	Iceland cruise report (ship)	9
SC/22/22	Norway cruise report	9
SC/22/23	Iceland aerial cruise report	9
SC/22/24	NASS Steering Committee post cruise	9

BACKGROUND DOCUMENTS

Doc.No.	Title	Agenda item
SC/22/O/01	Report of SC21	
SC/22/O/02	Report of SC20	
SC/22/O/03	NAMMCO23 Annual Report 2014	
SC/22/O/04	Vikingsson et al (2015) Distribution, abundance, and feeding ecology of baleen whales in Icelandic waters: have recent environmental changes had an effect?	6.4
SC/22/O/05	Carr et al (2015) Quantitative Phylogenomics of Within-Species Mitogenome Variation: Monte Carlo and Non-Parametric Analysis of Phylogeographic Structure among Discrete Transatlantic Breeding Areas of Harp Seals (*Pagophilus groenlandicus*)	7.1.2

SC/22/O/06	Øigård and Skaug (2015) Fitting state–space models to seal populations with scarce data	7.1.2
SC/22/O/07	Rødland and Bjørge (2015) Residency and abundance of sperm whales (*Physeter macrocephalus*) in the Bleik Canyon, Norway	8.12
SC/22/O/08	Murphy et al (2015) Reproductive Failure in UK Harbour Porpoises *Phocoena phocoena*: Legacy of Pollutant Exposure?	8.11
SC/22/O/09	Aars et al (2015) White-beaked dolphins trapped in the ice and eaten by polar bears	8.10
SC/22/O/10	Bogstad et al (2015) A review of the battle for food in the Barents Sea: cod vs. marine mammals	6.4
SC/22/O/11	Nøttestad et al (2015) Recent changes in distribution and relative abundance of cetaceans in the Norwegian Sea and their relationship with potential prey	6.4
SC/22/O/12	Ressler et al (2015) Acoustic surveys of euphausiids and models of baleen whale distribution in the Barents Sea	6.4
SC/22/O/13	Hamilton et al. (2015) Year-round haul-out behaviour of male walruses *Odobenus rosmarus* in the Northern Barents Sea	7
SC/22/O/14	Hammill et al (2015) Conservation of northwest Atlantic harp seals: Past success, future uncertainty?	7
SC/22/O/15	SCANS-III Revised proposal	9.3
SC/22/O/16	Laidre et al (2015) Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century	6
SC/22/O/17	ICES Working Group Bycatch 2015	5
SC/22/O/18	ICES WGHARP 2014	5
SC/22/O/19	ICES WGMME15	5
SC/22/O/20	Jepson et al Toxic legacy. PCBs in European dolphin	

Appendix 4 – Cooperation with other organisations - Observer's reports

INTERNATIONAL WHALING COMMISSION (ITEM 5.1 IN THE SC REPORT)

A short Summary of the 2015 IWC SC Report with emphasis on issues relevant for NAMMCO countries

The IWC Scientific Committee held its annual meeting in 2015 in San Diego from 22.05 to 03.06. The full SC report can be found on the IWC website: https://archive.iwc.int/?r=5429

General RMP issues
In 2013, the SC recommended that MSYR1+=1% be adopted as a pragmatic and precautionary lower bound for use in trials, and that MSYRmat=7% be changed to the roughly equivalent MSYR1+=4%. These changes are now being implemented in all IWC trials and also have consequences for catch limits calculated in the NAMMCO context by RMP. (The catch limits in general will be a little larger.)

The SC reviewed the Norwegian proposal for a revised *CLA* using the procedure agreed earlier in the meeting. The Committee focused on the comparison between the 'IWC Tuning' and the 'Norwegian Tuning'. These variants achieve different performance metrics because they are tuned to different median final depletions. However, the lower 5th percentiles of the lowest and final depletion distributions for the 'Norwegian Tuning' are less than those of the 0.6 tuning of the *CLA*. The Committee therefore concluded that the conservation performance of the 'Norwegian Tuning' was insufficient for the Committee to recommend it. It was also noted that the catch performance of the 'Norwegian Tuning' was superior to that of the 'IWC Tuning', but that this came at the expense of satisfactory conservation performance. The Committee speculated that the poorer conservation performance of the 'Norwegian Tuning' might be due to the parameter chosen to tune it (the slope parameter). Basing tuning on other parameters such as the maximum MSY rate parameter (perhaps in addition to the slope parameter) may lead to narrower distributions for final and lowest population size.

From a NAMMCO perspective it should be noted that the difference (loss) in conservation performance is minimal, while the difference (increase) in catches is substantial. In case NAMMCO is in need of a management procedure which will give higher catches than RMP with 0.60 tuning, the Norwegian procedure is definitely an alternative.

RMP – Implementation related matters
North Atlantic fin whale Implementation Review
The Committee was unable to complete the *Implementation Review* in 2014, but progress had been made through work by an intersessional steering group and an intersessional workshop, held at Copenhagen in February 2015. It was hoped to complete the *Implementation Review* this year. However, Allison advised that given workload issues in trying to undertake two major *Implementation Reviews* simultaneously, it had been impossible to complete coding of the *Implementation Simulation Trials*. This precluded completion of the *Implementation Review* at the 2015 meeting. A new intersessional workshop is planned for early 2016.

<u>North Atlantic common minke whale *Implementation Review*</u>
Last year, the Committee had hoped it might be possible to complete the *Implementation Review* at the 2015 Annual Meeting. To that end an intersessional workshop had been held in Copenhagen in February 2015. A work plan was established by the workshop. At the annual meeting the Committee noted that fits of the operating models to the actual data were generally good. However, some of the plots identified concerns with the conditioning. After further consideration it agreed that the inability to fit the abundance estimates for two sub-areas was not of major concern and that the truncated distribution for the operating model 'survey' sex-ratio for one sub-area was expected. However, addressing concerns over trends in abundance of mature females for one sub-stock and trends in abundance of 1+ animals in one sub-area appear to be caused by the 'entry' specifications of the mixing matrices. The Committee recommended that the mixing matrices be changed. In conclusion, despite considerable work, conditioning has not yet been successfully achieved. The Committee noted that the issues identified could only be detected once the full set of 100 replicates had been conducted. It also agreed to organize an Intersessional Workshop early in 2016.

Aboriginal subsistence whaling management procedure (AWMP)

The primary issues at this year's meeting comprised: (1) developing *SLA*s (*Strike Limit Algorithms*) and providing management advice for Greenlandic hunts, with focus on bowhead and fin whales; (2) providing management advice for the Greenland hunts and the humpback whale hunt of St. Vincent and The Grenadines; and (3) additional work related to the AWS (aboriginal subsistence whaling management scheme). Considerable progress on items (1) and (3) was made as a result of an AWMP intersessional Workshop.

In Greenland, a multispecies hunt occurs and the expressed need for Greenland is for 670 tons of edible products from large whales for West Greenland; this involves catches of common minke, fin, humpback and bowhead whales. The flexibility among species is important to the hunters and satisfying subsistence need to the greatest extent possible is an important component of management in the light of the agreed IWC objectives. For a number of reasons, primarily related to stock structure issues, development of *SLA*s for some Greenland aboriginal hunts (especially for common minke whales) is more complex than previous *Implementations* for stocks subject to aboriginal subsistence whaling. The Committee endorsed an interim safe approach to setting catch limits for the Greenland hunts in 2008, noting that this should be considered valid for two blocks i.e. the target will be for agreed and validated *SLA*s, at least by species, for the 2018 Annual Meeting at the latest.

<u>Development of an SLA for the common minke whale hunt off Greenland</u>
The complexity of the stock structure situation for common minke whales combined with the level of need (at present the annual strike limit is 164 – the highest allowed under the interim *SLA*) mean that the simple yet conservative approach adopted for fin whales cannot be applied for the common minke whale hunt. Depending on progress with the RMP *Implementation Review* at the present meeting, it may be possible to begin preliminary testing of initial candidate *SLA*s during the proposed forthcoming intersessional workshop. The Committee agrees to allocate highest priority to developing an *SLA* for this hunt in time for its recommendation to the Commission by 2018 at the latest.

<u>Development of an SLA for the bowhead whale hunt off West Greenland</u>
Considerable progress on the development of an *SLA* for the bowhead whale hunt had been reported last year. This continued intersessionally and at the February 2015 Intersessional Workshop, the focus was on reviewing the performance statistics and plots for revised candidate *SLA*s. The Workshop received the results from two developing teams for several candidate *SLA*s. Based upon the different properties of these *SLA*s and their performance, the Workshop developed three new 'combined' *SLA*s that performed better than their individual components. One of these slightly outperformed the other with respect to need satisfaction. Based upon these results3, the Workshop recommended that *SLA* to the Committee as the '*WG-Bowhead SLA'*.

At this meeting, new information was received about an increase in the quota for Canada in 2015 to seven that warranted further consideration; the catch off Canada during 2014 was two whales, against a quota of five. The Committee focused its work on determining that the *SLA* recommended at the February workshop is robust to reasonable assumptions made regarding future Canadian catches.

Aboriginal subsistence whaling management advice
<u>Eastern Canada and West Greenland bowhead whales</u>
No bowhead whales were taken in West Greenland in 2014 while two bowhead whales were taken in northeast Canada in 2014. Samples were reported to have been collected from one of the whales taken in Canada and 45 biopsy samples had been collected from West Greenland bowhead whales in 2014. The Committee welcomes this information and recommends continuation of the work. It also strongly encourages collaboration with Canada on genetic work. The Committee recalls that last year, it had agreed that the mark-recapture estimate of 1,274 (CV=0.12) for 2012 provides the best estimate of abundance for the number of bowhead whales visiting West Greenland.

Management advice: Based on the agreed best 2012 estimates of abundance for bowhead whales (1,274 CV=0.12), and using the agreed interim approach, the Committee repeats its advice that an annual strike limit of two whales will not harm the stock.

<u>Common minke whales off West Greenland</u>

Management advice: In 2009, the Committee was able to provide management advice for this stock for the first time (IWC, 2010b). This year, using the agreed interim approach and last year's revised estimate of abundance (16,100 CV=0.43), the Committee advises that an annual strike limit of 164 will not harm the stock.

Common minke whales off East Greenland
Management advice: Catches of minke whales off East Greenland are believed to come from the large Central stock of minke whales. The most recent strike limit of 12 represents a very small proportion of the Central stock (see Annex E, table 3) The Committee advises that the strike limit of 12 will not harm the stock.

Fin whales off West Greenland
Management advice: Based on the agreed 2007 estimate of abundance for fin whales (4,500 95% CI 1,900-10,100), and using the agreed interim approach, the Committee advises that an annual strike limit of 19 whales will not harm the stock.

Humpback whales off West Greenland
Management advice: Based on the Humpback SLA that was agreed by the Commission last year, the Committee agrees that an annual strike limit of 10 whales will not harm the stock.

Management advice was also given for the hunt of humpback whales off St Vincent and the Grenadines, the hunt of the North Pacific Grey whales, and the hunt of the BCB Seas stock of bowhead whales. The advices were all without surprises.

Environmental concerns
The Committee discussed effects of pollution, marine debris, anthropogenic sound and climate change on cetaceans. In March 2014, the IWC held a workshop on the impacts of increased marine activities on cetaceans in the Arctic.

Ecosystem modelling
For the last five years the Committee has discussed apparent declining trends in blubber thickness and body condition in Antarctic minke whales over the 18 years (1987/88-2004/05) of the JARPA special permit programme. This item is relevant to ecosystem modelling because the findings have implications for energetics, reproductive fitness, foraging success, and the prey base itself, all of which are important as input in models. A number of concerns have been raised and addressed on the statistical methods that were used to derive these trends. Following considerable discussion the Committee concluded that there was not sufficient support to modify its conclusion from last year that 'a decline in blubber thickness and in fat weight that was statistically significant at the 5% level had occurred'.

Scientific permits
There was considerable difficult discussions on the proposed new Japanese research programme NEWREP-A. A JARPN II review workshop is planned for February 2016.

ASCOBANS (ITEM 5.2 IN THE SC REPORT)

Observer report from the 22nd ASCOBANS Advisory Committee meeting, The Hague, Netherlands, 29 September – 1 October 2015
Desportes attended the AC 22 meeting, organized as usual in two sessions: a scientific session and an institutional session. A number of reports were presented and discussed that emanated from various working groups appointed under ASCOBANS. Three of these focused on harbour porpoise conservation at a regional level in the remit of three regional Action Plans covering the Baltic, the Western Baltic, Belt Sea and Kattegat, and North Sea. Other working groups deal more generally with Threats to Small Cetaceans (By-catch, Underwater Noise, Negative Effects of Vessels and Other Forms of Disturbance, Pollution and its effects, Marine Debris). The meeting reviewed new information on threats to small cetaceans and considered necessary steps in order to mitigate impacts of human activities on the animals and their habitats. Emerging issues were the impact of Climate Change and the development of Marine Renewable Energy, as well as ways of Managing Cumulative Anthropogenic Impacts on the Marine Environment. AC 22 was the last Advisory Committee Meeting before the 8th Meeting of the Parties (MOP8, Helsinki, Finland, 30 August - 1 September 2016), and the focus was on the decisions to be prepared for consideration and adoption at MOP8. Several topics were

agreed upon that drafting groups will now elaborate on: PCBs, underwater unexploded ordnance, managing cumulative impacts on small cetaceans, best practice regarding necropsy and rescue of small cetaceans, and marine renewables. Work would also be carried out in order to update the Recovery Plan for Baltic Harbour Porpoises (Jastarnia Plan), and to advance the development of a Conservation Plan for Common Dolphins. The terms of reference for such a plan were agreed and a Steering Group was established. Two workshops were planned for 2016, one on *Conserving Europe's cetaceans through synergy-building between the relevant legislative frameworks* (joint ECS/ASCOBANS/ACCOBAMS in conjunction with the 2016 European Cetacean Society Conference), and one carrying forward the Agreement's work on management procedures relating to anthropogenic removal of small cetaceans. The Special Species Session at the 23rd Meeting of the Advisory Committee will feature the white-beaked dolphin, a species of interest to NAMMCO.

The North Sea Group – the steering group for the Conservation Plan for the Harbour Porpoise in the North Sea – held its 5th meeting prior to AC 22 on September 28. Conclusions continued to be that monitoring of marine mammal by-catch in the North Sea remains inadequate. Proper data are still lacking for a reliable impact assessment, because of inadequate and insufficient monitoring of the various net fisheries. Better quality data on by-catch rates and fishing effort for net fisheries were required from EU Member Countries before an assessment could be refined and conclusions drawn as to the overall by-catch of harbour porpoise in the North Sea. Focus was on finalising the position of ASCOBANS on the requirements of EU legislation to address monitoring and mitigation of small cetacean by-catch, to be forwarded to the European Commission.

A workshop on Remote Electronic Monitoring with Regards to By-catch of Small Cetaceans was held on Friday, 2 October.

CMS/ASCOBANS contacted the Faroese Authorities (Executive Secretary of CMS and ASCOBANS, July 27 2015), with a request to provide information on recent hunts, in particular details regarding the species affected by the hunt, how sustainability was assessed, what regulations and management were in place, and how the catches were utilized. The answer from the Faroes (Foreign Service, 29 September 2015) reached the ASCOBANS Secretariat during the AC meeting and was therefore not discussed at the meeting.

Two interesting presentations of interest to NAMMCO were given. "*Reproductive failure in UK harbour porpoises: legacy of pollutant exposure*?"[4] presented results suggesting that reproductive failure could have occurred in up to 39% or more of mature females sampled and estimated a pregnancy rate of 50% for "healthy" UK females, lower compared to other populations. The results raise concerns about the current and future population-level effects of PCBs on the continuous-system North-east Atlantic harbour porpoise population. Even though previous research[5] reported that bycaught harbour porpoises in the North Sea were in a poorer health status than their more northern counterparts from Iceland and Norway, the results should be of concern to NAMMCO. Although the use and production of PCBs in Europe was phased out in the 1980s, diffuse inputs into the marine environment continue and environmental levels in marine biota (fish and mussels) are either declining slowly, or there is no general improvement[6].

The pan-European meta-analysis "*Toxic legacy? Severe PCB pollution in European dolphins*"[7] of stranded (n=929) or biopsied (n=152) harbour porpoises (HP), striped dolphins (SD), bottlenose dolphins (BND) and killer whales (KW) showed that SDs, BNDs and KWs had mean PCB levels that markedly exceeded all known marine mammal PCB toxicity thresholds. These very high mean blubber PCB concentrations are likely to cause population declines and suppress population recovery. Some small or declining populations of BNDs and KWs in the NE Atlantic were indeed associated with low recruitment, consistent with PCB-induced reproductive toxicity. The analysis did not include samples from NAMMCO parties, although these would represent interesting elements of comparison and killer whale samples could be available in Greenland, Iceland and Norway. The lead author confirmed that he would be happy to get the opportunity to collaborate with

[4] Murphy S, Barber JL, Learmonth JA, Read FL, Deaville R, Perkins MW, et al. (2015) Reproductive Failure in UK Harbour Porpoises Phocoena phocoena: Legacy of Pollutant Exposure? PLoS ONE 10(7): e0131085. doi:10.1371/journal. pone.0131085
[5] Siebert U, Tolley K, Vikingsson GA, Olafsdottir D, Lehnert K, Weiss R, et al. Pathological findings in harbour porpoises (Phocoena phocoena) from Norwegian and Icelandic Waters. Journal of Comparative Pathology. 2006; 134(2–3):134–42. PMID: 16527299
[6] EEA. European Environment Agency. Hazardous substances in marine organisms (MAR 001). Available: http://www.eea.europa.eu/data-and-maps/indicators/hazardous-substances-in-marineorganisms/hazardous-substances-in-marine-organisms-3.
[7] Jepson, P.D., Deaville, R., et al. in press. Toxic legacy? Severe PCB pollution in European dolphins.

NAMMCO colleagues on PCBs in KWs across the entire NE Atlantic region, as well as the PCB issue in cetacean top predators across all European countries.

Possible future scientific cooperation between ASCOBANS and NAMMCO

The assessment of harbour porpoises is an area where ASCOBANS and NAMMCO may want to cooperate or indeed need to cooperate as, in the present state of knowledge, North Sea harbour porpoises are considered a single stock – therefore a shared stock between one NAMMCO party (Norway) and several ASCOBANS parties (Sweden, Denmark, UK, Germany, Netherlands, Belgium, France). The estimation of life parameters, population health status, impact of anthropogenic disturbances and their mitigation are all areas benefitting of a wider expertise.

Within the framework of ecosystem-based management, it seems relevant for NAMMCO to monitor/support monitoring of the actual impact of OC pollutants on marine top predators, to inform conservation management. The development of a Conservation Plan for Common Dolphins may also be an area where the input of NAMMCO could be of interest to ASCOBANS, especially when the distribution of species seems to have extended further North.

INTERNATIONAL COUNCIL ON THE EXPLORATION OF THE SEAS (ICES) (ITEM 5.3 IN THE SC REPORT)

Report from the 2014 and 2015 Activities in ICES

Tore Haug, Institute of Marine Research, Tromsø, Norway

The ICES Working Group on Marine Mammal Ecology (WGMME)

ICES WGMME met at the Institute of Zoology, Zoological Society of London (ZSL), Regent's Park, London, UK, from 9-12 February 2015.

New information on **distribution** and **abundanc**e of harbour porpoise available from aerial surveys in the North Sea has been compiled and will be used in project DE-PONS (Disturbance Effects on the Harbour Porpoise Population in the North Sea) to identify areas with high porpoise densities and to predict seasonal distribution and density. New information on abundance and trends available for coastal bottlenose dolphins in Scottish and Welsh waters in the UK, in waters west of Ireland, off the Normano-Breton coast of France, and off the north coast of Spain has been collated as well, together with new information on sperm whales and short-finned pilot whales in the Canary Islands. Updated or new information on distribution and abundance of several cetacean species was available from extensive coastal and offshore surveys off France, mainland Portugal and Madeira. Large-scale cetacean surveys are planned for European Atlantic waters in summer 2016 (SCANS-III). Plans for a Mediterranean cetacean survey continue to be pursued.

New results on **population structure**, available for harbour porpoise and bottlenose dolphin have been compiled. Satellite telemetry and static acoustic monitoring data were used to assign boundaries between populations in the North Sea-Skagerrak, the Belt Sea and the Baltic proper. New results from a genetic analysis of harbour porpoise tissue from Iberia, northern Europe and Turkey indicate a level of differentiation of the Iberian population that may warrant categorisation as a separate subspecies. New results from genetic, stable isotope and diet studies indicate that bottlenose dolphin population structure is hierarchical in the Northeast Atlantic, comprising coastal and pelagic ecotypes. The coastal ecotype comprises a north and south population and there are pelagic ecotypes in the Atlantic and Mediterranean. No new information was available on management frameworks.

A **threat** matrix was completed for the main marine mammal species in each regional seas area. While fishery by-catch is a significant concern, especially for harbour porpoise, common dolphin, coastal bottlenose dolphin and ringed seal, contaminants are also a major concern, especially for harbour porpoise, killer whale and bottlenose dolphin. In the Baltic Sea, contaminants and habitat degradation are a serious concern for all resident marine mammal species. In the Bay of Biscay/Iberian Peninsula and Macaronesia, sonar is a significant threat to beaked whales, and in the former area fin whale and sperm whale are threatened by collisions with shipping. The small population of Mediterranean monk seal in Madeira is threatened by habitat degradation, disturbance and deliberate killing. Text on marine mammals has been provided for the ICES Ecosystem Overviews.

Where their distributions overlap, there is some evidence of **negative ecological interactions** between harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*). There is spatial variation in their populations trajectories: in some regions both species are increasing (e.g. Wadden Sea, Baltic Sea and Kattegat, Ireland, France) while in other regions harbour seals are declining while grey seal numbers are on the rise (e.g. North Sea, Orkney, Sable Island). Potential interactions (at-sea distribution, competition for prey, haul-out site use, and predation of harbour seals by grey seals) were reviewed. Recent evidence of direct predation of harbour seals by grey seals in the North Sea was highlighted, as well as evidence of predation of harbour porpoises by grey seals in the same region.

The ICES **seals database** was updated with limited data from few countries. It is anticipated that the database will be fully updated in 2015 to contribute to OSPAR's Intermediate Assessment in 2017.

Marine mammals have been included in whole **ecosystem models** (e.g. Ecopath with Ecosim, EwE) and in minimum realistic models (e.g. GADGET), among others, in studies principally focused on trophic relationships, resource competition between fisheries and marine mammals, and consequences for fish stocks. There is the potential to add fishery by-catch mortality of marine mammals to such models although few examples exist where this has been done. Other types of biological interaction (e.g. parasite transmission) have been less well covered. All models have limitations and some kind of validation exercise is essential to confer credibility on the predictions.

The ICES Working Group on Bycatch of Protected Species (WGBYC)
ICES WGBYC met in Copenhagen at ICES headquarters 2-6 February 2015. Since the commencement of WGBYC in 2009, the WG has been collating, storing and summarizing **annual by-catch and monitoring effort data** reported by European member states affected by EC Regulation 812/2004. This has resulted in the development of WGBYC database that currently stores eight years (2006–2013) of data on cetaceans as reported to the European Commission by member states affected by the regulation. WGBYC continues to cooperate with the ICES Data Centre and make advances toward a more comprehensive database design.

This year WGBYC undertook an historical review of Reg. 812 to the extent practicable. A significant limitation in evaluating the magnitude of by-catch mortality since the implementation of the regulation is not having an accurate estimate or census of total fishing effort from relevant European waters. There is considerable uncertainty in the representativeness of total fishing effort reported by member state to the European Commission. In addition, WGBYC has continually reported on the inconsistent submission and content of annual reports by some member states and the shortcomings of the Reg. 812 to accurately reflect the true magnitude of cetacean by-catch in gears affected by the regulation.

Total observer effort reported by member states in relation to Reg. 812 was highest in the North Atlantic, followed by the Baltic, Mediterranean, and North Sea. This result generally applies to both gillnets and pelagic trawls. Based on Reg. 812 reporting, common and striped dolphins are taken as by-catch in both gillnet and pelagic trawl gear. Harbour porpoise by-catch is only evident in gillnets and bottlenose dolphins have been recorded taken as by-catch in both gillnet and pelagic trawl gears. For gillnets, harbour porpoise by-catch rates were on average lowest in the Baltic, followed by the North Sea/Eastern Arctic with the highest by-catch rates on average in the North Atlantic. Common and striped dolphin by-catch rates in gillnets were also reported for the North Atlantic regional coordination meeting (RCM) but were lower than harbour porpoise by-catch rates from the same area. For pelagic trawls, the North Atlantic common dolphin by-catch rate was higher on average than by-catch rates reported for bottlenose and striped dolphins from the Mediterranean and Black Sea. Potential significant sources of uncertainty in by-catch rates include missing data and different monitoring duties among regions. Mediterranean by-catch rates for gillnets are expected to be underestimated due to the lack of monitoring requirement under Reg. 812. In addition, North Atlantic and Mediterranean by-catch rates for pelagic/midwater trawls are likely underestimated due to missing data from Finland (since 2008), France (2012–2013), Spain (since 2009) and Sweden (since 2013).

WGBYC continues to develop a **by-catch risk assessment** with the aim of identifying regions that may pose the greatest threat to nontarget species in the absence of reliable data that would be needed to quantify the by-catch of protected, endangered and threatened species in a statistically rigorous manner. The WG applied a by-catch risk assessment to harbour porpoise where a range (high/low) in by-catch levels were estimated for regions within greater European Atlantic waters (i.e. Celtic and Irish Seas, North Sea, and Kattegat and Belt Seas). Data for the Celtic and Irish Sea assessment unit suggest that 1.39% of the harbour porpoise population is being taken if the upper 95% confidence limit by-catch rate is applied. This falls short of the 1.7% limit established by ASCOBANS. The North Sea and Kattegat Seas upper limit mortality estimates fell below 1.00% of their respective abundance estimates. However, many caveats apply to this upper limit, with the effort data reliability and the potential for biases involved. The WG will continue to improve upon and apply the by-catch risk assessment approach to other species/taxa as more data become available.

Several member states continue to design and test various **mitigation methods** to minimize by-catch of protected species. Current mitigation research includes continued development of a porpoise Alarm in German waters, development of fisher brochures of best practices for reducing by-catch in Portuguese waters, continued research on pinger effectiveness in Danish and UK waters, and the development of alternative fishing gears in Swedish waters. WGBYC seeks a continued commitment by its members to support and engage in the development and imple-mentation of mitigation research by seeking funding sources and collaborative re-search proposal ideas.

The ICES Working Group on Harp and Hooded Seals (*ICES WGHARP*)
ICES WGHARP now the ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHARP) met during 17-21 November 2014 Quebec City, QC Canada, to consider recent research and to assess the status and harvest potential of harp seal stocks in the White Sea/Barents Sea and in the Northwest Atlantic. The WG received presentations related to catch (mortality) estimates, abundance estimates, and biological parameters of all the stocks in question. Additionally, the WG examined different management options and subsequent scenarios of reductions of the Northwest Atlantic harp seal stock.

The 2015 ICES Annual Science Conference (ASC)
ICES ASC was held in Copenhagen, Denmark, 21-25 September 2015. The conference included no particular theme session devoterd entirely to marine mammals. Nevertheless, some sessions were designed with marine mammals included as an integral part – particular relevant sessions were: "Operationalizing ecosystem-based fisheries managemenmt", "Ecosystem monitoring in practice" and "How to hit an uncertain moving target: achieving Good Environmental Status under the Marine Strategy Framework Directive". More information is available at the ICES web side www.ices.dk.

JCNB (ITEM 5.4 IN THE SC REPORT)

No observer's report was available, but see discussion under Items 5.4, 8.4, and 8.5.

ARCTIC COUNCIL (ITEM 5.5 IN THE SC REPORT)

Observer report from Arctic Council related meetings

Arctic Council WGs (PAME, CAFF, AMAP, ACAP) Board Meeting
Desportes observed at two Working Group, PAME (September 15) and CAFF (September 16 and 17) and also joined the joint meeting of the four WG, PAME, CAFF, AMAP, ACAP (September 16am).

The information brought up to the PAME WG, although interesting was mostly not directly relevant to the present work of NAMMCO, except for the discussions related to Ecosystem-based Approach and Ecosystem-based Approach. One interesting presentation though was on a new arctic initiative, the Arctic Future Initiative (AFI)[8], of which NAMMCO may want to follow the development.

Several agenda points of the CAFF WG were more relevant. Among the interesting points were:
- "Provisional Ideas for Studies of Ice-Associated Marine Mammals", prepared by the US and Norway.
- Discussion on the development towards integrated sets of ecological objectives, which is also going on in EU (MFSD) and OSPAR.
- Discussion on Marine Protected Areas. Both CAFF § PAME[9] are promoting a network of MPAs throughout the Arctic.
- WWF strategy for the Arctic

[8] http://www.iiasa.ac.at/web/home/research/arctic-futures.html
[9] https://oaarchive.arctic-council.org/bitstream/handle/11374/417/MPA_final_web.pdf?sequence=1&isAllowed=y

The feedback to the presentation on NAMMCO activities in the Arctic[10] given at the PAME WG was positive. The Alaska ICC-chair, J. Stotts thanked NAMMCO for saying so directly that marine mammal were resources, as other marine resources. The US raised the question about the inclusion of traditional knowledge and local communities in the work of NAMMCO. N. Kutaeva from the Marine Rescue Service of Rosmorrechflot (MRS), Russia, said that she had seen on the web a video on the Faroe Islands where 800 dolphins were killed as sport and asked whether NAMMCO was doing anything about it. The answer was that that take had been mentioned in the talk and was regulated and NAMMCO had conducted an assessment and was planning to update it. The drive fishery was considered sustainable and was well regulated by the Faroese authorities. Kutaeva kept answering that this was different, and was not removals and not whales but dolphins hunted for sport. However later on at the evening event that anything could be find on the internet, also on Russia.

Some directly interesting and relevant contacts were made:
UNEP - Takehiro Nakamura, Chef of the Marine and Coastal Ecosystems Unit, Division of Environmental Policy Implementation. Discussion, a.o., on the Food Security Issue and the fact that marine mammals were usually not considered as ressources in the UN documents;
EEA – Nikolaj Bock, Special Advisor on International Affairs, on NAMMCO attitude to marine mammals and relationship with ICES and EU;
OSPAR – Darius Campbell, Executive Secretary. Discussion, a.o., on reinforcing the cooperation between OSPAR and NAMMCO;
CAFF – Tom Barry, CAFF Executive Secretary & **Tom Christensen**, CBMP Co-Chair. On increasing cooperation between CAFF and NAMMCO, and the possible participation of NAMMCO in the next meeting of the Marine Mammal Expert Network in Pasvik, NO, Nov 2-6;
CAFF Secretariat - Nina B. Vaaja, J. Hämäläinen, A. Meldgaard, on functioning and procedures in both secretariat and possible cooperation and exchange.

CAFF's Marine Expert Network (MEN) meeting, Pasvik, Norway, November 3-5, 2015
The Circumpolar Biodiversity Monitoring Program (CBMP - www.cbmp.is) is the cornerstone programme of the conservation of Arctic Flora and Fauna (CAFF - www.caff.is), the biodiversity Working Group of the Arctic Council. It is an international network of scientists, governments, Indigenous organisations and conservation groups working to harmonize and integrate efforts to monitor the Arctic's living resources. Its goal is to facilitate more rapid detection, communication, and response to the significant biodiversity-related trends and pressures affecting the circumpolar world. The CBMP organizes its efforts around the major ecosystems of the Arctic, marine, freshwater, terrestrial and coastal.

The CBMP has been endorsed by the Arctic Council and the UN Convention on Biological Diversity and the official Arctic Biodiversity Observation Network of the Group on Earth Observations Biodiversity Observation Network (GEO BON).
The CBMP – Marine held its annual meeting in Norway November 3rd – 5th at Svanhovd Conference Center in Pasvik, Finnmark. **The focus of the meeting was making progress on the** draft of the State of the Arctic Marine ecosystem Report (SAMBR) developed by the Circumpolar Biodiversity Monitoring Programme (CBMP). The report is scheduled to be completed and delivered to an Arctic Council Ministerial meeting in early 2017. The SAMBR is the first primary product from the implementation of the CBMPs Arctic Marine Biodiversity monitoring plan. It will present baselines and (where possible) trends in Arctic marine biodiversity at different trophic levels and by Arctic Marine Areas. The attendees had presentation on and discussed the state of Arctic sea ice biota, plankton, benthos, fishes, seabirds and marine mammals, and what was driving changes.

The Marine Mammal Expert Group, where NAMMCO was observer, met and made progress on the section of the report related to Marine Mammals. NAMMCO brought attention to the new abundance estimate and updated trends and assessment on different stocks of marine mammals, in particular narwhal, beluga and walrus, referring in particular to the latest reports of the Joint JCNB Working Group.

[10] http://www.pame.is/images/05_Protectec_Area/2015/PAME_2/Presentations/AMSA_4.9_-_NAMMCO_Presentation.pdf

ANNEX 1 - Report of the SC WG on Large Whale Assessment
Copenhagen, Denmark, 5-7 October 2015

1. OPENING REMARKS

Chairman Lars Walløe welcomed the assessment working group (WG) to the Greenland Representation. He noted that Geneviève Desportes was unfortunately not able to attend the meeting, and that Lars Witting would be attending on Tuesday and Wednesday only. The decision was made to start the meeting with fin whales because Lars Witting's input was necessary mainly for the common minke and humpback whale sections.

Previously (2011) the WG agreed on the high value of the process in the IWC of developing the Revised Management Procedure (RMP) and Aboriginal Whaling Management Procedure (AWMP), and especially of the concept of feedback control mechanisms based on regular abundance estimates, catch history and a population model. It also agreed that these principles are valuable and worth carrying over into any NAMMCO management process.

As far as the WG was aware, there had not been any additional work done on the common minke whale *Implementation Review* since the 2015 IWC SC meeting in San Diego.

For the fin whale work in the IWC SC, there is still some work to do on conditioning, etc., but the *Implementation Review* analyses are nearly complete.

2. ADOPTION OF THE AGENDA

The revised agenda (Appendix 1) was adopted.

3. APPOINTMENT OF RAPPORTEUR

Prewitt was appointed as rapporteur, with help from participants as needed.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

The WG reviewed the available documents.

5. NORTH ATLANTIC COMMON MINKE WHALE

Background

The NAMMCO SC has been requested (R-3.3.4) to conduct a full assessment, including long-term sustainability of catches, of common minke whales in the Central North Atlantic. At NAMMCO/23, Council adopted amendments to request R-3.3.4 to be changed to the following text: "The SC is requested to complete assessments of common minke whales in the North Atlantic and include estimation of sustainable catch levels in the Central North Atlantic. While long-term advice based on the outcome of the RMP *Implementation Reviews* (with 0.60 tuning levels) is desirable, a shorter-term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015."

Assessments

Past assessments for all regions of the North Atlantic have been completed by the IWC SC starting in 1992.

Assessments in NAMMCO using Hitter-Fitter models of the Central North Atlantic common minke whale population have been presented in previous reports (NAMMCO 2003, 2009). These assessments, together with projections under the future catch levels specified by the Council, were conducted for both the CIC *sub-area* and the complete Central *Medium Area*, and for $MSYR_{1+}$ values of 1%, 2% and 4%.

Regarding stock structure, recent examination of mainly genetic data has failed to provide clear evidence of stock structure amongst common minke whales in the North Atlantic, except for small differences on an ocean-wide scale (IWC 2014). While this may suggest a single ocean-wide stock with incomplete mixing, in a management context in the IWC SC it has been decided operate with three stocks at a "Medium Area" level, i.e., a Western (W), Central (C) and Eastern (E) stock (Fig. 1). The WG endorses the single-stock hypothesis, and the use of the W, C and E Management Areas.

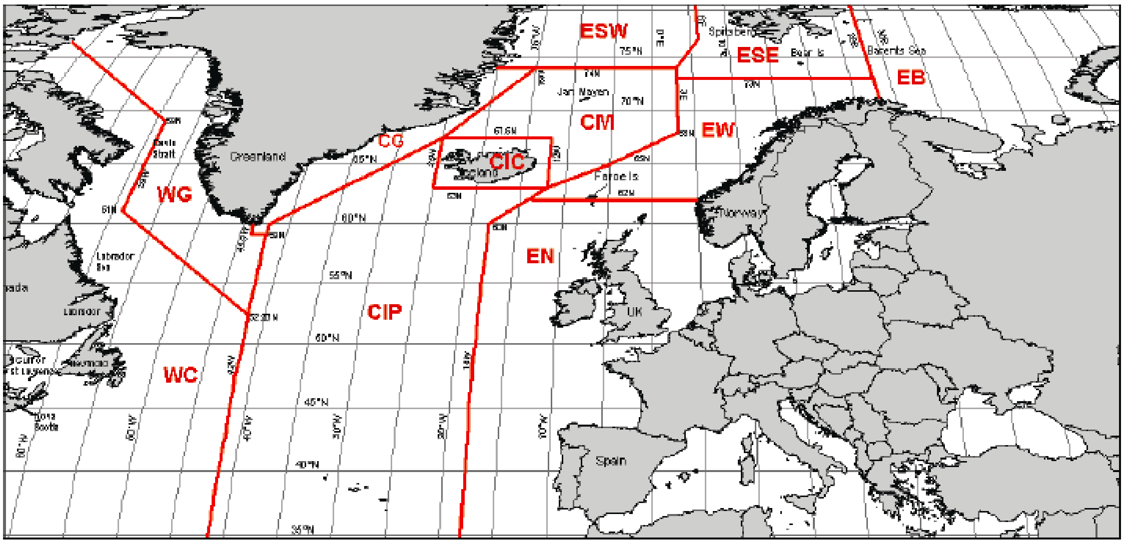


Fig. 1. Map of the North Atlantic showing the *sub-areas* defined for the North Atlantic common minke whales.

The most recent assessments available on this basis are those that constitute part of the conditioning of the trials in the current ongoing, though now virtually complete, IWC *Implementation Review* for North Atlantic common minke whales. Although a few small adjustments still need to be made, the WG considered that the existing results provide an up-to-date and reasonably robust indication of the current status of common minke whales in the North Atlantic.

Figure 2 reproduces existing results from some baseline trials (IWC 2015) from this conditioning for a scenario of three stocks (W, C and E) with some overlap on their northern feeding grounds, and with the E stock split into two sub-stocks. The mature female trajectories shown indicate that these populations have either:

i) never been substantially reduced below their pre-exploitation levels, or

ii) been earlier reduced by no more than about 50%, but recently have been increasing.

Hence these assessments do not indicate any reason for concern about the status of common minke whales in the North Atlantic.

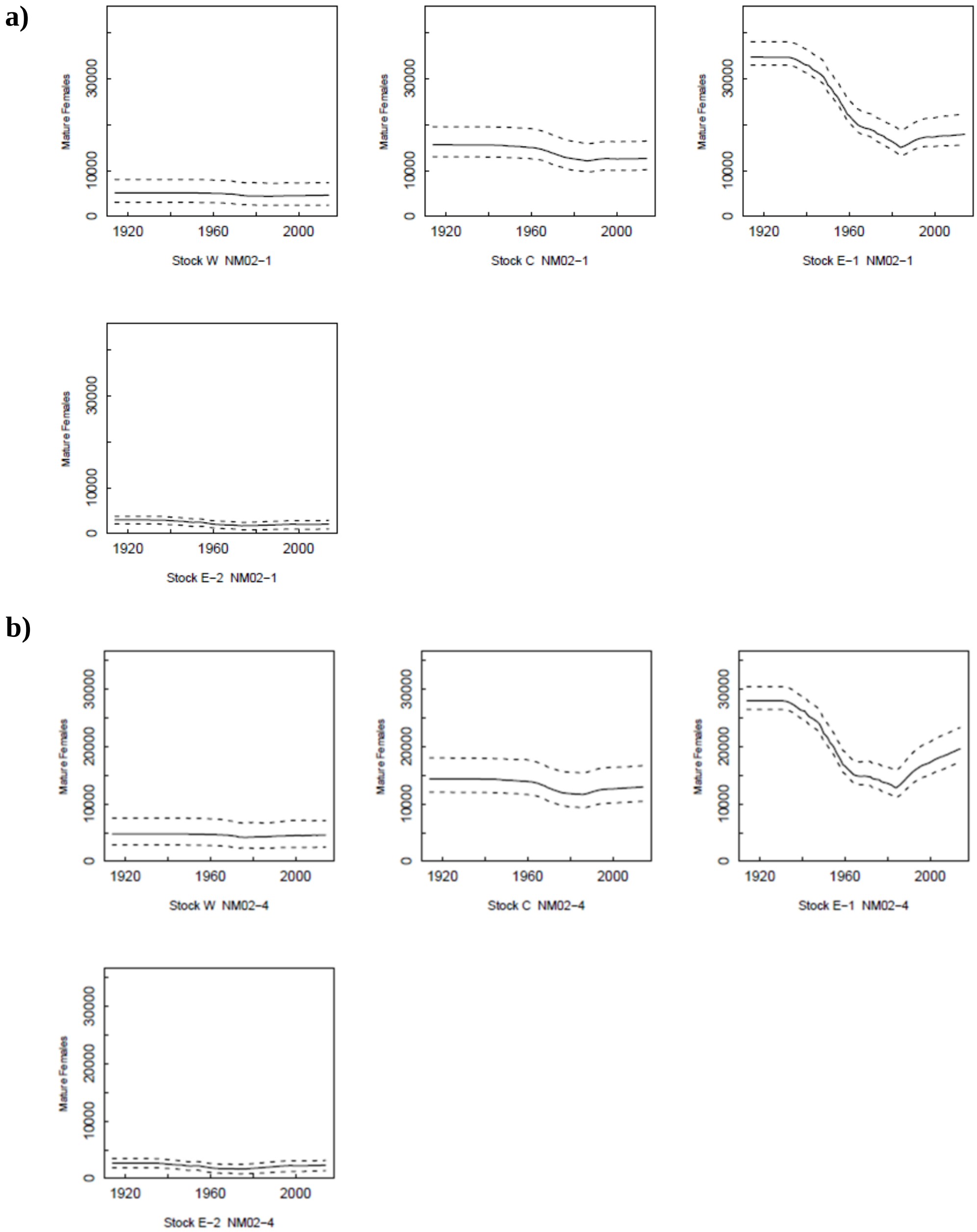


Fig. 2. From IWC (2015) Annex D, Appendix 5. a) NM02-1 median and 90%ile on mature female population for $MSYR_{1+}$=1%, b) NM02−4; median & 90%ile mature female populations for $MSYR_{mat}$=4% by (sub-)stock for North Atlantic common minke whales

Management

In the past, management for the eastern North Atlantic common minke whales has been based on application of a variant of the RMP. For the central North Atlantic advice has been provided by NAMMCO, more recently using the RMP. In the western North Atlantic, advice has been developed in the IWC SC standing WG on the AWMP, more recently using an interim Strike Limit Algorithm (*SLA*).

West "*Medium area*"

There is currently no whaling in the WC (see Fig. 1) *sub-area*.

The current IWC management advice for West Greenland (WG, see Fig. 1) common minke whales (164) is based on the interim AWMP procedure applied to the 2007 estimate of 16,100 (CV: 0.43) common minke whales off West Greenland. The IWC advice for the next block quota starting in 2018 is planned to be based a management procedure that has not yet been established, but is planned to be developed from the trial structure of the ongoing RMP *Implementation Review*. The development is thus dependent on the finalization of this *Review*, with the possibility of small scale adjustments (by the IWC AWMP group) to the West Greenland component to address details that may have been overlooked in this *Review*.

Central "*Medium Area*"

The NAMMCO SC previously agreed that implementation of the IWC to calculate catch limits provided an appropriate basis to address the Council's requests for assessments and advice. The RMP can be applied at a "*sub-area*" level, or to combinations of such *sub-areas*. For the Central North Atlantic common minke whale population there are four such *sub-areas* (see Fig. 1): the Jan Mayen *sub-area* (CM), the Icelandic coastal *sub-area* (CIC) in which Icelandic catches would concentrate, the East Greenland *sub-area* (CG) and the Icelandic pelagic *sub-area* (CIP). In 2010 the assessment WG and subsequently the NAMMCO SC agreed to management advice for the CIC *sub-area*, based on the RMP CLA with level of 0.60. The CLA was run with two different tuning levels (0.60 and 0.72) and variable inclusion of the two most recent abundance estimates for 2007 and 2009. Based on this assessment the NAMMCO SC concluded that annual removal of up to 216 common minke whales from the CIC *sub-area* is safe and precautionary. The advice was considered conservative in the sense that it was based on the uncorrected, downward biased 2009 abundance estimate as well as the lower of the two accepted abundance estimates from 2007. Similarly, an annual removal of 121 common minke whales from the CM *sub-area* was given as safe and precautionary management advice (NAMMCO 2010 p. 30). In 2011, the advice was updated using corrected estimates from 2007 and 2009 and a catch of 60 common minke whales in 2010. These new catch limit calculations gave a recommended catch limit of 229 for the CIC *sub-area*.

The management advice for East Greenland (EG, see Fig. 1) has been developed in the IWC SC standing WG on the AWMP.

East "Medium Area"

For the IWC East *Medium Area* the IWC-SC agreed the abundance estimates (mid time point 2011) in 2014, and agreed that the genetic data showed that all common minke whales in this *Medium Area* could be regarded as belonging to one stock.

For precautionary reasons the IWC-SC agreed that the EN *sub-area* should continue to be regarded as a *Small Area*, but that the *sub-areas* EW, EB and ES should be combined in a new *Small Area*. The IWC-SC *Implementation Simulation Trials (ISTs)* for the North Atlantic Central and East *Medium Areas* showed acceptable performance for this structure. For these reasons management advice for common minke whales in the next six year period from 2016 for the East *Medium Area* should be based on the 2011 abundance estimates using RMP with *tuning level* 0.60 and with *catch cascading* between the two remaining *sub-areas*.

Management advice for the Central *Medium Area*

Table 1 summarises the NAMMCO SC's management advice for the Central *Medium Area* in the past.

Table 1. NAMMCO SC management advice for Central North Atlantic common minke whales.

Year	Latest survey	CIC	Central	Source	Basis for Advice
1997	1987	185	292	SC6 (21/MC4)	Hitting-with-fixed-MSYR model
2003	2001	400	400	SC11	Hitter
2009	2007	200	200	SC15	Hitter
2010	2009	216	337	SC17	RMP-CLA
2011	2009	229	350	SC18	RMP-CLA

Elvarsson presented SC/22/AS/04, which is based on the IWC RMP, and provides catch limits for North Atlantic common minke whales in the Iceland coastal CIC *sub-area*. This advice follows from an analysis that is based on the same approach as used in SC/18/AS/05; the only new input information is updated catch data.

Based on SC/22/AS/04, the WG recommended that a catch limit of 224 common minke whales (based on the CIC management unit and a tuning level of 0.60) for common minke whales in the CIC *sub-area* is safe and precautionary, and that this advice should be considered valid for a maximum of 3 years (2016 — 2018). This is interim advice because the most recent abundance estimate is from 2009, and the WG reiterated its previous recommendation that 10 years is the longest period the approach applied could be used without a new abundance estimate becoming available. The WG also recognised that a survey had been carried out this past summer (2015), although the associated areal coverage was considered to be poor.

It should be noted that the catches in the CIC *sub-area* have in recent years been a small fraction of the total allowable catch, and although catch limits have been allocated to the CM *sub-area*, no whales have been taken there in recent years (since 2011).

<u>Rationale</u>
Although this WG recommends using the three *Medium Areas* as management units in the future, the WG agreed to use the CIC *sub-area* as the management unit for this short-term advice based on the reasons below.

- This can be viewed as a conservative approach because it focuses on this *sub-area* only, although recent genetic studies have shown that at least the whole Central *Medium Area* can be considered as a single stock. For example, after the drop in abundance in the Icelandic coastal *sub-area* (CIC) between the 2001 and 2007 surveys, the management advice was reduced from 400 to 200 common minke whales based on assessments using the Hitter approach (Table 1).
- The WG would prefer to apply the CLA to the whole Central *Medium Area*, but the most recent abundance survey was that in 2009 which covered only the CIC *sub-area*. To apply the RMP at the *Medium Area* level would mean that the most recent abundance estimate for that whole region is from 2007, and so already almost 10 years old.

The WG noted that a new abundance estimate is needed for the whole Central *Medium Area*.

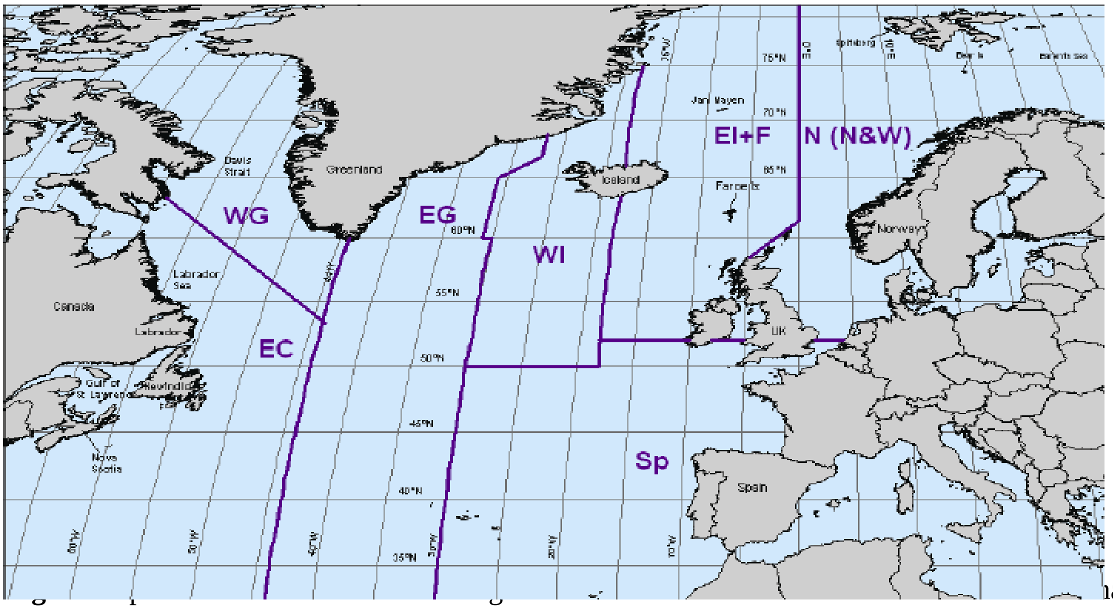
6. NORTH ATLANTIC FIN WHALE

In 2008 the NAMMCO SC was requested (R-3.1.7) to complete an assessment of fin whales in the North Atlantic, and also to include an estimation of sustainable catch levels in the Central North Atlantic.

At NAMMCO 23, Council endorsed an amendment to request R-3.1.7 to include the following additional text: “While long-term advice based on the outcome of the RMP *Implementation Reviews* (with 0.60 tuning level) is desirable, shorter term, interim advice may be necessary, depending on the progress within the IWC. This work should be completed before the annual meeting of the SC in 2015.”

Management Advice

At the 2010 NAMMCO fin whale assessment the WG agreed to use WI + EG as the unit for which a catch limit should be calculated (Fig. 3). The WG stated at that time that: “The IWC SC RMP trials also show that the [WI+EG management unit] would not lead to any serious conservation concern in the short to medium term (up to 10 years), even under the most pessimistic combination of stock-structure and MSYR value choices”. The WG applied the RMP on this basis, leading to the recommendation that an annual catch up to 155 fin whales could be taken in the WI *sub-area*.



hales

Elvarsson presented SC/22/AS/04 which is based on the IWC RMP, and provides catch limits for North Atlantic fin whales in Iceland. This advice follows from an analysis that is based on the same approach as used in 2010; the only new input information is updated catch data.

Based on SC/22/AS/04, the WG **recommended** that a catch limit of 146 fin whales (based on the EG+WI management unit and a tuning level of 0.60) for fin whales that can be taken anywhere in the EG+WI region is safe and precautionary, and that this advice should be considered valid for a maximum of 2 years (2016 and 2017). This is interim advice because the most recent abundance estimate is from 2007, and the WG reiterated its previous recommendation that 10 years was the longest period the approach applied could be used without a new abundance estimate becoming available. The WG also recognised that a survey had been carried out this past summer (2015), and by this time next year a further agreed abundance estimate should be available.

The WG discussed that the catch limits advised at this meeting of 146 fin whales is lower than previous advice of 155 fin whales, even though the recent catches have been lower than the catch limits adopted and there is no new abundance estimate included in this new analysis. The reason for the slight decrease in this limit from the 2010 result, despite recent catches having been less than catch limits, is probably that for a resource estimated initially to be close to carrying capacity, the RMP gives catch limits that tend to decease over time as catches lead to a decrease in abundance.

Rationale
As mentioned above, in 2010 the WG agreed to use the combined WI+EG *sub-areas* as the management unit. This WG meeting reiterated this recommendation and expanded upon the reasons below.

- Vikingsson et al. (2009, 2015) show a more homogeneous distribution of fin whales across the EG+WI *sub-areas* than in the past, suggesting that it is even less likely that there are different stocks in this region.

- The RMP was designed to be a robust procedure that can deal with distributional shifts within stocks, and recently observed shifts in distribution were within the boundaries of the EG+WI sub-areas (Vikingsson et al. 2009, 2015).

- Recent updated IWC SC *Implementation Simulation* Trials (*ISTs*) (with $MSYR_{1+}$=1%), have shown poor fit of the data under Hypothesis IV (which treats the EG and WI *sub-areas* as feeding grounds for essentially separate stocks rendering their combination for catch limit computation problematic). This suggests that Hypothesis IV (with $MSYR_{1+}$=1%) is of low plausibility.

- IWC SC development of these new *ISTs* has not led to the inclusion of any more conservative situations than encompassed by the previous *ISTs* (e.g., when recommendations to investigate density dependence were implemented)**.**

Population trajectories from the *ISTs* (with the exception of Hypothesis IV) for the main stock exploited in the EG+WI sub-areas show a steady increase over recent decades to levels near or above that at which MSY would be obtained. Fig. 4 shows an example of such trajectories (Elvarsson pers. comm.; based on the *IST* for Hypothesis III).

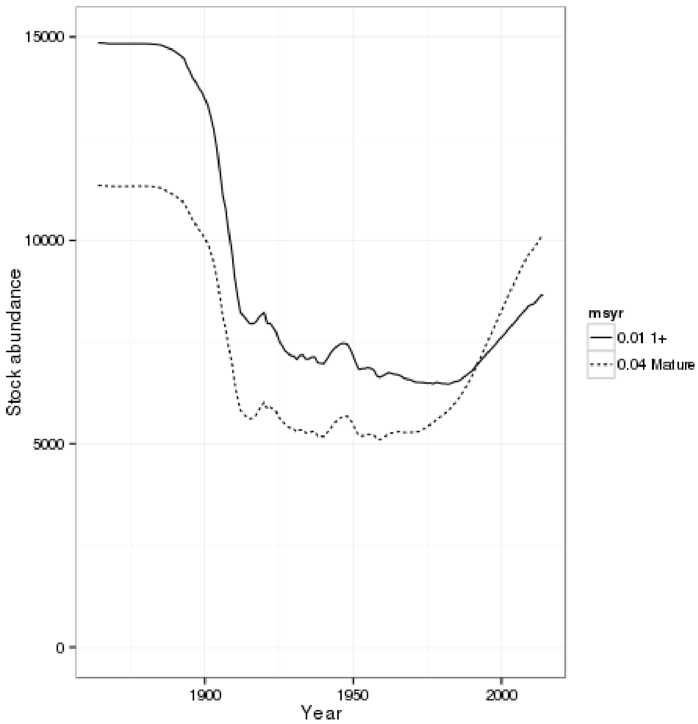


Fig. 4. Mature female population trajectories, estimated for the purposes of *Implementation Simulation Trials*, for the three central sub stocks combined for stock structure Hypothesis III for different MSYR rates.

Future Work
The WG discussed work that is currently underway, and may be informative for long-term advice within the next year or so.

1) A new abundance estimate is expected from this year's sightings survey (NASS2015), and will likely be accepted by the NAMMCO SC next year.

This new abundance estimate would provide new information to update the catch limit using the RMP.

The WG discussed an apparent problem with the realised effort for NASS2015 in that the observation effort in the fisheries surveys off East Greenland was mainly realized on transit legs along the shelf, due to unfavourable conditions at other times. Deleting this effort for a design based estimation approach will result in limited and unbalanced effort in the area; therefore some model-based approach may need to be considered.

2) Completion of IWC *IST* revision

This work is ongoing and an IWC workshop has been tentatively scheduled for February 2016. Completion of the IWC's work will be informative for long-term advice; however the WG recognises that this IWC work has been postponed in the past, and issues may yet arise that again delay completion of this work.
This *IST* revision could result in the formal rejection of Hypothesis IV (the most conservative hypothesis), and furthermore formal acceptance of Variant 3 (EG+WI+EIF) is possible, which could allow higher catch limits for harvests within the WI *sub-area*.

3) Revision of RMP with 0.6 tuning

The NAMMCO SC has requested that the RMP would be rerun with 0.6 tuning (NAMMCO 2010). These runs are conditional on the completion of the IWC *IST* revision. At the time these runs are performed it was suggested that two issues may need to be addressed:

- The CLA may need to be recalibrated as recently the minimum MSYR for trials has been revised. Previously the RMP-CLA used in the RMP has been tuned with respect to an MSYR of 1% for the mature population, but recently the IWC SC agreed to change the minimum MSYR to 1% on 1+ population.
- Acceptability of the management variants may need to be revised. Currently the *ISTs* consider threshold levels based on equivalent single stock trials (based on the T1-D1 trial) where the lower 5% quantiles of the final and minimum depletion levels when the CLA is applied with 0.6 and 0.72 tuning define the boundaries between unacceptable, borderline, and acceptable.

4) Results on research into stock structure.

Work is currently underway on genetics and tagging studies to inform further on stock structure.

Iceland is currently investigating genetics to identify close kin relationships. There are plans for some analyses to be available for the 2016 IWC SC meeting. A potential problem with these analyses is that the majority of the samples have been taken on the Icelandic whaling grounds, so that their distribution is limited and it would be hard to distinguish between potential stocks. Iceland is working on obtaining samples from Norway and Greenland, both from catches and biopsies. Biopsies will be very useful particularly because they come from a wider geographical area. If the genetics detects close relations present on both sides of the EG/WI boundary, it may be possible to reject the two stock hypothesis (Hypothesis IV) for this region.

Satellite tagging is also ongoing; however results are not expected within the next couple of years.

7. NORTH ATLANTIC HUMPBACK WHALE

The NAMMCO SC last reviewed the status of the West Greenland humpback whales in 2010. At that time, the SC applied the "interim SLA" to the most recent abundance estimate from 2007 to conclude that an annual catch of 20 whales was safe, and that this level of catch would allow the population to increase.

Within the IWC, management advice for humpback whales off West Greenland has been provided by the SC, which agreed on a final AWMP *SLA* for this stock in 2014. This NAMMCO WG endorsed this *SLA* as the best current basis for providing management advice for West Greenland humpback whales, as well as the current advice of up to 10 strikes per year requested by Greenland (within the IWC system) as being safe. This WG discussed but did not come to a conclusion on whether NAMMCO (if in a position to provide advice to Greenland) should consider the impact that the IWC's *Needs Statement* has on the quotas given by the *SLA*, considering that it is a component of the *SLA* procedure.

This advice applies up to and including 2017, and with an expected new abundance estimate from the NASS2015, a new calculation to provide advice should be straightforward.

8. NEXT NAMMCO SC WG ON ASSESSMENT – PREPARATION

The WG recommends that it meet again when abundance estimates are available from NASS2015 to provide updated advice. One possibility is to hold a joint meeting with Abundance Estimates WG.

The WG requires direction on for which species/areas further advice is wanted, noting the Council's wish to avoid duplication of work between the IWC and NAMMCO SCs.
The WG notes the following as necessary preparatory work for the next meeting:

1) Updated abundance estimates
2) Conduct of simulation trials of CLA re-calibration described for fin and minke whales

The WG noted that catch limit calculations could be conducted within the meeting.

9. OTHER BUSINESS

No other business was discussed.

10. ADOPTION OF THE REPORT

The content of the report was adopted during the meeting at 1:55pm on 7 October 2015, and in final editorial form by correspondence on 4 November 2015.

The WG thanked the Chair for his able chairmanship, and the invited experts for their hard work.

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Appendix 1 - Agenda

1. OPENING REMARKS
2. ADOPTION OF THE AGENDA
3. APPOINTMENT OF RAPPORTEUR
4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS
5. NORTH ATLANTIC COMMON MINKE WHALE
   Background
   Assessments
   Management
   Management advice for the central medium area
6. NORTH ATLANTIC FIN WHALE
   Management
   Future work
7. NORTH ATLANTIC HUMPBACK WHALE
8. NEXT NAMMCO SC WG ON ASSESSMENT – PREPARATION
9. OTHER BUSINESS
10. ADOPTION OF THE REPORT

Appendix 2 - List of Participants

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ANNEX 2 – Report of the meeting of the NAMMCO/JCNB

NAMMCO SCIENTIFIC COMMITTEE WORKING GROUP ON THE POPULATION STATUS OF NARWHAL AND BELUGA IN THE NORTH ATLANTIC

And the

CANADA/GREENLAND JOINT COMMISSION ON CONSERVATION AND MANAGEMENT OF NARWHAL AND BELUGA SCIENTIFIC WORKING GROUP

Ottawa, Canada, 11-13 March 2015

EXECUTIVE SUMMARY

A Joint Meeting of the NAMMCO Scientific Committee Working Group on the Population Status of Narwhal and Beluga in the North Atlantic and the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga Scientific Working Group met in Ottawa, Canada, during 11-13 March 2015. The group reviewed new information on the biology of narwhals and belugas, updated the assessments and catch advice based on new information, and discussed the development and application of the Catch Allocation Model developed by the Catch Allocation Sub-Group.

NARWHALS

The JWG reviewed papers on narwhal biology, including studies on dietary differences based on stable isotopes, differences in mating systems between narwhals and belugas, comparison of diving behaviour between the three main populations, and passive acoustic monitoring of narwhals in Scott Inlet (Nunavut). Information in these papers were not used to update the assessment and advice at this meeting, but contribute to the overall knowledge of narwhal biology.

Catch Statistics and Struck and Lost
Information on catch statistics and struck and lost was presented from both Greenland and Canada.

Greenland presented a time series that provides realistic catch levels from West Greenland during 1862-2014, which was constructed with catches split into hunting grounds and corrected for under-reporting detected from purchases of mattak (low option), for periods without catch records (medium option) and from rates of killed-but-lost whales (high option). Struck and lost rates have been estimated using factors such as community, season, hunting method, and these estimates are included in the catch history that is used in the assessment model.

Canada presented catch statistics and a summary of the process of management advice in Canada. The catch statistics provided by Canada have not been split by summering stocks or struck and lost rates by communities. For the purposes of this meeting, a single value of 1.28 was multiplied by the raw landed catch to estimate the total removals.

The JWG reiterated the recommendation for Canada to provide corrected catch statistics to include in the assessments, including historical catches which are corrected for estimates of struck and lost that are based on factors such as the community, hunting methods, and season, rather than applying a uniform stuck and lost rate to all of the data. The JWG noted that ideally there would be monitoring programmes occasionally for struck and lost that could be used to update the values but recognised that there are no plans for this in the near future.

Surveys and Abundance
The JWG reviewed new correction factors for availability of narwhals during surveys based on satellite tagged narwhals (Watt et al. 2015). The JWG identified potential technical problems with the satellite tags that the authors agreed to review before the next meeting. The JWG agreed to use the new correction factors in the current assessment, and pending the outcome of the review of the possible technical problems.

Abundance estimates were presented from the High Arctic Cetacean Survey that was conducted in Canada in August 2013. The details of the survey will be discussed at the next JWG meeting when working papers are available.

New abundance estimates for narwhals in Melville Bay (one of the two summering areas in West Greenland) and East Baffin Bay based on aerial surveys were presented and these estimates of 2,983 narwhals (cv=0.39; 95% CI 1,452-6,127) and 3,091 (cv=0.50; 95% CI 1,228-7,783) in 2012 and 2014 were accepted by the JWG for use in the assessment.

An abundance estimate of narwhals in the North Water in winter was also presented, however, while these results can be used as information on winter distribution, these abundance estimates are not used in the assessment. The results do provide information suggesting a large number of narwhals use the North Water polynya in late winter and are available to move north, east, and west into summer aggregations areas: Jones Sound-Norwegian Bay, Inglefield Bredning, and Smith Sound.

Catch Allocation Model

Recognizing that the narwhals hunted in different regions cannot easily be attributed to their summering aggregation based on genetics or other stock identity information, the JWG tasked a sub-group to develop a model that includes the sum of all information that is available including telemetry movements, all survey abundance estimates, and historical catch data.

The Catch Allocation sub-group of the NAMMCO-JCNB Joint Scientific Working Group (JWGsub) met 10–12 March 2014 in Copenhagen, Denmark, and again in Ottawa, Canada 9-10 March 2015.

The Terms of Reference for this meeting were to:

- review information on distribution, movements and harvest locations of narwhal;
- develop an allocation model that will provide a mechanism for assigning harvested animals to all summer stocks based on existing data;
- specify and quantify exchange rates between aggregations and stocks;
- identify and quantify uncertainty in the allocation model and determine implications for management; and
- recommend future work to resolve uncertainties within the model structure.

The main purpose for these meetings was to develop a model for catch allocations for the Baffin Bay narwhal population that is shared by Canada and Greenland, but not to decide on the sustainability and/or provide advice on the actual quotas. The JWG_{sub} reviewed the available data on takes and migratory movements of narwhals and determined that in some areas different stocks of narwhals were available to hunters in different seasons. Data from satellite tags attached to narwhal in summer aggregations and expert opinion was used to determine which summer aggregations were available to hunters in villages and the timing of that availability.

Hunts were divided into four seasons to correspond with the spring and fall migrations the summer aggregation period and the overwintering areas. A total of 24 seasonal hunts were identified to be allocated among the 8 summer aggregations. To do this an allocation matrix with 24 rows by 8 columns was devised. The eight columns were the individual summer aggregations of Smith Sound, Jones Sound, Inglefield Bredning, Melville Bay, Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island. The 24 rows represented 24 hunts in 10 regions and some regions hunts were divided by season.

Thus for each summer aggregation and hunt there is a cell in the matrix, and the matrix is devised so that when multiplied by a number of removals, the resulting number will determine the total removals from each summer aggregation. The cells in the matrix were determined using the tag data, or when no tag data was available, then expert opinion and the relative abundance of each summer aggregation. The tag data determined the fraction of the summer aggregation that was available to a hunt, which was multiplied by the size of the stock to determine the numbers from each summer aggregation exposed to each hunt. These were then divided by the total number of whales available to a hunt to determine the proportion of the hunt that came from the summer aggregation. The JWG_{sub} identified a number of points of uncertainty and thus developed a method for testing the sensitivity of the allocation to data uncertainty as well as stochastic variation of the matrix from year to year.

The JWG recommended that the remaining tasks are now the responsibility of the full JWG. Therefore, the Catch Allocation subgroup work was considered completed.

Metapopulation Model
A metapopulation model was presented that combined the catch allocation model for narwhals in East Canada and West Greenland with Bayesian population modelling of the eight summer aggregations of narwhals in the region. The catch allocation model allocates the catches in different hunting areas and seasons to the different summer aggregations, and the population models analyses the impact of these catches on the population dynamics of the eight narwhal aggregations. The metapopulation model uses population trajectories and catch histories from 1970 to 2014 to estimate the catches taken from the different summer aggregations during this period.

The population dynamics that are estimated for the different summer aggregations from these catch histories were presented. Some of the summer aggregations, like those in Smith and Jones Sound, have very low catches that have little affect the dynamics, while the narwhal aggregation in Melville Bay is clearly influenced by the historical takes. The narwhal aggregation around Somerset Island may have an increasing trend, and those in Inglefield Bredning, Admiralty Inlet, Eclipse Sound and East Baffin Island appears relatively stable. The model estimates that nearly all the aggregations are above the maximum sustainable yield level (MSYL) where slightly decreasing trends usually are of no concern. The exceptions are Inglefield Bredning and Melville Bay. Both of these aggregations are estimated to be depleted to levels below the MSYL, implying that future harvest levels should be set to ensure an increasing number of narwhals in these summering areas.

For situations where stocks may be below or above the MSYL, realistic management objectives could reflect allowable takes that ensures that stocks below the MSYL are increasing towards the MSYL, while the takes from stocks above the MSYL level should be smaller than the maximum sustainable yield (MSY), e.g., smaller than 90% of the MSY. Given such a management objective, the JWG reviewed the estimated annual takes from the different summering aggregations over the next five years that allows this management objective to be fulfilled with a probability from 0.5 to 0.95.

The take of narwhals from the different summering aggregations cannot be managed by consideration of summering grounds exclusively because many narwhals are caught in other hunting areas at other times of the year (e.g., during migration). Instead, management limits for different hunts and season must be considered together.

The JWG reviewed two potential scenarios of takes and their relation to management objectives. In these scenarios, the average removals from 2009-2013 from Melville Bay did not meet the above management objective example of 70% probability of success and East Baffin did not meet 80%, thus the JWG **recommends** reducing the hunts that remove narwhals from these stocks. The JWG proposed an alternative using a simple approach to reallocation as an example of adjusting take limits to meet the management objectives. The JWG **recommends** using the catch allocation model with the assessment models to verify that allowable takes do not exceed acceptable risk levels.

While the model can be used to determine the risk of a particular harvest regime, the JWG **seeks further guidance** from the JCNB/NAMMCO on the management objectives.

East Greenland Assessment
The updated assessment suggests somewhat lower catch than the previous advice for the Ittoqqortormiit area. The JWG **recommends** this lower quota since the data that is available (2008) is now seven years old and consequently less reliable to represent the current status of the narwhals in that area. The JWG also **recommends** that a new survey be conducted in East Greenland.

The JWG discussed whether the East Greenland stocks should be considered depleted, stable or growing, information that would assist in setting management objectives.

Future Research
The JWG recommends that future research includes:

5) Aerial survey in East Greenland
6) More satellite tag and dive data from the stocks in West Greenland and Eastern Canada to obtain more information about movement between summer aggregations and information for availability bias for survey correction factors
7) Developing a model (e.g., "Hidden Markov") to incorporate perception bias, which requires detailed dive cycle information

BELUGAS

The JWG reviewed new information on beluga biology including ageing using aspartic acid racemisation and fatty acids, and estimating weaning ages using stable isotopes. This information was not used in the assessments at this meeting.

Catch Statistics
Updated catch statistics from Greenland were presented. Catch levels in the past five decades are evaluated on the basis of official catch statistics, trade in mattak (whale skin), sampling of jaws and reports from local residents and other observers. Options are given for corrections of catch statistics based upon auxiliary statistics on trade of mattak, catches in previous decades for areas without reporting and on likely levels of loss rates in different hunting operations. Catches were also corrected for underreporting and struck and lost. The JWG approved the methods and the medium and high options are provided for the assessment model as correction options.

The group noted that in 2013 there were higher catches than usual in Upernavik. The reason for this is not known, however it may be informative to review the seismic activities that occurred in the region in 2013. It is possible that seismic activities could have driven the whales closer to shore, making them more susceptible to hunting. It is already known that belugas are easily scared into the coast, and also that the migration patterns of belugas are potentially affected by seismic activities.

Canada presented catch statistics and a summary of the process of management advice in Canada. The catches presented did not include struck and lost rates. The JWG agreed that there is a need to construct a table that better illustrates which catches are thought to be shared between Canada and Greenland. This table needs to go back to 1970 to be included in the assessment models.

Abundance
The JWG reviewed a new abundance estimate from eastern Davis Strait and Baffin Bay based on an aerial survey conducted in March-April 2012. The population remains depleted compared to historical levels (20,000 in ca 1980, probably previously even higher than that), but has levelled off after a catch quota was introduced (and thus catches reduced). The JWG agreed to accept the mark-recapture abundance estimate of 9,072 whales (CV=0.32, CI: 4,895-16,450).

A winter abundance in the North Water was presented. Similar to narwhals, this estimate is not used in the assessment, however it provides useful information on winter distribution.

Assessment Update
The JWG reviewed an update on the population assessment for belugas, which used recent abundance estimates and historical catches in an age-structured population model with density-regulated growth to perform Bayesian assessments of the beluga aggregation that winters off West Greenland. The model starts from a stable age-structure in 1970 under the assumption that the 1970-abundance was below the current carrying capacity, and it was applied with a high and low prior on adult survival.

The dynamics of the high survival model estimates a decline from 19,140 (90% CI:12,680-28,260) individuals in 1970 to a maximal depletion of 8,130 (90% CI:5,740-11,440) in 2004, and an increase to 11,420 (90% CI:6,370-17,850) individuals in 2020 (assuming yearly post 2014 catches of 294). The predicted change from a declining to an increasing population was caused by the introduction of quotas in Greenland, with annual catches in the order of 500 to 700 reduced to less than 200 after 2004. Given total annual removals of 320 individuals from 2015 to 2020, the low survival model estimates that there will be a 70% chance of an increasing population over the period.

The group discussed how the current analysis could allow higher catches even with a lower recent abundance estimate. The group concluded that the recent lower catches has allowed the population to increase and hence allows recommendations of higher catches. While the recent point abundance estimate is lower, it is not statistically different than the previous abundance estimate consequently the model considered the population to be stable or increasing.

Advice from the JWG

Reiteration of Past Advice
The JWG **reiterates** the previous advice from 2005 and 2012 about seasonal closures. The following seasonal closures are **recommended**:

- Northern (Uummannaq, Upernavik and Qaanaaq): June through August
- Central (Disko Bay): June through October
- Southern (South of Kangaatsiaq): May through October.
- For the area south of 65°N, it is recommended that no harvesting of beluga be allowed at any time.

The function of these closures is to protect the few belugas that may remain from historical summer aggregations in Greenland, and to allow for the possibility of reestablishment of the aggregations.

No specific advice was given on the North Water, noting that the removals remain at a low level relative to the population size derived from the 2009-2010 and 2014 surveys in the North Water and around Somerset Island in 1996, and assuming that future catches remain at low levels.

New Advice
With the new accepted abundance estimate for belugas in West Greenland in 2012, the JWG provided updated advice provided in Table 5 in the Main Report.

Other Business
The JWG noted that traditional knowledge is used whenever relevant. The JWG also discussed issues related to the impact of human-made noise. A Symposium on the impacts of human disturbance on arctic marine mammals planned for fall 2015, convened by NAMMCO. A summary report from this Symposium will likely be available at the next JWG meeting.

The JWG also agreed that at the next meeting, the group should discuss guidelines for giving advice in data-poor situations.

The JWG adopted the draft ROP which will be sent to the JCNB and NAMMCO Council for approval (Appendix 5 of the Main Report).

MAIN REPORT

1. OPENING REMARKS

NAMMCO Chair Roderick Hobbs welcomed the participants (Appendix 1) to the meeting. Steve Ferguson agreed to chair for the JCNB, recognizing that this will be his third meeting as chair, where in the past JCNB chairs have served for two meetings. The JWG selected Rikke Guldborg Hansen as the co-chair for the JCNB at the next meeting and NAMMCO will notify the NAMMCO SC that we have invited Roderick Hobbs to continue as the NAMMCO Chair.

2. ADOPTION OF JOINT AGENDA

The agenda was adopted with minor changes.

3. APPOINTMENT OF RAPPORTEURS

Prewitt agreed to rapporteur with support of meeting participants.

4. REVIEW OF AVAILABLE DOCUMENTS

Chair Hobbs reviewed the available documents (Appendix 2).

5. NARWHALS

5.1 Stock structure

5.1.1 Genetic information

There was no new information on genetics.

5.1.2 Satellite tracking

No new satellite tracking information was available.

5.1.3 Other information

Dietary differences by stable isotope analysis

Watt presented on differences in diets by population based on stable isotopes. Narwhals (*Monodon monoceros*) are sentinel species in the Arctic and to investigate dietary differences, both spatially among three narwhal populations, and temporally within two of the populations, we examined diet using fatty acids, $\delta^{15}N$, and $\delta^{13}C$. Stable isotope analysis revealed the three populations have distinct $\delta^{15}N$ and $\delta^{13}C$ values that are not expected based on geographic differences and that males in all populations had significantly higher $\delta^{13}C$. Stable isotope mixing models revealed narwhals in East Greenland (EG) forage more on pelagic prey, while those in Northern Hudson Bay (NHB) typically forage in the benthos. Temporal changes in diet were investigated over 30 years in the Canadian narwhal populations (NHB and Baffin Bay (BB)) with greater changes predicted for the more southern population (NHB). In NHB, $\delta^{15}N$ significantly increased, $\delta^{13}C$ displayed a parabolic trend, and fatty acids gradually shifted, albeit not significantly, over time. $\delta^{15}N$ was stable, $\delta^{13}C$ decreased, and fatty acids significantly changed over time in BB. Stable isotope mixing models indicated a dietary reduction in capelin (*Mallotus villosus*) and increase in Greenland halibut (*Reinhardtius hippoglossoides*) from 1994-2000 to 2006-2011 in BB, while capelin was an important dietary component for narwhals in NHB in recent years (2006-2011). These dietary changes may be attributed to changes in sea ice and narwhal migration.

<u>Discussion by JWG</u>

Samples were skin and muscle that came from hunted animals in August and September. The prey is changing, but these samples were compared to prey from around the timeframe. The JWG has discussed using SI to delineate stocks in the past and this information is interesting for the JWG to monitor future results.

5.2 Biological parameters

5.2.1 Age estimation

No new information was available.

5.2.2 Reproductive rates

No new information was available.

5.2.3 Population Dynamics

Beluga and Narwhal mating systems

Ferguson presented Kelley et al. (2014) which looked at mating systems in narwhal and beluga (*Delphinapterus leucas*). Narwhal and beluga whales are important species to Arctic ecosystems, including subsistence hunting by Inuit, and little is understood about their mating ecology. Reproductive tract metrics vary across species in relation to mating strategy, and have been used to infer mating ecology. Reproductive tracts from beluga and narwhal were collected between 1997 and 2008 from five beluga stocks and two narwhal stocks across the Canadian Arctic. Tract length for males and females, relative testes mass for males, and tusk length for male narwhal were measured. We assessed variation relative to species, body size, stock, maturity, and season. Beluga whales from the High Arctic were the heaviest, followed by Beaufort Sea, then Cumberland Sound, and smallest whales came from Western and Eastern Hudson Bay stocks. Significant variation was found in testes mass across month and stock for beluga, and no significant difference between stock or date of harvest for narwhal. Beluga had significantly larger testes relative to body size than narwhal, suggesting they were more promiscuous than narwhal. A significant relationship was found between narwhal tusk length and testes mass, indicating the tusk may be important in female mate choice. No significant differences were found between narwhal and beluga reproductive tract length for males or females. The mating systems suggested for narwhal and belugas by our results suggests that the two species may respond differently to climate change.

<u>Discussion by the JWG</u>

The group discussed whether sexual dimorphism was considered, i.e., how different are males versus females in narwhal and belugas, given the different mating strategies of each whale.

5.2.4 Diving behaviour

Diving behaviour in Northern Hudson Bay, East Greenland and Baffin Bay

Watt presented paper NAMMCO/SC/22-JCNB/SWG/2015-JWG/07 which analysed dive behaviour in the three populations of narwhals in the world; the Northern Hudson Bay (NHB), East Greenland (EG), and Baffin Bay (BB) populations. Thirty-four narwhals from these populations were equipped with satellite-linked transmitters in order to evaluate the total number of dives and time spent in pre-defined depth categories. Repeated-measures ANOVAs found narwhals from EG made significantly more dives and spent more time in the mid-water column compared to other populations. NHB narwhals made more dives in the deep zone than in the mid-water region. BB narwhals spent time and made most dives within the upper water column and the deep zone, which suggests deep-dwelling prey may contribute substantially to their diet. Within the BB and EG populations, there were sex-specific differences in time spent at depth and we identified seasonal changes in diving for all populations. This is the first study to compare dive behaviour in all three of the world's narwhal populations.

<u>Discussion of the JWG</u>

Dive behaviours between EG and BB are likely due to differences in foraging behaviour even though depths are similar in these areas.

The seasons used in this study were based on Dietz et al. (2001) which defines summer as the end of July to the end of September. The group suggested that the data could be reanalysed using different definitions of season, especially using a summer season that ends before the fall migration begins (as recommended in the Catch Allocation JWG_{sub} meeting). It is possible that changing the definition of summer season in the Watt et al. study presented here could change some of the results since the summer season currently may encompass some migratory behaviour.

The group discussed whether differences in dive behaviour could be attributed to migration or feeding based on displacement data.

It was noted that by considering individual dives as samples, the standard errors for the averages were very small and consequently small differences that were statistically significant may not be biologically significant. Previous studies using stable isotopes showed differences between these narwhal populations, and the diving study was aimed at looking to see if the dive behaviour supported this.

5.2.5 Other information.

Passive Acoustic Monitoring

Marcoux presented information on a passive acoustic monitoring study in Scott Inlet. An acoustic recorder was deployed in Scott Inlet (Nunavut) to monitor the presence of narwhals and other marine mammals. Twelve percent of the files were manually inspected to detect sounds from marine mammals. An automated detector was applied to detect clicks from narwhals. The detection of marine mammal sounds was highly influenced by the presence of ice. We discussed the potential to estimate narwhal densities from the number of clicks, the limitations of this technique and future work required.

Discussion by the JWG

Acoustic tags in Greenland have shown that individual animals can be quiet for 24 hrs or more and it demonstrates the need for tags that can record for several days.

Marcoux et al. have not yet investigated whether any of the recorders picked up seismic noise.

5.3 Catch statistics

5.3.1 Canadian and Greenlandic catch statistics

Greenland

Heide-Jørgensen presented information and statistics including some trade statistics on catches of narwhals in Greenland since 1862 (NAMMCO/SC/22-JCNB/SWG/2015-JWG/06). Detailed statistics split by hunting grounds are missing for most of the years. For the northernmost area, the municipality of Qaanaaq, only sporadic reporting exists. Based on statistics from the most recent three decades a time series is constructed for West Greenland with catches split into hunting grounds and corrected for under-reporting detected from purchases of mattak (low option), for periods without catch records (medium option) and from rates of killed-but-lost whales (high option). This reveals a time series of somewhat realistic catch levels from 1862 through 2014. Since 1993, catches have declined in West Greenland especially in Uummannaq and Disko Bay where the decline is significant. In East Greenland there has been an increase of 5% per year since 1993.

Discussion by the JWG

Overall increases in the harvest have been seen in East Greenland, but it is variable. The methods presented here have been reviewed by the JWG in the past, and this update is based on information that is provided by the government of Greenland. The JWG noted that there could be some under-reporting but the magnitude is unknown, and this is considered and adjusted for in the high option for the early years.

Canada

Ferguson presented paper NAMMCO/SC/22-JCNB/SWG/2015-JWG/12 which provided catch data and a summary of the process of management advice in Canada. Canadian narwhal and beluga fisheries are regulated by the Fisheries Act (R.S., 1985, c. F-14) and regulations made pursuant to it, including the Fishery (General) Regulations and the Marine Mammal Regulations. In the Nunavut Settlement Area, these fisheries are co-managed by Fisheries and Oceans Canada (DFO), the Nunavut Wildlife Management Board (NWMB), Regional Wildlife Organisations (RWOs), and Hunter and Trapper Organisations (HTOs), and Nunavut Tunngavik Inc. (NTI) in accordance with the Nunavut Land Claims Agreement (NLCA), and the Fisheries Act. Where an inconsistency exists between federal statutes and the NLCA, the Agreement shall prevail to the extent of the inconsistency. The NWMB is the main instrument of wildlife management in the Nunavut Settlement Area; however, the federal government retains ultimate responsibility for wildlife management.

Discussion by the JWG

The Integrated Fisheries Management Plan is a new approach that included information on movements among summer stocks, rather than just being based on the hunt from each community.

The JWG acknowledged that these were raw catch data and had not been adjusted for struck and lost or under-reporting. However, an average rate of 1.28 was applied to these Canadian catch data to represent struck and lost in the data provided to the catch allocation model (described below in section 5.5.1).

5.3.2 Struck and lost

Greenland

Hunters are required to report struck and lost but it is likely that there is some under-reporting of lost animals. For narwhal and beluga, the quota is set as a strike limit, which includes both the landed take and the reported struck and lost. In Greenland, hunters are not allowed to shoot before harpooning, and they are not allowed to shoot from the shore.

Struck and lost rates have been estimated using factors such as community, season, hunting method, and these estimates are included in the catch history that is used in the assessment model.

Canada
It is known that the struck and lost rate likely varies by factors such as community, season, hunting method, and experience of the hunter. For example, some communities use a harpoon before shooting, which probably lowers their struck and lost rate, whereas a floe edge hunt may have higher struck and lost. For the purpose of the allocation model, a single value of 1.28 was multiplied by the raw landed catch to estimate the total removals.

Discussion of JWG
The catch statistics provided by Canada have not been split by summering stocks or struck and lost rates by communities. It would be informative for the JWG to have this information provided as a working paper with text on the methods.

The JWG reiterates the recommendation for Canada to provide corrected catch statistics to include in the assessments, including historical catches which are corrected for estimates of struck and lost that are based on factors such as the community, hunting methods, and season, rather than applying a uniform stuck and lost rate to all of the data. The JWG noted that ideally there would be monitoring programmes occasionally for struck and lost that could be used to update the values but recognised that there are no plans for this in the near future. The JWG agreed to use the analysis of struck and lost data that is ongoing in Canada, plus incorporate observations of locations and hunting methods where the rates may differ. These estimates will be presented at the next JWG meeting. The JWG agreed that the development of the Catch Allocation model does not need to be delayed to wait for these estimates of struck and lost, however the recent data, once analysed, should be incorporated into the Catch Allocation model following a review by the JWG.

5.3.3 Ice entrapments

Ice entrapments are natural events, but catches from known ice entrapments are included in the catch history that is used in the allocation model.

More discussion of ice entrapments (and their possible causes) are included under Item 8.

5.4 Abundance

5.4.1 Recent estimates

Instantaneous correction factors for narwhal availability
Watt et al. (2015) provided information on correction factors based on narwhal dive behaviour. Narwhals (n = 24) equipped with satellite tags near the communities of Arctic Bay and Pond Inlet, Nunavut from 2009-2012 provided information on the time narwhals spend at different depths. Aerial surveys to estimate narwhal abundance were conducted in August 2013 and require incorporation of an availability bias correction to account for narwhals that may have been present but were either not visible to observers, or not distinguishable from beluga whales. An instantaneous availability correction factor used to correct aerial surveys can be estimated from the proportion of time diving animals spend near the surface where they can be detected and identified. Narwhals diving deeper than 2 m are not distinguishable from an aircraft in clear waters, while narwhals in highly turbid waters, such as that found in fiords where glacial runoff enters, may not be distinguishable at >1 m depths. The proportion of time narwhals spent at 0-1 m, and 0-2 m depths was analysed in a mixed effect model with whale as a random variable and period of August (mid versus late), time of day (day or night), sex, and area of tagging as fixed factors. The chosen model included no variables for the 0-1 m bin and period of August for the 0-2 m bin. Tagged narwhals spent 20.4 ± 0.78 % of their time in the 0-1 m bin in August and we recommend an instantaneous availability correction of 4.90 (± 0.187) for the 2013 survey in regions with highly turbid waters where visibility may be limited. Narwhals spent 31.4 ± 1.06 % of their time in the 0-2 m bin in mid-August and we recommend an instantaneous correction of 3.18 (± 0.107) for 2013 survey strata occurring in clear waters.

Discussion of the JWG
The JWG suggested that issues with drift in the pressure transducer should be investigated. Greenland has information that drift of the pressure transducer caused large portions of their data to be discarded. The authors recognise that this could be an issue and will investigate further.

The JWG agreed to proceed with the correction factors produced from this study, pending the results of the review of the drift issue. This will be reviewed at the next meeting of the JWG.

High Arctic Cetacean Survey
The Department of Fisheries and Oceans conducted a High Arctic survey in August 2013 to estimate abundance of the six Canadian Baffin Bay narwhal summer stocks. Narwhal abundance was estimated using a double-platform aerial survey. The survey was flown at an altitude of 1,000 feet (305 m) and a target speed of 100 knots (185 km/h) using three deHavilland Twin Otter 300 aircraft, each equipped with four bubble windows on the sides and a large belly window used for cameras. The survey was designed to cover the largest possible proportion of the summering areas of Baffin Bay stocks while at the same time improving on the precision of past estimates. Each stock range was divided in several strata, based on geographic boundaries as well as presumed densities of narwhals inferred from past surveys. Distance sampling methods were used to estimate detection probability away from the track line. A mark-recapture model was used on the sighting data from pairs of observers on each side of the aircraft to correct for perception bias. Abundance in fiords was estimated using density spatial modelling to account for their complex shape and uneven coverage. Estimates were corrected for availability bias using an updated analysis of satellite-linked time depth recorders transmitting information on the diving behaviour of narwhals in August. Fully corrected abundance estimates were 12,694 (CV 33%) for the Jones Sound stock, 16,360 (CV 65%) for the Smith Sound stock, 49,768 (CV 20%) for the Somerset Island stock, 35,043 (CV 42%) for the Admiralty Inlet stock, 10,489 (CV 24%) for the Eclipse Sound stock, and 17,555 (35%) for the East Baffin Island stock. No previous survey had counted all of the Canadian Baffin Bay narwhal stocks during one summer. Major sources of uncertainty include high levels of clustering in some areas as well as the difficulty of identifying duplicate sightings between observers viewing large aggregations of narwhal.

Discussion by the JWG
The details of the survey will be reviewed at the next JWG meeting when working papers are available. As mentioned above, there is some concern about the availability correction factor due to the transducer drift issue, which will be investigated before the next meeting.

The group noted that the western part of Lancaster Sound was not covered by the survey. Considering other changes in behaviour, it is possible that some narwhals could have been in that area. No survey of narwhal in Lancaster Sound is planned since previous surveys of this area in summer (August) did not observe many narwhal. This region is considered a migration corridor between winter and summer ranges and narwhal occur there only briefly while in transit.

All of the observations of narwhals on East Baffin Island occurred in fjords with opaque water conditions. Due to the opacity of the water here, a correction factor based on the 0-1 m depth bin was used (i.e., it was assumed that observers could not spot and identify narwhals that swam deeper than 1 m), whereas non-fjord areas as well as fjords in other strata (e.g., Admiralty Inlet, Eclipse Sound, and Ellesmere Island) all used the 0-2 m bin. In other words, water conditions in fjords other than the East Baffin stratum were not considered opaque enough to justify using a different correction factor.

The group discussed whether a correction factor should be developed just for animals at the surface, however the data on the dive cycle is needed to be able to do this. A Hidden Markov model may be considered for future analysis.

Abundance in Melville Bay
Hansen presented a recent abundance estimate from Melville Bay in the summer (NAMMCO/SC/22-JCNB/SWG/2015-JWG/14). Narwhals have one of their two West Greenland summering grounds in the Melville Bay. Aerial surveys of the abundance of narwhals in Melville Bay were conducted in late August 2012 and 2014. Three analytical models were deployed to derive fully corrected abundance estimates. In 2012 the perception bias estimation was augmented with samples from two other identical surveys conducted in

August and September 2012. A mark-recapture distance sampling (MRDS) model provided estimates corrected for at-surface availability of 22% (cv=0.09) of 2,983 narwhals (cv=0.39; 95% CI 1,452-6,127) and 3,091 (cv=0.50; 95% CI 1,228-7,783) in 2012 and 2014, respectively. A Hidden Markov line transect model (HMLTM) that takes the time the whales are in view of the observers into account provided estimates of 741 (cv=0.44, 95% CI 324-1651) and 1710 (cv=0.39, 95% CI 422-3,064) for 2012 and 2014, respectively. The data on availability used in the HMLTM were based on data on duration of surfacings and submergence above and below 2 m depth with an overall availability of 39% (cv=0.02) collected from narwhals in East Greenland. When using dive cycle parameters scaled to a total availability of 20% (cv=0.02) the HMLTM estimates increased to 1391 (cv=0.41, 95% CI 564-3144) and 3164 (cv=0.41, 95% CI 859-5,767) in 2012 and 2014, respectively.

A CDS analysis with an availability correction factor of 39% gives an abundance estimate of 904 narwhals (cv=0.38, 95% CI 427-1,913) and 2,008 (cv=0.43, 95% CI 843-4,785) in 2012 and 2014, respectively. The point estimates is reduced to 820 and 1,543 if the correction factor of Laake et al. (1997) is used. The CDS analysis with an availability correction factor of 22% gives an estimate of abundance of 1,603 narwhals (cv=0.38, 95% CI 757-3,395) and 3,563 (cv=0.43, 95% CI 1,495-8,488) in 2012 and 2014, respectively.

The main difference between the four estimates are: 1) The MRDS model utilizes data from two similar surveys in (2012) in the detection process estimation. 2) The MRDS model does not correct for the non-instantaneous availability of the whales. 3) The HMLTM corrects for non-instantaneous availability but not for perception bias. 4) The CDS does not include corrections for perception bias and is only partly corrected for non-instantaneous availability. The animals were within detectable forward distance of about 4% and 8% of their mean dive cycle length in 2012 and 2014, respectively, and this implies that the 2012-survey is ‘more instantaneous’ than the 2014-survey.

Discussion by the JWG

The group noted that the three surveys conducted in 2012 cannot be combined because they occurred during different times during the year and the last survey was conducted when the migration had already begun. In addition, the three surveys were designed to occur before, during and after seismic surveys.

The Hidden Markov model is useful for non-instantaneous surveys, although it does not currently correct for the perception bias, and to do so requires very detailed information on the dive profile. When the Hidden Markov model was used, the dive cycle data was obtained from a time-depth recorder (Acousonde™) deployed on one narwhal in East Greenland in 2013. There is a problem of the pressure transducer not giving an accurate time-at-surface due to issues with the effect of temperature on the function of the transducer. One option is to take the average time around zero, however it is likely not precise enough. The authors are working towards applying a function to compensate for this.

The MRDS estimates corrected for availability were **accepted** by the JWG for use in the assessment.

Abundance in East Baffin Bay

Hansen presented the recent abundance estimate from East Baffin Bay (NAMMCO/SC/22-JCNB/SWG/2015-JWG/15). An aerial visual survey of the density and abundance of narwhals was conducted in the eastern part of Davis Strait and Baffin Bay in March-April 2012. The survey was conducted as a double platform aerial line transect survey, and sampled approximately 7,800 km of the total survey area of ca. 243,000 km2. Two different analysis of sightings were applied; Hidden Markov line transect model (HMLTM) and mark-recapture distance sampling (MRDS). The HMLTM methods do not assume certain detection at perpendicular distance zero; they assume only certain detection of animals that are available (i.e. not too deep to be seen) at radial distance zero. The best model included Beaufort sea state as an explanatory variable and resulted in estimated narwhal abundance of 11,259 narwhals with (cv=0.34, 95% CI 4,390-20,568). However, this model fits the perpendicular distance data poorly. When the HMLTM model was fitted with an alternative availability model in which whales are estimated to be available 20% (cv= 0.02) of the time, abundance estimates increased by 88% to 21,115 (cv=0.35, 95% CI 9,506- 39,416). The mark-recapture distance sampling (MRDS) estimator of individual abundance yielded an abundance estimate of 4,367 whales (cv=0.39, 95% 1,869-10,203). The time narwhals are estimated to be available in April in the survey area is 23.5% (cv=0.32) and when correcting the MRDS estimate with this correction factor, the estimate of animal abundance increases to 18,583 whales (cv=0.50, 95% CI 7,308-47,254).

Discussion by the JWG

The offshore strata was intended to be surveyed more intensely but this was not possible due to poor weather. The aggregations seen in this area are likely due to animals clumping at the sea ice edge. It was noted that there are likely bathymetric features that explains why the narwhals are congregating in this area.

The group discussed whether these results could be used to look at the densities that are potentially available to hunters in Disko Bay in the winter for the catch allocation model. However, the allocation model does not calculate the density of whales in the area, and thus would need to be modified to utilise that information.

This abundance estimate was **accepted** by the JWG, but is not utilised in the Catch Allocation model assessment at this time.

Winter estimate from the North Water

NAMMCO/SC/22-JCNB/SWG/2015-JWG/08 includes information on winter abundance in the North Water. The importance of the North Water polynya as an overwintering area for marine mammals has been questioned. One way to address the issue is to assess the abundance of selected marine mammals that are present during winter in the North Water. Visual aerial surveys involving double observer platforms were conducted over the eastern part of the North Water polynya in April 2014. Four species of marine mammals were included in strip census estimation of abundance. Perception bias was addressed using a double-platform survey protocol and a Chapman mark-recapture estimator. Availability bias was addressed by correcting the abundance estimates by the percentage of time animals detected in water were available for detection at the surface. The resulting abundance estimates revealed that 2,085 walruses (95% CI 1,397-3,112), 10,003 bearded seals (6,702-14,932), 2,324 belugas (1,786-2,820) and 3,059 narwhals (1,760-5,316) wintered in the eastern part of the North Water polynya in April 2014. The estimate of the abundance of walrus is larger than previous summer estimates covering the entire North Water and it emphasizes the importance of the habitat along the Greenland coast as a walrus wintering ground. The estimate of belugas is likely negatively biased due to the partial coverage of the potential habitat. The estimate of narwhals is large compared to the few previous observations of narwhals in winter in the North Water and it demonstrates that large numbers of narwhals winter in the North Water. The overall conclusion is that the North Water is indeed an important wintering area for at least walruses, belugas, narwhals and bearded seals.

Discussion by the JWG

These results can be used as information on winter distribution, but not abundance estimates used in the assessment. However, results do provide information suggesting a large number of narwhal use the North Water polynya in late winter and are available to move north, east, and west into summer aggregations areas: Jones Sound-Norwegian Bay, Inglefield Bredning, and Smith Sound. The latter Smith Sound stock included areas along the east coast of Ellesmere Island used by narwhal during the summer aggregation season. Of note, large numbers of narwhal were observed in Makinson Inlet during the Canadian August 2013 survey.

5.4.2 Estimates by management units

New abundance estimates for summering stocks in Canada were presented, but the JWG could not formally review them until full documentation is available. However, the JWG decided to include the Jones Sound-Norwegian Bay and Smith Sound abundance estimates in the Catch Allocation model assessment since there is no other survey information available.

5.4.3 Future survey plans

No new information on survey plans.

5.4.5 Recent changes in distribution in Canada

No new information was available. However, the JWG briefly discussed the Admiralty Inlet and Eclipse Sound abundance estimates from the 2013 Canadian survey as an indication that the two summer stocks may be linked.

5.5 Assessment

5.5.1 Catch Allocation for west Greenland and Canada

Recognizing that the narwhals hunted in different regions cannot easily be attributed to their summering aggregation based on genetics or other stock identity information, the JWG tasked a sub-group to develop a model that includes the information that is available.

The Catch Allocation sub-group of the NAMMCO-JCNB Joint Scientific Working Group (JWG_{sub}) met 10–12 March 2014 in Copenhagen, Denmark, and again in Ottawa, Canada 9-10 March 2015. The report of these meetings was available as NAMMCO/SC/22-CNB/SWG/2015-JWG/17 (Annex 1).

The Terms of Reference for this meeting were to:

- review information on distribution, movements and harvest locations of narwhal;
- develop an allocation model that will provide a mechanism for assigning harvested animals to all summer stocks based on existing data;
- specify and quantify exchange rates between aggregations and stocks;
- identify and quantify uncertainty in the allocation model and determine implications for management; and
- recommend future work to resolve uncertainties within the model structure.

The main purpose for these meetings was to develop a model for catch allocations for the Baffin Bay narwhal population that is shared by Canada and Greenland, but not to decide on the sustainability and/or provide advice on the actual quotas. The JWG_{sub} reviewed the available data on takes and migratory movements of narwhals and determined that in some areas different stocks of narwhals were available to hunters in different seasons. Data from satellite tags attached to narwhal in summer aggregations and expert opinion was used to determine which summer aggregations were available to hunters in villages and the timing of that availability. Hunts were divided into four seasons to correspond with the spring and fall migrations the summer aggregation period and the overwintering areas. A total of 24 seasonal hunts were identified to be allocated among the 8 summer aggregations. To do this an allocation matrix with 24 rows by 8 columns was devised. The eight columns were the individual summer aggregations of Smith Sound, Jones Sound, Inglefield Bredning, Melville Bay, Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island. The 24 rows represented 24 hunts in 10 regions and some regions hunts were divided by season. Thus for each summer aggregation and hunt there is a cell in the matrix, and the matrix is devised so that when multiplied by a vector of removals, the resulting vector will determine the total removals from each summer aggregation. The cells in the matrix determined using the tag data or where no tag data was available then expert opinion and the relative abundance of each summer aggregation. The tag data determined the fraction of the summer aggregation that was available to a hunt, which was multiplied by the size of the population to determine the numbers from each summer aggregation exposed to each hunt. These were then divided by the total number of whales exposed to a hunt to determine the proportion of the hunt that came from the summer aggregation. The JBG_{sub} identified a number of points of uncertainty and thus developed a method for testing the sensitivity of the allocation to data uncertainty as well as stochastic variation of the matrix from year to year. See the report from the subgroup for details.

The JWG thanked the JWG_{sub} for their work and recommended that the remaining tasks are now the responsibility of the full JWG. Therefore, the Catch Allocation subgroup work was considered completed.

<u>5.5.2 Assessment of aggregations in West Greenland and Canada (meta population model)</u>

Narwhal Meta Aggregation

NAMMCO/SC/22-JCNB/SWG/2015-JWG/010 combined the catch allocation model for narwhals in East Canada and West Greenland with Bayesian population modelling of the eight summer aggregations of narwhals in the region. The catch allocation model allocates the catches in different hunting areas and seasons to the different summer aggregations, and the population models analyse the impact of these catches on the population dynamics of the eight narwhal aggregations.

The population models run from 1970 (Canadian catches prior to 1977 were assumed to be 0 in the model, see below), and the catch allocation model needs population trajectories from 1970 to the present in order to estimate the catches taken from the different summer aggregations during this period. In an initial run it uses linear transitions between the available abundance estimates; but more elaborate population trajectories are estimated by the fit of the population models to the abundance data. The two models are therefore run in an iterative manner until the catch histories that are estimated by the allocation model, and the abundance trajectories that are estimated by the population models, converge between runs.

The distributions of takes reflect the uncertainty in the allocation of catches from the hunting areas to the summering grounds, with narrow distributions reflecting little uncertainty, and wider distributions reflecting a more uncertain allocation of the catches.

The population dynamics that are estimated for the different summer aggregations from these catch histories are shown in Figure 1. Some of the summer aggregations, like those in Smith and Jones Sound, have very low catches that hardly affect the dynamics, while the narwhal aggregation in Melville Bay is clearly influenced by the historical takes. The narwhal aggregation around Somerset Island may have an increasing trend, and those in Inglefield Bredning, Admiralty Inlet, Eclipse Sound and East Baffin Island appears relatively stable. The model estimates that nearly all the aggregations are above the maximum sustainable yield level (MSYL) where slightly decreasing trends usually are of no concern. The exceptions are Inglefield Bredning and Melville Bay. Both of these aggregations are estimated to be depleted to levels below the MSYL, implying that future harvest levels should be set to ensure an increasing number of narwhals in these summering areas.

For situations where stocks may be below or above the MSYL realistic management objectives could reflect allowable takes that ensures that stocks below the MSYL are increasing towards the MSYL, while the takes from stocks above the MSYL level should be smaller than the maximum sustainable yield (MSY), e.g., smaller than 90% of the MSY. Given such a management objective, Table 1 shows the estimated annual takes from the different summering aggregations over the next five years that allows this management objective to be fulfilled with a probability from 0.5 to 0.95.

The take of narwhals from the different summering aggregations cannot be managed by consideration of summering grounds exclusively because many narwhals are caught in other hunting areas at other times of the year (e.g., during migration). Instead, management limits for different hunts and season must be considered together. Tables 2 and 3 illustrate two potential scenarios of takes and their relation to management objectives using Table 1. In Table 2, the average catch option (C0) uses the average annual take (including struck and loss) in the different hunts over the five year period from 2009 to 2013 as the takes for the period 2015-2020.

Using the allocation matrix to relate these takes to the removals from summer aggregations yields values for C0 in Table 3. The values for C0 are then compared to the risk levels in Table 1 to estimate the probability of meeting management objectives. In this example, setting harvest at the average for the years 2009-2013 of possible distribution of hunt allocations using probabilities of management success of 70% for summer aggregations in Greenland and 80% for summer aggregations in Canada (C0) we find that the harvest from Melville Bay stock (Upernavik in summer) and East Baffin stocks do not meet the management objectives. Making ad hoc adjustments, the required catch reductions in Greenland (30 in Upernavik, summer) and Canada (1 in summer and 1 in fall in Baffin Island South; 1 in spring, 9 in summer and 4 in fall in Baffin Island Central) are then moved to the hunts in each country that are taken from the summer aggregations that are least susceptible to overharvest (i.e., Uummannaq and Central Canadian Arctic). Scaling is then applied to all the hunts in both countries that remain below the accepted risk to develop an example (C1, Table 2) of possible distribution of hunt allocations that meet the probabilities of management success for the summer aggregations (C1,Table 3). Note that Melville Bay does not meet the objective in this example but is substantially closer than the C0 example.

While this example (C1) does meet most of the management objectives, we reiterate that it is one possible allocation, but other allocation scenarios may also meet the example management objectives as determined by the Commissioners.

Robustness trials (NAMMCO/SC/22-JCNB/SWG/2015-JWG/010d,e) were conducted in which the Z value which determine level of variation in the allocation matrix (high values >1000 having no variation and low values <10 having very high variation) was set at 100 and all takes were multiplied by 1.2 respectively. The new Canadian abundance estimates were included in these runs. The JWG concluded that the results indicated that the models were robust to changing Z values and uncertainty in catches. NAMMCO/SC/22-JCNB/SWG/2015-JWG/010a,b,c represent earlier iterations of the analysis (See Appendix 3 for more information).

Advice by the JWG
While the model can be used to determine the risk of a particular harvest regime, the JWG **seeks further guidance** from the JCNB/NAMMCO on the management objectives.

The catch allocation algorithm in paper NAMMCO/SC/22-JCNB/SWG/2015-JWG/010 uses agreed upon abundance estimates, plus the abundance estimates from Smith Sound and Jones Sound from the 2013 survey in Canada. The JWG acknowledges that the Smith Sound and Jones Sound estimates have not been formally reviewed by the JWG but were necessary for the analysis as they are the only surveys available in these areas, but the impact of including these is considered minimal given the low expected catches coming from Canada and Greenland hunts of these stocks.

In Table 2 above, the average removals from 2009-2013 (C0) from Melville Bay did not meet the above management objective example of 70% probability of success and East Baffin did not meet 80%, thus we recommend reducing the hunts that remove narwhals from these stocks. The JWG proposed an alternative using a simple approach to reallocation described above as an example of adjusting take limits to meet the management objectives. The JWG **recommends** using the catch allocation model with the assessment models to verify that allowable takes do not exceed acceptable risk levels.

Table 1. Catch objective trade-off per stock. The total annual removals per stock that meet given probabilities (P) of meeting management objectives. The simulated period is from 2015 to 2020, and this assumes a 50% catch of females.

P	Smith Sound	Jones Sound	Inglefield Bredning	Melville Bay	Somerset Island	Admiralty Inlet	Eclipse Sound	East Baffin Island
0.5	284	231	147	108	914	394	398	192
0.55	259	215	135	102	871	371	377	180
0.6	231	200	123	97	828	347	354	169
0.65	206	186	111	90	780	325	332	158
0.7	185	171	98	82	732	301	310	147
0.75	165	156	83	72	684	273	287	135
0.8	144	141	68	63	635	243	262	123
0.85	123	126	52	53	580	213	234	110
0.9	100	106	33	40	512	177	198	94
0.95	67	78	5	21	403	124	151	72

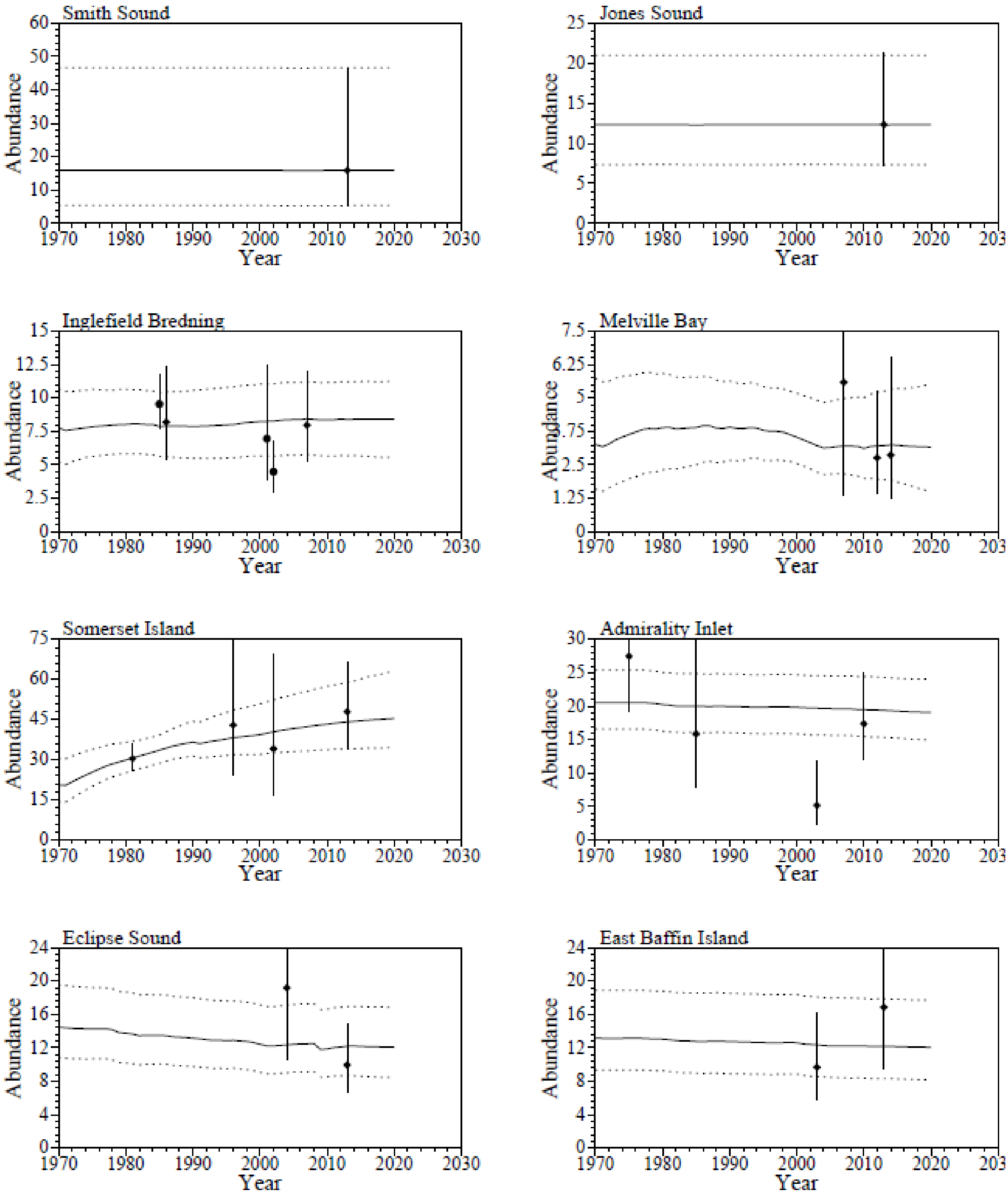


Fig 1. The population trajectories from the assessment model by summering aggregation. The medians (black) and 90% confidence intervals (dotted) of the estimated population dynamics from the eight summer aggregations of narwhals in East Canada and West Greenland, together with abundance estimates from aerial surveys (dots).

Table 2. Two potential scenarios of takes of narwhal in the 24 different hunts.

		Catch Options	
Hunt	Season	C0 (Average)	C1
Etah	Spring	4	5
Qaanaaq	Summer	98	98
Grise Fiord	Spring	7	9
Grise Fiord	Summer	11	15
Grise Fiord	Fall	0	0
Upernavik	Summer	100	70
Ummannaaq	Fall	86	154
Disko Bay	Winter	73	97
Central Canadian Arctic	Spring	4	6
Central Canadian Arctic	Summer	74	118
Central Canadian Arctic	Fall	2	3
Arctic Bay	Spring	31	41
Arctic Bay	Summer	141	188
Arctic Bay	Fall	0	0
Pond Inlet	Spring	58	77
Pond Inlet	Summer	55	73
Pond Inlet	Fall	4	5
Baffin Island Central	Spring	12	11
Baffin Island Central	Summer	100	91
Baffin Island Central	Fall	44	40
Baffin Island South	Spring	5	5
Baffin Island South	Summer	9	8
Baffin Island South	Fall	12	11
Baffin Island South	Winter	0	0

Table 3. Examples of future annual removals (C#) per summer aggregation, with associated probabilities (P#) of fulfilling management objectives. The different removals follow from the catch options in Table 2, and the 90% confidence intervals of the estimates are given by the sub and super scripts.

	Smith Sound	Jones Sound	Inglefield Bredning	Melville Bay	Somerset Island	Admiralty Inlet	Eclipse Sound	Baffin Island
C0	4_{4}^{4}	18_{18}^{18}	98_{98}^{98}	109_{101}^{141}	219_{175}^{265}	185_{161}^{226}	155_{104}^{207}	134_{120}^{152}
P0	$1.00_{1.00}^{1.00}$	$1.00_{1.00}^{1.00}$	$0.7_{0.7}^{0.7}$	$0.49_{0.26}^{0.56}$	$0.99_{0.99}^{0.99}$	$0.89_{0.83}^{0.92}$	$0.95_{0.89}^{0.98}$	$0.76_{0.68}^{0.81}$
C1	5_{5}^{5}	24_{24}^{24}	98_{98}^{98}	83_{72}^{126}	343_{283}^{399}	243_{212}^{296}	198_{134}^{262}	122_{110}^{138}
P1	$1.00_{1.00}^{1.00}$	$1.00_{1.00}^{1.00}$	$0.7_{0.7}^{0.7}$	$0.7_{0.36}^{0.75}$	$0.97_{0.95}^{0.98}$	$0.8_{0.71}^{0.85}$	$0.9_{0.8}^{0.96}$	$0.8_{0.74}^{0.85}$

5.5.4 East Greenland

Assessment of East Greenland

NAMMCO/SC/22-JCNB/SWG/2015-JWG/16 provided separate assessments for narwhals at the two hunting areas in East Greenland, i.e., in the Ittoqqortormiit and Tasilaq/Kangerlussuaq areas. Population models with exponential growth were fitted to a single abundance estimate from 2008 for each area and an age-distribution sampled from animals caught around Ittoqqortormiit between 2007 and 2010. Assuming an average natural adult survival of either 0.97 or 0.98 in the prior, it was estimated that narwhals in the Ittoqqortormiit area have increased slightly, while narwhals in the Tasilaq/Kangerlussuaq area might be stable or increasing slightly. The current growth rate in the absence of harvest was estimated to lie between 1.2% (90% CI:0-3.6) and 3.7% (90% CI:1.6-5.9), depending upon model and area.

Table 4. Narwhal in East Greenland. The estimated trade-off between the total annual removal and the probability (P) of an increasing stock from 2015 to 2020, for Ittoqqortormiit and Tasiilaq in East Greenland.

P	**0.70**	**0.75**	**0.80**	**0.85**	**0.90**	**0.95**
Ittoqqortormiit	50	40	30	20	10	4
Tasilaq	16	13	9	4	1	0

Discussion by the JWG

The JWG noted that the only new information available was updated harvest numbers.

The updated assessment suggests somewhat lower catch than the previous advice for the Ittoqqortormiit area. The JWG **recommends** this lower quota (Table 4 above) since we are further away in time from the data that is available. The JWG also **recommends** that a new survey be conducted in East Greenland.

The JWG discussed whether the East Greenland stocks should be considered depleted, stable or growing, information that would assist in setting management objectives.

5.6 Future research requirements

The JWG recommends that future research includes:

8) Aerial survey in East Greenland
9) More satellite tag and dive data from the stocks in West Greenland and Eastern Canada to obtain more information about movement between summer aggregations and information for availability bias for survey correction factors
10) Developing the Hidden Markov model to incorporate perception bias, which requires detailed dive cycle information

6. BELUGA

6.1 Stock structure

No new information was available.

6.2 Biological parameters

No new information was available.

6.2.1 Age estimation

Ageing using aspartic acid racemisation

Ferguson presented information on using aspartic acid racemisation as a technique for ageing. Age determination is key to studying population dynamics and life-history, which are the basis for wildlife management. Mammal ages have been estimated using different methods and for beluga whales the traditional method is counting tooth growth layer groups (GLG). To explore and test novel methods of ageing requires testing validity against the traditional tooth GLG method. Aspartic acid (AA) is a non-essential α-amino acid that is used as a building block for proteins. AA is optically active with two isomeric forms, D- and L-. In living organisms, only the L-isomer is synthesized and useful for biological purposes, and organisms maintain the disequilibrium state metabolically. In the absence of such a maintenance, a process called racemization results in the L-isomer being converted to the D-isomer. At birth, the theoretical ratio of D/L should be ∞, although the true value is usually a number slightly greater than zero. Therefore, the extent to which racemization has occurred in an animal can be used as a measure of age. We explored the AA racemization technique for ageing beluga whales using mass spectrometry (MS) detection of D/L ratio of beluga eye lenses collected from subsistence hunts. Preliminary results appear promising as the D/L ratio compared to GLG age in 25 beluga resulted in a significant relationship ($y= 0.00338x +0.0130$; $r2= 0.932$). We plan to further develop the method for beluga ageing as a replacement to GLG ageing of beluga whales.

Discussion by the JWG

The group noted that this is an interesting technique, but that it should include young animals, if possible. Ferguson informed the group that they are requesting more samples, including those from young animals but that sampling from the hunt implies that the sample will be biased toward older animals.

Using fatty acids for ageing

Marcoux et al. (in press, Marine Mammal Science) was presented. Recently, a few studies have highlighted the potential of using fatty acid (FA) composition in blubber biopsy samples to estimate age in some cetaceans. We explore the opportunity of using this technique to estimate the age of free-ranging belugas from three different populations. Belugas were sampled post-mortem for blubber FA analysis and aged by counting the number of growth layer groups in teeth dentine. We found significant positive and negative relationships between some FAs and age. These relationships were stronger with outer blubber layer samples, the layer which is the most accessible via biopsy, than in inner or middle layer samples, a pattern that is consistent with observed turnover rates and biological function across the blubber depth. The FA 12:0, 14:1n-7 and 14:1n-9 were promising correlates of age in belugas, allowing estimation of age with a precision of ± 7-10 years. Further work is required to determine the mechanisms underlying changes in FA composition with age and whether these mechanisms are stable through time and across populations. Future effort should concentrate on short-chain fatty acids.

Discussion by the JWG

The JWG noted that the negative correlations with age are interesting, but the mechanisms determining the correlations are not well understood. Most of the negatively correlating FAs are dietary FAs, but some are biosynthesized. Ideally, biosynthesized FA would be used instead of dietary FA since differences in dietary FAs could also be due to differences between populations, life history, etc. Interestingly, some of the FA found to be correlated with age in belugas are also some of the same FA found to be correlated with age in killer whales.

6.2.2 Reproductive rates

Weaning ages estimated by stable isotopes

Ferguson presented information on determining weaning ages based on using stable isotopes in teeth. Beluga whales have a protracted nursing period estimated to last from 6-32 months, although current estimates of beluga nursing duration are derived using approaches subject to capture bias. Recent studies have shown stable isotope (SI) profiles of dentine growth layer groups (GLGs) in marine mammal teeth serve as a reliable nursing proxy, and can be used to assess individual weaning patterns. We measured stable isotope ratios of nitrogen ($\delta15N$) and carbon ($\delta13C$) of dentine GLGs in teeth from eastern Canadian Arctic belugas to estimate weaning age and assess relative contributions of milk and solid food during the nursing period. $\delta15N$ declines of ~1‰ over the 1st three GLGs of most individuals were interpreted as evidence of weaning. Individual $\delta15N$ profiles indicated 15 of 27 whales were completely weaned by the end of their 2nd year, although a number of whales were weaned by the end of their 1st or 3rd year (9 and 3, respectively). Intermediate GLG2 $\delta15N$ values relative to GLGs 1 and 3 indicated most whales consumed a mixture of milk and solid food during their 2nd year, consistent with gradual weaning. Contrary to predictions based on parental care theory, nursing duration was not related to relative GLG width (used as a proxy for somatic growth). Also, no differences were found between females and males, or among populations. $\delta13C$ variation was not a reliable indicator of nursing duration, as approximately half of the whales showed no ontogenetic $\delta13C$ patterns across GLGs deposited over the nursing period. This study provided novel life history information which may inform beluga conservation and management decisions, and indicates belugas share prolonged nursing duration marked by individual variation observed in other odontocetes.

Discussion by the JWG
The group discussed that it is important to know how long the SI signature remains in the tissues. Nitrogen intake and body mass would need to be considered to estimate turnover.

The group noted that identifying a specific weaning age may not be possible using annual results in changes in stable isotopes.

The group also noted that there was more individual variation than previously expected.

6.3 Recent catch statistics

Catch statistics for Greenland
Paper NAMMCO/SC/22-JCNB/SWG/2015-JWG/05 included information and statistics including trade statistics on catches of white whales, or belugas, in West Greenland since 1862. The period before 1952 was dominated by large catches south of 66°N that peaked with 1,380 reported kills in 1922. Catch levels in the past five decades are evaluated on the basis of official catch statistics, trade in *mattak* (whale skin), sampling of jaws and reports from local residents and other observers. Options are given for corrections of catch statistics based upon auxiliary statistics on trade of *mattak*, catches in previous decades for areas without reporting and on likely levels of loss rates in different hunting operations. The fractions of the reported catches that are caused by ice entrapments of whales are estimated. During 1954-1999 total reported catches ranged from 216 to 1,874 and they peaked around 1970. Correcting for underreporting and killed-but-lost whales increases the catch reports by 42% on average for 1954-1998. If the whales killed in ice entrapments are removed then the corrected catch estimate is on average 28% larger than the reported catches. Catches declined during 1979-2014 to levels below 300 whales per year after 2004. All catches are assumed to be taken from the Somerset Island summering stock of belugas and all the catches in West Greenland are presumably taken from the fraction of that stock that winters in West Greenland. The exception is the winter catches in Qaanaaq (approx. 5% of annual catches in Qaanaaq) that likely are taken from the fraction that winter in the North Water. It is unknown which stock is supplying the summer hunt in Qaaanaq (approx. 15% of annual catches in Qaanaaq). A few confirmed catches (and sightings) of belugas have been recently been report from East Greenland.

Discussion by the JWG
The JWG noted that these catch statistics did not include any new methods in analysis or struck and lost rates, and therefore the method has already been approved. The medium and high options are provided for the assessment model as correction options.

The group noted that in 2013 there were higher catches than usual in Upernavik. The reason for this is not known, however it may be informative to look at what the seismic activities were in 2013. It is possible that seismic activities could have driven the whales closer to shore, making them more susceptible to hunting. It is already known that belugas are easily scared into the coast, and also that the migration patterns of belugas are potentially affected by seismic activities. Further discussion of the possible effects of disturbance are addressed in Item 10.

Under-reporting remains a potential problem however there is little means to correct for this.

Catch statistics from Canada
Ferguson presented NAMMCO/SC/22-JCNB/SWG/2015-JWG/12 that includes the catch statistics from Canada. The summary of the document is under Item 5.3.1 in the narwhal section.

Discussion by the JWG
It is not thought that the catches from Iqaluit and Pangnirtung are from a shared stock with Greenland.

The JWG agreed that there is a need to construct a table that better illustrates which catches are thought to be shared. This table needs to go back to 1970 to be included in the assessment models.

The catches presented here do not include struck and lost rates. Struck and lost data has been collected but has not been analysed.

6.4 Abundance

6.4.1 Recent and future estimates

Abundance of belugas in West Greenland

Heide-Jørgensen presented paper NAMMCO/SC/22-JCNB/SWG/2015-JWG/11. An aerial visual survey of the density and abundance of belugas was conducted in the eastern part of Davis Strait and Baffin Bay in March-April 2012. The survey was conducted as a double platform aerial line transect survey, and sampled approximately 7,800 km of the total survey area of ca. 243,000 kmP2P. The largest abundance of whales was found at the northern part of Store Hellefiske Bank, at the eastern edge of the Baffin Bay pack ice, a pattern similar to that found in nine systematic surveys conducted since 1981. A clear relationship between decreasing sea-ice cover and increasing offshore distance of beluga sightings was established from all previous surveys, suggesting that belugas expand their distribution westward as new open water areas on the banks of West Greenland open up earlier in spring with reduced sea-ice coverage or early annual ice recession. No dive data specific to belugas in West Greenland in winter are available and availability correction factors for whales that are submerged during the passing of the plane must be developed from time-at-depth series from other areas and seasons. Methods that take account of stochastic animal availability by using independent estimates of the availability process and forward as well as perpendicular distances of sightings, were used to estimate beluga abundance. Abundance estimates from two of the three best models fitted to the data were found to be sensitive to a single large school (3 times larger than any other) that was detected in the stratum with the highest abundance. The only one of these three models that appears robust to this large school size variation was preferred. It yields an estimate of 7,456 beluga whales (CV=44%, 95% CI 3,293; 16,987). Belugas are within detectable forward distance for 3.3% of their mean dive cycle length and hence the survey is a nearly instantaneous process. A conventional distance sampling estimator of individual abundance using the same data, and "correcting" availability bias by dividing the estimate by the proportion of time belugas are estimated to be available (43%) yielded an estimate of 7,546 whales (CV=38%, 95% CI 3,462; 16,450). A mark-recapture distance analysis correcting for perception bias, and using the same availability factor of 43%, estimates the abundance to be 9,072 whales (CV=32%, 95% CI 4,895; 16,815).

<u>Discussion by the JWG</u>

The group noted that they appreciate the different approaches that were presented.

The population remains depleted versus historical levels (20,000 in ca 1980, probably previously even higher than that), but has levelled off after a catch quota was introduced (and thus catches reduced).

The JWG agreed to accept the mark-recapture abundance estimate (9,072 CV=0.32, CI: 4,895-16,450). The paper makes the case that it is almost instantaneous, and the bias introduced from not being completely instantaneous is almost the same as when the Hidden Markov model is used (which tries to remove any bias from not being instantaneous). The survey was almost instantaneous because the observers were surveying on the side of ice floes, and observers would not be able to detect anything further away anyway. The ice floes provided spatial cues so it is likely that the observers looked straight down.

Winter Abundance in the North Water

The summary of paper NAMMCO/SC/22-JCNB/SWG/2015-JWG/08 is given under Item 5.4.1 in the narwhal section.

<u>Discussion by the JWG</u>

This abundance estimate is likely an underestimate due to the strip width and the fact that the entire area was not surveyed, making this a conservative approach.

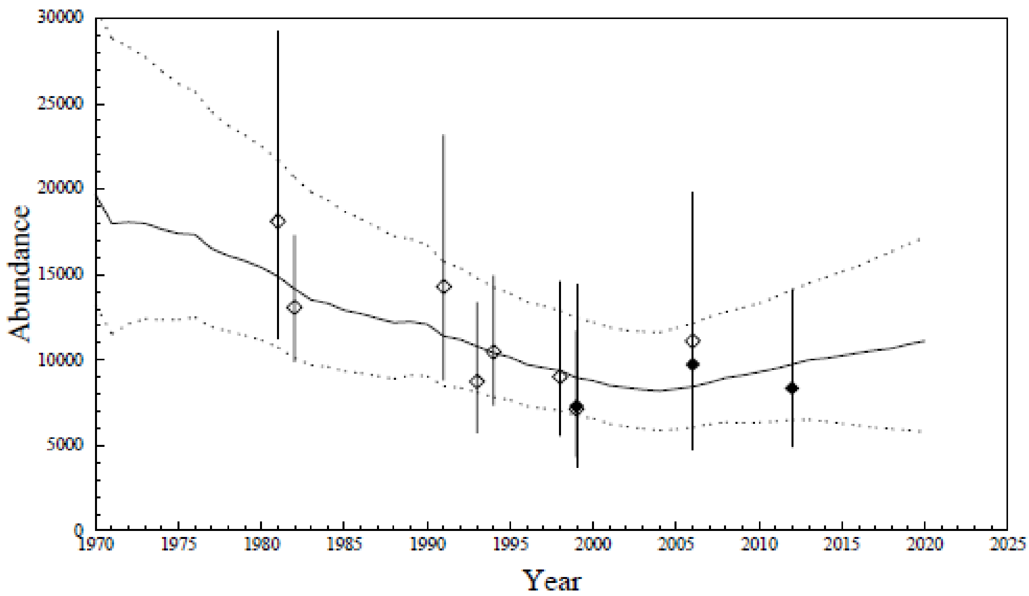
6.5 Assessment update

6.5.1 West Greenland

NAMMCO/SC/22-JCNB/SWG/2015-JWG/09 used recent abundance estimates and historical catches in an age-structured population model with density-regulated growth to perform Bayesian assessments of the beluga aggregation that winters off West Greenland. The model starts from a stable age-structure in 1970 under the assumption that the 1970-abundance was below the current carrying capacity, and it was applied with a high and low prior on adult survival.

The dynamics of the high survival model is shown in Figure 2. It estimates a decline from 19,140 (90% CI:12,680-28,260) individuals in 1970 to a maximal depletion of 8,130 (90% CI:5,740-11,440) in 2004, and an increase to 11,420 (90% CI:6,370-17,850) individuals in 2020 (assuming yearly post 2014 catches of 294). The predicted change from a declining to an increasing population was caused by the introduction of quotas in Greenland, with annual catches in the order of 500 to 700 reduced to less than 200 after 2004. Given total annual removals of 320 individuals from 2015 to 2020, the low survival model estimates that there will be a 70% chance of an increasing population over the period.

Figure 2. The estimated dynamics (curves) of the aggregation of belugas that winter off West



Greenland, together with the abundance estimates from aerial surveys (absolute estimates solid diamonds; relative estimates open diamonds). The bars and dotted curves show the 90% confidence interval.

<u>Discussion by the JWG</u>
This method has been largely reviewed before by the JWG. The only major difference from previous is the initiation of stable age structure, due to separation from catch history.

The model was reanalysed using a beta distribution for the birth rate using data from Greenland (11/36 mature females pregnant; Heide-Jørgensen and Teilmann 1993).

The group discussed the age at maturity that is used in the model, and whether to use an age at maturity based on data that is available rather than a uniform prior. The age at maturity data available suggests that maturity is reached between 8 and 14 years (based on a low sample size of females in the hunt). The JWG agreed to continue using the age at maturity of 8-12 that is currently in the model.

<u>Advice from the JWG</u>
Reiteration of Past Advice

The JWG **reiterates** the previous advice from 2005 and 2012 about seasonal closures. The following seasonal closures are **recommended**:

- Northern (Uummannaq, Upernavik and Qaanaaq): June through August
- Central (Disko Bay): June through October
- Southern (South of Kangaatsiaq): May through October.
- For the area south of 65°N, it is recommended that no harvesting of beluga be allowed at any time.

The function of these closures is to protect the few animals that may remain from historical summer aggregations in Greenland, and to allow for the possibility of reestablishment of the aggregations.

No specific advice was given on the North Water, noting that the removals remain at a low level relative to the population size derived from the 2009-2010 and 2014 surveys in the North Water and around Somerset Island in 1996, and assuming that future catches remain at low levels.

New Advice

With the new accepted abundance estimate for belugas in West Greenland in 2012, the JWG provided updated advice in Table 5 below.

Table 5. Beluga in West Greenland. The estimated trade-off between the total annual removal and the probability (P) of an increase in the number of beluga that winters off West Greenland over the period from 2015 to 2020.

P	**0.70**	**0.75**	**0.80**	**0.85**	**0.90**	**0.95**
West Greenland	320	290	260	225	195	145

7. TRADITIONAL KNOWLEDGE

Traditional knowledge was used when available and relevant.

The JWG was informed that DFO in collaboration with other groups (e.g., Government of Nunavut and World Wildlife Fund) has been collecting traditional knowledge on narwhals. The Government of Nunavut through a Coastal Inventory Survey is also collecting information on distribution in belugas and narwhals, and more information may be provided at the next JWG meeting if available.

8. IMPACT OF HUMAN-MADE-NOISE

In Greenland, 2010-12 were the highest years of seismic exploration. In 2012, narwhals were observed during the survey to be closer to shore compared to the previous survey, potentially changing availability to hunters. There was little seismic exploration in 2013, and none in 2014. In 2015, there is planned seismic exploration in East Greenland. Ice entrapments have been reported in areas where animals are not usually located, and it is speculated that displacement resulting from anthropogenic noise could be the cause. It is possible that the whales could be remaining on, or moving back to, their summering grounds due to noise on their migration pattern.

While mechanisms by which stressors can cause harm are relatively straightforward, level and context of exposure leading to biological meaningful harassment, or to effects on short- and long-term heath are more difficult to assess. In the case of sub-lethal effects related to disturbance, the conceptual PCoD framework, i.e., the Population Consequences of Disturbance (e.g., Harwood et al. 2013), sets the main mechanisms by which disturbance may lead to effects on health or vital rates, and ultimately on population dynamics (NRC 2005). Effects can occur as a result of acute or chronic exposure to stressors, which may lead to detrimental physiological changes, and ultimately to effects on health and vital rates, but without necessarily eliciting observable behavioural reactions (Gills et al. 2001; Southall et al. 2007; Ellison et al. 2012; Wright et al. 2007). These subtle mechanisms may be particularly important in the case of chronic stressors, such as elevated ambient noise, regular vessel-interactions, or environmental contamination (e.g., Wright et al. 2007; Rolland et al. 2012; Tanabe 2002; Ross 2006; Breuner et al. 2013), or when operations overlap with key habitat with little alternative options, or with critical periods.

A Symposium on the impacts of human disturbance on arctic marine mammals planned for fall 2015, convened by NAMMCO. A summary report from this Symposium will likely be available at the next JWG meeting.

Baffin Island
Some Inuit and other groups have expressed concerns over the National Energy Board's (NEB) approval of the "2011 Northeastern Canada 2D Marine Seismic Survey" proposed for Baffin Bay and Davis Strait, off the coast of Baffin Island, Nunavut, by TGS/PGS/MKI (the consortium of companies who submitted the proposal to NEB) proposed to be conducted July 2015-November 30, 2019.

10. OTHER BUSINESS

10.1 NAMMCO question regarding Ageing workshop

10.1.1 Narwhal

10.1.2 Beluga

As of last JWG meeting, the Ageing workshop had been conducted, and the results are still in being analysed. *The NAMMCO Scientific Publications Volume 10: Age estimation of marine mammals with a focus on monodontids* is underway, with 8 papers published as online early versions, and additional papers are nearing completion.

10.2 Assessments in data-poor situations

At the next JWG meeting, the groups should discuss guidelines for giving advice in data-poor situations.

10.3 Review of ROP

The group reviewed the draft ROP and made a few minor changes (Appendix 4). The JWG **agreed** to adopt these ROP, send the document to JCNB and NAMMCO for approval.

11. ADOPTION OF REPORT

The report was adopted at 17:02 on the final day. The group thanked the Chair for his leadership.

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Appendix 1 - LIST OF PARTICIPANTS

Joint Meeting of the

NAMMCO SCIENTIFIC COMMITTEE WORKING GROUP ON THE POPULATION STATUS OF NARWHAL AND BELUGA IN THE NORTH ATLANTIC

And the

CANADA/GREENLAND JOINT COMMISSION ON CONSERVATION AND MANAGEMENT OF NARWHAL AND BELUGA SCIENTIFIC WORKING GROUP

Ottawa, Canada, 11-13 March 2015

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Appendix 2 - List of Documents

Document No.	Document Title
NAMMCO/SC/22-JCNB/SWG/2015-JWG/01	List of participants
NAMMCO/SC/22-JCNB/SWG/2015-JWG/02	Draft agenda
NAMMCO/SC/22-JCNB/SWG/2015-JWG/03	Draft list of documents
NAMMCO/SC/22-JCNB/SWG/2014-JWG/04	Draft Rules of Procedure
NAMMCO/SC/22-JCNB/SWG/2015-JWG/05	Heide-Jørgensen, MP and Hansen RG. Catch statistics for belugas in Greenland 1862 to 2014.
NAMMCO/SC/22-JCNB/SWG/2015-JWG/06	Heide-Jørgensen, MP and Hansen RG. Reconstructing catch statistics for narwhals in Greenland 1862 to 2014
NAMMCO/SC/22-JCNB/SWG/2015-JWG/07	Watt et al. Narwhal dive behaviour
NAMMCO/SC/22-JCNB/SWG/2015-JWG/08	Heide-Jørgensen et al. Winter abundance of large marine mammals in the North Water
NAMMCO/SC/22-JCNB/SWG/2015-JWG/09	Witting and Heide-Jørgensen. Population model for West Greenland beluga.
NAMMCO/SC/22-JCNB/SWG/2015-JWG/010	Witting L. Meta population modelling of narwhals in East Canada and West Greenland.
NAMMCO/SC/22-JCNB/SWG/2015-JWG/11	Heide-Jørgensen et al. Abundance of belugas in West Greenland 2012.
NAMMCO/SC/22-JCNB/SWG/2015-JWG/12	Hall et al. Catch Statistics for Narwhal and Beluga in Selected Communities in Nunavut, Canada (2004-2013)
NAMMCO/SC/22-JCNB/SWG/2015-JWG/13	Canada Resource Managers Questions to JCNB
NAMMCO/SC/22-JCNB/SWG/2015-JWG/14	Hansen et al. Abundance of narwhals in Melville Bay
NAMMCO/SC/22-JCNB/SWG/2015-JWG/15	Hansen et al. narwhals in E Baffin Bay
NAMMCO/SC/22-JCNB/SWG/2015-JWG/16	Witting and Heide-Jørgensen EG narwhals
NAMMCO/SC/22-JCNB/SWG/2015-JWG/17	Narwhal Catch Allocation Subgroup Report

For Information Documents

Document No.	Document Title
NAMMCO/SC/22-JCNB/SWG/2015-JWG/O/01	Watt et al. (2013) How adaptable are narwhal? A comparison of foraging patterns among the world's three narwhal populations
NAMMCO/SC/22-JCNB/SWG/2015-JWG/O/02	Instantaneous availability bias correction for calculating aerial survey abundance estimates for narwhal (*Monodon monoceros*) in the Canadian High Arctic
NAMMCO/SC/22-JCNB/SWG/2015-JWG/O/03	Watt and Ferguson (2015) Fatty acids and stable isotopes (δ13C and δ15N) reveal temporal changes in narwhal (*Monodon monoceros*) diet linked to migration patterns
NAMMCO/SC/22-JCNB/SWG/2015-JWG/O/04	SC19-14-JWG_2012 Final Report *(report from last JWG meeting*)
NAMMCO/SC/22-JCNB/SWG/2015-JWG/O/05	Catch Allocation PRELIMINARY Report REVISED July2014 (*report will be updated after Catch Alloc. meeting in Ottawa 9-10 Marc*h)
NAMMCO/SC/22-JCNB/SWG/2015-JWG/O/06	Kelly et al. (2014) Mating ecology of beluga (*Delphinapterus leucas*) and narwhal (*Monodon monoceros*) as estimated by reproductive tract metrics
NAMMCO/SC/22-JCNB/SWG/2015-JWG/O/07	Marcoux et al. (in review) Age estimation of belugas *Delphinapterus leucas* using fatty acid composition: a promising method

Appendix 3 - Information on the different versions of the JWG 2015 10 paper

The complete paper is referred to as JWG10. The following versions are referred to in more specific cases. All versions are available from the NAMMCO Secretariat.

- JWG10a: File: JWG_2015_10_2014_Matrix: Based on the availability matrix from the last meeting of the allocation group

- JWG10b: File: JWG_2015_10_Uniform_B: As JWG_2015_10_2014_Matrix but with new availability matrix

- JWG10c: File: JWG_2015_10_Beta_B: As JWG_2015_10_Uniform_B but with informative Beta priors on the reproductive rate

- JWG10d: File: JWG_2015_10_n100: As JWG_2015_10_Beta_B but with soft soft zeros and soft soft ones (z=100)

- JWG10e: File: JWG_2015_10_C1.2: As JWG_2015_10_Beta_B but with all catches multiplied by 1.2

- JWG10f: File: JWG_2015_10_Advice: As JWG_2015_10_Beta_B but with some of the 2013 abundance estimates from Canada removed

Appendix 4

*The following edits were made to the draft Rules of Procedure, and were adopted by the JWG at the March 2015 meeting in Ottawa. Deletions are marked by ~~strikethrough~~ and new text is in **bold**.*

Rules of Procedure for the Scientific Joint Working Group (JWG) of the North Atlantic Marine Mammal Commission (NAMMCO) and the Joint Canada Greenland Commission on Narwhal and Beluga (JCNB)

I. Terms of Reference

1. The JWG shall provide scientific advice to the Councils of NAMMCO and the JCNB on such matters that are referred to it, and ensure that this advice is based on the best available scientific findings at any given time. This includes review and evaluation of data on stock identity, biological parameters, stock size, catch history and other information necessary for conducting an assessment of the species or stock in question and for providing advice on catch limits and conservation.

2. The JWG may make proposals to NAMMCO and the JCNB concerning any scientific tasks to be included in its future work.

II. Membership

1. Each Party ([11]Member Country/[12]Organisation) shall nominate scientists and other specialists as members of the JWG. These members may serve until otherwise notified, and may vote on scientific matters where a decision is required. However, when procedural or organisational matters are being dealt with, each Party shall have one vote.

2. The JWG shall be jointly chaired by two Chairs: one representing the interests of the JCNB and the other of NAMMCO. These chairs shall be appointed by the two organisations respectively, and they may serve for ~~three years~~ **two meetings**, after which they may be re~~-elected~~ **appointed**.

3. If for any reason a Chair is unable to complete his/her term of office, a new Chair shall be ~~elected at a regular meeting. If needed, a postal election of the Chair can be held.~~ **appointed by JCNB or NAMMCO.**

4. ~~The JWG may,~~ **Each party** on an ad-hoc basis ~~and subject to approval of the Councils of both NAMMCO and the JCNB~~ **may** nominate other experts to participate in meetings of the Committee as *ex officio* non-voting members. Any such nomination of experts must reach the **relevant party (**Secretary of NAMMCO ~~and~~ **or** the JCNB Commissioners**)** no later than 30 days before the start of the meeting in question. **Requests within 30 days of the meeting will be forwarded to the NAMMCO and JCNB Councils at the discretion of the co-Chairs.**

III. Observers

1. Attendance of observers shall not be permitted at the meetings of the JWG unless otherwise decided by the Chairs after consultation with members of the JWG and ~~approved by~~ **notification to** the Councils of NAMMCO and the JCNB Commissioners. Observers may not vote, but may contribute to the meeting if so

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[11] Canada and Greenland

[12] NAMMCO

allowed by the Chairs. Observers must regard all matters discussed as confidential until the final approved reports from the JWG meetings are publicly available.

IV. Organisation

1. The JWG is responsible for collecting and compiling the necessary information for providing scientific advice. While avoiding duplication of work being carried out elsewhere, the JWG decides where and how this information is to be obtained. If the JWG considers it necessary to consult information not available in the published literature or in the possession of any of the Members, any cooperation in this field with external authorities shall be undertaken by the JWG Chairs in consultation with NAMMCO and the JCNB Commissioners.

2. The JWG may establish designated Working Groups and Workshops on clearly defined subjects related to the work needed to be carried out for dissemination of the required scientific advice.

4. The Working Groups and Workshops report their findings in writing to the JWG according to their terms of reference.

5. The JWG reports its findings in writing to the ~~Councils~~ **Scientific Committee** of NAMMCO and the JCNB within ~~four~~ **eight** weeks after the conclusion of its deliberations. The contents of the report shall be considered strictly confidential ~~prior to that~~ **until released by either NAMMCO or JCNB.** The Chairs seek to have all views expressed on substantive matters during the deliberations of the JWG made clear in its report and the wording approved by the members before the end of its meeting ~~or~~**. Minor edits may be approved** by correspondence. Approval of the report requires consensus among the members.

V. Meetings

1. The JWG shall meet as required in order to provide updates on scientific advice to NAMMCO and the JCNB for management.

2. A provisional agenda for ~~all~~ JWG meetings shall be developed by the Chairs and distributed to the members no later than 30 days prior to the meeting in question. Comments or suggestions for revision of the provisional agenda ~~shall~~ **should** reach the Chairs no less than 10 days prior to that meeting.

3. The Chairs ~~shall,~~ in consultation with ~~other~~ members of the JWG **should** ensure that key ~~documentation of relevance to the provisional agenda is~~ **documents are** available at the ~~start of each~~ meeting. **In addition, where necessary, Chairs can request NAMMCO or the JCNB to provide information necessary for decisions.** This may involve compilation of published information and invitation to members, Parties, Working Group Chairs or external experts to submit and present scientific papers at the meetings. Any scientist may submit scientific paper(s) for consideration by the JWG, as appropriate.

4. Each Party having information on the biology of marine mammals relevant for management objectives, including research and statistical material on catches of relevant species or stocks, shall briefly report on such information at the relevant meetings of the JWG.

5. The JWG may make proposals for Contract Studies to be conducted on specific agenda items to be dealt with at its meetings. These will be coordinated by the Secretariat of NAMMCO in correspondence with the JCNB Commissioners.

6. The Secretary of NAMMCO, in correspondence with the JCNB Commissioners, may, with the concurrence of the Committee, set technical guidelines for the preparation, format and presentation of all meeting documents, including type and format of data on catches that each Party reports with respect to any relevant catch operation.

7. ~~Titles of~~ **Meeting** documents outlined in V.3.-5. above shall~~, if possible,~~ reach the Secretariat of NAMMCO no less than 10 days in advance of the meeting in question and be distributed ~~prior to the meeting to the members of the JWG after consultation with the Chairs.~~ **within 7 days** of the **meeting.** ~~A copy of the correspondence should be given to JCNB Commissioners in Greenland and Canada/Nunavut~~. All documents ~~registered before the end of the first day of~~ **available 7 days prior to** the meeting shall be considered Primary Documents for consideration at the meeting. **Later documents can be included at the discretion of the Chairs.**

8. English shall be the official language of the JWG and all primary documents shall be written in English. The Chairs can give exemptions from this general rule after consultation with other members and the Secretary of NAMMCO and JCNB Commissioners.

VI. Data Availability

1. The reports of the JWG and any subsidiary Working Groups and Workshops, and other scientific papers presented to the JWG shall be made available by the NAMMCO Secretariat, in correspondence with JCNB Commissioners to anyone whom so wishes, subject to approval by the Councils of NAMMCO and the JCNB.

2. The Secretariat of NAMMCO may, with the concurrence of the Councils of NAMMCO and the JCNB Commissioners, require that statistical material and computing programmes for use in evaluation of the status of stocks or for calculations of catch limits, such as detailed catch and abundance data, be submitted in advance to the Secretariat of NAMMCO in an electronic data storage medium, for validation and ~~preparation prior to the meeting~~ **review.** Submitted statistical material or other raw data shall only be released from the Secretariat of NAMMCO subject to approval of the scientist or Party submitting the data.

VII. Amendments of Rules

1. Proposals for amendment of these Rules of Procedure shall reach the Chairs of the JWG not less than 60 days prior to the JWG meeting at which the matter is to be discussed. The Rules of Procedures must be approved by the Council of NAMMCO and JCNB.

ANNEX 1 - REPORT

Joint Meeting of the

Narwhal Catch Allocation Sub-Group (JWG_{sub})

of the

NAMMCO SCIENTIFIC COMMITTEE WORKING GROUP ON THE POPULATION STATUS OF NARWHAL AND BELUGA IN THE NORTH ATLANTIC

And the

CANADA/GREENLAND JOINT COMMISSION ON CONSERVATION AND MANAGEMENT OF NARWHAL AND BELUGA SCIENTIFIC WORKING GROUP

Copenhagen, Denmark, 10–12 March 2014 and Ottawa, Canada 9-10 March 2015

A sub-group of the NAMMCO-JCNB Joint Scientific Working Group (JWG_{sub}) met 10–12 March 2014 in Copenhagen, Denmark, and again in Ottawa, Canada 9-10 March 2015. The Terms of Reference for this meeting were to:

- review information on distribution, movements and harvest locations of narwhal;
- develop an allocation model that will provide a mechanism for assigning harvested animals to all summer stocks based on existing data;
- specify and quantify exchange rates between aggregations and stocks;
- identify and quantify uncertainty in the allocation model and determine implications for management; and
- recommend future work to resolve uncertainties within the model structure.

The JWG_{sub} agreed that the main purpose for these meetings was to develop a model for catch allocations for the Baffin Bay narwhal population that is shared by Canada and Greenland, but not to decide on the sustainability and/or provide advice on the actual quotas. These issues are for the main Joint Working Group (JWG).

The JWG_{sub} agreed that the model developed during this meeting can be updated with future information (such as abundance estimates and catch statistics) that is approved by the main JWG.

REVIEW OF INFORMATION ON DISTRIBUTION, MOVEMENTS AND HARVEST LOCATIONS OF NARWHAL

Distribution and Movements

Stock structure

The JWG_{sub} discussed new information on stock structure. There was new information to update from Heide-Jørgensen *et al.* (2012). In Canada, narwhals (presumably Somerset Island stock) are moving further west towards Alaska during late summer and were harvested by Cambridge Bay in 2011 and 2012. Other communities that hunt from the Somerset Island stock and have seen an increase in availability of narwhal include Kugaaruk, Taloyoak, and Gjoa Haven and these should be added to the Creswell Bay box on (Fig. 10 from Heide-Jørgensen *et al.* 2012). These hunts are not an issue for creating the model because the catches are from a single stock, i.e., not a mixed stock. These hunts are counted against the Somerset Island quotas.

At the 2015 meeting, Canada informed the group that during the 2013 survey they observed narwhals in Makinson Inlet, which could be attributed to the Smith Sound summer aggregation, but may be a separate aggregation. This subgroup recommends that the main JWG discuss whether to split Makinson Inlet from the Smith Sound aggregation.

The stocks are identified by summer aggregations, which are present in August, however this does not always match with the summer hunt time frames in Canada, which causes difficulties of allocations where the time frame may encompass migrating periods and summer resident periods. For example, tracking results indicate that AI, ES, and SI narwhal begin movements out of their summer aggregation areas and into adjacent summer aggregation areas at the end of August and into September whereas the summer hunt season dates provided by the Canadian harvest data includes September.

Satellite tracking

Satellite tagging of narwhals has been occurring over the last 20 years. Tagging data are available from many summering grounds except Jones, Smith, East Baffin, and Inglefield Bredning.

Heide-Jørgensen informed the JWG_{sub} that an animal tagged in June 2013 on the southern side of Smith Sound went North of Buchanan Bay. Ferguson added that Canada surveyed this area in 2013.

No new tagging data was available from Canada or Greenland.

Genetic information

No new information was available for genetics of narwhals.

Other information on stock structure

The JWG_{sub} agreed that stable isotope data were reviewed extensively at the last meeting, and that there was no new information to add at this meeting.

Based on this review, the geographical extent of the narwhal summer aggregations used in this model are presented in Fig. 1.

Harvest Locations

The harvest locations used in this model are presented in Fig. 2, which was developed during the 2014 meeting. The location *Central Canadian Arctic* includes the communities of Gjoa Haven, Hall Beach, Igloolik, Kugaaruk, Resolute/Cresswell, Cambridge Bay, and Taloyoak. *Baffin Island Central* includes Clyde River and Qikiqtarjuaq. *Baffin Island South* includes Iqaluit and Pangnirtung.

Following the 2014 meeting, the map of hunting locations was reviewed by other experts in Canada. Greenland compared the map of hunting locations to locations that are received from hunters using GPS indicating where the hunts occurred. These locations are within the hunting regions shown on this map.

The group has determined that the existing map of hunting locations may not reflect the hunt of the same community by different seasons. The group suggests that better information is needed on hunting locations and dates to provide season-specific hunting areas for each regional community hunt.

Catch statistics

Canada informed the JWG_{sub} that they have data on harvest from all localities in Fig. 10 of Heide-Jørgensen *et al.* (2012). Ferguson presented Romberg 2014 (NAMMCO/SC/21-JCNB/SWG/2014-JWG/05) which contained an explanation of revisions to the Canadian narwhal management regime that were implemented in 2013 as a result of the development of an Integrated Fisheries Management Plan, cumulative landed catch information for all Canadian communities that harvested narwhal from 1998–2012, and a detailed breakdown of the seasonal harvest for select Nunavut communities for the period 2003–2012. Lastly, preliminary information was presented for 2013 harvests under the revised narwhal management regime (Tables 1 and 10 in Romberg 2014).

Ferguson also presented Higdon and Ferguson 2014 (NAMMCO/SC/21-JCNB/SWG/2014-JWG/09).

Management seasons in Canada

For Canada, seasons were defined as: Spring = Julian Days 1–204 (1 January to 23 July), Summer = Julian Days 205–274 (24 July to 30 September), and Fall = Julian Days 275–365 (1 October to 31 December) (Romberg and Richard 2005). The JWG_{sub} with support of Canada adopted a winter hunt (1 December – 1 April) to account for narwhal hunted by Pangnirtung and Iqaluit hunters during the same winter period as the Disko Bay hunt.

As mentioned above, harvest information from Canada needs locations and dates to be complete.

The JWG$_{sub}$ recommends that management seasons be reviewed in conjunction with the satellite tagging data, and should be considered relative to narwhal migration patterns. Hunting season dates may vary based on location. The group agreed to define the summer season based on residence of narwhal in the summering grounds.

For Greenland, the seasons are presented in Table 1.

Table 1. Hunting areas in Greenland, and the seasons in which the hunt takes place.

Hunting Area	Hunting Season
Etah	1 May – 1 August
Qaanaaq and Upernavik	1 April – 1 September
Uummannaq	1 November – 1 May
Disko Bay	1 December – 1 April

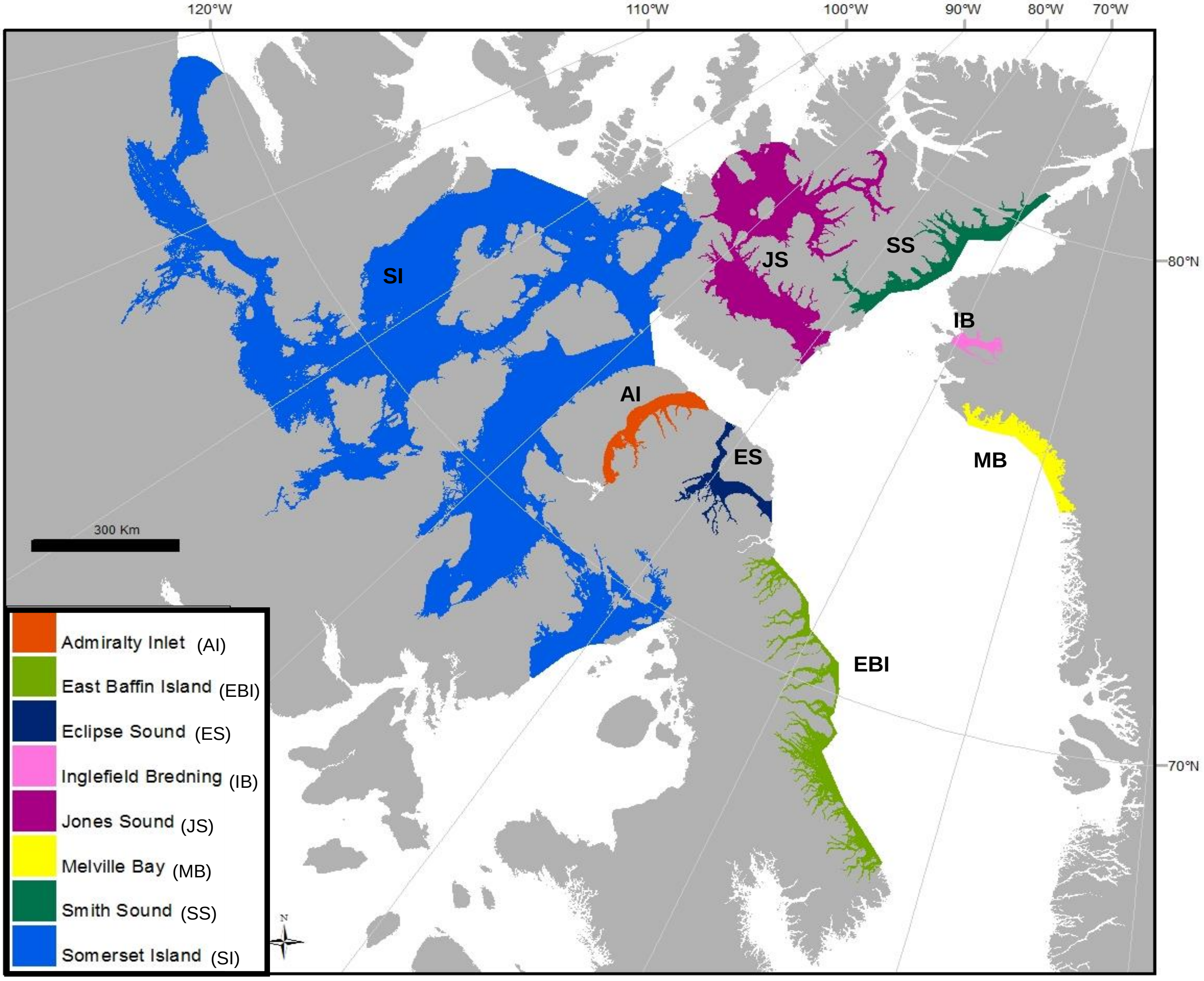

Fig. 1. Map of narwhal summer aggregations used in the model described in this report. Abbreviations in this figure correspond to those in Figures 3 and 4, and Table 3.

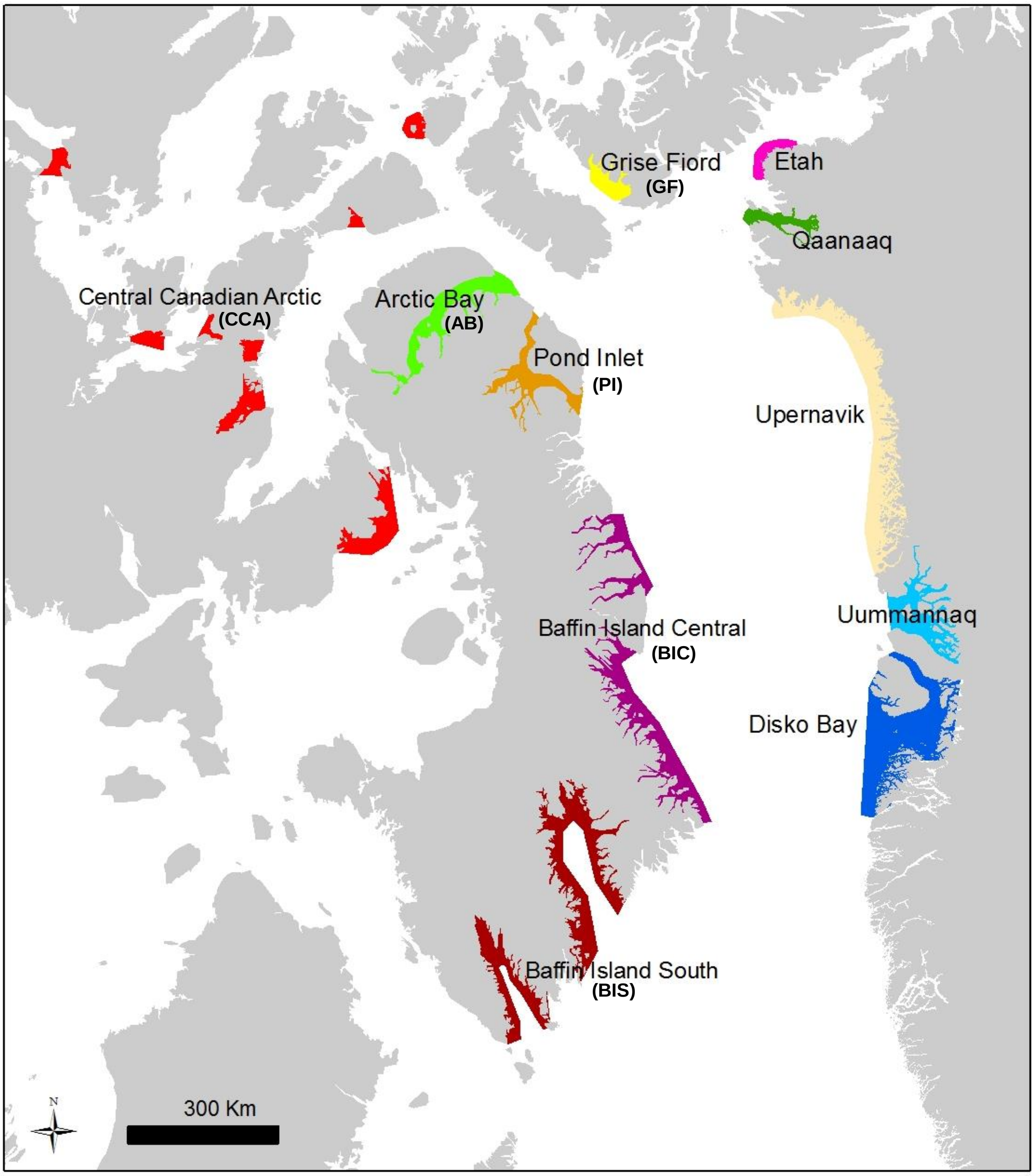

Fig. 2. Map of harvest locations used in the model described in this report. Abbreviations correspond to the abbreviations used in the Figures 3 and 4, and Table 3.

Catch History for the allocation model

Statistics on total removals were used, starting at 1970, a time frame determined by the earliest abundance estimates in Greenland (1981) and Canada (1975). The high option catch history data in Greenland, including struck and lost (1.15 and 1.30) and under-reporting (averages applied to missing information), were from Heide-Jørgensen and Hansen (2012).

Catch history data for Canada for 1970-2013, by community, were taken from Stewart (2009) and updated with recent information provided by Romberg (2014). The percentage catches by season for communities was taken from Romberg (2014) for 2003–2012 and applied retrospectively to the catch data (although as noted previously, management seasons must be revised). The group noted that actual catch dates are needed as input for the model.

Struck and lost

Canada informed the JWG_{sub} that they have not completed the study on struck and lost rates, and still need to come up with struck and lost estimates, including for different seasons. Although data on struck and lost is not available, Grise Fiord is thought to have a low struck and lost rate, mainly due to using a harpoon before shooting.

No new information was available for struck and lost in Greenland.

Values for struck and lost rates are similar in Canada and Greenland since both countries were informed by the same Canadian studies (Weaver and Walker 1988; Roberge and Dunn 1990) except that the unique kayak hunt in Greenland is assumed to have a low loss rate. The group agreed that the main JWG should review the struck and lost data.

Abundance

Information on narwhal population abundance and trends is needed for long-term monitoring and sustainable harvest management. Higdon and Ferguson 2014 (NAMMCO/SC/21-JCNB/SWG/2014-JWG/09) conducted a literature review of surveys and associated abundance estimates for the narwhal summer stocks that occur in Canadian waters (no non-summer surveys were included). Two narwhal populations were assessed, with five summer stocks (four in the Baffin Bay population) as defined by Fisheries and Oceans Canada (DFO). Some stocks are shared with other countries (i.e., Greenland), and some occur in multiple Canadian jurisdictions (e.g., Nunavut and Nunavik). Metadata in the database includes area studied, time frame, survey type, assumptions on availability bias, and use of corrections. The focus was on peer-reviewed scientific publications and government documents where the primary goal was abundance estimation. A number of consulting company reports also detail industry-funded surveys that have been conducted throughout the Canadian Arctic. These surveys are generally conducted for different reasons (impact predictions versus population estimates) and are generally not peer-reviewed. Reports from relevant industry-funded studies are noted in Higdon and Ferguson 2014 (NAMMCO/SC/21-JCNB/SWG/2014-JWG/09) where appropriate but have not been included in the database. The addition of these studies could provide additional abundance estimates that may be useful for trend analyses.

Higdon and Ferguson 2014 (NAMMCO/SC/21-JCNB/SWG/2014-JWG/09) compiled 16 survey records for the five narwhal summer stocks, conducted between 1975 and 2011 (a wide-ranging survey was also conducted in August 2013 and analyses are on-going). Some stocks have been surveyed numerous times and have recent abundance estimates (e.g., Admiralty Inlet, n=5 surveys total, most recently in 2010), others have only have been surveyed once and/or have dated estimates. Several narwhal summer stocks (Somerset Island and East Baffin Island) cover large areas and may have further sub-structuring. Narwhals are also known to occur elsewhere in the Canadian High Arctic during summer (e.g., Parry Islands, Jones Sound), but no surveys have been conducted in these areas (prior to 2013 surveys which are currently being analysed).

Canada informed the group about the recent 2013 High Arctic Cetacean Survey conducted by DFO between August 1 and August 26 2013. The survey teams flew for a combined total of 241 hours and covered most of the summering range of Canadian Baffin Bay narwhal stocks. New abundance estimates based on this synoptic survey will be presented to the main JWG meeting for the Jones Sound, Smith Sound, Somerset Island, Admiralty Inlet, Eclipse Sound and East Baffin summer aggregations.

The aerial survey was flown using three deHavilland Twin Otter 300 aircraft, each with four observers collecting double-platform sighting data and following line transect survey methods. In addition, photographic records were collected continuously below the aircraft using dual oblique cameras pointing downwards towards either side of the track line. These geo-referenced images will be used to generate separate abundance estimates and will allow the recovery of missing sighting angles from observers, and positive identification of whale species within the frames.

Total narwhal population size in Canada, across all five stocks, is ca. 95–110,000 animals. This estimate may be negatively-biased by lack of coverage of some areas, but many of the estimates are also dated. Trend analyses suggested that populations of narwhal summer stocks are generally stable, although power was low for all tests (Higdon and Ferguson 2014; NAMMCO/SC/21-JCNB/SWG/2014-JWG/09). Results from the 2013 survey, once available, will assist with establishing recent trends in Canadian Arctic narwhal populations. Preliminary results were used during this meeting as current abundance estimates.

The JWG_{sub} agreed that new abundance estimates discussed at this meeting are solely for informational purposes during this meeting to assist in building the model, but formal review of those will be left to the JWG as a whole.

Abundance estimates used in the allocation model for both Greenland and Canada are provided in Table 2. Canadian summer aggregation historic abundance data was taken from Higdon and Ferguson 2014 (NAMMCO/SC/21-JCNB/SWG/2014-JWG/09). A common availability bias was applied to all surveys that provided the total surface observations (2.9 for visual and 3.1 for photographic).

New information from Greenlandic surveys on wintering grounds for narwhals in the North Water was presented at the main JWG meeting (see paper NAMMCO/SC/22-JCNB/SWG/2015-JWG/08 from main JWG 2015 meeting). This group recognizes that these results inform us on distribution, but winter abundances cannot be directly reconciled with summer stocks. However these results indicate that large numbers of narwhal remain in the North Water in winter.

Table 2. Preliminary abundance estimates for summer aggregations of narwhal used in the model. CVs are in parentheses. The most recent abundance estimate was used in the matrix.

Summer Aggregation	Smith Sound	Jones Sound	Inglefield Bredning	Melville Bay	Somerset Island	Admiralty Inlet	Eclipse Sound	East Baffin Island
1975						28,265 (0.22)		
1981					32,523 (0.10)			
1985			3,164 (0.13)			16,402 (0.43)		
1986			8,706 (0.25)					
1996					45,358 (0.35)			
2001			2,297 (0.35)					
2002			1,478 (0.25)		35,806 (0.43)			
2003						5,362 (0.5)		10,073 (0.31)
2004							20,225 (0.36)	
2007			8,368 (0.25)	6,024 (0.86)				
2009	2,309 (1.62)							
2010						18,049 (0.22)		
2012				2,983 (0.39)				
2013	16,360 (0.65)	12,694 (0.33)			49,768 (0.20)	35,043 (0.42)	10,489 (0.24)	17,555 (0.35)
2014				3,091 (0.50)				

Notes:

The surveys from Admiralty Inlet in 1975 and Somerset Island in 1981 were multiplied by 2,919 (cv=0.45, Richard *et al.* 2010) to make them compatible with later surveys that included corrections for perception and availability bias. The Admiralty Inlet survey in 1985 was photographic and therefore a correction of 3.1 was used (Asselin and Richard 2011)
The surveys from Inglefield Bredning in 1985 and 1986 were multiplied by 2,919 (cv=0.45, Richard *et al.* 2010) to make them compatible with later surveys that included corrections for perception and availability bias
The abundance in Smith Sound in 2009 was obtained by subtracting the abundance in Inglefield Bredning from the abundance in the North Water (supposed to include both stocks, Heide-Jørgensen *et al.* 2012)

DEVELOPMENT OF AN ALLOCATION MODEL

This model developed by the JWG_{sub} will provide a mechanism for assigning harvested animals to all summer aggregations based on existing data. The JWG_{sub} assumed for this model that there is no exchange between summer aggregations.

The main purpose of the model is to give management advice; suggest sustainable harvest levels/allocations. The group agreed that the model is also a tool that can be used for retrospective and forecasting analyses in addition to quota allocation. Retrospective analysis could include investigating the effects of past hunting on narwhal population abundance estimates. Future analysis could include how changes in proposed harvest scenarios could affect population abundances.

The model was developed in the form of a 24 rows by 8 columns allocation matrix. The eight columns were the individual summer aggregations of Smith Sound, Jones Sound, Inglefeld Bredning, Melville Bay, Somerset Island, Admiralty Inlet, Eclipse Sound, and East Baffin Island (locations shown in Fig. 1). The 24 rows represented 24 hunts divided by 10 regions and for some regions hunts were divided by season (Fig. 2). Thus for each summer aggregation and hunt there is a cell in the matrix, and the matrix is devised so that when multiplied by a vector of removals, the resulting vector will determine the total removals from each summer aggregation, described below.

Each cell of the allocation matrix, **A**, had the value:

$$\mathbf{A}_{ijt} = \frac{\mathbf{P}_{ij}\, N_{it}}{\sum_i \mathbf{P}_{ij}\, N_{it}}$$

Where,

$\mathbf{A}_{ijt}$ is the proportion of the *j*th hunt that is assigned to the *i*th summer aggregation in year *t*.

$\mathbf{P}_{ij}$ is the proportional availability of the *i*th summer aggregation to the *j*th hunt.

N_{it} is the abundance of the *i*th summer aggregation in year *t*.

This model assumes that for each summer aggregation there is a proportion between zero and one, $\mathbf{P}_{ij}$, that is available to hunters during the hunting period on the hunting grounds. Each individual that is available is then at equal risk of being taken in the hunt. The sum of the $\mathbf{A}_{ijt}$ should be 1 for each row of $\mathbf{A}_t$.

To set up the proportional availability matrix, **P**, we reviewed each cell so that each cell in the matrix was given one of five designations:

Zero Availability (“hard zero”): This designated cells that represented improbable situations such as a summer harvest that was not at a summering ground (e.g. a narwhal harvested in summer in Resolute could not come from the Smith Sound summer aggregation and would be assigned to Somerset Island stock) and to hunts in areas that could not have originated in a particular summering ground based on known movements.

Unlikely Availability (“soft zero”): This designated cells in which a summering aggregation was unlikely to be hunted but proximity during the hunting season, or a presumed migration route did not rule out possible catches and designated cells with no tag data.

Partial availability (based on tagging data): This designated cells with tag data showing a portion of the summering aggregation was available or not to hunters.

Expected availability (“soft one”): This designated cells in which a summering aggregation was likely to be fully available to a hunt, based on its geographical proximity to a summering ground or migration route, but for which there was no quantitative evidence such as tag data.

Complete availability ("hard one"): This designated cells representing hunts on summering grounds or known wintering areas of summering aggregations.

Proportional Availability Matrix
Two versions of the proportional availability matrix were considered with different treatments of each designation. In the fixed version, both *Zero Availability* and the *Unlikely Availability* were given the value zero and both the *Expected Availability* and *Complete Availability* were given the value one. As outlined below, the *Partial Availability* hunts were given values resulting from tag data as the fraction of the possible tags that went into the hunt area. The second version is a stochastic matrix in which the value for each cell is drawn from a distribution as described in the sensitivity analysis.

The fixed matrix can be used to provide single value results. The stochastic matrix can be used for sensitivity analysis and risk assessment on its own or with a stochastic vector of abundance estimates or hunt takes.

With the development of A_t the full model is then:

$$\mathrm{S}_t = \mathbf{A}_t \mathrm{H}_t$$

Where,

S_t is a vector of the number of narwhal taken in hunts from each summer aggregation in year *t*.

$\mathbf{A}_t$ is the **A** matrix in year *t*.

H_t is a vector of the numbers of narwhal taken in hunts at each hunting area by season in year *t*.

As noted above, both $\mathbf{P}_{ij}$ and N_{it} may be stochastic, thus S_t would be stochastic as well. Stochastic versions of $\mathbf{P}_{ij}$ and N_{it} are considered below in the sensitivity analysis. The group discussed the point that as more movement data becomes available from satellite tracking experiments the **P** matrix will be modified and if behavioural changes are suspected over time the **P** matrix will become time dependent as well. One suggestion was to weight the most recent tag data more heavily and decreasing the weight with the age of the data in comparison to the year of the **P** matrix. This can also be done for a **P** matrix for a past year with newer data being given lower weight than the years around the time of the **P** matrix.

The group discussed two uses of the model but deferred further discussion to the full JWG, these were:

1. Modification to estimate the removals as a fraction of each summering stock so that S* is a vector of the fraction of a summering stock taken by hunting with elements $Sit^* = S_{it}/N_{it}$ or if the **A** matrix is modified, S* = A* H where,

$$\mathbf{A}^*_{ijt} = \frac{\mathbf{P}_{ij}}{\sum_i \mathbf{P}_{ij}\, N_{it}}$$

2. The reverse problem of estimating sustainable take limits from take on summering aggregations. The group noted that the reverse problem of estimating recommended limits for individual hunts is under specified so further information regarding how optimum hunt quotas or limits are defined is necessary before a single result can be identified. Alternatively the reverse problem could identify a range of limits that would be equivalent for sustainability or limiting risk and then managers could use other criteria to choose among these.

SPECIFICATION AND QUANTIFICATION OF EXCHANGE RATES AMONG AGGREGATIONS

To determine the proportional availability of each summer aggregation in the different hunting regions (P_{ij}) value, we used satellite tracking data where available, and data on distribution and movements where satellite tracking was insufficient.

<u>Rules for assigning risk of taking in a hunt using the narwhal tag data</u>

The following rules were developed by the JWG_{sub}. Individual decisions on each cell in the matrix are provided in Appendix CA1.

1. Narwhal satellite-tagged during the summer are assumed to belong to the aggregation where they were tagged. This is thought to be generally true but one example of a movement between summer stocks in subsequent years and early departure on migration during the last week of August and early September have occurred. These were designated as "*Complete Availability*" on their summing grounds and "*Zero Availability*" to summer hunts outside of the summering grounds.

2. Narwhal tagged in other seasons are used if the tags last long enough to record a movement to a summering area. In the case of Uummannaq these were interpreted as a connection but could not be used to estimate a probability, however Somerset Island was the only summer stock related to Uummannaq by tag data.

3. Currently, we define sample weight as one for each tag that entered the hunting season. In the future, the weight will be the number of days in a hunting season until the last transmission of the tag during the season divided by the total number of days comprising the hunting season, so that a tag lasting through the season has a weight of 1 and a tag that fails prior to the season has a weight of 0.

4. Sample size for tag data is the sum of the tags that originated in a summering ground and lasted until the beginning day of hunting multiplied by their weight (see #3).

5. The number of narwhals at risk of hunting is the sum of the number of narwhals that entered the hunting area at least once during the hunting season multiplied by their weight from item 3. An example would be the 3 tags last into the hunting season 2 last through the season one enters the hunting area the other doesn't. The third whale lasts through half the season but enters the hunting area. The sample is then

   $$Y=(1*1+1*1+1*0.5)=2.5\text{: the number at risk is then } X=(1*1+0*1+1*0.5)=1.5$$

6. These proportions were calculated using the number of whales (X) tracked from a summer aggregation that visited a hunting region during the hunting season. X was then divided by the number of tagged whales that were transmitting at that time (Y) that had originated in the summer aggregation. For instance, continuing the example in Item 5, this would be 1.5/2.5.

7. Currently, for those designated as *Partial Availability*, decisions to ascertain whether a tracked whale entered the area "available" to the hunters of a given community were based on review of its trajectory and by the JWG_{sub}. In the future, a narwhal is considered to have entered a hunting area, if any good quality location or trackline (i.e. only ARGOS quality 1,2,3 locations) buffered by 10km falls within the hunting area. In cases where the trackline crosses land, these will be reviewed to determine whether it is in close proximity to a hunting area.

8. Hunting areas are defined based on the areas utilized by hunters in each season. Ideally this is based either on location data from takes or on local knowledge and observations.

9. Hunting takes are assigned by season to the area of a community hunt. In some cases hunters take narwhal in other areas these should be assigned to the area of take rather than the community.

10. When tag data is not available Expert opinion is used based on: 1) seasonal distribution observation from surveys, 2) traditional knowledge and expert understanding of animal movements 3) proximity to hunting areas, 4) by analogy to other stocks presumed to have similar migration patterns.

11. Cells with *Zero Availability* and *Unlikely Availability* were assigned a proportional availability of 0. By definition, all summer stocks had a proportional availability of 1 for the summer hunt occurring within their own summer range (*Complete Availability*). Cells with *Expected Availability* were also given a proportion of 1.

Applying the 11 rules above to the hunts and summer aggregations results in the deterministic version of the matrix shown in Table 3 (see also Appendix CA1).

IDENTIFY AND QUANTIFY UNCERTAINTY IN THE ALLOCATION MODEL AND DETERMINE IMPLICATIONS FOR MANAGEMENT

There are two main sources of uncertainty in the analysis: uncertainty in the proportion of whales from one stock that are available to hunters at a given hunting site ($\mathbf{P}_{ij}$), and errors in stock abundance estimates from aerial surveys ($\boldsymbol{N_{it}}$). We integrated them in the allocation model and quantified their impact on the removal vectors.

Uncertainty in the proportional availability matrix P

We quantified uncertainty around proportions $\mathbf{P}_{ij}$ by assuming that the number of whales located in a certain area followed a binomial distribution with a sample size equal to the number of transmitting tags (Y) and a probability equal to the true proportion of the summer aggregation that visits this area. This true proportion is unknown but follows a beta distribution, Beta(X+1,Y-X+1) (Johnson and Kotz, 1970), where X is the number of transmitting tags that visited the hunting area.

When no movements were documented between a summer aggregation and a hunting ground, we distinguished between movements that were deemed extremely unlikely based on expert knowledge, and movements that were considered unlikely but not impossible. As described in the previous section, the former, designated as *Zero Availability*, were assigned a proportional availability of 0, with no uncertainty. The latter, designated as *Unlikely Availability*, were also assigned a proportional availability of 0, but were given a Beta(1,Z+1) probability distribution, where Z is an uncertainty parameter that can vary from 1 to infinity (larger values represent lower uncertainty). Cells with *Expected Availability* were given a Beta(Z+1,1) distribution. In practice the parameter Z can be thought of as a hypothetical number of transmitting tags that would result in no tags visiting a hunting area, thus a minimum value for Z would be the number of tags to date and higher values would reflect certainty resulting from other sources. For this exercise this parameter was used for sensitivity testing of the model, setting Z to be identical for all cells designated as *Unlikely Availability* assuming Z= 10,000 as the base case (i.e., no uncertainty).

Inclusion of uncertainty changes $\mathbf{P}_{ij}$ from a table with fixed values to a table in which each cell contains a probability distribution (Table 4). For cells with *Zero Availability* and *Complete Availability*, these distributions have essentially zero variance and result in a single value of 0 or 1, respectively. Cells with *Partial Availability* show a distribution with mean equal to the corresponding value in the fixed version of the table, and which variance reflects uncertainty around this value.

For cells with *Unlikely Availability*, both mean and variance depend on the value of Z. The maximum value of Z=10,000 results in a distribution identical to *Zero Availability*. Lower values of Z result in larger means and larger coefficients of variation.

Table 3. Proportional availability matrix P (deterministic version). Each cell describes the availability of narwhals from summer aggregations to hunting regions. Black numbers represent "hard" zeros and ones, red numbers are "soft" zeros and ones, and blue numbers are based on the proportion of tracked whales that visited a hunting region, as described in rule 6.

		Summer Aggregation							
Hunt	Season	Smith Sound	Jones Sound	Inglefeld Bredning	Melville Bay	Somerset Island	Admiralty Inlet	Eclipse Sound	East Baffin Island
Qaanaaq	Spring	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Qaanaaq	Summer	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Grise Fjord	Spring	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Grise Fjord	Summer	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Grise Fjord	Fall	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Upernavik	Summer	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
Uummannaq	Fall	0.00	0.00	0.00	0.11	1.00	0.00	0.00	0.00
Disko Bay	Winter	0.00	0.00	0.00	0.14	0.00	0.02	0.17	0.00
CCA	Spring	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
CCA	Summer	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
CCA	Fall	0.00	0.00	0.00	0.00	1.00	0.17	0.04	0.00
Arctic Bay	Spring	0.00	0.00	0.00	0.00	1.00	1.00	0.20	0.00
Arctic Bay	Summer	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Arctic Bay	Fall	0.00	0.00	0.00	0.00	0.00	1.00	0.23	0.00
Pond Inlet	Spring	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00
Pond Inlet	Summer	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Pond Inlet	Fall	0.00	0.00	0.00	0.00	0.00	0.10	1.00	0.00
BIC	Spring	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
BIC	Summer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
BIC	Fall	0.00	0.00	0.00	0.00	0.00	0.24	0.62	1.00
BIS	Spring	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
BIS	Summer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
BIS	Fall	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.00
BIS	Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00

Table 4. Proportional availability matrix P (stochastic version). Each cell describes the availability of narwhals from summer aggregations to hunting regions [X/Y: available (X) over total (Y)]. Black numbers are fixed, blue and red are beta distributions (α = X+1; β = Y-X+1); red cells are sensitive to changes in uncertainty parameter Z.

		Summer Aggregation							
Hunt	**Season**	**Smith Sound**	**Jones Sound**	**Inglefeld Bredning**	**Melville Bay**	**Somerset Island**	**Admiralty Inlet**	**Eclipse Sound**	**East Baffin Island**
Qaanaaq	Spring	1	0/Z	0	0	0	0	0	0
Qaanaaq	Summer	0	0	1	0	0	0	0	0
Grise Fjord	Spring	0/Z	1	0/Z	0	0/Z	0	0	0
Grise Fjord	Summer	0	1	0	0	0	0	0	0
Grise Fjord	Fall	0/Z	1	0/Z	0	0/Z	0	0	0
Upernavik	Summer	0	0	0	1	0	0	0	0
Ummannaaq	Fall	0/Z	0/Z	0/Z	1/9	1	0/42	0/26	0/Z
Disko Bay	Winter	0/Z	0/Z	0/Z	1/7	0/Z	1/42	1/6	0/Z
CCA	Spring	0	0	0	0	1	0/4	0/5	0
CCA	Summer	0	0	0	0	1	0	0	0
CCA	Fall	0	0	0	0	1	1/6	1/26	0
Arctic Bay	Spring	0	0	0	0	1	1	1/5	0
Arctic Bay	Summer	0	0	0	0	0	1	0	0
Arctic Bay	Fall	0	0	0	0	0/Z	1	6/26	0
Pond Inlet	Spring	0	0/Z	0/Z	0	2/2	4/4	1	0/Z
Pond Inlet	Summer	0	0	0	0	0	0	1	0
Pond Inlet	Fall	0	0/Z	0/Z	0	0/14	4/42	1	0/Z
BIC	Spring	0	0/Z	0/Z	0	0/2	0/4	0/6	1
BIC	Summer	0	0	0	0	0	0	0	1
BIC	Fall	0	0/Z	0/Z	0	0/5	5/21	8/13	1
BIS	Spring	0	0	0	0	0/2	0/4	0/6	Z/Z
BIS	Summer	0	0	0	0	0	0	0	1
BIS	Fall	0	0	0	0	0/5	0/42	1/13	Z/Z
BIS	Winter	0	0	0	0	0/2	0/42	1/6	Z/Z

Integrating uncertainty in abundance vectors N_{it}
Abundance estimates with a given mean (N) and coefficient of variation (CV) were assumed to follow a log-normal distribution with parameters μ and σ given by:

$$\mu = \log \frac{N^2}{\sqrt{N^2(1+CV^2)}}$$

and

$$\sigma = \sqrt{\log(1+CV^2)}$$

To integrate uncertainty in abundance vectors N_{it} in the allocation matrix $\mathbf{A}_{ijt}$, we used Monte-Carlo sampling. We drew 100,000 samples from a beta distribution for each cell in $\mathbf{P}_{ij}$ and 100,000 samples from a lognormal distribution for each value of N_{it}. We then calculated the value of $\mathbf{A}_{ijt}$ for each cell and each sample. The resulting distributions thus include the full uncertainty in proportional availabilities and abundance estimates (Fig. 3 for Z=10,000 and Fig. 4 for Z=1).

Effect of uncertainty on removals
After integrating uncertainty in *Partial Availability*, *Unlikely Availability*, and *Expected Availability* distributions from matrix **P**, as well as uncertainty in abundance vectors, the removals from each stock now have an error distribution (rather than being fixed values). Table 5 shows mean removals and associated coefficients of variation. Uncertainty around *Unlikely Availability* proportions depend on Z, and therefore Z also has an effect on the mean value of removal vectors. One example of this effect is shown for the Admiralty Inlet and East Baffin Island stocks (Fig. 5): when uncertainty increases, a larger part of the Pond Inlet catch is redistributed to the Somerset Island and East Baffin stocks, thus reducing total removals from Admiralty Inlet. If we think of Z in terms of the tag data, when Z is large compared to the number of tags then the results are insensitive to Z. When Z is similar to or smaller than the number of tags, the results are highly sensitive to Z. Thus the application of this matrix will require careful consideration of the lower bounds for Z in individual cells and demonstrates the need for more tagging data in summering aggregations where the allocation matrix is most sensitive.

Determining the management implications of the allocation model is deferred to the JWG.

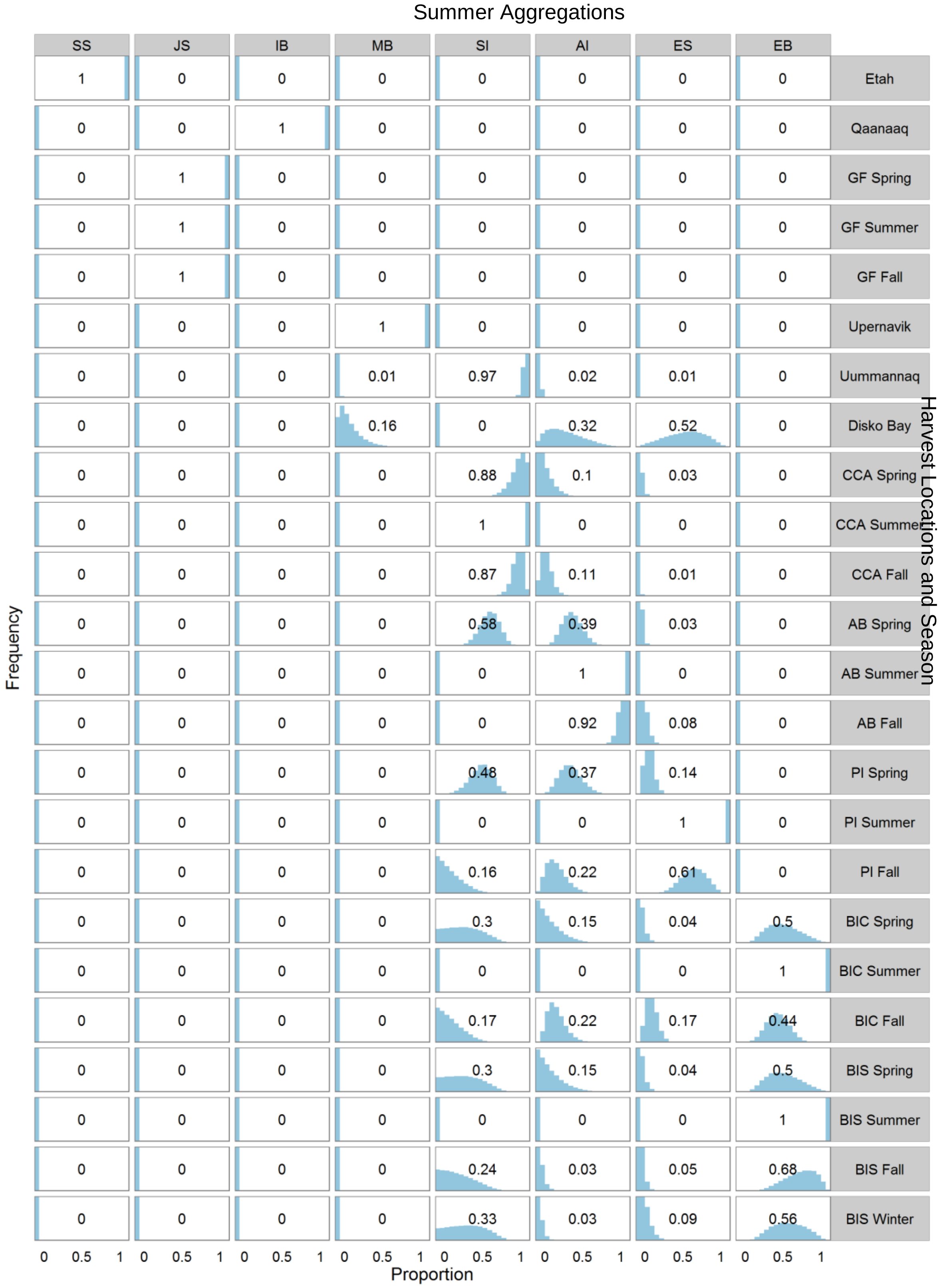

Figure 3. Allocation matrix $\mathbf{A}_{ij}$ with uncertainty in *Partial Availabilities* and no uncertainty in *Unlikely* and *Expected Availabilities* (Z = 10,000). Abbreviations are defined in Figures 1 and 2.

Summer Aggregations

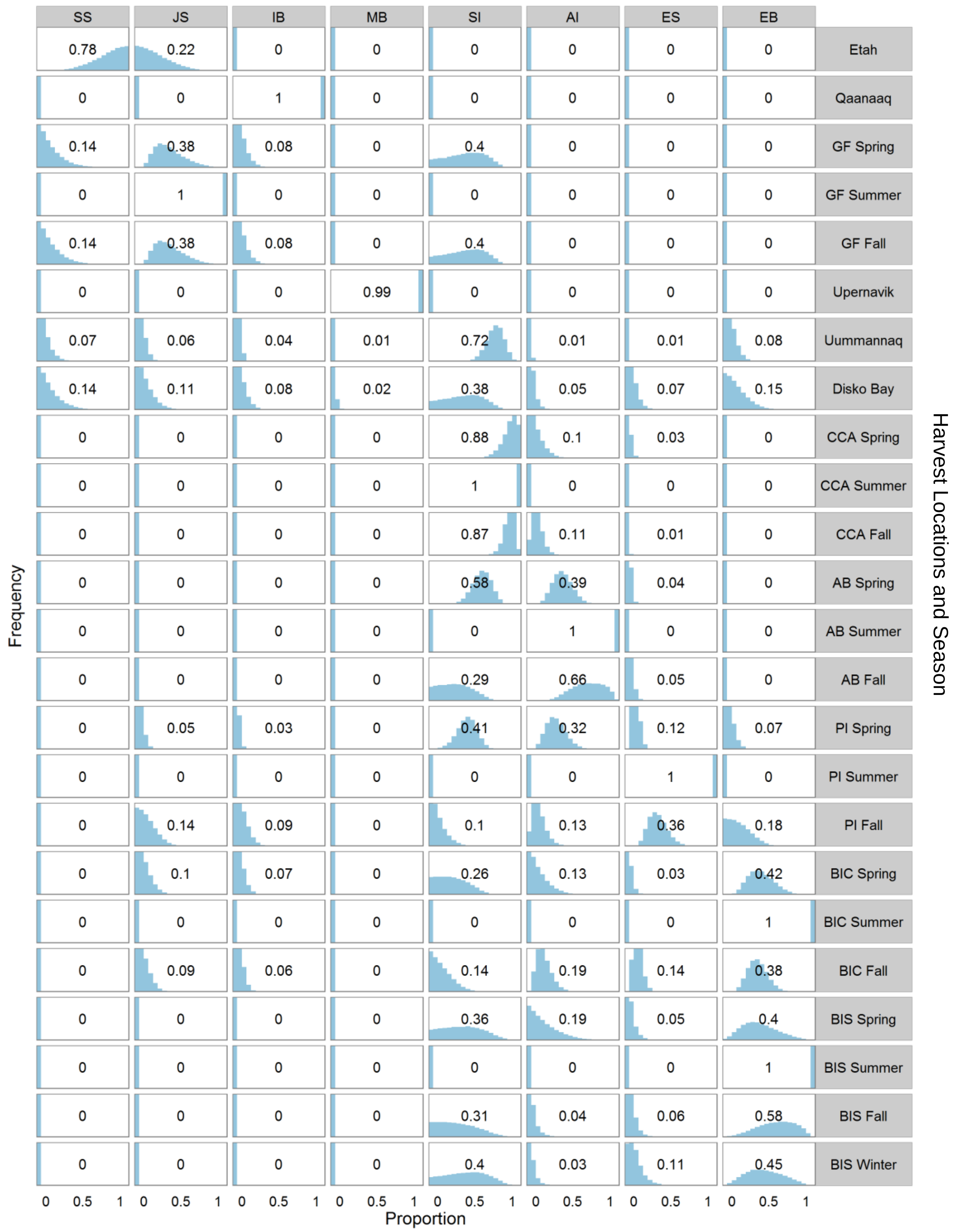

Figure 4. Allocation matrix $\mathbf{A}_{ij}$ with uncertainty in *Partial Availabilities* and Z = 1 for quantifying uncertainty in *Unlikely* and *Expected Availabilities*. Abbreviations are defined in Figures 1 and 2.

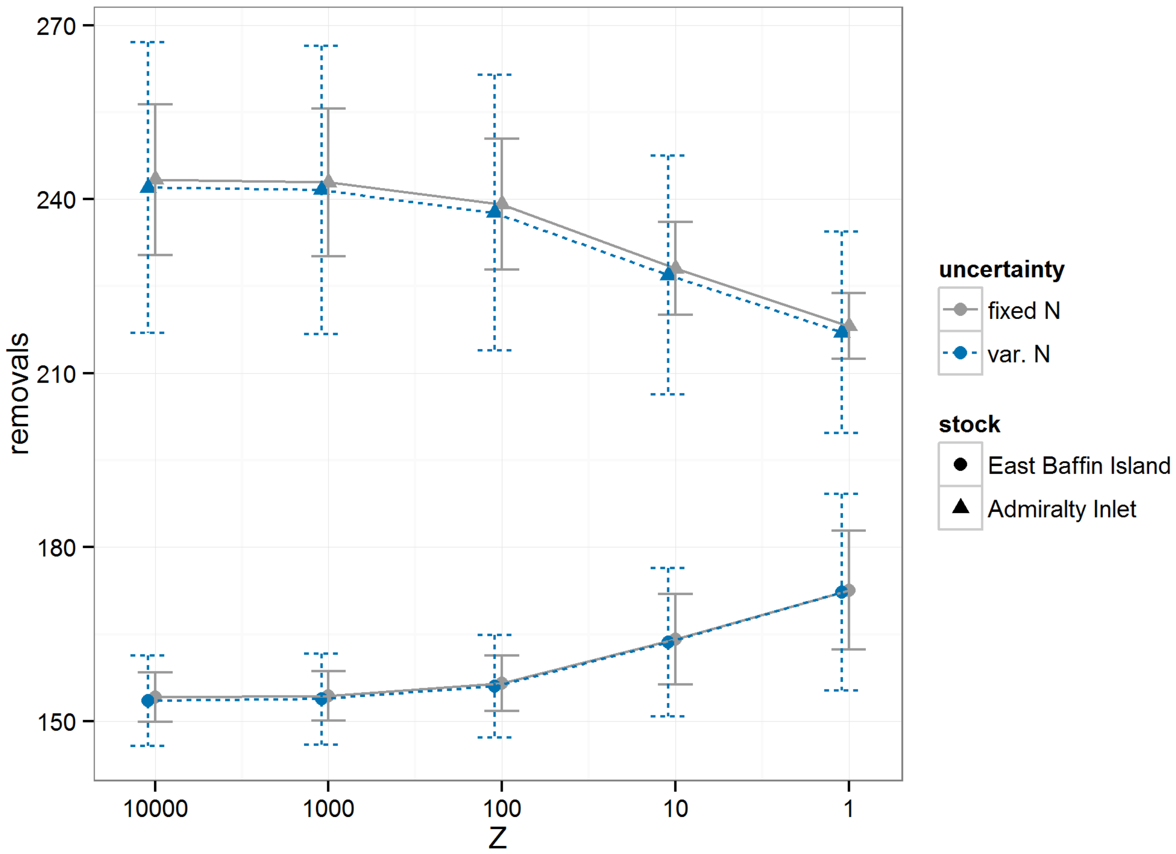

Figure 5. Effect of Z and uncertainty in abundance estimates on removals (± SD) from the AI and EB stocks, based on allocation of 2013 Greenland and Canadian catches. Fixed N: assuming no uncertainty in abundance estimates. Var. N: including uncertainty in abundance estimates. Uncertainty in *Unlikely Availability* proportions increases as Z decreases.

Table 5. Removals (and CV%) from each stock based on allocation of 2013 Greenland and Canadian catches, under several assumptions. Z=10,000: including uncertainty in *Partial Availability* proportions but assuming no uncertainty for *Unlikely Availability*. Z=1: including maximum uncertainty for *Unlikely availability*. Fixed N: assuming no uncertainty in abundance estimates. Var. N: including uncertainty in abundance estimates.

Stocks	SS	JS	IB	MB	SI	AI	ES	EB
Deterministic	0	9	87	93	230	243	170	154
Z=10,000 fixed N	0 (0%)	9 (1%)	87 (0%)	93 (7%)	230 (4%)	243 (5%)	170 (7%)	154 (3%)
Z=1 fixed N	18 (49%)	31 (26%)	103 (5%)	84 (1%)	225 (7%)	218 (3%)	136 (3%)	173 (6%)
Z=10,000 var. N	0 (0%)	9 (1%)	87 (0%)	93 (9%)	232 (7%)	242 (10%)	171 (10%)	154 (5%)
Z=1 var. N	17 (72%)	31 (36%)	103 (7%)	84 (2%)	226 (11%)	217 (8%)	136 (6%)	172 (10%)

RECOMMENDATIONS FOR FUTURE WORK TO RESOLVE UNCERTAINTIES WITHIN THE MODEL STRUCTURE

1) The JWG_{sub} recommends that the JWG review the sensitivity analysis and identifies key components that will improve the model. For example, sensitivity analysis could help identify where increased sample sizes of telemetry data could be useful.

2) The JWG_{sub} recommends considering alternative methods of stock identification such as genetics, stable isotop es, etc. as they become available.

3) The JWG_{sub} recognises that small sample sizes of satellite tag data includes uncertainty that further tagging efforts would reduce. Additional satellite tagging should be undertaken, especially in areas where no tagging or limited tagging data has been collected.

4) The JWG_{sub} recommends that the JWG address the generation of management advice using the allocation model.

Tasks for the next JWG meeting:

1) Complete sensitivity analysis of the matrix to identify points of uncertainty critical to management advice (Witting).

2) Define hunt seasons and hunt areas individually (e.g., each hunt season may have different areas hunted), using hunter knowledge and GPS locations of takes (where available). (Ferguson)

3) Analyse telemetry tracking data to provide consistent maps of all tagged narwhal; thereby providing future review of each whale individually and calculating the proportion of time each whale was tracked within a season. (Hansen will write script, Watt has provided Canadian data from 2009 to 2012).

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Appendix 1

Appendix CA1. Table of decisions on assigning proportions. Note that in a few cases (*notes in italics*) the JWG_{sub} made a preliminary determination based on incomplete data or noting a discrepancy in dates of a hunt on migrating narwhal with the dates of migration. These were left to the JWG to resolve at a later meeting but none were considered critical to the use of the allocation matrix.

Stock	Site	Prop	Comment
Admiralty Inlet	Etah (Qaanaaq spring)	Hard 0	based on likely migration patterns
Admiralty Inlet	Qaanaaq	Hard 0	unlikely movement
Admiralty Inlet	GF Spring	Hard 0	unlikely movement
Admiralty Inlet	GF Summer	Hard 0	by definition of summer aggregations
Admiralty Inlet	GF Fall	Hard 0	unlikely movement
Admiralty Inlet	Upernavik (summer)	Hard 0	by definition of summer aggs
Admiralty Inlet	Uummannaq	Hard 0	based on tag data (0/42)
Admiralty Inlet	Disko Bay (winter)	Soft 0	based on tag data (1/42)
Admiralty Inlet	CCA Spring	Hard 0	based on migration patterns not likely they would go there in spring, none of the tagged animals
Admiralty Inlet	CCA Summer	Hard 0	by definition of summer aggregations
Admiralty Inlet	CCA Fall	0.166667	tagged data
Admiralty Inlet	AB Spring	Hard 1	by definition of summer aggregations
Admiralty Inlet	AB Summer	Hard 1	by definition of summer aggregations
Admiralty Inlet	AB Fall	Hard 1	by definition of summer aggregations
Admiralty Inlet	PI Spring	Hard 1	tag data (4/4 tagged animals went there), but migration pattern hugs coast and hunters behaviour (floe edge hunt)
Admiralty Inlet	PI Summer	Hard 0	by definition of summer aggregations
Admiralty Inlet	PI Fall	0.095238	tagged data (4/42) *Catch season dates need to be revisited because they do not fit with the timing of migration*
Admiralty Inlet	BIC Spring	0	no tagged animals there (0/4)
Admiralty Inlet	BIC Summer	Hard 0	by definition of summer aggregations
Admiralty Inlet	BIC Fall	0.238095	10 tags out of 42
Admiralty Inlet	BIS Spring	0	0/4 tags nearby
Admiralty Inlet	BIS Summer	Hard 0	by definition of summer aggregations
Admiralty Inlet	BIS Fall	0	0/42 tagged animals nearby
Admiralty Inlet	BIS Winter	0	0/42 tagged animals nearby
East Baffin Island	Etah (Qaanaaq spring)	Hard 0	likely movement
East Baffin Island	Qaanaaq	Hard 0	likely movement
East Baffin Island	GF Spring	Hard 0	likely movement
East Baffin Island	GF Summer	Hard 0	by definition of summer aggregation
East Baffin Island	GF Fall	Hard 0	likely movement
East Baffin Island	Upernavik	Hard 0	likely movement
East Baffin Island	Uummannaq	Soft 1	geographically close, analogy with other migrating stocks
East Baffin Island	Disko Bay	Soft 0	geographically close, analogy with other migrating stocks

Stock	**Site**	**Prop**	**Comment**
East Baffin Island	CCA Spring	Hard 0	unlikely movement
East Baffin Island	CCA Summer	Hard 0	by definition of summer aggregation
East Baffin Island	CCA Fall	Hard 0	unlikely movement
East Baffin Island	AB Spring	Hard 0	unlikely movement
East Baffin Island	AB Summer	Hard 0	by definition of summer aggregation
East Baffin Island	AB Fall	Hard 0	unlikely movement
East Baffin Island	PI Spring	Soft 0	based on proximity
East Baffin Island	PI Summer	Soft 0	based on proximity
East Baffin Island	PI Fall	Soft 0	based on proximity
East Baffin Island	BIC Spring	Hard 1	likely movement
East Baffin Island	BIC Summer	Hard 1	by definition of summer aggregation
East Baffin Island	BIC Fall	Hard 1	likely movement
East Baffin Island	BIS Spring	Soft 1	not sure what other animals could contribute significantly
East Baffin Island	BIS Summer	Hard 1	by definition of summer aggregation, only animals available to summer hunt
East Baffin Island	BIS Fall	Soft 1	not sure what other animals could contribute significantly
East Baffin Island	BIS Winter	Soft 1	not sure what other animals could contribute significantly
Eclipse Sound	Etah (Qaanaaq spring)	Hard 0	unlikely movement
Eclipse Sound	Qaanaaq	Hard 0	by definition of summer aggregations
Eclipse Sound	GF Spring	Hard 0	unlikely movement
Eclipse Sound	GF Summer	Hard 0	unlikely movement
Eclipse Sound	GF Fall	Hard 0	unlikely movement
Eclipse Sound	Upernavik	Hard 0	unlikely movement
Eclipse Sound	Uummannaq	Hard 0	0/26 tagged animals
Eclipse Sound	Disko Bay	0.166667	1/6 tagged animals
Eclipse Sound	CCA Spring	Hard 0	0/5 tagged animals
Eclipse Sound	CCA Summer	Hard 0	by definition of summer aggregations
Eclipse Sound	CCA Fall	Soft 0	1/26 tagged animals
Eclipse Sound	AB Spring	0.2	1/5 tagged animals
Eclipse Sound	AB Summer	Hard 0	By definition of summer aggregations. *There was one animal tagged in 2010 in Eclipse Sound with a satellite transmitter that lasted until October 2011 that returned from the winter range to summer in Admiralty Inlet, but all other expert opinion says this violates the rule that summer animals stay within their summer aggregation. In future, perhaps Admiralty and Eclipse should be one stock. For precautionary management purposes right now they are considered two stocks.*
Eclipse Sound	AB Fall	0.230769	6/26 tagged animals
Eclipse Sound	PI Spring	Hard 1	likely movement
Eclipse Sound	PI Summer	Hard 1	by definition of summer aggregations
Eclipse Sound	PI Fall	Hard 1	likely movement

Stock	Site	Prop	Comment
Eclipse Sound	BIC Spring	0	likely movement
Eclipse Sound	BIC Summer	Hard 0	by definition of summer aggregations
Eclipse Sound	BIC Fall	0.615385	tagged animals
Eclipse Sound	BIS Spring	0	tag data (0/6)
Eclipse Sound	BIS Summer	Hard 0	by definition of summer aggregations
Eclipse Sound	BIS Fall	0.076923	2/26 tagged animals
Eclipse Sound	BIS Winter	0	tagged animals (1/6) *Check Dates*
Inglefield Bredning	Etah (Qaanaaq spring)	Hard 0	unlikely movement
Inglefield Bredning	Qaanaaq	Hard 1	based on summer aggregations
Inglefield Bredning	GF Spring	Soft 0	unlikely movement
Inglefield Bredning	GF Summer	Hard 0	unlikely movement
Inglefield Bredning	GF Fall	Soft 0	could be hunted by GF in fall
Inglefield Bredning	Upernavik	Hard 0	unlikely movement
Inglefield Bredning	Uummannaq	Hard 0	unlikely movement
Inglefield Bredning	Disko Bay	Soft 0	unlikely movement
Inglefield Bredning	CCA Spring	Hard 0	unlikely movement
Inglefield Bredning	CCA Summer	Hard 0	by definition of summer aggregations
Inglefield Bredning	CCA Fall	Hard 0	unlikely movement
Inglefield Bredning	AB Spring	Hard 0	unlikely movement
Inglefield Bredning	AB Summer	Hard 0	by definition of summer aggregations
Inglefield Bredning	AB Fall	Hard 0	unlikely movement
Inglefield Bredning	PI Spring	Hard 0	unlikely movement
Inglefield Bredning	PI Summer	Hard 0	by definition of summer aggregations
Inglefield Bredning	PI Fall	Soft 0	unlikely movement
Inglefield Bredning	BIC Spring	Hard 0	unlikely movement
Inglefield Bredning	BIC Summer	Hard 0	by definition of summer aggregations
Inglefield Bredning	BIC Fall	Hard 0	unlikely movement
Inglefield Bredning	BIS Spring	Hard 0	unlikely movement
Inglefield Bredning	BIS Summer	Hard 0	by definition of summer aggregations
Inglefield Bredning	BIS Fall	Hard 0	unlikely movement
Inglefield Bredning	BIS Winter	Hard 0	unlikely movement
Jones	Etah (Qaanaaq spring)	Soft 0	unlikely movement
Jones	Qaanaaq (summer stock)	Hard 0	all Jones animals are in Jones
Jones	GF Spring	Hard 1	likely migration pattern
Jones	GF Summer	Hard 1	by definition of summer aggregations
Jones	GF Fall	Hard 1	likely migration pattern
Jones	Upernavik	Soft 0	unlikely movement
Jones	Uummannaq	Soft 0	based on behaviour similar to other summering stocks on the west side of Baffin Bay
Jones	Disko Bay	Soft 0	based on behaviour similar to other summering stocks on the west side of Baffin Bay
Jones	CCA Spring	Hard 0	unlikely movement

Stock	Site	Prop	Comment
Jones	CCA Summer	Hard 0	by definition of summer aggregations
Jones	CCA Fall	Hard 0	unlikely movement
Jones	AB Spring	Hard 0	unlikely movement
Jones	AB Summer	Hard 0	by definition of summer aggregations
Jones	AB Fall	Hard 0	unlikely movement
Jones	PI Spring	Soft 0	by analogy with other stocks that move to central Baffin
Jones	PI Summer	Hard 0	by definition of summer aggregations
Jones	PI Fall	Hard 0	by analogy with other stocks that move to central Baffin
Jones	BIC Spring	Hard 0	unlikely movement
Jones	BIC Summer	Hard 0	by definition of summer aggregations
Jones	BIC Fall	Hard 0	unlikely movement
Jones	BIS Spring	Hard 0	unlikely movement
Jones	BIS Summer	Hard 0	by definition of summer aggregations
Jones	BIS Fall	Hard 0	unlikely movement
Jones	BIS Winter	Hard 0	unlikely movement
Melville Bay	Etah (Qaanaaq spring)	Hard 0	unlikely movement
Melville Bay	Qaanaaq	Hard 0	unlikely movement
Melville Bay	GF Spring	Hard 0	unlikely movement
Melville Bay	GF Summer	Hard 0	by definition of summer aggregations
Melville Bay	GF Fall	Hard 0	unlikely movement
Melville Bay	Upernavik (summer)	Hard 1	by definition of summer aggregations
Melville Bay	Uummannaq	Soft 0	tag data
Melville Bay	Disko Bay	0.142857	tag data
Melville Bay	CCA Spring	Hard 0	unlikely movement
Melville Bay	CCA Summer	Hard 0	by definition of summer aggregations
Melville Bay	CCA Fall	Hard 0	unlikely movement
Melville Bay	AB Spring	Hard 0	unlikely movement
Melville Bay	AB Summer	Hard 0	by definition of summer aggregations
Melville Bay	AB Fall	Hard 0	unlikely movement
Melville Bay	PI Spring	Hard 0	unlikely movement
Melville Bay	PI Summer	Hard 0	by definition of summer aggregations
Melville Bay	PI Fall	Hard 0	unlikely movement
Melville Bay	BIC Spring	Hard 0	unlikely movement
Melville Bay	BIC Summer	Hard 0	by definition of summer aggregations
Melville Bay	BIC Fall	Hard 0	unlikely movement
Melville Bay	BIS Spring	Hard 0	unlikely movement
Melville Bay	BIS Summer	Hard 0	by definition of summer aggregations
Melville Bay	BIS Fall	Hard 0	unlikely movement
Melville Bay	BIS Winter	Hard 0	unlikely movement
Smith Sound	Etah (Qaanaaq spring)	Hard 1	Based on one tagged animal data, and Etah hunting site is ice edge hunting site in Smith Sound
Smith Sound	Qaanaaq	Hard 0	animals are in Ingelfeld Bredning

Stock	Site	Prop	Comment
Smith Sound	GF Spring	Soft 0	*Uncertainty of timing of hunt and movement of animals. JWG_{sub} unsure of whether SS narwhals are available to GF hunt in spring. Review of dates of spring hunted animals required.*
Smith Sound	GF Summer	Hard 0	by definition of summer aggregations
Smith Sound	GF Fall	Soft 0	low probability of availability, no tag data
Smith Sound	Upernavik (year round)	Hard 0	by definition of summer aggregations
Smith Sound	Uummannaq (November)	Hard 0	by definition of summer aggregations
Smith Sound	Disko Bay (winter)	Hard 0	unlikely movement
Smith Sound	CCA Spring	Hard 0	unlikely movement
Smith Sound	CCA Summer	Hard 0	by definition of summer aggregations
Smith Sound	CCA Fall	Hard 0	unlikely movement
Smith Sound	AB Spring	Hard 0	unlikely movement
Smith Sound	AB Summer	Hard 0	by definition of summer aggregations
Smith Sound	AB Fall	Hard 0	unlikely movement
Smith Sound	PI Spring	Hard 0	unlikely movement
Smith Sound	PI Summer	Hard 0	by definition of summer aggregations
Smith Sound	PI Fall	Hard 0	unlikely movement
Smith Sound	BIC Spring	Hard 0	unlikely movement
Smith Sound	BIC Summer	Hard 0	by definition of summer aggregations
Smith Sound	BIC Fall	Hard 0	unlikely movement
Smith Sound	BIS Spring	Hard 0	unlikely movement
Smith Sound	BIS Summer	Hard 0	by definition of summer aggregations
Smith Sound	BIS Fall	Hard 0	unlikely movement
Smith Sound	BIS Winter	Hard 0	unlikely movement
Somerset Island	Etah (Qaanaaq spring)	Hard 0	unlikely movement
Somerset Island	Qaanaaq	Hard 0	summer definition
Somerset Island	GF Spring	Soft 0	unlikely movement
Somerset Island	GF Summer	Hard 0	by definition of summer aggregation
Somerset Island	GF Fall	Hard 0	unlikely movement
Somerset Island	Upernavik	Hard 0	by definition of summer aggregations
Somerset Island	Uummannaq (fall)	Hard 1	tag data (one tag suggests connectivity) as indicative of behaviour
Somerset Island	Disko Bay	Soft 0	unlikely movement
Somerset Island	CCA Spring	Hard 1	likely migration pattern
Somerset Island	CCA Summer	Hard 1	by definition of summer aggregations
Somerset Island	CCA Fall	Hard 1	likely migration pattern
Somerset Island	AB Spring	Hard 1	observed migration pattern from tagged animals plus location of floe edge hunt
Somerset Island	AB Summer	Hard 0	by definition of summer aggregations
Somerset Island	AB Fall	Soft 0	observed migration pattern from tagged animals but unknown hunting location

Stock	**Site**	**Prop**	**Comment**
Somerset Island	PI Spring	Hard 1	based on tags that show presumed migration behaviour and occurrence of floe edge hunt
Somerset Island	PI Summer	Hard 0	by definition of summer aggregations
Somerset Island	PI Fall	Soft 0	unlikely movement (no close by tagged data)
Somerset Island	BIC Spring	Soft 0	follow migration patterns follow similar patterns of animals moving into Baffin Bay (no tagged animals went there)
Somerset Island	BIC Summer	Hard 0	by definition of summer aggregations
Somerset Island	BIC Fall	Soft 0	likely migration pattern (tagged animals did not go there, 0/5)
Somerset Island	BIS Spring	Hard 0	likely migration pattern, no tagged animals went there
Somerset Island	BIS Summer	Hard 0	by definition of summer aggregations
Somerset Island	BIS Fall	0	tag data
Somerset Island	BIS Winter	0	tag data

ANNEX 3 – Report of the Survey Planning WG

Reykjavik, Iceland 14-15 April 2015

1. WELCOME

Chair Desportes welcomed the group and thanked Iceland for hosting the meeting. Desportes reviewed some of the major decisions from the meeting in October 2014, and at the SC meeting in November 2014. Among other decisions, it had been agreed that Iceland and Faroese would adopt a double platform configuration, with two independent and symmetrical platforms for the shipboard surveys (IO mode), surveying approximately the same area of the sea.

The Chair noted that the survey was less than two months ahead, as it was April 14th and the Icelandic vessels were starting surveying on June 9th and 10th. Many important things such as survey protocols and data collection systems (Faroese and Iceland) were not decided upon yet, and one vessel and some observers (Faroese) still needed to be chartered/hired. It was therefore necessary to be very practically oriented in order to complete the planning of the survey.

The Chair indicated that by end of the meeting a draft instead of a full meeting report would be agreed upon and that the full report will be submitted to the Participants for approval by e-mail by the week following the meeting.

Hammond commented that the surveys were not "coordinated" but rather a collection of associated national surveys. Desportes noted that this lower level of coordination compared to the 2007 survey reflected the choice made by the SC at the 2012 annual meeting.

It had however been agreed that the Icelandic and the Faroese ship-based surveys would be coordinated and follow the same basic procedures, thus allowing joined analyses. The aim of this meeting was to review the plan of the Icelandic aerial surveys and to facilitate the completion of the planning for the Icelandic-Faroese shipboard surveys. Norway and Greenland had not wished to participate, as their plans were largely set and on track since they will mostly follow previous survey protocols. Rikke Hansen did participate as an Invited Expert for aerial surveys, especially the associated equipment.

At the time of the meeting, it was unknown whether the NAMMCO proposal to the Norwegian Ministry of Foreign Affairs for the Extension surveys (which include the survey of the Jan Mayen area) would be funded. For the purpose of this meeting the group assumed that the Jan Mayen area would be surveyed either this year or by the Norwegian Institute of Marine Research in 2016 (as part of their normal mosaic surveys).

2. ADOPTION OF AGENDA

The agenda was adopted with minor revisions.

3. RAPPORTEURS

Prewitt was appointed as rapporteur with help from participants as needed.

4. RESOURCES PER AREA

4.1 Iceland

Iceland informed the group that the status of the funds available were the same as had been reported previously at the Scientific Committee and Council meetings, i.e., ¾ of requested funds were approved. The planned changes that are a result of the reduction in funds will be some reduction in effort, but also using mackerel and redfish survey vessels in addition to one dedicated survey vessel. Details on resources can be found in Table 1.

Table 1. Resources available during the 2015 surveys. The survey areas are shown in Figure 1.

Countries	**Vessel/ plane Platform eye-height (m)**	**Survey platform**	**Period**	**Nbr of Obs**	**Cruise Leader**
Iceland	**BS** 15,5 / 10,5	Dedicated	09/06 – 02/07 (24 days)	7	T. Gunnlaugsson
			06/07 – 26/07 (21 days)	7	
	ÁF 18,6 / 15,3	Red fish/ cetacean Irminger Sea	10/06 – 30/06 (20 days)	6	G. Víkingsson
		Mackerel/ cetacean survey - IS	06/07 – 23/07 (18 days)	6	D. Gislason
		Mackerel/ cetacean survey - GR	24/07 – 10/08 (18 days)	4	
	Partenavia	Dedicated	20/06 – 17/07 (28 days)	3	D. Pike
Faroes	? ?	Dedicated	01/07 - ??? (about 5 weeks, 35 days)	8	B. Mikkelsen
Greenland	Twin Otter	Dedicated	04/08 – 19/08 (15 days)	4	R. Hansen
			20/08 – 24/09 (36 days)	4	
Norway	One vessel	Dedicated	Summer 2015		N. Øien

4.2 Faroes

The Faroes informed the group they will have one dedicated vessel, which has not yet been identified and chartered. Their plan was also to put observers on the mackerel survey, but there was likely not enough space on the vessel for marine mammal observers. Details on resources can be found in Table 1.

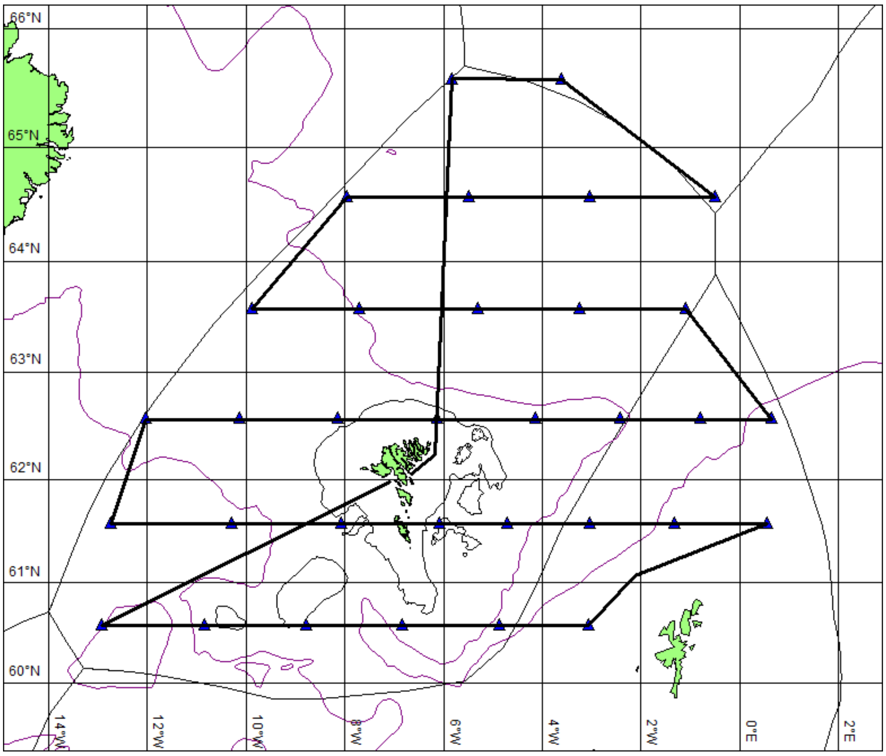

Figure 1. Map of mackerel survey around the Faroes. There will not be space on the vessel for marine mammal observers in 2015.

5. AERIAL SURVEYS

5.1 Survey methodology and protocols

5.1.1 Survey modes

Iceland will use the Partenavia airplane that has been used for previous surveys. The survey mode will be a partial double platform using cue counting. A video camera will be used with the intention of using it as an additional platform.

Pike presented SC/22/SPWG/05 which contained a survey plan and protocols.

5.1.2 Equipment

It was not clear at this point which data recording equipment would be used. The Redhen system was not developed as expected. See under 5.4.1.

5.1.3 Survey procedures

The survey procedure will be similar as in the past. Common minke whales are the target species for the aerial survey with cue counting as the primary method, and dive as cue. Data will be collected on all species encountered. The data will be collected in a manner to allow either cue counting or line transect analyses as appropriate.

The surveys will be carried out in independent mode, with two independent observers on the right side and one on the left side. The video camera might also be used as an independent platform. Further details can be found in the protocol document. However this document did not include details on the use of the camera since information about the camera was not available to Pike prior to the meeting.

5.1.4 Sighting protocol

The sighting protocol would be similar as in the past, with adjustment to the new recording equipment including the new digital inclinometer as is discussed below in Item 5.4.2.

5.1.5 Data collection procedures

Additional data that will be collected include Beaufort, glare, and sightability. These are collected whenever conditions change, or every 10 mins. Turbidity has not been collected routinely in the past because it is not often seen in Iceland, but it is noted when it is observed. Turbidity is also not much of an issue for common minke whales since the cue is a dive, but it could be an issue for other species.

5.2 Survey Design

5.2.1 Coordination with other surveys

There will be some coordination with the Greenlandic aerial survey on the new equipment and the subsequent changes in protocols.

5.2.2 Stratification

The stratification will be the same as in previous surveys.

5.2.3 Effort allocation by stratum

The effort allocation by stratum will be the same as in previous surveys.

5.2.4 Transect design

The zig-zag transect lines of the aerial survey had first been drawn in 1987 and the same lines had been used in all subsequent surveys. These lines do not derive from a formal design and thus cannot be guaranteed to provide equal coverage probability of each block. Equal-spaced parallel lines typically achieve equal coverage probability whatever the shape of survey blocks but zig-zag lines are unlikely to achieve this except for approximately rectangular shaped blocks. The inner survey blocks have highly irregular boundaries at the coast and the possibility of improving the design by using equal-spaced parallel lines was discussed.

One potential disadvantage of parallel lines is the time spent off effort flying from the end of one line to the beginning of the next. However, this time is typically used for observers to get a few minutes rest from searching so is not wasted unless the distance between lines is large. In the Icelandic survey, the lines in the inner blocks are closely spaced so flying between the ends of parallel lines would not waste time.

Program DISTANCE provides an easy and effective way to assess how well a survey design achieves equal coverage probability through simulation and, therefore, to choose the most appropriate design. The SPWG **agreed** that Pike would explore equal-spaced parallel line and equal-spaced zig-zag line survey designs for the inner blocks (numbers 1, 2, 4, 6, 8) to determine which design best achieved equal coverage probability. Program DISTANCE then generates a random realisation of the chosen design and produces a file of transect waypoints.

The outer survey blocks (3, 5, 7, 9) are approximately rectangular and it was agreed that the zig-zag lines provided more or less equal coverage probability and should remain the same as previous years. Replacing these wide-angle zig-zag lines with equal-spaced parallel lines would unnecessarily increase the amount of time flown between transects.

These new designs will be generated by Pike and then Iceland will decide on the best survey design.

5.2.5 Rules for adaptation

Generally the survey will be flown as designed. However, if time is running short and the opportunity arises to partially complete a stratum, a portion of the planned effort may be flown by skipping lines or be transecting between every second endpoint in strata covered by zig-zags.

If the plane encounters pack ice while on a track line survey should keep going as planned.

Occasionally very large groups of pilot whales, humpback whales or dolphins are encountered. At the discretion of the cruise leader, these will be closed upon after visual observations are completed, and flown in an adaptive video strip survey to provide a complete count.

5.3 Platform
As mentioned above, the same Partenavia plane will be used this year as in the previous surveys.

5.4 Equipment and software
The plan is to incorporate HD video to function as an independent platform. The camera will be pointed at an oblique angle on the right side to provide resighting data for the two observers on that side, and the observers will be rotated on a daily basis. The group noted that it will be important to make sure there is some overlap of what the front observer can see and what the camera will see.

Iceland noted that they will use the camera that comes with the Redhen system (same camera as Greenland).

5.4.1 Redhen update
On Monday 13 April Hansen provided an update and training session with the Redhen system. Unfortunately the equipment provided did not provide 4 separate recording channels as had been requested, making it unusable for recording observer audio. The hope is that this can be resolved in time for the surveys. If not, Greenland plans to test their old audio recording system with the new Redhen VMS (Video Mapping System). If this does not work, they may have to use Dictaphones for audio recording.

Iceland will investigate other audio recording systems, including, potentially, the systems used by SCANS and another system using android phones or tablets.

5.4.2 Inclinometer/angle measurement device
NAMMCO funds were used to develop a prototype of a new device to electronically measure and log angles. Gunnlaugsson worked with a company in Iceland, Pi Engineering Service (*Pi Verkfræðiþjonusta ehf*.) who presented the prototype to a subset of the group the day before the main meeting. The group agreed that the technical aspects of the device were impressive. The group thanked Gunnlaugsson for his efforts on developing this new piece of equipment, which represented a major step in technical development. The group recommended that a technical paper be developed describing the new device once the testing has been completed. Another idea is that this could be presented at the Society for Marine Mammalogy meeting in December 2015.

The group noted that the ergonomics of the device would need to be adjusted to fit the logistics of aerial surveys. Baldur Thorgilsson from Pi Engineering Service will modify the shape based on input from Pike and Hansen. Pike will develop some testing procedures and modify the protocol to include the new features of the digital inclinometer. For example, it should not be necessary to wait until the animal is abeam to take the angle of the sighting, since the angle can be measured as soon as the animal is sighted. In addition, it would be easier to get more angle measurements on large groups of animals since it is very quick. It will make it also easier to record accurate angles to every cue.

5.5 Survey leaders and Observers
5.5.1 Hiring of observers and crew leader
The two observers have been hired. The crew leader will be Dan Pike.

The group discussed that it could be a good idea to have a “backup” observer or two who could be available on short notice in case one of the observers is not able to continue. Having backup observers already identified is also particularly important because Vikingsson and Gunnlaugsson will be on board the vessel surveys for a large part of the time during the aerial surveys, and therefore may be unavailable to assist with crew logistics. A couple of possibilities for backup observers could include someone from the Secretariat (Prewitt), Rikke Hansen from GINR, or Hansen could provide a few names of observers Greenland have used.

5.5.2 Training
The plan is to have some classroom time, some ground training in the plane, and to do 1-2 test flights. Iceland will have access to the plane for about 3 days before the start of the survey (20 June) for ground training.

It has become nearly impossible to find accommodations at short notice in Iceland during the summer, which is an issue for the aerial survey because the location of the operational base is weather dependent. Therefore, it will be necessary to make arrangements in advance for short-notice accommodations for 3 people in Reykjavik, and 4 in Akureyri, Egilstadir and possibly Isifjorthur. MRI agreed to make these arrangements.

6. VESSEL BASED SURVEYS

6.1 Update from testing of new procedures

6.1.1 Drones

Mikkelsen informed the group that a drone was purchased with NAMMCO funds in December 2014, but has not been tested yet. There is a person in the Faroes with drone experience and Mikkelsen will coordinate testing out flying the drone with this person. If it appears to work well, the Faroes will buy another drone to have a spare on the boat.

Protocols for testing and use during the survey were not available at the meeting. Mikkelsen plans to begin testing by flying the drone on land, and then bringing it out on the sea. Mikkelsen noted that others have told him that it can be quite difficult to fly drones over the sea. Ideally some test flights would be done if there is a drive hunt.

The battery life of the drone is about 15 minutes. The transect is designed on a mobile phone and then it flies on its own. When the drone is flying, the vessel will need to stop. The drone will have an HD camera with a polarised filter that will collect video of pilot whale groups to help estimate group size.

The protocol for when to deploy the drone will need to be defined. Drone pilot/cruise leader will decide when to launch the drone.

6.1.2 Helikites

Mikkelsen has been in contact with the manufacturer, but the helikite has not been purchased yet. The group discussed whether video or still images would be collected and noted that video is easier for people watching to see animals, and either one takes lots of time for post-processing.

The group concluded that there is not enough time until the survey at this point, and there is a concern that the other survey components should not be jeopardised by spending time on developing the helikite.

6.1.3 Pilot whale satellite tagging

The Faroes have satellite tags and have also ordered some limpet tags. However there has not been any tagging since 2012.

It was previously discussed that tagging information could be used to define survey areas and strata, using “home range” information for intensifying survey coverage in some areas/blocks. Hammond noted that caution should be exercised in allocating different coverage intensities to small blocks because this precluded pooling data across blocks for estimation of encounter rate should the number of sightings in some blocks be very small.

The group decided to define the survey boundaries based on the knowledge that is available now, rather than trying to use satellite tracks.

6.2 Survey methodology and protocols

6.2.1 Survey modes

At the meeting in October 2014, the group agreed that both Iceland and the Faroes would use double platform, IO method, where two independent and symmetrical platforms survey the same body of water (some difference in area will arise from the difference in height of the platforms). The method does not assume that the probability of detecting an animal on the trackline is one. The two platforms act as two (independent) primary platforms, both providing a sighting rate. There will be six to seven observers per vessel, each of whom will be assigned to one platform for the whole survey.
For common minke whale sightings, it will be very important to record the cue to have the possibility to analyse the data in the same manner as the Norwegian surveys.

Communication between observers and the bridge is necessary, and technicians from MRI are ensuring this.

The shipboard surveys will be conducted in passing mode for the Icelandic and Faroese dedicated vessels, with the possibility of delayed closing for checking species identification and school size. Requests to close on sightings should follow rules outlined in the survey protocol and the final decision will be taken by the officer in the bridge based on information received from the two independent platforms.

Sighting forms will be developed by Gunnlaugsson and sent to the Faroes for comments. It is useful to restrict the Excel cells so that observers can only type in the specified codes (i.e., the cell does not allow observers to type something that does not exist).

6.2.2 Equipment

Recording equipment for the vessels had not been decided upon at the time of the meeting.

Iceland informed the group that Thorvaldur will obtain binoculars with reticles (and preferably without a compass). If only find binoculars with reticles and a compass are available, they will have to use those.

The equipment needs to be decided upon soon, and Gunnlaugsson and Mikkelsen need to liaise on this in the next weeks. This is also necessary to complete the survey protocol.

6.2.2.1 Angle boards

Mikkelsen is looking into developing a new device to measure angles. Plan B will be to use the angle boards. If angle boards are used, each observer should have their own (not a centralized angle board).

6.2.3 Survey procedures

6.2.3.1 Vessel

Sighting protocol

On both platforms, two observers will be searching at any one time, one observer by naked eye and the other one using binoculars with reticles. Search methods will rotate between observers. The search pattern is as follows:

The observer searching with naked eyes will scan the sea from 90 to 90, though concentrating his search from 70° to 70° from the ship to approximately 1000 metres. This observer will estimate the radial distance to the sighting using the distance stick or using the reticles on the binoculars.

The other observer will search with 7X50 binoculars, concentrating within 30° port to 30° starboard and concentrating beyond 500m. This observer will estimate radial distances using the reticles.

Large Groups

The Faroes plan to use the method used in previous surveys, where sightings of large groups are split into subgroups, and subgroup size and the angle and radial distance to the centre of each subgroup were recorded. Distance between 2 groups is defined by a number of body lengths, with a group containing individuals not more than 2-3 animal lengths from each other.

Data collection procedures

Procedures for all initial sightings of any cetacean species are similar, but the following resighting procedures vary somewhat according to the species sighted. Only common minke whales should be tracked, i.e. every resighting recorded, until the sighting comes abeam and record time, angle and distance for each surfacing. Specific protocols are described in the sighting protocols.

Once a group is abeam, if the species or the group size has not been identified with confidence, then the vessel may go off effort and close on the group. The upper platform will decide whether to close on a group. This procedure will be limited to sightings within 1 km of the trackline at the time of the closing and to unidentified baleen whale for species identification and to common minke, fin and pilot whales for school size estimation.

Ice edge protocol

The northern Iceland dedicated vessel could encounter ice. If the ice edge is not encountered where planned the IWC-SOWER protocol (guidelines 2006-7) should be followed.

Ice edge waypoints are established 2.5 nautical miles from the planned ice edge. If the ice edge is encountered prior to reaching a planned waypoint, 2.5 nautical miles from the estimated ice edge, the vessel shall follow the ice edge, off-effort, until the survey can be resumed on the planned trackline. If the ice edge is not encountered on reaching a planned ice edge waypoint, research shall be conducted on a bisector (on effort), until 2.5 nautical miles from the true ice edge. Returning to the planned way point is done on effort as well. If the constructed cruise track intersects a peninsula of pack ice, the vessel will steam around the peninsula until effort can be resumed on the constructed trackline.

The exact position of the ice edge should be recorded or estimated as accurately as possible close to and of both sides of the point of encounter, so the actual/true shape and size of the strata area can be approximated.

Group size estimation

A group can be thought of as the smallest unit that could be "tracked". A convenient rule is to define a group as containing individuals not more than 2-3 animal lengths from each other. The group may be exhibiting the same swimming pattern and/or general behaviour such as travelling, milling or resting, although not necessarily with a synchronised surfacing pattern. The distance and angle measurement should always be estimated to the geometric centre of the group.

Difficulties arise when groups are not distributed in tight, easily defined clusters, but in loose aggregations whose boundaries, and size, must be determined subjectively. It is better to identify, smaller, homogeneous groups (sub-groups) within the aggregation, each associated with a separate distance, angle and group size estimate.

Calibration experiments

It will not be possible to perform distance experiments on the mackerel surveys, so the observers will have to train when the vessel is travelling. The group did not think that it was necessary for the dedicated vessels to conduct distance and angle experiments, as this information has not been used in the analysis.

The IWC RMP requirements and guidelines for conducting surveys (IWC 2012) state:

"Subjective estimation by eye of distance to sighted groups may be used provided that adequately documented experiments are conducted on each vessel to enable corroboration or calibration of the distance estimates... Angle and distance experiments should be carried out, if possible, before, during and after the survey. Methods that allow accurate determination of the angles and distances to the target objects, simultaneously with the estimated angles and distances, should be implemented."

Data validation

It was underlined that validation of the data should ideally be done the same day. Missing data should be completed by going back to the audio recordings. However, as the recorded procedures were not yet defined it was not possible to establish the validation procedures at this point.

6.2.3.2 Drones

Sighting protocol

Data collection procedures

Calibration experiments

No protocol or procedures have been developed as the drone has not yet been tested; there was no further discussion on this subject (see under 6.1.1).

6.3 Survey Design

6.3.1 Coordination with other surveys

The survey design updated at this meeting was developed assuming that the Jan Mayen area will be surveyed either this year (with funds from the Norwegian Ministry of Foreign Affairs) or by the Norwegian Institute of Marine Research in 2016 (as part of their normal mosaic surveys).

The design of the survey was made taking into account a probable SCANS-III survey that will survey an area with a northern boundary of 62°N, which is the southern boundary of the Norwegian surveys, and otherwise extent as far west as 200nm from the coast of UK and Ireland.

6.3.2 Survey boundaries and stratification

Survey boundaries decided upon at this meeting are given in Figure 1. Table 2 shows the surface area of the planned survey blocks.

If East Greenland is not surveyed then the Icelandic dedicated survey boundary will be expanded towards to coast.

6.2.1 Effort allocation by stratum

For fin whales, the Irminger Sea is a critical area where there were many sightings in 2007. Currently it will be partly covered by the Icelandic redfish survey and the Russian redfish survey. Effort will be allocated from the dedicated Icelandic survey to this area to guarantee good and continuous coverage. There is also a possibility that the Russian redfish survey may be able to follow the same observation protocols as Iceland (double platform, IO, etc.).

Given the importance of specific areas, the group discussed how to allocate effort to the blocks shown in Figure 1 and decided that the average realised effort from previous surveys (Table 3, below) should be used to estimate how much actual effort was likely to be available during the 2015 surveys.

Equal effort/intensity will be applied in the Faroes areas.

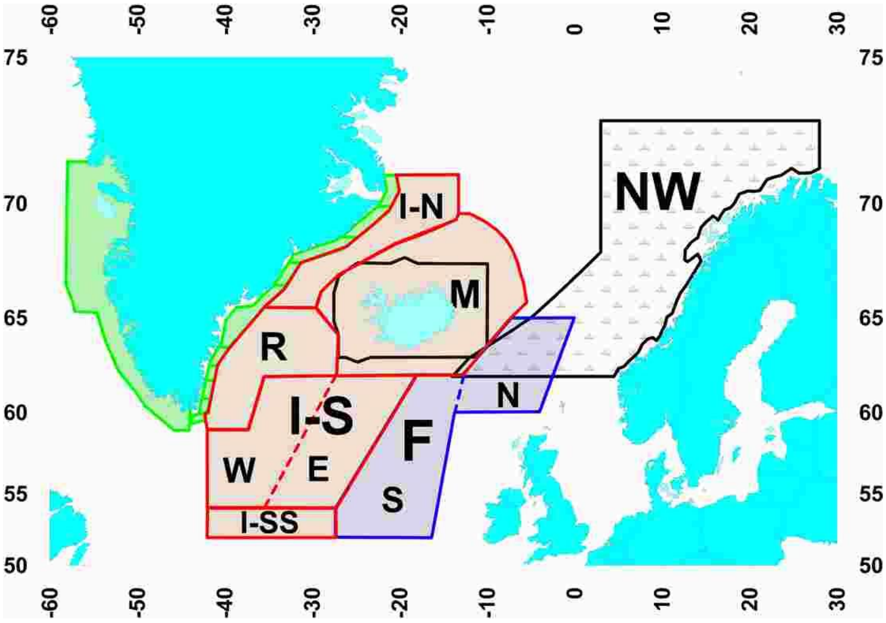

Figure 1. Map (Mercator projection) of the planned survey areas for 2015. NW=Norwegian surveys, F=Faroes (N=North block, S=South block), I-N=Iceland North block, I-S=Iceland South block, I-SS=Iceland South sub-block, R=Redfish surveys, M=Mackerel surveys. Green areas show Greenlandic aerial survey areas.

Table 2. Surface area of the survey blocks shown in Figure 1. The CM area (in italics) is not included in the total area calculation. The CM and I-Air blocks are not shown on Figure 1.

Block	Sub-Block	Area (nm^2)
CM (2016)		*301,033*
I-S	W	164,334
	E	175,246
	Sub-TOTAL	339,580
I-SS		87,066
I-N		62,695
I-R		120,524
I-M		212,384
I-AIR		85,546
F	N	102,201
	S	245,471
	Sub-TOTAL	915,887
GE		37,685
GW		47,691
	TOTAL	85,376
NW		333,877
GRAND TOTAL		**1,674,720**

Table 3. Effort for cetacean surveys in Iceland and the Faroe Islands, 1987-2007. Only full observation effort in Beaufort 0-5 included.

Year	Vessel	Area	Speed (Avg on full effort)	Days at sea	Full effort/ day, incl. transit (nm)	Full effort: redfish research survey (nm)
2007	AF2	Irminger Sea	10.9	30	56.5	60
2007	JB	South Iceland	9.4	26	89.7	
2007	VE	North Iceland	9.8	23	37.6	
2007	FI	South of Iceland/Faroes	8.9	24	62.6	
2001	AF2	W and SW Iceland	11	22	82.4	96.3
2001	BS	W and SW Iceland	10.6	22	79.4	91.6
2001	AF1	N/NE Iceland (Jan Mayen)	9.2	35	97.3	
2001	FI	Scottish S coast/Faroes/SE Iceland	9.5	27	91.9	
1995	AF2	Irminger Sea	9.1	30	65	
1995	ST	Irminger Sea	9.4	41	62.7	
1995	FI	Around Faroes	8.8	30	55.7	
1989	AF2	South Iceland	8.6	35	75.1	
1989	SK	South Iceland	9.6	34	69.1	
1989	H9	East Greenland/South Iceland	8.9	18	87.5	
1989	H8	East Greenland/South Iceland	9.2	18	96.2	
1989	FI	Area around SE Iceland/W Ireland	11.1	25	59.6	
1987	AF1	North part Irminger Sea/Jan Mayen	9.8	34	104.7	
1987	KE	South Irminger Sea	9.3	34	117	
1987	SK	West Iceland to East Greenland	9.9	34	98.3	
1987	FI	N and S of Faroes/S Norway	9.6	56	97.7	

6.2.2 Transect design

A double set of transects will be designed for each stratum. Pike will design the transects for the Faroes vessel survey, and the Icelandic aerial and vessel surveys.

6.2.3 Rules for adaptation

For the dedicated surveys (i.e., not the fisheries surveys), the design will be fixed before the survey, and surveying at the ice edge is the only time when a survey transect line may be adapted. If the ice edge is not where expected, the adaptation should occur according to the standard IWC-SOWER protocol (see under point 6.2.3.1.3).

6.3 Platform(s)

It is important to ensure that the observation platforms are isolated acoustically and visually to maintain independence between the observers.

The Icelandic platforms are available and will be put on the vessels in the weeks/days before the survey.

The Faroes have the platforms that were used on previous surveys and will install them on the vessel in the days before the survey.

6.4 Cruise leaders and observers

6.4.1 Personnel

The cruise leaders on the dedicated Icelandic vessels will be Thorvaldur Gunnlaugsson and Gisli Vikingsson. The cruise leader on the mackerel survey will be Davið Gìslason. The observers have all been hired, and there will be about 2/3 experienced observers and 1/3 inexperienced.

For the Faroes survey, Mikkelsen will be the cruise leader, and the plan is to have 5 experienced observer (2 have been hired), and 3 inexperienced observers (all 3 of which have been hired). The remaining 3 experienced observers will be hired as soon as possible.

6.4.2 Training

The Faroes plan to bring observers in a few days before the survey and have a meeting to go through the protocols. The observers will also be used to help prepare the ship, and then the first hours or days of the ship time will be used for training.

Iceland's training plan is similar to Faroes' plan described above, with a meeting with all observers prior to the vessel leaving, and then training on the transit out to the survey area. Iceland will have the vessel 2-3 days prior to the dedicated survey area so there will be time for training with equipment (e.g., in the harbour).

7. COLLECTION OF ANCILLARY DATA

Iceland

Mackerel surveys will collect hydrographical data, acoustic monitoring of fish and krill. It was noted that there may be data for krill in the old survey files as well that can be used for comparison.

The dedicated Icelandic vessel will collect SST. For the aerial survey, Pike will investigate whether the SST measuring equipment that was used in Canada is available for this survey, and also whether it would fit in the port with the camera.

Faroes

No plans to collect any ancillary data.

8. ACOUSTIC SURVEY

Iceland have no plans to collect acoustic data. In TNASS-2007, the data yielded very few detections. Vessel noise was the likely problem last time and this year they will be using the same vessel.

The Faroes still have the equipment that was used during TNASS-2007. Doug Gillespie from SMRU is willing to help set it up for this year's survey. However the vessel noise must be measured once the vessel is known or it is pointless to deploy the equipment.

9. BIOPSY AND TAGGING STUDIES

The Faroes plans to deploy 7 satellite tags during the survey.

Iceland noted that they need samples from East Greenland, but after discussion within their group, and in consultation with Mads Peter Heide-Jørgensen, they decided that it would take too much time on the big survey vessel. It will be much easier to do this from the coast on a smaller boat.

10. BIRD SURVEY

Faroes have no plans to have bird observers.

Iceland noted that they have room for bird observers on their dedicated survey vessel. They have invited the bird researchers but have not yet had a response.

11. CONTACT AND COORDINATION DURING MAIN SURVEY

The group noted that the survey boundaries will not change even if something goes wrong with a vessel. The southernmost block of the Icelandic dedicated survey could be completed by either the Faroes or Iceland, so communication must be maintained during the survey.

The Secretariat is interested in getting updates…. noted that if vessels/observers send updates/pictures/stories etc. to the Secretariat, we will post them (NAMMCO website, Facebook, etc.).

12. COORDINATION WITH OTHER SURVEYS

The Faroe Islands will coordinate their survey areas with the probable SCANS-III survey.

13. STRATEGY FOR DISSEMINATION TO THE WIDER PUBLIC AND PRESS

As noted above, the Secretariat will post on the website if we receive information vessels.

14. TASKS TO BE COMPLETED

Aerial

- MRI agreed to make housing arrangements for the crew leader and observers- **Vikingsson**
- Investigate options for recording equipment- **Hansen/Pike**
- Protocols- **Pike** will update with recording equipment and digital inclinometer
- Purchase high capacity hard drives for backing up data (aerial), phones + spare- **Gunnlaugsson**
- Redesign- **Pike**
- Camera purchase (need 1 week)
- Purchase recording equipment
- Camera mount- **Gunnlaugsson** will coordinate with pilot
- **Pike** will make sure observers have protocols
- **Pike** will investigate the SST device used by the Canadian surveys

Vessel

- **Gunnlaugsson** will give **Pike** the effort data from the previous surveys to use as the estimated effort that will be available for this survey (Friday 17 April 2015)
- Faroes needs to charter a vessel- **Mikkelsen** (2 weeks)
- Faroes observers hired- **Mikkelsen** (2 weeks)
- Drone testing and Protocol- **Mikkelsen**
- Weather and effort recording software- **Mikkelsen**
- Recording equipment-**Gunnlaugsson/Vikingsson/Mikkelsen** (April)
- Vessel protocols (2 weeks)- **Gunnlaugsson/Vikingsson/Mikkelsen/Desportes**. When finalised, these will be sent to Debi Palka because she is very experienced with IO surveying.
- Crib sheets (list of codes, data to record, etc.)- **Mikkelsen**. Will be sent to Iceland to print and laminate
- High capacity hard drives for backing up data, phones (if used) + spares- **Vikingsson**
- Equipment list for vessels- **Vikingsson**

15. DATA VALIDATION AND ANALYSIS (POST SURVEY)

- Gunnlaugsson will validate the data from Iceland and the Faroes before it is given to Pike for analysis.
- The current plan for the Iceland aerial survey data is to contract Pike to do the analysis.
- The Faroes data will need to be analysed separately from the SCANS-III data since Faroes are using IO and SCANS-III will use tracker method. Pike will likely be contracted to analyse the Faroese data.
- The SPWG noted that there are also still papers from the TNASS-2007 survey that need to be published. The pilot whale trend paper is nearly completed, and the group discussed whether to finalise the paper, or wait until the 2015 data is analysed. It was decided that it would be best to wait for the 2015 data and include that in the paper.
- The plan for the large baleen whale data is to analyse the Icelandic and Faroese data together.
- The group noted that papers from the NASS2015 surveys could be written up in the form of papers to be published, rather than working papers. There is the possibility to publish old TNASS-2007 and NASS2015 papers together in a themed volume of the *NAMMCO Scientific Publications.*

16. OTHER ITEMS

The Chair reminded the SPWG that there is now less than 8 weeks to the start of the survey (in Iceland) and action should be taken.

17. NEXT MEETING

A post-survey debrief meeting will be held in conjunction with the SC meeting (1 day early), week 46 (9-13 November) in the Faroe Islands.

18. ADOPTION OF REPORT

The Chair thanked all of the participants, and in particular the Invited Experts Hammond, Hansen, and Pike for their efforts. The participants thanked the Scientific Secretary for her hard work, and all thanked the Chair for a well-run and productive meeting.

A draft version of the report was adopted during the meeting and was finalised via correspondence on 30 April 2015.

REFERENCE

International Whaling Commission (2012) Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme. *J. Cetacean Res. Manage.* 13 (suppl.):507-518

Addendum to Survey Planning WG meeting (30 April 2015)

Based on the information available during the meeting, the SPWG assumed that the East Greenland aerial survey would occur in 2015, and survey boundaries were developed based on this information. As of 30 April 2015, NAMMCO still has not received an answer on our proposal to the Norwegian Foreign Ministry for NASS2015 funding. When the Secretariat inquired whether the logistics could still be arranged for surveying the Jan Mayen area even with such late notice, Øien confirmed that it was too late to arrange for surveying Jan Mayen. The NASS2015 Steering Committee met via Skype on 27 April 2015 and prepared an answer to a request from the FAC for an update on the situation (see below). The main discussions of the StC meeting was that the Norwegians will not survey the Jan Mayen area in 2015, and therefore Greenland has now decided to apply the funds from the East Greenland survey towards the West Greenland surveys, which have more management implications for Greenland. This will leave much of the coastal East Greenland area unsurveyed, as the Icelandic vessel survey area can be modified in the northern block to fill in where the East Greenlandic aerial survey may have occurred, but this is not possible in the southern part which is covered by the redfish surveys.

ANNEX 4 - Post-cruise report of the NASS2015 Steering Committee

Extension surveys conducted as part of the national cetacean surveys in the North Atlantic in 2015.

Funding for the planned extensions of the national survey effort, as a continuation of the North Atlantic Sighting Surveys (NASS), was available in June 2015. The late approval of the funding complicated the logistical arrangements for the survey somewhat; however, with the exception of a two-week delay of the aerial survey in East Greenland, all parts of the extension surveys were accomplished.

Originally the survey was planned as a Trans-Atlantic Survey but the lack of participation from Canada and the US made the survey similar in coverage and range to the previous NASS surveys.

INTENSIFIED SURVEY EFFORT AROUND THE FAROE ISLES TARGETING PILOT WHALES

The Faroese participation in NASS 2015 was to cover basically the Faroese EEZ as well as an area south of the Faroese waters, south to 52˚N, between UK EEZ and 21˚W (Fig. 1). The waters to the west were surveyed by Iceland; and the plan is for UK to survey the waters to the east, the UK EEZ, in 2016.

The survey methodology was Independent Observer mode, with two parallel two-way independent platforms. Duplicate identification was to be done post survey. Target species was the pilot whale. Transects were designed by Daniel Pike, with a total planned effort of 3200 nm. The 65 m. long fishing vessel "Høgiklettur" was rented for 35 days. Eight observers, operating in two teams of four observers each, were contracted. Five of the observers had previous experienced with whale surveys, while three observers had basically no experience. Three observers were on effort on each platform at any time, one searching the transect line with 7x50 binocular, out to 30º, while the naked eye observers were covering each side of the transect line, out to 45º. The working schedule was a 30 min. rotation between the three positions on the platform, and 30 min. off, from 06 to 22, with 1/2h meal breaks at 12.30 and 18.30.

Effort data was registered in the software Logger 2010, running on a laptop, connected to a GPS antenna, for precise time and position logging. The computer was located on the right platform, and the observer located at the computer, was entering the effort data. Sightings were entered on paper forms, each observer responsible for own registrations. But observers helped each other for data recording, especially the 7x50 observer with precise time stamp and angle recording (distance was made with reticule readings). For distance estimation, each observer used a measure stich. A central time display was located on each platform, synchronized with the GPS time. Observers were responsible for validation and backup of own data in the end of each day.

Realized effort was approximately 2900 nm, or around 90% of planned effort. 65% of effort was covered in Beaufort 3 or less, 25% in Beaufort 4 and 10% of the effort was sailed in Beaufort 5. 16 cetacean species were observed during the survey. The sighting data is not been processed yet.

For more precise estimation of pilot whale group size, the idea was to use a drone to film compact groups from above, and compare with the group size estimates by the observers. During the survey, it was possible to film around eight individual groups by the drone. These data have not been analysed yet. The plan was also to tag some individuals from groups of pilot whales, with satellite transmitters, in order to follow the movements and distribution in the period during and after the survey. The combination of pilot whales presence and good weather was uncommon, and only one attempt was made to approach pilot whales from an inflatable. The whales avoided the boat, and it was not possible to come sufficiently close to the whales to deploy the tags.

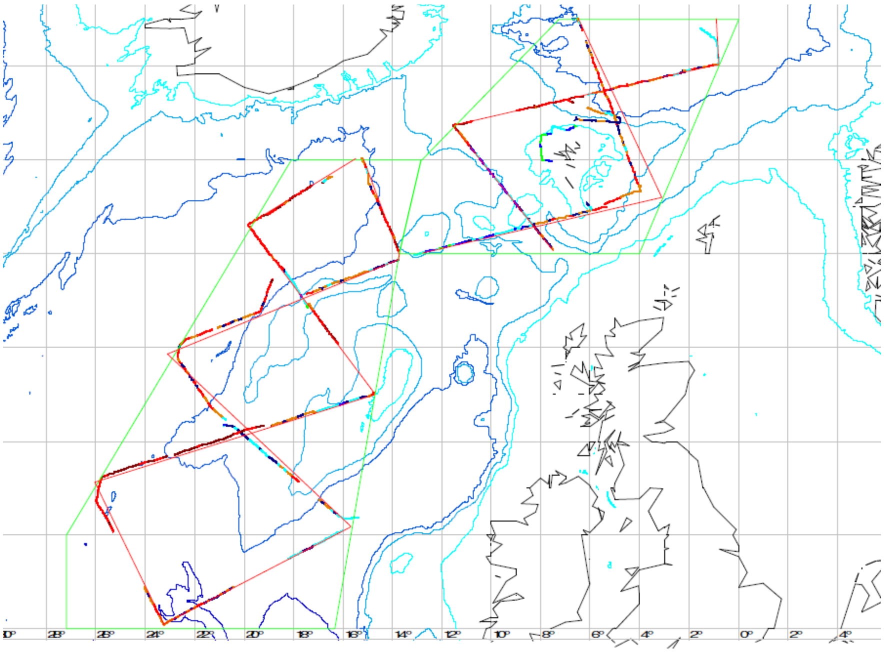

Figure 1. Transect line covered by the Faroese ship-based survey effort in 2014.

SURVEYS OF EAST AND WEST GREENLAND

Aerial surveys of East and West Greenland were conducted between 15 August and 1 October 2015. The East Greenland coastal area was covered between 18 August and 27 August after initial observer training off the coast between Eyiafjördur and Skjálfandi Bay on 17 August. The survey platform was a high-winged twin engine DeHavilland Twin Otter charted from Norlandair and equipped with four bubble windows and a long range fuel tank. Observations were made independently from a front and a rear platform with a total of four observers. The observers were instructed to record data on time at first detection, angle abeam measured with Suuno inclinometers, group size and species. Recording of observations was done on Sony Dictaphones and on a specially developed recording system for aerial surveys developed by Remote Geo (3307 South College Ave. Fort Collins, Colorado) that included high definition video monitoring of the trackline with georeferenced GPS track and individual observer recordings.

Weather conditions were favourable during the survey of East Greenland however in West Greenland the alternating fog and wind provided limited windows with acceptable survey conditions with sea states less than 4. Parts of the northern area in West Greenland planned to be included in the survey could not be covered due to inclement weather conditions.

The total survey effort under acceptable conditions included 4,064 km in East Greenland and 9,235 km in West Greenland. The distribution of realized survey effort under acceptable conditions is shown in Fig. 2.

The total number of sightings was 564 and the distribution on species and East and West Greenland are indicated in Table 1.

The analyses of the survey results will include corrections for perception bias estimated from the double observer trials and availability bias will be addressed by telemetry studies of the time the animals are available to be detected at the surface. Data from telemetry studies are available for minke whales, humpback whales and harbour porpoises.

Table 1. Distribution of sightings and areas for the aerial surveys in East and West Greenland. The sightings include unique sightings seen by either the front or rear survey platforms.

Sightings	**Right side of plane**		**Left side of plane**		**Both sides of plane**		**TOTAL**
	East Greenland	West Greenland	East Greenland	West Greenland	East Greenland	West Greenland	
Minke whale	11	12	8	9	19	21	40
Fin whale	59	20	58	12	117	32	149
Humpback whale	34	11	45	8	79	19	98
Blue whale	0	0	1	0	1	0	1
Sei whale	0	1	0	0	0	1	1
Sperm whale	3	4	0	1	3	5	8
Bottlenose whale	0	5	0	8	0	13	13
Killer whale	2	1	2	0	4	1	5
Long-finned pilot whale	4	22	0	18	4	40	44
White-beaked dolphin	9	14	13	14	22	28	50
Harbour porpoise	2	44	0	11	2	55	57
Unidentified small whale	2	2	0	0	2	2	4
Unidentified medium whale	1	1	0	0	1	1	2
Unidentified large whale	26	3	30	4	56	7	63
Footprint	7	3	7	12	14	15	29
Sum							564

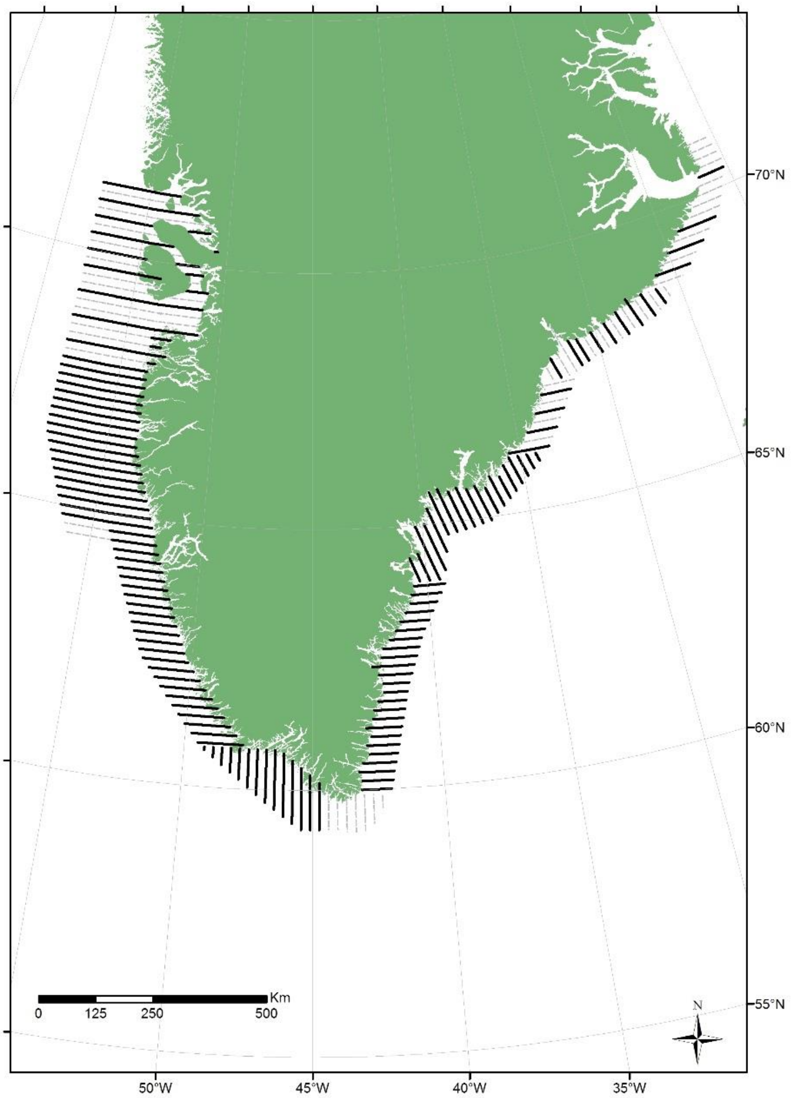

Figure 2. Map of realized (black) versus planned (grey) survey effort in sea state <5.

SURVEYS OF THE JAN MAYEN AREA AND THE NORWEGIAN SEA

The surveys were conducted from the M/S Fisktrans (57.3m) over the period 22 June to 30 August 2015 with a double platform design, based on the methods adopted for the Norwegian national surveys with minke whales as the target species. The surveys involves two independent symmetrical platforms and tracking of minke whales. It was divided into three survey periods and finally the last week was dedicated to sampling of biopsies and photo ID. The first and third survey period was conducted within the originally planned EW are (coastal and eastern Norwegian Sea), while the second period (13 July to 2 August 2015) was dedicated to the Jan Mayen area.

In the Norwegian Sea (EW) about 55 % of the planned transect was covered in primary search mode (Fig. 3). The coverage seems to be about as in 2011 for the Norwegian Sea. For Jan Mayen numbers are not yet available, but apparently also there about 50 % of the planned transects were covered in primary search mode.

The number of sightings of groups are distributed by species and area are shown in Table 2. For the Norwegian Sea the total impression was that there were few sightings and many of them in the northeast, off North Norway. There were few minke whale sightings, and these were thinly distributed over the area but none were seen in coastal areas south of Vestfjorden. Fin whale sightings were made off North Norway, and there were perhaps more fin whale sightings in this area than in earlier surveys.

For the Jan Mayen area, the initial impression is that relatively few baleen whales were seen and minke whales were mainly seen in the northeastern part of CM3.

Table 2. Preliminary summary of sightings 2015. Number of groups of whales seen from the upper and lower platforms during primary search by survey stratum, during the 2015 survey. The 'F' effort is conducted in conditions outside the boundaries defined for the primary 'T' effort, and observations during 'F' effort are given in parentheses.

		Survey block					
Species	***Platform***	**EW1**	**EW2**	**EW3**	**CM1a**	**CM3**	**Total**
Minke whale	*Upper*	8	11	11	4	25	**59**
	Lower	9	10 (+1)	13	3	26 (+3)	**61 (+4)**
Fin whale	*Upper*	46	2	0	1	6	**55**
	Lower	35	1	0	0	4	**40**
Blue whale	*Upper*	0	0	0	0	2	**2**
	Lower	0	0	0	0	1	**1**
Humpback whale	*Upper*	10	3	0	0	1	**14**
	Lower	4	3	0	0	2	**9**
Harbour porpoise	*Upper*	7	0	0	0	0	**7**
	Lower	8	0	0	0	0	**8**
White-beaked dolphin	*Upper*	31	0	0	0	0	**31**
	Lower	26	0 (+3)	0	0	0	**26 (+3)**
White-sided dolphin	*Upper*	2	0	0	0	0	**2**
	Lower	1	0	0	0	0	**1**
Lagenorhynchus sp.	*Upper*	8	0	2	0	0	**10**
	Lower	2	0	0	0	0	**2**
Killer whale	*Upper*	3	8	5	0	6	**22**
	Lower	1 (+1)	4 (+1)	3	1 (+2)	10	**19 (+4)**
Northern bottlenose whale	*Upper*	0	0	0	1	0	**1**
	Lower	0	0	0	2	0 (+2)	**2 (+2)**
Sperm whale	*Upper*	5	20	3	9	1	**38**
	Lower	5 (+1)	12	3	10	2	**32 (+1)**
Large whales	*Upper*	3	4	0	0	2	**9**
	Lower	8	1	1	0	6	**16**
Total, groups	***Upper***	**123**	**48**	**21**	**15**	**43**	**250**
	Lower	**99 (+2)**	**31 (+5)**	**20**	**16 (+2)**	**51 (+5)**	**217 (+14)**

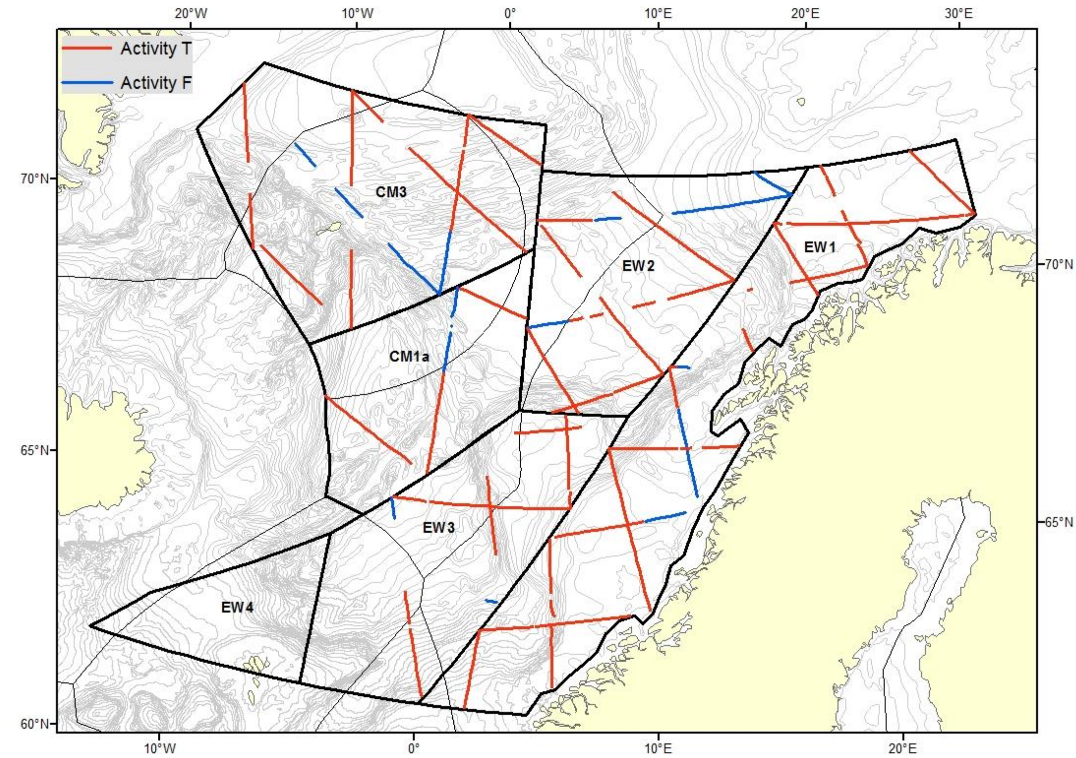

Figure 3. Survey blocks and (preliminary) transects conducted in primary search mode (T, red) and secondary search mode (F, blue).

BRIEF REVIEW OF SURVEY EFFORT FUNDED NATIONALLY BY NAMMCO MEMBER COUNTRIES

Greenland conducted an aerial survey in West Greenland that was combined with the East Greenland coastal survey mentioned above.

The **Icelandic** part of the North Atlantic Sightings survey (NASS 2015) was conducted during 9 June to 10th August 2015. The primary target species were fin whales and common minke whales. However, emphasis was made to identify as many sightings to species as possible, in particular to distinguish fin and blue whales and in the south, sei whales. Identification of long-finned pilot whales was also given high priority. The survey was conducted as a double platform two-way independent line transect survey. The survey was conducted in passing mode on the R/S Árni Friðriksson (AF) with possible delayed closing on the dedicated vessel, R/S Bjarni Sæmundsson (BS).

The BS surveyed in a southern block (IS) between 54°N and 61°N and 15°W to 42°W during the first part and during the second part it surveyed in a northern block (IN) between 65.3 and 72°N from Greenland coast to 12°W, but south of the Norwegian survey area CM2 (Fig. 4). The vessel AF surveyed west of Iceland in the Iceland (IW) Greenland (IG) area between the north and south blocks during the redfish survey and the latter part of the mackerel survey, where some effort at Greenland extended into the south block (IS) and west of 42°W (SW).

The first part of the mackerel survey covered mainly the Icelandic 200 nm EEZ (aerial survey block) (IC), with overlap into the south (IS) and north (IN) blocks and farther east than 10°W (IE) (Fig. 5).

A summary of sightings by area and observation effort is given in Table 3. Fin whales were the most commonly observed species (446 sightings) followed by long-finned pilot whales (108 sightings), common minke whales (92 sightings) and humpback whales (85 sightings).

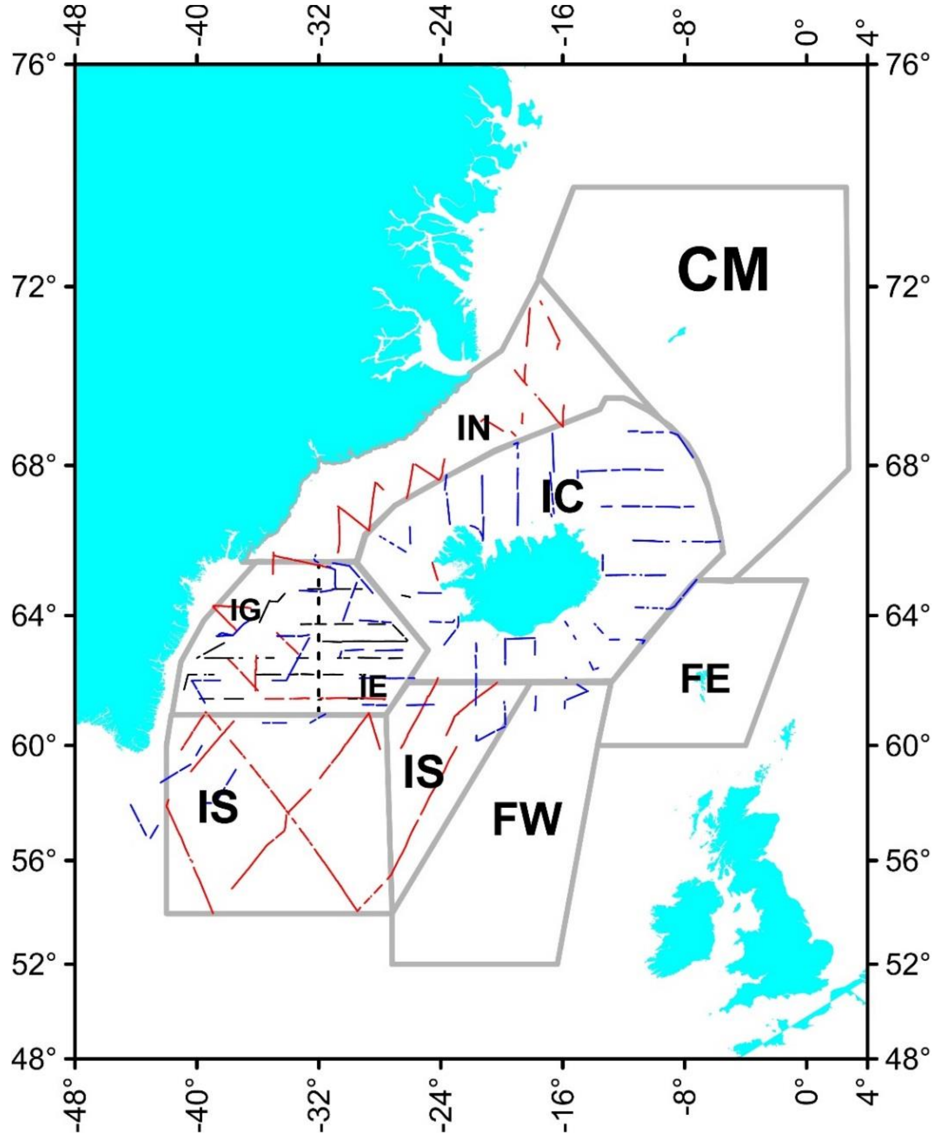

Fig. 4. Survey blocks and realized coverage of the Icelandic shipboard survey. Blue: R/S Árni Friðriksson (ÁF); Red: R/S Bjarni Sæmundsson (BS).

Table 3. Number of sightings of cetaceans encountered during the Icelandic shipboard survey. BP=fin whale, BB=sei whale, BA= minke whale, MN= humpback whale, PM= sperm whale, OO=killer whale, GM=pilot whale, HA=bottlenose whale, D?= dolphin, M?S?= xxxx

Area/Time	**nm**	**BP**	**BB**	**BM**	**BA**	**MN**	**B?**	**PM**	**OO**	**GM**	**HA**	**D?**	**M?,S?**
IW-I	569	53		3	1	2		1		1		3	
IW-III	435	74	3	5	2	2	55	15		22	4	17	6
IG-I	809	107	1	1	4		3	7	4	5	7	20	
IG-III	434	95	2	6	30	2	37	16		28		6	5
IC	952	26		1	29	16	11	9	12	26		29	10
IN	1128	60		14	14	61	14	1	2	3	1	2	1
IS	2371	27	30	10			6	12		16	1	9	1
<10°W	215	1			12	2		2	2	2	5		5
>42°W	118	4		1			3	10		5		3	1
Total	7031	446	36	41	92	85	129	73	20	108	18	89	29
Podsize		1.35	1.69	1.34	1.07	1.59	1.14	1.12	4.25	26.94	2.78	6.36	2.01

Iceland also conducted a coastal survey during June-July from a high-winged twin-engine Partenavia aircraft. The survey crew consisted of the pilot and cruise leader in the left and right front seats, and 2 primary observers in the right and left rear seats, using the bubble windows.

Realized effort is shown in Fig. 5 and Table 4. Blocks 1 and 8 received nearly complete coverage, while over 70% coverage was achieved in block 9. Blocks 2, 3 and 6 received under 50% coverage, while blocks 4, 5 and 7 were not covered at all. First-pass (*i.e.* non-repeat) coverage for the entire survey was only 37%, the lowest of the 6 surveys attempted since 1987.

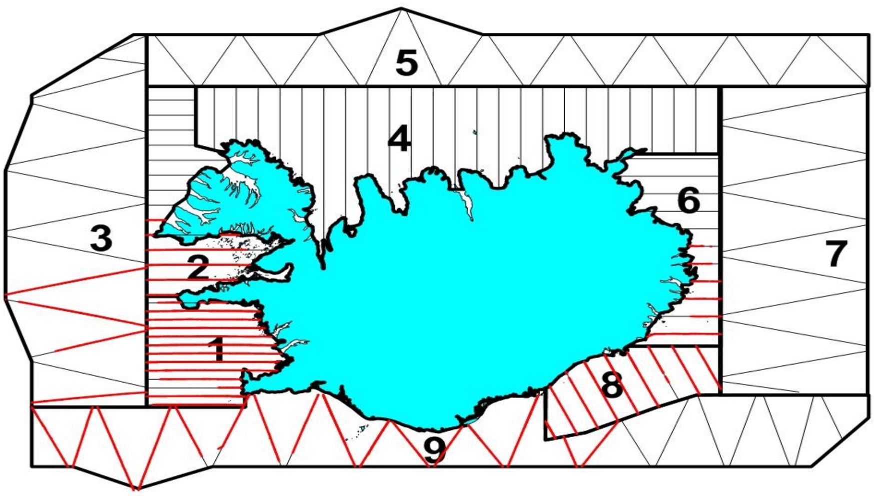

Fig. 5. Stratification and planned (black) and realized (red) effort in the 2015 Icelandic aerial survey.

Table 4. Cetacean sightings during Icelandic Aerial Survey in 2015. BA minke whale; BM blue whale; BP fin whale; GM long-finned pilot whale; GM/LA mixed pilot whale and white-beaked dolphins; LA white-beaked dolphin; MN humpback whale; OO killer whale; PM sperm whale.

STRATUM	BA	BM	BP	GM	GM/LA	LA	MN	OO	PM	PP	OTHER	TOTAL
1	16		1	16	4	29		3		4	5	**79**
2	1					1	2	1		3	1	**9**
3	1			3		1	8				1	**14**
6	2									1	4	**7**
8	3					2					1	**6**
9	8	2	4	39	1	8			2	5	3	**72**
TOTAL	**31**	**2**	**5**	**58**	**5**	**41**	**10**	**4**	**2**	**13**	**16**	**187**

Norway covered the Norwegian Sea together with the Jan Mayen area – see above.

FINANCIAL STATUS FOR THE SURVEYS

As proposed in the original budget there is funding left for initial analyses and development of abundance and for a review meeting of the results of the surveys.

PLAN FOR ANALYSIS AND PRESENTATION OF RESULTS

A first step of the presentation of the results is to prepare standardized maps of all sightings, effort distributed by sea state as well as stratum delineations. This task will be undertaken by Nils Øien (Norway) the following **time schedule** has been decided:

1 February 2016: submission of raw positional data or shapefiles to Nils Øien
1 March 2016: draft maps are being circulated
1 April 2016: final maps should be ready after review by survey leaders.

For the analyses of the survey results the following schedule was decided for the initial analyses:

Analyses of **pilot whale abundance** from the Faroese (and the Icelandic) survey will be conducted by contracting Daniel Pike and the group suggested that could be paid by NAMMCO using the remaining MFA funds.

Analyses of the **Greenland** aerial survey data for the target species (minke whales, fin whales and humpback whale) will be conducted by the Greenland Institute of Natural Resources (Hansen and Heide-Jørgensen).

Analyses of minke and fin whale data from the Norwegian surveys will be conducted by the Institute of Marine Research Bergen (Øien).

The Iceland minke and fin whale data (incl. Faroese sightings) will be analysed by Daniel Pike and the group suggested that could be paid by NAMMCO using the remaining MFA funds.

The preliminary time schedule for the analyses was decided as follows:

Mid-April 2016: short update to group on progress of the analyses.

Mid-May 2016: Initial analyses should be completed and preliminary reports circulated for minke, fin whale and pilot whales.

A review meeting of the involved researchers is planned for mid May 2016. This will be a meeting of the NAMMCO Abundance Estimates Working Group. The location of the meeting will likely be the Greenland Institute of Natural Resources offices in Copenhagen.

Initial analyses of remaining species:

Greenland will complete a first presentation of humpback whale abundance estimates by mid May 2016.

Preliminary abundance estimates for other species (such as harbour porpoise, humpback whales (Iceland and Norway) and pilot whales and dolphins (Greenland)) will be presented in fall 2016 at next NAMMCO SC meeting.

DATA DEPOSITION AND FUTURE DATA SHARING

Data from the surveys will be deposited with NAMMCO secretariat, but may also be deposited at IWC if required according to the RMP or the AMWP.

It was agreed to restrict the distribution of the raw data from this survey to only include the researchers involved. Data dissemination outside the survey group depends on agreement in the group.

FUTURE OF THE NASS2015 STEERING GROUP

With reference to NAMMCO's FAC, it is recommended that the NASS2015 Scientific Steering Group has, with the circulation of this report, completed its task. The follow-up on the survey and the development and approval of the abundance estimates are from now on deferred to the NAMMCO SC and no further activities are planned for the NASS2015 Scientific Steering Committee.

SECTION 6 NATIONAL PROGRESS REPORTS

FAROE ISLANDS
PROGRESS REPORT ON MARINE MAMMALS 2014

By Bjarni Mikkelsen and Maria Dam

I. INTRODUCTION

This report summarises research on cetaceans and pinnipeds conducted in the Faroe Islands in 2014. Research has been conducted by the Museum of Natural History and the Environment Agency.

II. RESEARCH B Y SPECIES 2014

II.a Species/Stocks studied

- Grey seal (*Halichoerus grypus*) – hunting statistics
- Pilot whale (*Globicephala melas*) – landed animals
- Bottlenose whale (*Hyperoodon ampullatus*) – stranded animals

II.b Field work

In 2014, a total of 47 "full samples" were collected from **pilot whales** by the Natural History Museum, from 2 drives – Fuglafjørður on 18 May (13 samples) and Sandur on 30 September (34). This is a continuation of a "small-scale" sampling programme, with the future plan to complement it with a more comprehensive monitoring programme, one priority being age determination of all individuals. A "full sample" refers to recording/sampling total length, weight (when possible), sex, teeth, reproductive organs and stomach as well as muscle, blubber, kidney and liver tissues. Foetuses are sampled when present.

The Environment Agency did not collect samples of **pilot whales** in 2014.

On 28 September 2014, five **bottlenose whales** stranded in Hvalba, Suðuroy. Samples from stomachs, reproductive organs and lower jaws were delivered to the Museum of Natural History for examinations.

II.c Laboratory work

The biological material collected from **pilot whales** in 2014 has been prepared ready for finalizing examinations of age, diet and reproduction.

In 2014, the activities of the Environment Agency in relation to **pilot whales** were limited to that of preparing samples from previous years for analyses, as no new samples were taken in 2014. The samples selected for analyses in 2014 are shown in Table 1 and Table 2 on the next page.

In addition, the Environmental Agency delivered **pilot whale** samples for genetic studies, to be undertaken as part of an MSc project at the University of the Azores, by Marilia Olio (in all 37 samples of pilot whales liver or muscle). The study is delayed and the results are not available at present.

II.d Other studies

In the Faroe Islands **grey seals** are merely killed at salmon sea farms, when interfering with the installations. In 2010 a logbook system of seal culls was implemented and farmers were motivated to deliver statistics on an annual basis. Unfortunately, the reporting system is still not optimal in providing a full overview of grey seal removals.

Table 1 Samples of pilot whales selected for analyses for the AMAP programme.

Date of kill	ID whales	Number of whales	Tissue	Analyses	Results
300713	nos 7, 9	2	Liver and blubber	PFAS (liver) and PBDE (blubber)	not available
80813	nos, , 3, 19, 27	3	Liver and blubber	PFAS (liver) and PBDE (blubber)	not available
80813	nos. 6, 8, 12, 18, 20, 21, 25.	7	Liver	Selenium	not available
80813	nos, 1, 3, 5, 6, 7, 10, 11, 16, 19, 21, 24, 26, 27	13	Muscle and blubber	Selenium and stable isotopes (N and C) in muscle, POPs in blubber.	not available
300713	nos. 3, 7, 8, 9, 11, 13, 18, 19, 20, 22, 28, 30.	12	Muscle and blubber	Selenium and stable isotopes (N and C) in muscle, POPs in blubber.	not available
300713	nos. 8, 15, 18, 20, 21, 23, 28, 29.	8	Liver	Selenium	not available

Table 2 Samples of pilot whales selected for analyses for PFAS.

Number	ID	Scientific name	Location	Sampling date
1	30-06-1994-0018	Globicephala melas	Hvannasund	30-06-1994
2	30-06-1994-0046	Globicephala melas	Hvannasund	30-06-1994
3	280696-0266	Globicephala melas	Vestmanna	28-jun-96
4	280696-0267	Globicephala melas	Vestmanna	28-jun-96
5	280696-0282	Globicephala melas	Vestmanna	28-jun-96
6	251198-0045	Globicephala melas	Hvalvík	25-nov-98
7	251198-0048	Globicephala melas	Hvalvík	25-nov-98
8	140399-0046	Globicephala melas	Tórshavn	14-mar-99
9	140399-0018	Globicephala melas	Tórshavn	14-mar-99
10	080999-0019	Globicephala melas	Vestmanna	08-sep-99
11	310800-118	Globicephala melas	Hvannasund	31-aug-00
12	310800-120	Globicephala melas	Hvannasund	31-aug-00
13	090900-016	Globicephala melas	Tórshavn	09-sep-00

II.e Research results

A study, integrating **pilot whale** samples, explored the utility of Hg stable isotope ratios in human hair as a new method for discerning MeHg exposure sources. The study characterized Hg isotope fractionation between humans and their diets using hair samples from Faroese whalers exposed to MeHg predominantly from pilot whales. It was observed an increase of 1.75‰ in δ202Hg values between pilot whale muscle tissue and Faroese whalers' hair but no mass-independent fractionation (Li et al., 2014).

Results of PFAS analysis were partially presented in Sunderland et al. (see Figure 1) at the Goldschmidt 2015 Conference in Prague, 17 August 2015. The results show that, in contrast to the declining trend observed a few years ago, even PFOS in pilot whale muscle appears to be increasing again (Figure 2).

Figure 1. Authors and affiliations for the Sunderland et al., 2015 presentation.

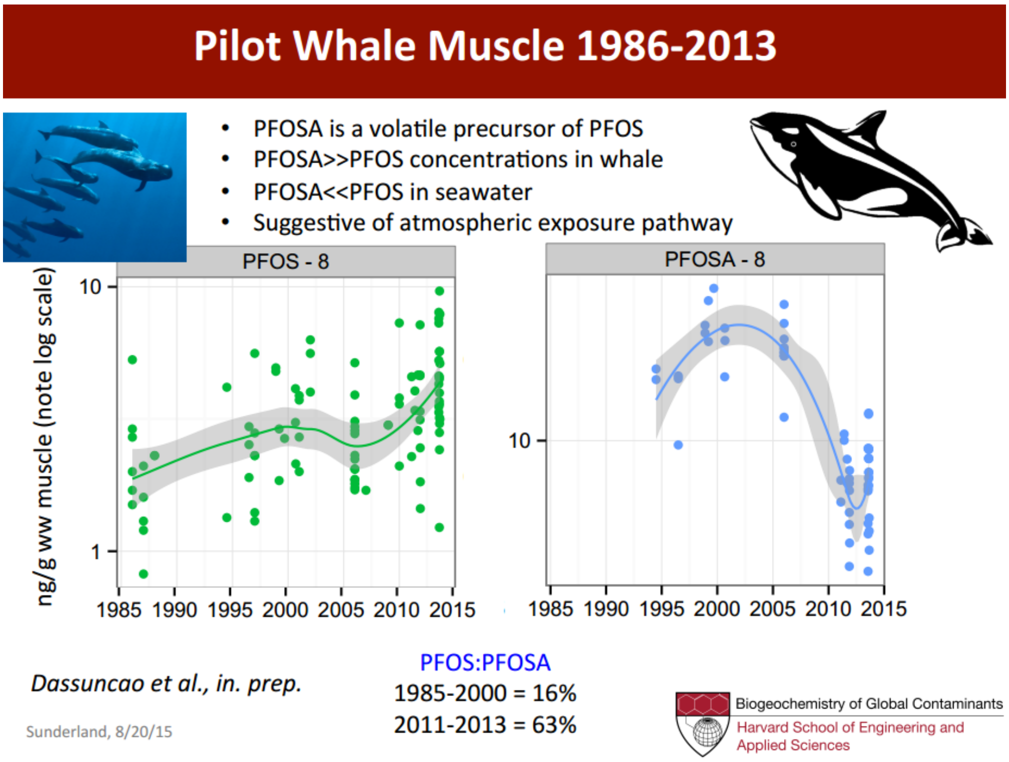

Figure 2. Slide from the Sundeland et al., 2015 presentation.

A study on neurons and glial cells in **pilot whale** brain found that the long-finned pilot whale neocortex has approximately 37.29×10^9 neurons, which is almost twice as many as humans, and 127×10^9 glial cells. Thus, the absolute number of neurons in the human neocortex is not correlated with the superior cognitive abilities of humans (at least compared to cetaceans) as has previously been hypothesized. However, as neuron density in long-finned pilot whales is lower than that in humans, their higher cell number appears to be due to their larger brain (Mortensen et al., 2014).
A report summarising the findings of the monitoring of environmental pollutants in **pilot whales** as in other selected species from the Faroe Islands for the Arctic Monitoring and Assessment programme (AMAP) has been published in Nielsen et al., 2014.

III. ONGOING (CURRENT) RESEARCH

The Museum of Natural History will continue tracking **pilot whales** by satellite telemetry, in order to assess migration patterns and the distribution area of pilot whales recruiting to the Faroese harvest.

A PhD study at the Environment Agency on negative effects of pollutants on hormone and vitamin concentrations in **pilot whales** is in progress.

IV. CATCH DATA

Given in Appendix 1.

V. BY-CATCH DATA

The electronic logbook system for all fishing vessels larger than 15 GRT, with mandatory reporting of marine mammal by-catches, has been in function for three years now, still for some selected fleets. Reported by-catches are given in Appendix 2. The rare incidences with by-catches of large whales are by tradition reported directly to the Museum.

VI. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

None

VII. PUBLICATIONS AND DOCUMENTS

Mikkelsen, B., Bloch, D., Dam, M., Olsen, J. and Desportes, G. 2014. Faroe Islands – Progress report on Marine Mammals 2013. Paper presented to the NAMMCO Scientific Committee, Bergen, Norway, November. 5pp.

Miling, L., Sherman, L. S., Blum, J. D., Grandjean, P., Mikkelsen, B., Weihe, P., Sunderland, E. M. and Shine, J. P. 2014. Assessing Sources of Human Methylmercury Exposure Using Stable Mercury Isotopes. *Environ. Sci. Technol., 48* (15), pp 8800-8806.

Mortensen, H. S., Pakkenberg, B., Dam, M., Dietz, R., Sonne, C., Mikkelsen, B. and Eriksen, N. 2014. Quantitative relationships in delphinid neocortex. *Front Neuroanat., 8: 132.* 10pp.

Nielsen, Sanna í Túni, Rakul Mortensen, Katrin Hoydal, Sissal Vágsheyg Erenbjerg and Maria Dam, 2014. AMAP Faroe Islands Heavy Metals and POPs Core Programme 2009-2012 Environment Agency, Faroe Islands ISBN: 978-99918-819-9-7, pp. 64 excl. appendices. Available at http://us.fo/Default.aspx?ID=13912.

APPENDIX 1 – CATCH DATA

Pilot whale drives in the Faroe Islands, 2014.			
Date	Locality	Number of whales	Samples taken
18 May	Fuglafjørður	13	13
30 September	Sandur	35	34
2014	2 grinds	48 whales	47

APPENDIX 2 – BY-CATCH DATA

	By-catch of marine mammals in the Faroe Islands, 2014.				
Date	Locality	Species	Gear	Number	Samples
7 August	Faroese EEZ	G. melas	Trawl	15	0
22 October	Faroese EEZ	O. orca	Trawl	1	0
?	Faroese EEZ	Cetaceans	Trawl	2	0
2014				18	

APPENDIX 3 - STRANDINGS

Marine mammal stranding in the Faroe Islands, 2014.				
Date	Locality	Species	Number	Samples
28 September	Hvalba, Suðuroy	Hyperoodon ampullatus	5	5
2014			5	5

GREENLAND
PROGRESS REPORT ON MARINE MAMMALS 2014

Greenland Institute of Natural Resources

Catch, by-catch and strandings statistics provided by the Ministry of Fisheries, Hunting and Agriculture

I. INTRODUCTION

This report summarizes the research on pinnipeds and cetaceans done in Greenland in 2014 by The Greenland Institute of Natural Resources (GINR), in collaboration with several organisations.

II. RESEARCH 2014

A Species and stocks studied

Pinnipeds

- Walrus *Odobenus rosmarus* – Northern Baffin Bay, West Greenland /Southern Baffin Island & East Greenland
- Hooded seals *Cystophora cristata* –Western Atlantic
- Harbor seal *Phoca vitulina* – Central West and South Greenland
- Bearded seal *Erignathus barbatus* – Baffin Bay and South Greenland
- Ringed seal *Pusa hispida* - West and East Greenland

Cetaceans

- Narwhal *Monodon monoceros* - West and East Greenland
- Beluga *Delphinapterus leucas* – West Greenland
- Harbour porpoise *Phocoena phocoena* – West Greenland
- Sperm whale *Pyseter macrocephalus* – West and East Greenland
- Bowhead whale *Balaena mysticetus* –West Greenland
- Humpback whale *Megaptera novaeangliae* - West and East Greenland
- Fin whale *Balaenoptera physalus* – West and East Greenland
- Minke whale *Balaenoptera acutorostrata* – West and East Greenland

B Field work in 2014

Walrus

An aerial survey with walruses as primary target was conducted in the North Water Polynia in late winter 2014, with narwhal, beluga and bearded seal as secondary target species.

Seals

The harbor seal is classified as "Critically Endangered" in the Greenland Red List, and in 2010 all hunting of harbour seals was banned. Despite reports of sporadic observations, no stable colonies have been identified in recent years on the west coast north of Cape Farewell. Based on information from local hunters, a haul out site for harbor seals was identified south from Nuuk, in the municipality of Sermersooq in 2010, and information about a new one further south was obtained in 2012. Both places were monitored in 2013 and the presence of pups was confirmed for the southernmost site, suggesting that this location may seasonally contain a stable breeding colony. The sites were monitored again in 2014.

Collection of stomach samples and other tissues from the seal harvest in the Icefjord near Ilulissat in Disko Bay started in 2012 and continued in 2013 and 2014. The aims of the project are to identify the diet of seals in the area and to look into ecological interactions. Samples of fish are also collected and all the practical aspects of this project are run by locals.

In collaboration with the University of New York, and with oceanographic measurements as primary objective, ringed seal were tagged with satellite transmitters in Sermilik Fjord, South of Tasiilaq in East Greenland and in the Icefjord in Ilulissat, Disko Bay. The telemetry in Disko Bay may also help to produce advice regarding stock structure and management of ringed seals at a local level

Cetaceans

To better understand their foraging behaviour and in preparation for future studies of the effect of human disturbance on cetaceans, narwhals from East Greenland were equipped with temperature sensitive stomach probes, coupled with acoustic tags, heart rate sensors and satellite transmitters.

To better advice the Government of Greenland regarding the effect of oil exploration and other human activities in the narwhals of Melville Bay, 3 projects were carried out in 2014: an aerial survey during summer; deployment of moorings for passive acoustic monitoring of narwhals near selected glaciers and a social science study of local knowledge and perception on the effects of oil exploration on narwhals, based on interviews of hunters and analysis of catch data and tracks of seismic vessels.

In Maniitsoq, harbor porpoises were tagged and biological samples from the catch were collected as part of a PhD study on the life history and ecology of harbor porpoises.

As part of a comprehensive series of studies on the ecology, abundance and stock structure of bowhead whales, carried out by GINR in cooperation with other institutions, hunters from Qeqertarsuaq collected biopsies from bowhead whales in Disko Bay between March and May. The samples are being used for sex determination, genetic identification and stock identity.

A project launched in 2013 continued, in cooperation with the US Fisheries and Wildlife Services, with the aim of developing equipment and techniques to deploy sound recorders on bowhead whales, to study the effect of anthropogenic noise on the behaviour of this species. In 2014, bowhead whales were tagged with combined radio transmitters and acoustic recorders.

Outi Tervo obtained a post-doctoral grant at GINR for studies focusing on the effects of anthropogenic noise on the singing behavior of bowhead whales.

As in previous years, the occurrence and site fidelity of humpback whales in Godhåbsfjorden (Nuuk) was investigated using photo-identification. Pictures of humpback whale flukes and dorsal fins were also provided by the public and tour operators in Nuuk and Disko Bay. In addition, biopsies were obtained from humpback whales in Nuuk and satellite tags were deployed.

A study of the ecology, movements and occurrence of large whales in East Greenland that started in Tasiilaq in 2013 continued in 2014. Methods include photo identification, satellite telemetry and acoustic and oceanographic moorings.

Biological samples and empiric data on the weight of edible products from humpback whales were obtained in cooperation with whale hunters in 2014. This was a task requested by the International Whaling Commission.

As part of the requirements for obtaining a whaling licence, hunters provided GINR with tissue samples from minke whales, fin whales and humpback whales.

The Danish Centre for Energy and Environment (DCE), University of Aarhus, maintains a database with observations collected by dedicated marine mammal and sea bird observers on board vessels carrying out seismic surveys under licences provided by the Bureau of Minerals and Petroleum.

C Laboratory work in 2014

Laboratory work carried out in 2014 included the analysis of stomach samples from seals, fish and harbour porpoises in Nuuk, as well as genetic analyses of bowhead whales at the University of Oslo and of walruses at the University of Aarhus.

Sound recordings from moorings in West and East Greenland are being analyzed for estimates of background noise and seasonal occurrence of cetaceans and bearded seals, as well as monitoring of seismic exploration.

D Other studies in 2014

A number of desktop studies were carried out during 2014, including analysis of catch statistics and assessments of narwhal and beluga for scientific working groups under NAMMCO/JCNB and of large whales for the IWC.

E Research results in 2014

The majority of research results from the fieldwork of 2014 are not available yet.

III ONGOING RESEARCH IN 2015

As in previous years, GINR focuses on identifying important areas for harbor seals in order to implement monitoring programs. Harbour seals were totally protected in 2010. Nevertheless, a few hunters report catching this species each year. To verify whether these are real catches or reporting mistakes, telephonic interviews of hunters reporting catches of harbour seals begun in 2015. Tagging of ringed seals in the vicinity of Ilulissat (West Greenland) and Tasiilaq (East Greenland) for obtaining oceanographic data (temperature at depth) with the help of seals continued in 2015.

In order to understand the stock delineation and to obtain complementary data for abundance estimates, GINR runs a series of satellite telemetry studies on walrus and narwhals in West Greenland, as well as narwhals in East Greenland. Satellite telemetry of narwhals in East Greenland was complemented with the use of sensors to document feeding events, heart rate and received sound levels to develop techniques for assessing the impact of anthropogenic noise.

As part of NAMMCO's T-NASS, there were aerial surveys for cetaceans during summer 2015 in East and West Greenland. The East Greenland Survey was financed by NAMMCO, through a Norwegian contribution.

The long-term studies of bowhead whales in Disko Bay for 2015 focused on testing technology for combining satellite telemetry and recording sounds on the surface of whale bodies, in order to better understand the effect of sound from seismic air guns. In addition, oceanographic tags that record temperature, salinity, depth and position are under development. Furthermore, postdoctoral research focusing on the singing behavior of bowhead whales and the effects of anthropogenic noise continued.

Collection of identification pictures of humpback whales flukes and dorsal fins from West Greenland continued throughout 2015. The work in Nuuk in 2015 included photo-identification, biopsy sampling and satellite telemetry.

Studies of large whales in Tasiilaq, Southeast Greenland continued in 2015, and were expanded to include photo identification, biopsy darting, satellite telemetry, passive acoustic monitoring, oceanographic measurements and distributin of potential prey.

IV ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

Advice and quotas for cetaceans and pinnipeds in the calendar year 2014 are summarized in table 1.

Table 1. Overview of management advice per stock in 2014, the year of survey used in assessment for advice valid in 2014, the year of the most recent survey (by the fall 2015), the quota or other management measures used in 2014 and the potential removals if all the quota was taken. Potential removals include catches in Greenland, catches in Canada for shared stocks and estimated struck but lost animals. Potential removals for narwhals given under the assumption that hunters report stuck and lost animals

Species - stock	**Year of survey used for advice in 2014 (*year of last survey*)**	**Advisor**	**Advice**	**Quota 2013/ Management measure 2013**	**Potential removals**
Harbour seal	2013 (*2014*)	NAMMCO	Total protection	Protected since 2010	-
Grey seal	2009 (2009)	NAMMCO	Total protection	Protected since 2010	-
Harp seal	2013 (2015)	ICES/NAFO	No concern	No catch limit	-
Hooded seal	2013 (2015)	ICES/NAFO	No concern	No catch limit	-
Walrus - Baffin Bay	2010 *(2014)*	NAMMCO	93 or less removals	Quota of 86	93[13], 94[14] or 103[15]
Walrus - Davis Strait / Baffin Island	2012 *(2012)*	NAMMCO	100 or less removals	Quota of 69	98
Walrus - East Greenland	2008 *(2008)*	NAMMCO	20 or less removals	Quota of 18	20
Beluga - West Greenland	2006 *(2012)*	JCNB (& NAMMCO)	310 or less removals	Quota of 310	310
Beluga - Qaanaaq	2010 (2014)	JCNB (& NAMMCO)	20 removals acceptable	Quota of 20	20
Narwhal - Inglefield Bredning	2009 *(2007[16])*	JCNB (& NAMMCO)	85 or less removals	Quota of 85	85

[13] Using an estimated catch of 4 walruses in Canada and a loss rate of 3 % as estimate by the Department of Fisheries, Hunting and Agriculture through telephone interviews of 7 hunters in Qaanaaq in 2014

[14] Using an estimated catch of 4 walruses in Canada and a loss rate of 5 % as estimate by GINR (unpublished data) in an interviews with 64 walrus hunters from West Greenland

[15] Using an estimated catch of 4 walruses in Canada and a loss rate of 15 % as used by NAMMCO in assessment from 2013

[16] Survey in the North Water Polynya in late witnter 2014. Connection of these narwhals with the ones harvested in Inglefield Bredning on summer is not fully understood

Narwhal - Melville Bay	2007 *(2014)*	JCNB (& NAMMCO)	81 or less removals	Quota of 111	111
Narwhal - Uummannaq	-	JCNB (& NAMMCO)	81 or less removals	Quota of 81	81
Narwhal - Disko Bay area	2006 *(2012)*	JCNB (& NAMMCO)	59 or less removals	Quota of 59	59
Narwhals - Ittoqqortormiit	2008 (2008)	NAMMCO (& JCNB)	70 or less removals	Quota of 70	70
Narwhal - Tasiilaq	2008 (2008)	NAMMCO (& JCNB)	18 or less removals	Quota of 18	18
Bowhead whale – West Greenland / Arctic Canada	2006 *(2013)*	IWC	5 removals acceptable	Quota of 2	2
Humpback whale – West Greenland	2007 (2015)	IWC	10 removals acceptable	Quota of 10	10
Fin whale – West Greenland	2007 (2015)	IWC	19 removals acceptable	Quota of 19	19
Minke whale – West Greenland	2007 (2015?)	IWC	178 removals acceptable	Quota of 178	178
Minke whale – East Greenland	2007 (2015)	IWC	12 removals acceptable	Quota of 12	12

According to legislation, animals that are struck but lost should be reported and will be taken from the quotas. However, the scarcity of reports suggests that there is underreporting of struck bust lost animals for beluga, narwhal and walrus. The two stocks of walrus in West Greenland are also hunted in Canada. In consequence, walrus quotas are lower than the recommended removals to allow for struck but lost animals and for harvest in Canada.

With the exemption of narwhals Melville Bay, where the quota was raised by 30 narwhals, all catch levels of cetaceans and pinnipeds in 2014 were in accordance with biological advice. The extra narwhal quota was given to the Upernavik area because atypically open water in spring led to the original quota being used before start of the summer hunting season.

In 2015, an extra quota of 10 narwhals was given in Tasiilaq, which will probably result in catches being higher than the advice.

In 2013, the walrus quota for Qaanaaq was raised above the advice. A working group under the NAMMCO Scientific Committee assessed walruses of all Greenland stocks at the end of 2013, using the catches from 2013 in the analysis. Following this assessment, an updated advice was provided by NAMMCO in 2014 and the quotas for 2014 were closer to the advice. In 2014, the CITES management authority of Greenland requested an updated Non Detriment Findings report (NDF) from its scientific authority. The NDF, issued in 2015, concluded that catches of walrus in Greenland are probably sustainable and therefore export of products derived from walrus are not detrimental for the stocks. However, quotas in Qaanaaq may be higher than the advice, as there is uncertainty about the number of animals that are struck and lost.

In 2013, NAMMCO recommended that that Greenland should take a closer look at the accuracy of catch data for harbor porpoises and killer whales. This work has not been completed.

Quotas for large whales are normally set by the IWC. However, in 2012 there was no agreement about quota levels for Greenland for the period 2013-2018. In the absence of IWC quotas, the Government of Greenland sat catch levels based on the advice of the Scientific Committee of the IWC. The IWC has moved from yearly to biennial meetings, so Greenland quotas for 2014 were also self-imposed. On its meeting in 2014, the IWC agreed upon quotas for the remaining years of the block period; 2015 – 2018.

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ICELAND
PROGRESS REPORT ON MARINE MAMMALS IN 2014

Compiled by Gísli A. Víkingsson, Þorvaldur Gunnlaugsson, Sandra Granquist and Sverrir D. Halldórsson.

I. INTRODUCTION

The following report is on studies on marine mammals in Icelandic and adjacent waters in 2014. While most of the studies were conducted by the Marine Research Institute (MRI) and it's various research partners, queries for information on research were sent to all offices or individuals known to have been involved in marine mammal research or data collection during the period. These include University of Iceland Research Center in Húsavík (UIRCH), Húsavík Whale Museum (HWM); Faxaflói Cetacean Research project (FCR), Innovation Centre, Iceland (ICI); Keldur, Institute for Experimental Pathology (KIEP); The Institute of Natural History (INH); University of Iceland (UI), Icelandic Seal Center (ISC), Institute of Freshwater Fisheries (IFF) as well as data collection from private commercial platforms such as whaling and whale watching companies. As in previous years research efforts on marine mammals at the MRI in 2014 were largely devoted to a comprehensive biological programme from the commercial catch of fin whales initiated in autumn 2006 and catches taken since (2009, 2010, 2013 and 2014 seasons). Further analysis of the previous NASS sightings surveys was conducted and planning for the survey in 2015. Sightings data on all species and effort is routinely collected on board the Hvalfjorður station whaling vessels, and stored in a database at the MRI.

The MRI preserves all genetic samples available from cetacean catches, by-catches, strandings and biopsies. Since 2012 skin samples for genetic analysis have been routinely collected from most cetacean marine mammals, bycaught in the MRI fisheries surveys. The MRI hosts the central Icelandic photo-identification database.

The INH is responsible for collection and preservation of museum specimens of marine mammals in Iceland. The INH archives mammal skeletons and bone remains discovered from the natural environment and archaeological material from middens. Information on strandings of whales found

in Icelandic waters has been collected by the MRI over many decades. This includes dead whales, ice-locked live animals and live animals driven ashore, historical and recent. Biological investigations of strandings is conducted on an opportunistic basis.

The ISC monitors visits of vagrant seals to the coast of Iceland by collecting information about such visits from the news or human resources (photos of life animals) or by receiving corpses of stranded dead pinnipeds. In recent years increasing number of scientists have conducted research on marine mammals from platforms of opportunity such as those offered by the rapidly expanding commercial whale watching operations. The geographical scale of these studies is generally small, but the frequency of observation is high during the summer and some companies operate throughout the year. Studies on cetaceans conducted under the auspices of the University of Iceland (mainly UIRCH) have focused on acoustics, photo-id, behaviour and distribution in near-shore areas.

II. RESEARCH 2014

a. Species/stocks studied

Pinnipeds

- Grey seal (*Halichoerus grypus*)
- Harbour seal (*Phoca vitulina*)
- Harp seal (*Pagophilus groenlandica*)
- Hooded seal (*Cystophora cristata*)
- Bearded seal (*Erignahtus barbatus*)
- Walrus (*Odobenus rosmarus*)

Cetaceans

- Blue whale (*Balaenoptera musculus*)
- Fin whale (*Balaenoptera physalus*)
- Common minke whale (*Balaenoptera acutorostrata*)
- Humpback whale (*Megaptera novaeangliae*)
- Sperm whales (*Physeter macrocephalus*)
- Northern bottlenose whale (*Hyperoodon ampullatus*)
- Long-finned pilot whale (*Globicephala melas*)
- Killer whale (*Orcinus orca*)
- White-beaked dolphins (*Lagenorhyncus albirostris*)
- Harbour porpoise (*Phocoena phocoena*)

Pinnipeds

Harbour seals

Analyses of abundance and trends

Partial population count: The ISC and IFF conducted a partial population count of harbour seals in 2014 during the moulting period in August-September. The biggest haul-out sites were counted from a Cessna airplane. In addition, an experiment was carried out, where a drone was used to count in some areas. This is the first time that harbour seal counting using a drone has been carried out in Iceland and an evaluation of the method is currently ongoing. Due to insufficient funding and thus limited coverage, the data provided by this survey will not produce a new reliable population estimate for the Icelandic harbour seal population. However, the results show a severe reduction in the surveyed areas since the last full count in 2011, implying that the population size is likely to be smaller than that defined in the management objectives by the Icelandic government.

The great seal count: A comprehensive seal count was carried out for the eighth year in a row in Húnaflói bay by the ISC. The count was carried out by several volunteers on 27th of July 2014 during low tide. All seals on the coastline of Vatnsnes and Heggstaðanes peninsulas in Húnaflói bay were counted (~100 km). The count resulted in 706 seals (mainly harbour seals), compared to 755 in the same area and time of year in 2013. Before 2013, the numbers were considerably higher, with over 1000 animals counted. The number of seals in the area of Vatnsnes and Heggstaðanes will be monitored by repeating the count annually.

Interaction with salmon fishery

A study on the effect of seals on salmonids was initiated in 2009 by ISC and IFF. The main goal is to determine feeding habits of seals in river mouths in the north western part of Iceland, especially in regards of the effect of seals on salmonids. Faecal samples from seals hauling out in the river moth area (collected between 2009 and 2011) were analysed with hardpart- and prey-DNA analysis during 2014. Prey-DNA analysis is made in co-operation between ISC, IFF, Stockholm University and Natural history museum in Stockholm and statistical analysis of the data is ongoing. In addition, hair samples from seals in the area were prepared for further stable-isotope analysis. Hair- and muscle samples from seals caught in nets in other parts of Iceland was analysed for stable isotopes for comparison purposes in 2014. The stable isotope analysis is cooperation between ISC, IFF, BioPol, MRI and Stockholm University and statistical analysis of the data is ongoing.

Effects of tourism on harbour seals

The effect of seal watching on the behaviour and distribution of harbour seals has been studied by ISC and IFF since 2008. Results were published in two papers in 2014 (Granquist. and Sigurjónsdóttir, 2014; Granquist and Nilsson, 2014).

Codes of conducts for visitors and tour operators in the area regarding how to behave during seal watching to reduce disturbance on seals was published in 2014 on behalf of The Wild North (www.twn.org).

During 2014 the compliance of tourists to seal watching codes of conducts was investigated (Marschall et al. 2014). A BS thesis reviewing codes of conducts for seal watching worldwide was finished in 2014 (Öqvist, 2014).

Other

An exploratory workshop on faunal history and exploitation of seals in Northern Europe was held in Stockholm in November 2014. The project is an interdisciplinary international co-operation between experts in seal biology, anthropologists and archaeologists.

Grey seals

No research on grey seals was carried out by ISC in 2014.

Other pinniped species

Analyses of abundance and trends

ISC monitors visits of vagrant seals to the coast of Iceland by collecting information about such visits from the news or human resources (photos of life animals). In 2014 ISC did not receive any information about vagrant seals.

Cetaceans

Fin whales

The MRI conducted routine sampling (age, reproduction, genetics, diet, energetics) and measurements of every landed fin whale in the whaling station in Hvalfjörður . In addition scientists from several other Icelandic and foreign research institutes performed sampling of the landed fin whales. Age reading of fin whales from the commercial hunt using laminated layers in ear plugs (MRI) and the asparctic acid racemisation method for eye lenses was continued in 2014. The results of the different methods will be compared for estimating their reliability.

MRI scientists participated actively in the RMP *Implementation Review* process under the auspices of the Scientific Committee of the IWC. This work is scheduled to be complete in 2016.

Analyses of stock structure of North Atlantic fin whales continued at the MRI in cooperation with scientist from Greenland and Norway.

A study of anatomy and properties of the middle and inner ear of fin whales was continued by the University Hostpital in Reykjavík.

A team of Canadian scientists from the University of British Columbia and collaborating institutes continued a broad fin whale sampling program including research on:

- structure and mechanics of lungs and diaphragm
- investigation of the airway cartilage, the laryngeal sac
- esophagus function and mechanism to blck food from airway
- stretchy nerves in the tongue and ventral groove blubber layer
- Wear patterns in baleen plates and bristles

Minke whales

Various biological sampling and measurements of common minke whales took place onboard the whaling vessels and the resulting data and samples provided to the MRI by whalers.

MRI scientists participated in genetic collaborative work on stock structure issues relevant to management of minke whales (Tiedemann et al 2014a and b).

Studies continued at the MRI on the development of a new ageing method for common minke whales based on asparctic acid racemisation in the eye lens.

Work on a PhD project: “Use of natural markings to study demography and social structure of common minke whales and white-beaked dolphins” was continued in 2014 by FCR.

Studies into the potential effects of recent environmental change on the distribution and abundance of minke whales in Icelandic waters were continued by the MRI.

Blue whales

Two blue whales were instrumented with a satellite tags on 29th May 2014. Position data were received until 4th June and 14th July, respectively.

Collection of Photo-id material continued in Skjálfandi Bay in 2014 by the MRI and UIRCH.

Humpback whales
During 10-15 November 2014 five humpback whales were tagged with satellite transmitter tags in Eyjafjörður, North Iceland by the MRI. . Data were received from four of these, two of which initiated migration in early December 2014 and 10th January 2015, respectively. The latter was tracked all the way to the breeding area in the Caribbean and half way back towards Iceland. This is the first time a compelte autumn migration of North Atlantic humpback whales has been documented via satellite.

Collection of Photo-id material continued in Skjálfandi Bay in 2014 by the MRI, FCR and UIRCH.

North of Iceland skin biopsies were collected by the MRI from 13 humpback whales in satellite tracking cruises in 2013. These samples are used in studies on population structure and to determine the gender of the tracked animals. One biopsy was obtained from a northern bottlenose whale.

Six humpback whales were tagged with acoustic tags and camera tags in Skjálfandi bay in 2014 by UIRCH and cooperating scientists. Sound recordings of humpback whales using a single hydrophone were made as a part of Master student program.

The year round occurrence and sound behaviour of humpback whales in Skjálfandi Bay, NE-Iceland was studied as a part of a PhD project at the UI using 1) long-term passive acoustic recordings using bottom moored acoustic recorders (EARs) where recordings were made during 2 – 5 months at a time and 2) visual observations during summer simultaneously to acoustic recordings using a hand held hydrophone recorder.

The sound behaviour and occurrence of humpback whales was studied in Skjálfandi Bay with different approaches. The fundamental aims were to 1) observe the occurrence of this species throughout the year and 2) their seasonal sound behaviour in Skjálfandi Bay. The findings indicate year round occurrence of humpback whales within the area. During the breeding season (Dec-March) of this species the humpback whales accumulate at the NE-coast of Iceland where they engage in singing, a behaviour related to sexual activity with less vocal activity during summer.

Killer whales
Data collection continued for the MRI's research project on killer whale ecology and behaviour in Breiðafjörður bay (late winter) and around the Vestmannaeyjar islands (summer). This project will be finalized by the end of 2015.

Harbour porpoise
Collaboration with the University of Potsdam is ongoing to make use the existing 1500 harbour porpoise samples from Iceland (1991 onwards) and future samples in a wide genetic study (Lah *et al*. 2014). In 2014 additional 14 samples (two with foetuses) were collected by lumpsucker fishermen and 12 obtained in the annual spring gillnet survey. In addition 28 samples (3 with foetuses) collected by UIRCH in 2011 and 2012 were received and stored in the MRI database.

<u>Sightings data</u>
Preparations for the large scale North Atlantic Sightings Survey (NASS) scheduled in 2015 were continued at the MRI is cooperation with other participating nations in 2014.

An analysis of the effects of changing environmental conditions on the distribution of fin whales using NASS data was completed in 2014 (Schleimer 2014).

Monitoring of sightings during whale watching operations was conducted in two bays, Faxaflói and Skjálfandi. Sighting and effort data is stored at each whale watching company and data from Skjálfandi is also stored and analysed at the HWM.

A project to study the effects of the whale watching boats on the distribution and behaviour of whales was continued at the UIRCH. This project is a part of the "Wild North project" which also includes a study on the potential disturbance of tourism on seal haul out behaviour (see above) (http://www.thewildnorth.org/).

III ONGOING (CURRENT) RESEARCH

Pinnipeds

Due to lack of financial support, no comprehensive count of harbour seals or grey seals has been carried out since 2011 and 2012 respectively. ISC and IFF will apply for funding for population counts of both species in 2016. The comprehensive seal count in Húnaflói bay is conducted annually in the end of July by the ISC (since 2007). The possibility and efficiency of counting harbour seals using thermal cameras on drones in Iceland was investigated by ISC and IFF during 2015.

Dietary studies of harbour seals that haul-out in river mouths in the north west of Iceland (by ISC and IFF), with special efforts put on investigating the effect of seals on salmonids will be continuing in 2015 and 2016 and results published.

A study on the effect of tourism on the spatial and behavioural haul-out patterns of harbour seal initiated in 2008 by ISC and IFF will continue the following years. The efficiency of presenting codes of conducts to tourists on signs was investigated during 2014-2015 (Marschall, 2015, MSC thesis). A study of the potential effect of boat-based seal watching on seal behaviour is ongoing. The perception of marine mammal watching tourists towards marine mammal conservation and management in Iceland is being investigated by ISC and IFF in co-operation with Stockholm University.

An investigation on the timing of birth among harbour seals in the north western part of Iceland is conducted at the moment at the ISC. In addition, data of abundance and haul-out patterns of harbour seals at Vatnsnes peninsula is being analysed at the ISC and results will soon be published.

Cetaceans

During June-August 2015, the MRI participated in a large scale cetacean sightings survey (NASS-2015) conducted in cooperation with the Faroes, Greenland and Norway under coordination of the NAMMCO Scientific Committee. The Icelandic part of the survey was conducted from two research vessels and one aircraft.

The MRI continued their biological sampling from the harvested fin and minke whales. MRI has established research cooperation with the University of Barcelona using stable isotopes and trace elements in baleen plates, as a continuous-time recorder of seasonal migration.
A three-year MRI project on the acoustic and feeding behaviour of killer whales in Icelandic waters will be concluded in 2015.

Photo-identification studies and behavioural observations using whale watching vessels as a platform for observations continued in Faxaflói and Skjálfandi bays by the UIRCH, HWM and FCR. The blue whale research project conducted in cooperation between UIRCH and MRI continued in 2015.

IV ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

Pinnipeds

MRI and ISC have underlined the importance of improved legislation regarding catch reports of pinnipeds in Iceland. While the MRI is the official advisory body regarding conservation and management of pinnipeds, the institute has through the years not received any funding for seal research as research responsibilities lie elsewhere, primarily with the ISC. Currently, an efficient reporting system for hunted seals is lacking in Iceland and hunters are not obliged to report catches. Although the reporting of by-catch, including marine mammals, is mandatory according to Icelandic law, the realized reporting is not considered reliable. The MRI has in recent years made attempts to estimate by-catch of marine mammals and seabirds (Gunnlaugsson et al. 2014, Pálsson et al. 2015) and will continue these efforts to improve the estimates.

The most recent abundance estimates for Icelandic harbour and grey seals are from 2011 and 2012 respectively. According to these surveys abundance of both species has declined and was close to the levels identified in the management objectives by the Icelandic authorities. While the ISC and MRI have stressed the importance of close monitoring of both populations, insufficient funding has been received for full scale surveys. Results from the partial counting survey of harbour seals in 2014 shows a severe decrease in numbers of seals in the most important haul-out areas and hence indicate a decrease in the harbour seal population in general. Given uncertainties in a) the sizes of grey seals and harbour seals stocks, b) the number of hunted seals and c) the number of net entangled animals, the MRI and SCI concluded that it is not possible to predict whether the observed decline in abundance in the past will continue. Hence, in it's advice to the government in 2015 the MRI declared that in the absence of new abundance estimates it was unable to evaluate whether the existing management objectives of grey seals and harbour seals are being met.

Aerial surveys of both populations are planned for 2016, if funds will be available.

Cetaceans

Based on assessments conducted by the Scientific Committees of NAMMCO and the IWC, the MRI recommended that annual catches in 2014-2015 do not exceed 154 fin whales on the traditional whaling grounds west of Iceland (West Iceland Small Area). On the same basis the MRI recommended maximum annual takes of 229 common minke whales in the Icelandic continental shelf (CIC) area, and 121 animals in the CM area (Jan Mayen) in 2014 and 2015.

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VI APPENDIX 1 - CATCH DATA

Cetacean catch in coastal Icelandic waters in the 2014 summer season.

Species (latin name)	**Year or Season**	**Stock Area / Region or Management Area**	**Catch or Strikes incl. Losses**			**Quota if applicable**		
			Male	**Female**	**Total incl. Unkn.**	**Male**	**Female**	**Total**
Balaenoptera acutorostrata	2014	Icelandic waters	16	7	24			229
Balaenoptera physalus	2014	Icelandic waters	80	54	137			154

Reported direct catches of pinnipeds in Icelandic waters in 2014. Catch reporting of seals is not mandatory in Iceland and the level of underreporting is unknown.

Species	Area	Unspecified	Pups	Older	Total
Harbour seal	Coastal Iceland	37	24	142	203
Grey seal	Coastal Iceland		1		1
Unspecified seal	Coastal Iceland	27			27

VII APPENDIX 2 - By-CATCH DATA

In 2014 information on marine mammal by-catch was obtained from all MRI research surveys, inspectors in the Fishery Directorate's observer programme and handwritten logbooks kept by most of the commercial lumpsucker fishery and a few of the gill net fishery boats (9 report some by-catch). Finally, information on by-catch events are received on occasional basis from anecdotal sources, skin trading reports and lists of samples collected by various research groups. Electronic log-book records kept by the rest of the fleet have not been received by the MRI. Total by-catch estimates for 2014 lumpsucker fishery were given in a report to the 21st Scientific Committee meeting (SC/21/11). Monitoring by-catch of pinnipeds is now the responsibility of the ISC where preparations have been made to improve the reporting. Inspectors have now been instructed to report all observed by-catch separately and check the reporting of the catchers.

In 2014 lumpsucker net fishing was rather less than in previous years and out of a total of 210 boats 96 reported some by-catch and inspectors were onboard in 75 trips. The reporting level was higher than in 2013. Gillnet effort (153344 net hauls) was 1/6 the 1991 to 2005 level and the lowest on record.
Reported pinniped by-catch in 2014. Where pups are known they are given separately.

Species	Area	Count	Pups	Gear	Source
Grey seal	Coastal Iceland	3		Gillnet	MRI survey
Harp seal	Coastal Iceland	3		Gillnet	MRI survey
Harbour seal	Coastal Iceland	2		Gillnet	Log books
Harp seal	Coastal Iceland	1		Gillnet	Log books
Unspecified seal	Coastal Iceland	20		Gillnet	Log books
Harbour seal	Coastal Iceland	1		Sein net	Inspector
Grey seal	Coastal Iceland	6		Lumpsucker net	Inspector
Harbour seal	Coastal Iceland	10*		Lumpsucker net	Inspector
Harp seal	Coastal Iceland	1^		Lumpsucker net	Inspector
Ringed seal	Coastal Iceland	2		Lumpsucker net	Inspector
Harbour seal	Coastal Iceland	78	22	Lumpsucker net	Log books
Grey seal	Coastal Iceland	38		Lumpsucker net	Log books
Ringed seal	Coastal Iceland	2		Lumpsucker net	Log books
Harp seal	Coastal Iceland	11		Lumpsucker net	Log books
Unspecified seal	Coastal Iceland	234		Lumpsucker net	Log books

* 7 also reported in log books.
^ 1 also reported in log books.

Reported by-catch of cetaceans by the Icelandic fishing fleet in 2014.

Harbour porpoise	Coastal Iceland	12	Gillnet	MRI survey
Harbour porpoise	Coastal Iceland	5	Gillnet	Inspectors
Harbour porpoise	Coastal Iceland	43	Gillnet	Log books
Unspecified dolphin	Coastal Iceland	2	Gillnet	Log books
Harbour porpoise	Coastal Iceland	6*	Lumpsucker net	Inspectors
Harbour porpoise	Coastal Iceland	124	Lumpsucker net	Log books
Unspecified dolphin	Coastal Iceland	1	Lumpsucker net	Log books

* 4 also reported in log books.

VIII APPENDIX 3 – STRANDINGS

Information on stranded cetaceans in Iceland is compiled by the MRI in cooperation with the INH and other relevant institutions (Table 1). According to an arrangement formally adopted in 2005 the Marine Research Institute is the central authority concerning science and research while other aspects of strandings s.a. euthanasia/rescue, disposal of carcasses and preservation of museum specimens fall under the responsibilities of the Chief Veterinary Office, the Environment Agency of Iceland and INH respectively.

Depending on the condition of the stranded animals and accessability, samples are taken for studies on diet (stomach), life history (teeth, ear plugs, eye lens and gonads), genetics (skin, muscle), energetics (muscle, blubber) and for morbillivirus antigen screening (blood). Various tissue samples for pollution studies have been routinely collected during dissections of stranded or by-caught cetaceans in recent years. These are stored frozen at the MRI. Samples for genetic studies are obtained from most animals.

Cetacean strandings in 2014

Species	Stranding events	No of animals
Sperm whale	3	3
Killer whale	1	1
Humpback whale	2	2
White-beaked dolphin	2	2
Common minke whale	3	3
Long-finned pilot whale	3	3
Unidentified sp	2	2

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NORWAY
PROGRESS REPORT ON MARINE MAMMALS 2014

Compiled by Nils Øien & Tore Haug

I INTRODUCTION

This report summarises Norwegian research on pinnipeds and cetaceans conducted in 2014 and conveyed to the compilators. The research presented here was conducted at, or by representatives and associated groups of:

- The Institute of Marine Research (IMR);
- University of Tromsø (UiT);
- The Norwegian Polar Institute (NP);
- University of Tromsø – The Arctic University of Norway/ Department of Arctic and Marine Biology (UIT-AMB);
- Norwegian University of Life Sciences **-** Laboratory for Environmental Toxicology (Department of Food Safety and Infection Biology) (NMBU);
- Norges Arktiske Universitet, Forskningsgruppe for arktisk infeksjonsbiologi (AIB);
- National Institute of Nutrition and Seafood Research (NIFES).

II RESEARCH BY SPECIES 2014

Pinnipeds

Harp seals *Phoca groenlandica*

In the period 18 March to 1 April 2012 IMR conducted aerial surveys in the Greenland Sea pack-ice (the West Ice) to assess the pup productions of the Greenland Sea populations of **harp** and **hooded seals**. The survey resulted in a total pup production estimate for harp seals of 89,590 (CV = 13.7%), which is lower than estimates obtained in similar surveys in 2002 and 2007. Nevertheless, the assessment model trajectory suggests an increase in the Greenland Sea harp seal population abundance from the 1970s to the present (2013) abundance of 627,410 (95% C.I. 470,540 – 784,280) animals. The total estimate of hooded seal pup production was 13,655 (CV = 13.9%), which is lower than estimates obtained from comparable surveys in 2005 and 2007. Recent analyses have indicated that pregnancy rates have remained rather constant around 70% in the period 1958 – 1999. Using this scenario, the model estimates a 2013 total hooded seal population of 82,830 (95% C.I. 67,104 – 98,573). (IMR)

The use of traditional photo aircrafts to assess seal populations in remote areas, such as the West Ice, is expensive, and has also become more difficult to operate during recent years. With funding from the Norwegian Research Council, IMR has now started experiments with alternative (and cheaper) methods to perform photobased aerial surveys of seals in the West Ice. A research survey was conducted with KV "Svalbard" to the West Ice during 16 to 26 March 2014. The aim of the survey was to test the usefulness of UAVs (Unmanned Aerial Vehicles), operated by the Northern Research Institute (Norut), to perform aerial photographic surveys of **harp** and **hooded seal** whelping patches on the drift ice. Two drones were tested: One small (wingspan 2.10 m) with electromotor and one larger (wingspan 3.80 m) petrol-driven UAV. Digital cameras were used, and the largest UAV was also instrumented with thermal infrared (IR) camera. Both aircrafts were launched by a mechanical launcher from the ship deck. The smaller UAV could be landed on KV Svalbard's helicopter platform, while the larger had to be landed on ice floes, preferably at least 80 m long and 20 m wide. Both UAVs fly along predefined transects and altitudes, both can be changes throughout the flight using satellite based communication. The UAVs are landed manually. The main aim of the pilot investigations in 2014 was to explore various survey altitudes and camera settings to obtain an optimal altitude and camera set up for photographing seal pups. Simultaneous use of digital and IR cameras enabled exploration of combinations of those to detect and classify seals. Experience obtained from using the UAVs and the quality of the images taken, are promising. Both harp and hooded seals, including pups, were easily identified on the images taken at a flight altitude of 300 m (the usual altitude for photographing during traditional surveys). Also preliminary results from the IR camera are promising. It is, however, necessary to improve the range of the largest UAV and the methods for landing the aircraft on ice floes. Also some technical improvements on both aircrafts and operational equipment should be performed. A new survey, building on the experience gained in 2014, will be conducted in the West Ice in 2015. (IMR)

Reproductive samples were taken from about 50 **harp seal** females in the southeastern Barents Sea in early May 2011. Because very few young seals were included in the sample, it could not be used for determination of age at maturity. Pregnancy rate was however estimated at 0.84 (SD=0.11) based on the presence or absence of a regressing *corpus luteum* in 46 adult females. This is significantly higher than a comparable estimate of 0.68 (95% CI=0.12) from 2006, but exactly equal to a fetus-based estimate from 1990-92. A new estimate of age at maturity is 3 years overdue for this stock in order to keep it "data rich" within the ICES framework. (IMR)

IMR **harp** (and **hooded**) **seal** diet data (contents from gastrointestinal tracts and faeces) have been collected in summer 2008 and 2010 along the ice edge east of Greenland between 71°N and 79°N. Most samples were taken in hooded seal moulting areas in the West Ice from 71°N to 73°N. In total, gastrointestinal tract samples were taken from 179 hooded seals and 20 harp seals, additionally 70 faeces samples were taken from harp seals on the ice. The observed diet varied considerably between the two species. Polar cod dominated the hooded seal diet which also included squid and some other fish species. For harp seals, the diet was particularly characterized by the pelagic amphipod *Themisto* sp. In addition the harp seals had taken some krill and polar cod. Squid contributed much less to the hooded seal diet in this study than in previous studies in the same area. (IMR, UiT)

Studies of **hooded seals** and **harp seals** from the Greenland Sea stock were conducted during a research cruise with R/V "Helmer Hanssen" to the Greenland Sea between 20 March and 5 April 2014. Seventeen newborn hooded seals and 2 newborn harp seals were culled for various scientific purposes: i) collection of brain tissue samples for continued studies of mechanisms underlying neuronal tolerance to lack of oxygen (hypoxia) (in collaboration with Dr. T. Burmester, Zoologisches Institut und Museum, Universität Hamburg, Germany and Dr. J. Larson, Psychiatry College of Medicine, University of Illinois, Chicago); ii) various studies of adaptations to fasting and to a pelagic lifestyle in hooded seal pups (the role of the liver as an energy store from birth via weaning and into the post-weaning fast; the role of leptin and its correlation to changes in blood energy substrates (glucose, free fatty acids, ketone bodies) during lactation and fasting; the role of exogenous water sources (snow/ice, sea water) for maintenance of water homeostasis and the potential occurrence of metabolic depression during the post-weaning fast); iii) anatomical studies of the nasal cavity and its complex turbinate structures in hooded seals, for subsequent modelling and assessment of its role in heat and water conservation. (UIT-AMB)

In addition, 6 **harp seals** (3 adult females, 3 newborns) and 5 **hooded seal** pups were live-captured and brought to the animal research facilities at Department of Arctic and Marine Biology (AMB). The harp seals were mainly for use in the Norwegian Research Council-funded research project COEXIST (led by Dr. M. Biuw at Akvaplan-niva and Lars Folkow at UIT-AMB), which deals with development of methodology/technology for studies of the buoyancy, diving and swimming behaviour of harp seals in order to allow more precise assessments of their energy expenditure and, ultimately, of the food requirements of harp seal populations. The hooded seal pups were used for studies of their physiological responses to the post-weaning fast (metabolic and water balance studies). (UIT-AMB)

The described field research was combined with research-based teaching given to 20 students that participated on the cruise, which represents a mandatory part of the course "Arctic Biology" (BIO-2310) at the University of Tromsø -The Arctic University of Norway. (UIT-AMB)

Hooded seals *Cystophora cristata*

For surveys, diet and reproductive research, see under harp seals. (IMR)

Nine samples of milk from Hooded seals (*Cystophora cristata*) were analysed for a large suite of organochlorinated pesticides (OCPs), PCBs, PCP, brominated flame retardants (BFRs) and novel brominated compounds and hydroxymetabolites of PCBs and BFRs. In addition 31 samples of plasma from Hooded seals (*Cystophora cristata*) were analysed for perfluorated compounds (PFASs). The analysed were done in connection to two Master of Science studies by Randi Grønnestad and Karl Johan Ullavik Bakken, at the University of Oslo (UiO). The study was financed by UiO and the Norwegian Polar Institute (NP). (NMBU)

Brucella pinnipedialis:

Post mortem sampling of stomachs of 53 harp seals (*Phoca groenlandica*), both pups (n = 5), yearlings (n =

43) and adults (n = 5), sacrificed during commercial hunting in April-May 2014 was performed. The stomachs and their content will be subjected to PCR analysis for the detection of marine *Brucella* spp. (NMBU)

In the natural environment, pathology in seals due to infection with *B. pinnipedialis* has not been documented. A lack of intracellular survival and multiplication in hooded seal macrophages *in vitro* indicates that *B. pinnipedialis* does not cause chronic infections in hooded seals (*Cystophora cristata*) and additionally is *B. pinnipedialis* from hooded seals shown to be avirulent in an established mouse model. An age related serological and bacteriological pattern for *B. pinnipedialis* in hooded seals might point to a transient infection of environmental origin, possibly through the food chain. (NMBU)

Primary leukocytes were isolated from head kidney of Atlantic cod and challenged with *B. pinnipedialis* from harbor seal (*Phoca vitulina*) and hooded seal in a gentamicin protection assay. By killing the extracellular bacteria with gentamicin prior to harvesting the cells we are able to determine the number of surviving intracellular *brucellae* at fixed time points by plating serial dilutions of the cell lysate. (NMBU)

Atlantic cod (*Gadus morhua*), which is found in hooded seals' diet, was experimentally infected with *B. pinnipedialis* hooded seal (HS) strain. The study is principal of its kind and the aim was to identify whether *B. pinnipedialis* has an extended ecological range including fish as a primary, or possible, transmission host. The fish was challenged with either 10^5 (low dose) or 10^8 (high dose) *B. pinnipedialis* intraperitonally. Samples of blood, liver, spleen, muscle, heart, head kidney, female gonads and feces were collected from 5 fish in each group at day 1, 7, 14 and 28 post infection to determine the bacterial load. Furthermore, the immunoglobulin response toward *B. pinnipedialis* was determined by the use of an ELISA designed specifically for this purpose. The cytokine profile following infection both *in vitro* and *in vivo* are currently being investigated by the use of real-time PCR. (NMBU)

The *in vitro* assays showed that *B. pinnipedialis* harbor seal strain and hooded seal strain were able to enter primary cod head kidney derived macrophages *in vitro*. Both bacterial strains entered the leukocytes and survived intracellularly without any major reduction in retrievable numbers for at least 48 hours. This is in contrast to the rapid elimination of intracellular bacteria from hooded seal alveolar macrophages. (NMBU)

Infected fish in the *in vivo* experiment showed a disseminated infection and an extended period of bacteraemia. Bacteria were found in blood samples from all infected fish at day 1, 7, and 14, and were retrieved from all organs sampled, except muscle, for at least 28 days post infection. No disease or mortality was recorded. A specific immunoglobulin response was detected at day 28 post infection. The *in vitro* assay along with the experimental infection suggests that *B. pinnipedialis* hooded seal strain may have a prolonged course of infection in the Atlantic cod. A sustained bacteraemia points in the same direction. Altogether, our results suggest that Atlantic cod may act as a transmission host for *B. pinnipedialis* hooded seal strain in the marine environment. (NMBU)

Harbour seals *Phoca vitulina*

Harbour seals have been counted along the Norwegian coast during moult (August) in 1996-1999, 2003-2006 and 2011-2014, resulting in respectively about 7500, 6700 and 7500 harbour seals. All known moulting areas along the coast were covered by aerial photo surveys during low tide (± 2 hours). In most areas, two or three independent surveys were conducted. Additionally, visual counts from small boats and islands were carried out in some selected areas. The results suggested an annual reduction by 1-2% between 1996-1999 and 2003-2006. In some areas the numbers were reduced by about 50%. Increased anthropogenic removals, and the phocine distemper virus (PDV) epidemic in the Skagerrak region in 2002, might both have contributed to the observed population decline. However, since the PDV-outbreak in 2002, the numbers of seals have increased the counties Vestfold and Telemark, to respectively 183 and 148 animals in 2014. In Østfold the numbers have been relatively constant around 250 seals in all periods. At the west coast, in the counties Rogaland, Sogn og Fjordane and Møre og Romsdal, 481, 659 (including Sognefjord and Nordfjord) and 689 harbour seals were counted, respectively. In Sør-Trøndelag county 632 harbour seals were observed, which was a significant reduction since 2003-2006 when 1527 seals were counted. Also in Nord-Trøndelag a significant reduction was observed, from 138 in 2003-2006 to 61seals in 2012. In Nordland county, the results in both periods were identical, 2465 seals were observed. In Troms county, an increase from 727 harbour seals in 2003-2006 to 986 in 2012-2013 were observed. In Finnmark county, a total of 981 harbour seals were counted, which includes areas in western part of the county that was not surveyed earlier. (IMR)

The EPIGRAPH project (2008-2011) was built as a comparative study of the ecosystems of two major fjords in Norway: the Porsangerfjord and Hardangerfjord. The project has had a wide focus on all levels of the ecosystem, including, in Porsangerfjord, a study on the ecological role of the top-predator thought to be the most influential in the area: the **harbour seal**. In order to understand the foraging behaviour of this seals' population, the movements of individual harbour seals were analysed and related to the dynamics in the distribution of their potential resources across different seasons. Between 2009 and 2013, 15 harbour seals were equipped with GPS phone tags and data on their movement and diving behaviour collected. First, several methodological issues, related to the interpretation of the seals behaviour at sea, were addressed. A multitude of indices are available in literature to infer foraging behaviour in free ranging diving animals. These indices are generally based on either the horizontal or the vertical movements of the animals. On the horizontal plane, the increase in path tortuosity and residence in given areas have been related to the intensification of the searching activity and therefore to the onset of foraging. In the vertical dimension, longer times spent at the bottom of the dives have been thought to be related to the presence of prey. However, the analysis of the temporal patterns of dives and dive characteristics in this study has shown that in this species a relevant proportion of time is spent resting, not only at haul-out sites, but also at sea, by floating at the surface or during low-activity diving. These behaviours have been found to positively bias the times of residence in certain areas, generating confusion in the detection of foraging from horizontal movements. The study has also shown that, for this coastal species, several other factors can affect the animal's movements and therefore the interpretation of the derived indices for the detection of foraging. In particular, the type of resource targeted and therefore the predatory tactic used (pelagic vs. benthic foraging) has been found to generate variation in the times spent at the bottom of dives. This suggests that several factors affect the seals behaviour while foraging and need to be taken into account when making behavioural inference from movement patterns. The selection of resources was then analysed for this seals' population by comparing the usage to the availability of resources at different scales. Harbour seals are central place foragers and perform regular trips from their haul-out sites to their selected foraging grounds. At the same time, haul-out locations are most likely chosen to be closest to the most profitable foraging areas. Resource selection was therefore analysed both at a small spatial scale, conditional to the haul-out locations, and at the scale of the entire fjord. The results indicate that, while the species behaved as a generalist at a small spatial scale, their large scale foraging grounds were located in the inner parts of the fjord, where the highest biomass concentrations of smaller fish species are to be found. This was confirmed by the results of a small diet study based on harbour seals scats, indicating that harbour seals fed mainly of small codfish, sculpins, and a smaller fraction of pelagic fish such as herring. The response to the changes in resource availability across seasons was as well seen at the home range level, with shifts in haul-out locations following for example the building and retreat of the ice in the inner part of the fjord. (IMR, UIT)

Grey seals *Halichoerus grypus*

Pup production estimation was attempted in Troms and Finnmark counties in late autumn in 2013 but difficult weather conditions made it impossible to carry out the survey. In September-October 2014, the numbers of grey seal pups in the counties Sør-Trøndelag, Nord-Trøndelag and southern parts of Nordland were counted. A significant reduction in the number of pups produced was found. Only about 40 % of the pup number estimated in 2007-2008 was found in 2014. The reduction could most possible be related to high by-catches in gill net fisheries for monk fish. (IMR)

Other species

Research vessels, coastguard vessels and other providers have collected incidental observations of marine mammals. Recorded data include date, position, species and numbers. During 2014, 59 pinniped observations were recorded. Of these, only 2 observations were recorded as **harp seal** groups, but many of the 23 groups recoded just as "seals" are probably this species. Otherwise, 9 **hooded seals**, 4 **bearded seals**, and 19 **walrus** groups were recorded. (IMR)

CETACEANS

Minke whales *Balaenoptera acutorostrata*

The Norwegian **minke whale** DNA register is a data base monitoring commercial harvest and trade of whale products. The register was used in a recent study investigating the genetic structure of northeast Atlantic minke whales. Several previous studies had investigated the population genetic structure within the north Atlantic minke whale with contrasting results. In order to shed further light IMR scientist, in cooperation with Japanese colleagues, conducted a spatial, temporal and cryptic population analysis of 2990 whales harvested in the northeast Atlantic during the period 2004 and 2007–2011. This large data set, which had been genotyped according to strict protocols upon which the Norwegian minke whale DNA register is based, failed to reveal any indication of geographical or temporal population genetic structure within the northeast Atlantic based upon the analysis of ten microsatellites and 331 bp of the mitochondrial D-loop. Furthermore, while three mtDNA lineages were revealed in the data, these did not show any underlying geographic pattern, and possibly represent an ancestral signal. The obtained results give no genetic support to maintain the five management areas in the northeast Atlantic. Anecdotally, north Atlantic minke whales have been suggested to follow an annual migration cycle between Arctic feeding grounds and breeding grounds on lower latitudes. The information on sightings of minke whales at low latitudes is, however very scarce and no breeding grounds have so far been demonstrated. Also, foetuses in different stages of development have been found in catches from the northern feeding grounds, indicating that mating may take place even there and over a long period. The current suggestion of panmixia could therefore be supported by these observations, also implying that separate breeding grounds may not exist. (IMR)

During the periods 16 June to to 24 August 2014, a sighting surveys was conducted with the chartered vessel F/F *Tromsøy* in Svalbard area. The area which was covered was the IWC *Small Area ES* (Svalbard, Greenland Sea) which is part of the Medium Management Area E which comprises waters in the northeast Atlantic. This was the first year of the six-year program 2014-2019 to cover the northeast Atlantic to provide a new abundance estimate of **minke whales** every sixth year as part of the management scheme established for this species. A total of 3,390 nautical miles was surveyed with independent double platforms on primary effort. During primary search effort, the number of observations from the primary platform was 61 sightings of **minke whales**. Sightings of other cetacean species include **fin whales** (112 primary sightings), **humpback whales** (10 primary sightings), **killer whale** (10 primary sightings), **blue whale** (3 primary sightings), **Lagenorhynchus dolphins** (177 primary sightings), and **sperm whale** (22 sightings) (IMR).

Minke whale catch data for the 2014 season have been computerised and evaluated. (IMR)

Killer whales *Orcinus orca*

The traditional perception of prey species preference of **killer whales** in the Northeast Atlantic has, to a large extent, been linked to herring. Few studies have investigated the feeding ecology of killer whales from the offshore parts of this ecosystem. During two summer-season ecosystem-based surveys in the Norwegian Sea (2006 and 2007), using observational, acoustic, oceanographic, plankton net, and pelagic trawl haul data, it was possible to quantify any spatial overlap between killer whales and the three most common and abundant pelagic fish species: herring, mackerel and blue whiting. No spatial relationships were found between killer whales and herring or blue whiting. However, there was a significant relationship and spatial overlap between killer whales and mackerel. Feeding on this epipelagic schooling fish species during summer may incur lower migration costs and higher energetic gain than feeding on alternative prey. Killer whale group size was also correlated to the size of mackerel trawl catches, indicating active group size adjustment to available prey concentrations. (IMR)

Other species

Research vessels, coastguard vessels and other providers have collected incidental observations of marine mammals. Recorded data include date, position, species and numbers. During 2014 a total of 927 cetacean observation incidents have been reported. The most frequently observed species were **minke whales** (213 groups), **Lagenorhynchus dolphins** (255), **fin whales** (64), **humpback whales** (103), **killer whales** (94), **harbour porpoises** (36 groups), **blue whales** (4), **sperm whales** (16), **northern bottlenose whales** (2), **long-finned pilot whales** (32), **bottlenose dolphins** (12), **sei whales** (4), **common dolphins** (14 groups) and **beluga** (2). (IMR)
During 2014 photo IDs have been collected from 4 **blue whales** and more than 400 **humpback whales** during field work and from incidental sources. In addition, biopsy samples have been collected from 9 humpback whales. Satellite tags were applied to one each of humpback, blue and minke whales. (IMR)

During the period 19 August to 6 September 2014 R/V *Helmer Hansen* conducted an Arctic survey north and west of Spitsbergen. Due to unusually heavy ice conditions north of Svalbard the survey did not extend as far north as planned. Few cetaceans were seen to the west, however, there were concentrations seen in the north off Hinlopen canyon, especially large whales. The whales were associated with high krill abundance (shown both by acoustics and trawling) and 36 blue whales, 37 fin whales and 21 humpback whales were recorded over a relatively small area. (IMR)

III ONGOING (CURRENT) RESEARCH

Pinnipeds

Walrus *Odobenus rosmarus*

Field work was carried out in the area of Tusenøyane in Svalbard in July 2014, where 20 male **walruses** were equipped with newly developed GPS-loggers. These were attached to the tusks of the animals and are designed to store 1 GPS position per hour for at least 5 years. Data has to be downloaded to stationary receiving stations placed on the five camera masts used for camera surveillance of walrus haul-out behaviour (see below) or to mobile stations brought along in the field. Various blood and other tissue samples were also collected from these walruses for various studies of health, pollution, diet etc.

The camera surveillance of **walrus** haul-out sites continued. Digital cameras taking pictures hourly were deployed on 5 different walrus haul-out sites during the period late June - early October to study haul-out behaviour and potential impact of visiting tourists to these sites. (NP)

Antarctic fur seals *Arctocephalus gazella* and Southern elephant seals *Mirounga leonina*:
Expedition to Bouvetøya December 2014-february 2015. CEMP monitoring of Antarctic fur seals. Also several scientific projects initiated on these two seal species on tracking, diet, population dynamics, pollution, genetics and others. (NP)

Analyses of **hooded seal** reproduction data (historical as well as new, sampled in 2008 and 2010) from the Greenland Sea are in progress. (IMR)

Analyses of historical and new data on demography and reproduction of **harp seals** in the Greenland Sea and Barents Sea / White Sea are in progress. (IMR)

Experiments to test the usefulness of UAVs (Unmanned Aerial Vehicles) to perform aerial photographic surveys of **harp** and **hooded seal** whelping patches on the drift ice, continues. (IMR)

Collection of material to assess efficiency and animal welfare issues in the Norwegian commercial sealing of **harp seals** in the Greenland Sea in April/May was started in 2013 and is still in progress. (IMR)

Final analyses of **grey seal** diet data from the Norwegian coast are inm progress, an article will be submitted. (IMR)

Genetic and population studies of **harbour** and **grey seals** continue. (IMR)

Ecological studies designed to provide data on habitat use, diet and food consumption of **harbour seals** will be continued in North Norway. (IMR, UIT)

Comparison of the ecological role of **minke whales** and **harp seals** in the Barents Sea, using fatty acid composition and stable isotopes, are in progress. Material for the study was collected in 2011. (IMR – UIT – NPI - APN)

Various aspects of **minke whale** genetics, using data from the Norwegian DNA register, are being studied in work in progress. (IMR)

Ship based registrations of **grey seal** pups, including tagging, counting and staging of pups, will be conducted in Nordland, Troms and Finnmark during the period September-December 2015. This is the second of a three year program aimed to provide a new abundance estimate for the species along the entire Norwegian coast from Rogaland county in the south to Finnmark county in the north. All known and many other potential whelping areas along the Norwegian coast will be surveyed. (IMR)

Previous studies in **hooded seals** have shown that their brain is unusually tolerant to lack of oxygen (hypoxia). Electrophysiological and biochemical studies of *in vitro* neuronal responses to hypoxic insult have been continued using fresh brain tissue from **hooded seals**, as part of ongoing collaborative studies (with Dr. T. Burmester, University of Hamburg, Germany, and Dr. John Larson, Psychiatry College of Medicine, University of Illinois, Chicago) on the tolerance to hypoxia and to reactive oxygen species in the brain of diving mammals. In particular, investigations into the *hippocampus* and its responses to hypoxia have been conducted, in order to elucidate how neural function, including synaptic transmission is affected under these conditions. Analyses of previously collected samples aimed at investigating the dynamics of the cerebral release of excitatory and inhibitory neurotransmitters during hypoxia exposure and their potential role in explaining pinniped neural hypoxia tolerance are also under way. These studies are part of a PhD-project. (UIT-AMB)

Various studies of adaptations to fasting and to a pelagic lifestyle in **hooded seal** pups were continued, based on samples collected in the field and on live animal studies in the lab (5 hooded seal pups). These studies include investigations into

- the role of the liver as an energy store from birth via weaning and into the post-weaning fast;
- the role of leptin and its correlation to changes in blood energy substrates (glucose, free fatty acids, ketone bodies) during lactation and fasting;
- role of exogenous water sources (snow/ice, sea water) for maintenance of water homeostasis and the potential occurrence of metabolic depression during the post-weaning fast

These projects all represent M.Sc. projects for 3 students who have not yet completed their studies. Results are, hence, under way. (UIT-AMB)

Three adult harp seals and three yearling pups that were captured in the Greenland Sea have been trained intensively to perform various tasks on command, which is a necessity for conducting parallel accelerometer and respirometry studies as part of the COEXIST project. Simultaneously, a field facility consisting of a large net pen with a respirometry dome installed, in which seals can dive and swim more freely (than in a shallow indoor tank) while their metabolic rate is measured, was established in nearby Kaldfjorden. Initial experiments have been conducted with the youngest seals, with promising results, but data analyses are yet to be performed. (Akvaplan-niva/UIT-AMB)

Lymphocytes were isolated from the peripheral blood of captive hooded seals that were culled for other purposes and then exposed to increasing concentrations of various contaminants (perifluorinated compunds (PFCs)) in order to assess the effects of environmental toxicants on their immune system. Parallel studies were conducted using mouse lymphocytes. The preliminary results suggest that the mouse model does not always correctly predict the effects in pinnipeds species, underlining the importance of assessing the immunotoxic potential of contaminants in the relevant species. Also, effects on the pinniped immune function were found upon in vitro exposure to PFCs at similar concentrations found in the blood of wild animals, suggesting that these may be at risk for immunotoxic effects upon natural exposure. This work is collaboration between the Department of Pathobiology and Veterinary Science, University of Connecticut, USA, Department of Bioscience at Aarhus University, Denmark, and UIT-AMB.

Analysis of lipid soluble persistent organic pollutants (POPs) in milk of hooded seal (Cystophora cristata) and investigation of maternal milk transfer of lipid soluble POPs as well as their phenolic metabolites - a Master's degree project, Master of Science in Environmental Toxicology. Master's student: Karl Johan Ullavik Bakken, Department of Bioscience (IBV), University of Oslo (UiO). (NMBU)

Levels and maternal transfer of per – and polyfluorinated compounds in Hooded seal (Cystophora cristata) mother-pup pairs: PFC analyses in plasma and milk - a Master's degree project, Master of Science in Environmental Toxicology, Department of Biosciences (IBV), University of Oslo (UiO). Master's student: Randi Grønnestad. (NMBU)

Present studies aim to provide knowledge of a possible environmental niche of *B. pinnipedialis*. An extended *in vivo* infection including 360 cods are presently being conducted. This current experimental infection has an extended length to further evaluate the chronicity of the infection, as well as investigation of possible contamination of naive uninfected in-contact fish. The effect of increased water temperature in the development of disease following infection with *B. pinnipedialis* hooded seal strain is also examined. Environmental samples (algae/phytoplankton, crustaceans) from the West-Ice area will be evaluated for the presence of marine *Brucella* spp. Survival of marine *Brucella* spp. in a sea-water model and protein expression profiling (proteomics) during starvation are currently investigated by our collaboration partner in Germany (Federal Institute of Risk Assessment (BfR), Berlin). (NMBU)

Cetaceans

Four acoustic recorders (AURALs) listening for **bowhead whales** *Balaena mysticetus*, **white whales** *Delphinapterus leucas* **and narwhals** *Monodon monoceros* (but also other species- and sounds) was deployed autumn 2013 and was retrieved during autumn 2014. One AURAL was deployed in the Framstrait, one on the continental slope north of Svalbard, one in the mouth of Kongsfjorden and one north of Rijpfjorden. Data was downloaded and the AURALs redeployed. (NP)

The **white whale** programme continued in 2014. The purpose of this programme was 1. Determine space use (satellite telemetry) over the entire annual cycle - to discern how these whales move in relation to sea ice, bathymetry, glacier fronts and oceanographic conditions, 2. Assess diet via stable isotope and fatty acid analyses bases on blood and blubber samples from live-captured whales, 3. Update the general health status of Svalbard's white whales based on screening of serum samples, 4. Conduct a screening of levels of various pollutants based on blood and blubber samples from live-captured whales. A total of 11 animals have been instrumented and sampled for blood and blubber for the various aspects of this programme so far. (NP)

Whale oil has been associated with various positive health effects. Since Dr. Bjørkkjær wrote his paper in 2010, several research and developmental projects in Norway have led to the first generation of capsuled whale oil, protein and balenine in addition to the traditional whale meat products from the small-type minke whaling. Investigations are going on in cooperation with "Myklebust Hvalprodukter", one of the biggest whale meat producers, to increase knowledge of health effects of whale products. (NIFES)

Abundance data collected during recent sightings surveys on large whales and odontocetes are being analysed with respect to distribution and trend information. Whale sightings collected during ecosystem surveys are analysed with respect to relative abundance and distribution patterns. (IMR)

Local abundance, migration and habitat use of **humpback whales** in the Barents Sea are studied based on photo ID (IMR) and population structure by genetic analyses of biopsy samples (IMR and University of Gröningen, Palsbøll).

IV ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

Sealing

Advice on the management of harp and hooded seals is based on deliberations in the ICES Working Group on Harp and Hooded Seals (WGHARP). WGHARP met during 26-30 August 2013 at PINRO, Murmansk, Russia, to assess the status and harvest potential of stocks of Greenland Sea harp and hooded seals and harp seals in the White Sea. The advice given by ICES in September 2013, based on the 2013 WGHARP meeting, were used by the Joint Norwegian-Russian Fisheries Commission to establish management advice for 2015.

The basis for the advice was a request from Norway in September 2012 where ICES was requested to assess the status and harvest potential of harp seal stocks in the Greenland Sea and White Sea/Barents Sea and of the hooded seal stocks in the Greenland Sea, and to assess the impact on the harp seal stocks in the Greenland Sea and the White Sea/Barents Sea of an annual harvest of: 1) Current harvest levels; 2) Sustainable catches (defined as the fixed annual catches that stabilizes the future 1+ population); 3) Catches that would reduce the population over a 10-year period in such a manner that it would remain above a level of 70% of current level with 80% probability.

ICES have developed a Precautionary harvest strategy for the management of harp and hooded seals. The strategy includes two precautionary and one conservation (limit) reference levels. The reference levels relate to the pristine population size, which is the population that would be present on average in the absence of exploitation, or a proxy of the pristine population (which in practical terms is referred to as the maximum population size historically observed, N_{max}). A conservation, or lower limit reference point, N_{lim}, identifies the lowest population size which should be avoided with high probability. The first precautionary reference level is established at 70% (N_{70}) of N_{max}.When the population is between N_{70} and N_{max}, harvest levels may be decided that stabilise, reduce or increase the population, so long as the population remains above the N_{70} level. ICES has suggested that this could be done by designing the TAC to satisfy a specific risk criterion which implicate

80% probability of remaining above N_{70} over a 10-year period. When a population falls below the N_{70} level, conservation objectives are required to allow the population to recover to above the precautionary (N_{70}) reference level. N_{50} is a second precautionary reference point where more strict control rules must be implemented, whereas the N_{lim} reference point (set by ICES at 30% (N_{30}) of N_{max}) is the ultimate limit point at which all harvest must be stopped.

The ICES management of harp and hooded seals require that the populations in question are defined as "data rich". Data rich stocks should have data available for estimating abundance where a time series of at least three abundance estimates should be available spanning a period of 10-15 years with surveys separated by 2-5 years, the most recent abundance estimates should be prepared from surveys and supporting data (e.g., birth and mortality estimates) that are no more than 5 years old. Stocks whose abundance estimates do not meet all these criteria are considered "data poor", and should be managed more conservatively.

Population assessments were based on a population model that estimates the current total population size, incorporating historical catch data, estimates of pup production and historical values of reproductive rates. The modelled abundance is projected into the future to provide a future population size for which statistical uncertainty is provided for various sets of catch options. In case of "data poor" populations, catch limits are estimated using the more conservative Potential Biological Removal (PBR) approach.

Using the population assessment model, the size of the **Greenland Sea harp seal** population was estimated at 627 410 (95% C.I. 470 540 – 784 280) animals in 2013. ICES consider this population to be data rich, and above the N_{70} level (i.e., more than 70% of known maximum abundance measured). Thus, it is appropriate to provide catch advice using the assessment model and to apply the Precautionary harvest strategy. Current catch level will likely result in an increase in population size of 21% over the 10 years period 2013-2023, whereas a catch of 14 600 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), per year would sustain the population at present level over the same period. Catches that would reduce the population over a 10-year period in such a manner that it would remain above a level of 70% of current level with 80% probability are 21 270 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), in 2014 and subsequent years. Any allowable catch should be contingent on an adequate monitoring scheme to detect adverse impacts before it is too late for them to be reversed, particularly if the TAC is set at a level where a decline is expected.

Recent Russian aerial surveys of the **White Sea/Barents Sea harp** seal stock suggest that there may have been a drop in pup production of since 2003. As a result of the 2009 and 2010 surveys, ICES have suggested that the reduced pup production observed since 2004 does not appear to be a result of poor survey timing, poor counting of imagery, disappearance or mortality of pups prior to the survey or increased adult mortality. The most likely explanation for the change in pup production seems to be a decline in the reproductive state of females.

The population assessment model used for the White Sea/Barents Sea harp seal population provided a poor fit to the pup production survey data. Nevertheless, ICES decided to use the model which estimated a total 2013 abundance of 1 419 800 (95% C.I. 1 266 910 – 1 572 690) seals. Based on current data availability, the Barents Sea / White Sea harp seal population is considered to be "data poor". The modelled total population in 2013 is estimated to be about 83% of N_{max}. Current catch level will likely result in an increase in the population size of 13% over the 10 year period 2013-2023. The equilibrium catch level is 17 400 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), in 2014 and subsequent years. A catch level of 26 650 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups) will bring the population size down to N_{70} with a probability 0.8 within 10 years. The PBR removals are estimated to be 40 430 (14% pups) seals. This catch option indicates a 16% reduction of the 1+ population over the next 10 year period. Despite the fact that this population is now classified as data poor, ICES expressed concerns over the high removals and declining population resulting from the PBR estimations, and concluded that the estimated equilibrium catches were the most preferred option.

Results from the most recent (2012) pup survey suggest that current **Greenland Sea hooded seal** pup production remains very low, and lower than observed in comparable surveys in 1997, 2005 and 2007. Due to some uncertainty regarding the historical data on pregnancy rates, the population model was run for a range of pregnancy rates (assuming that 50%, 70% or 90% of the mature females produced offspring, respectively). All model runs indicated a population currently well below N_{30} (30% of largest observed population size). Recent analyses have indicated that pregnancy rates have remained rather constant around 70% in the period 1958 – 1999. Using this scenario, the model estimates a 2013 total population of 82 830 (95% C.I. 67 104 – 98 573). Following the Precautionary harvest strategy and the fact that the population is below N_{lim}, ICES recommend that no harvest be allowed for Greenland Sea hooded seals at this time.

Traditionally, both Russia and Norway have participated in the sealing operations in the West Ice and the East Ice and have, therefore, allocated quotas on a bilateral basis in negotiations in the Joint Norwegian-Russian Fisheries Commission. However, the Russians cancelled their sealing operations in the West Ice in 2001. The Norwegian shares of the 2015 quotas would be the total TAC of harp seals in the West Ice. In the East Ice, the Norwegian quota was set at 7,000 harp seals.

In 1996 new regulations for the **coastal seal hunt**, including catch reports, were introduced. Quotas were set based on the available information on seal abundance along the coast. In 2003, quotas were increased substantially compared to the recommendations based on scientific advice, when they were set at 1186 grey seals (25% of abundance estimate) and 949 harbour seals (13% of abundance estimate). In 2003-2010, annual catches varied between 302-516 grey seals and 457-905 harbour seals. In 2010, new management plans for harbour and grey seals were implemented. The goal is to ensure sustainable populations of grey and harbour seals within their natural distribution areas. Regulating measures should be designed to ensure that they have the greatest impact in areas where there is documented significant damage to the fishing industry caused by seals. Target population sizes were decided to be 7000 harbour seals counted during moult and a grey seal population producing 1200 pups annually along the Norwegian coast. Hunting quotas should be set in order to regulate the seal populations in relation to the target levels. For 2011, quota for harbour seals was set to 460 and 230 seals were taken. For grey seals recommended quota was 460, set quota was 1040 but only 111 grey seals were taken. Compensations paid for shot seals were stopped for 2011. For 2012, 2013 and 2014, recommended and set quotas were 460, 482 and 425 harbour seals, respectively, and 460 grey seals in all years. Compensations paid for shot seals were again introduced in 2012 (250 NOK/seal): 355 harbour seals and 64 grey seals were taken in 2012; 483 harbour seals and 177 grey seals in 2013; 406 harbour seals and 213 grey seals in 2014.

Whaling

At the IWC Annual Meeting in 1992 Norway stated that it intended to reopen the traditional **minke** whaling in 1993. So far, IWC has accepted the RMP developed by its Scientific Committee as a basis for future management decisions but has not implemented the procedure. The Norwegian Government therefore decided to set quotas for the 1993 and following seasons based on RMP, with parameters tuned to the cautious approach level as expressed by the Commission and using the best current abundance estimates as judged by the IWC Scientific Committee. In recent years research has been conducted on modification and retuning of the procedure to other target levels than the original 0.72, chosen by the Commission.

Starting in 2009, a new five-year block quota was set with an annual total catch quota of 885 animals of which 750 could be taken within the Northeastern stock area (the E Small Areas, i.e. the EW, EN, ES and EB Small Areas) and 135 within the CM area of the Central **minke whale** stock. The catch quotas are set for each of the five management areas, and the whaling within an area is stopped when this quota limit is reached. On the other hand, untaken quotas may be transferred to following years within the time period which the block quota is set for.

For 2014 the total catch quota was set to 1286 **minke whales** (including transfers), the same as for 2013. The catching season opened April 1 and was closed medio September 2014.

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VI APPENDIX 1 – CATCH DATA

Sealing

Norwegian catches in the Greenland Sea in 2014 was taken by 3 vessels, whereas no Russian seal vessels participated in the area. Due to the uncertain status for Greenland Sea hooded seals, no animals of the species were permitted taken in the ordinary hunt operations in 2014. Only some animals were taken for scientific purposes. The 2014 TAC for harp seals in the Greenland Sea was set at 21 270 1+ animals (where 2 pups balance one 1+ animal), i.e. the removal level that would reduce the population with 30% over the next 10 year period.

A possible reduction in harp seal pup production in the White Sea may have prevailed after 2003. Due to concern over this, ICES recommended that removals be restricted to the estimated sustainable equilibrium level of 17,400 1+ animals (where 2 pups balance one 1+ animal) in the White and Barents Sea in 2014. The Joint Norwegian-Russian Fisheries Commission has followed this request and allocated 7,000 seals of this TAC to Norway.

Table IV.I shows the Norwegian catches of harp and hooded seals in 2014. The total quotas given were not fulfilled in any area: In the West Ice, 33% of the given harp seal quota was taken. Russian sealing in 2014 was planned to be continued using the new boat-based approach introduced in the White Sea catch in 2008. This catch, using ice class vessels fitted with small catcher boats, would focus primarily on weaned pups (beaters), to a much less extent on adult seals. No white-coats would be taken. However, as was also the case in 2009-

2013, Russian authorities implemented a ban of all White Sea pup catches. Despite considerable effort from PINRO specialists to explain that a sustainable harvest from the population would be perfectly possible, the Russian authorities concluded that all pup catches in the White Sea should be banned in 2014. Due to this, there were no commercial Russian harp seal catches in the White Sea in 2014. No Norwegian vessel aimed for this hunting area in 2014.

Table IV.1. Norwegian catches of harp and hooded seals in 2014. 1+ means one year old or older seals.

Catching area:	*The West Ice*			*The East Ice*		
Species	Pups	1+	Total	Pups	1+	Total
Harp seals	9,741	2,245	11,986	0	0	0
Hooded seals	24	0	24			

Whaling

After a temporary suspension, the traditional small type Norwegian **minke whaling** was again permitted in 1993 and quotas were implemented based on the Revised Management Procedure (RMP) developed by the International Whaling Commission's (IWC) Scientific Committee. The RMP allocates catch quotas to specific management areas. There are five such management areas within the region of interest to Norwegian whalers. The present areas are a revision of the original implementation and introduced by the IWC/SC at their Implementation Review of North Atlantic minke whales conducted at the 2003 Annual Meeting and later kept at the Implementation Review made in 2008. The areas are (1) the Svalbard-Bear Island area (coded ES), (2) the eastern Barents Sea (EB), (3) the Norwegian Sea and coastal zones off North Norway, including the Lofoten area (EW), (4) the North Sea (EN) and (5) the western Norwegian Sea-Jan Mayen area (CM).

In total, 21 vessels participated in the 2014 season of whaling and the catching period was 1 April to mid September. Table IV.2 shows the number of minke whales taken by area in the 2014 season. The quotas are given as five-year block quotas but is not fully utilised in all areas. There are several reasons for that, including problems with processing the catches and accessing remote areas like the Jan Mayen area and the eastern Barents Sea. The present five-year quota period started in 2009 and is given as annual basic quotas of 885 animals within Medium Area E and 135 whales within the Small Area CM, plus numbers not taken in previous years.

Table VI.2. Quotas and catches of minke whales in 2014 by management area as defined in RMP.

2013	Management area					
Small-type whaling	EB	EN	ES	EW	CM	Total
Catch	108	20	377	231	0	**736**
Quota						1286
Stock area	Northeastern				Central	

VII APPENDIX 2 – BY-CATCH DATA

Harbour porpoises are caught in gillnets in the coastal fisheries. To estimate the total by-catch of harbour porpoises in fisheries for cod and angler fish along the coast, data collected by contracted small vessels in the Coastal Reference Fleet (CRF) which use the same nets as the commercial coastal fleet, have been used. Estimated porpoise catch rates relative to catches of cod and angler fish in the CRF are being used to extrapolate to the entire commercial coastal fleet based on their total catches of cod and angler fish. Furthermore, detailed information from the CRF about the fishing operation allowed to identify influential factors potentially relevant as mitigation factors. Such factors include bottom depth were nets were set, net soaking times and geographic and seasonal variation in by-catch rates. The analyses indicate very high by-catch rates of harbour porpoises (Bjørge et al. 2013). The analysis work is ongoing.

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