

REPORT
of the
NAMMCO SCIENTIFIC COMMITTEE
WORKING GROUP ON 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.

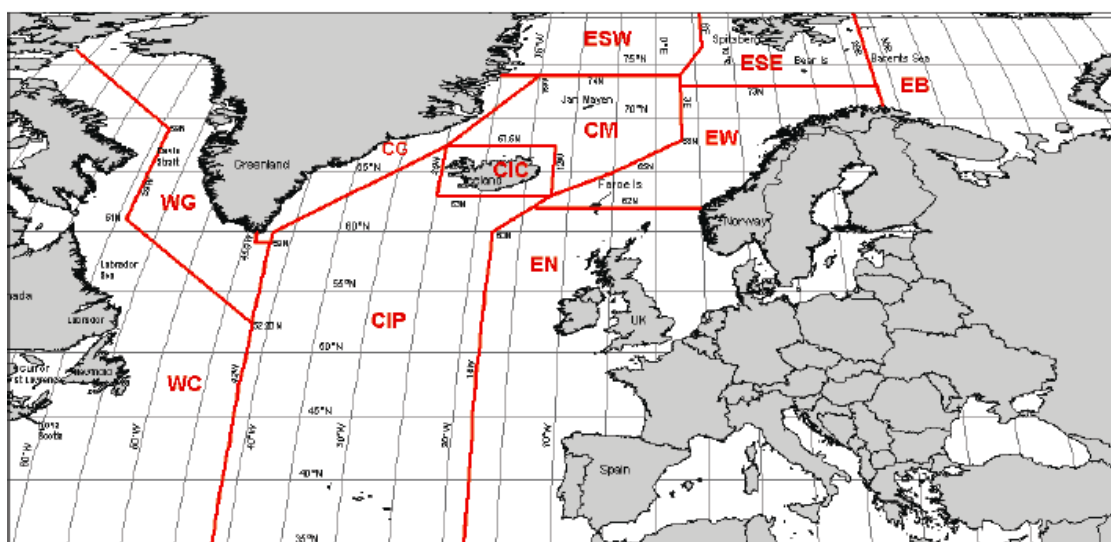


Fig. 1. Map of the North Atlantic showing the *sub-areas* defined for the North Atlantic common minke whales.

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.

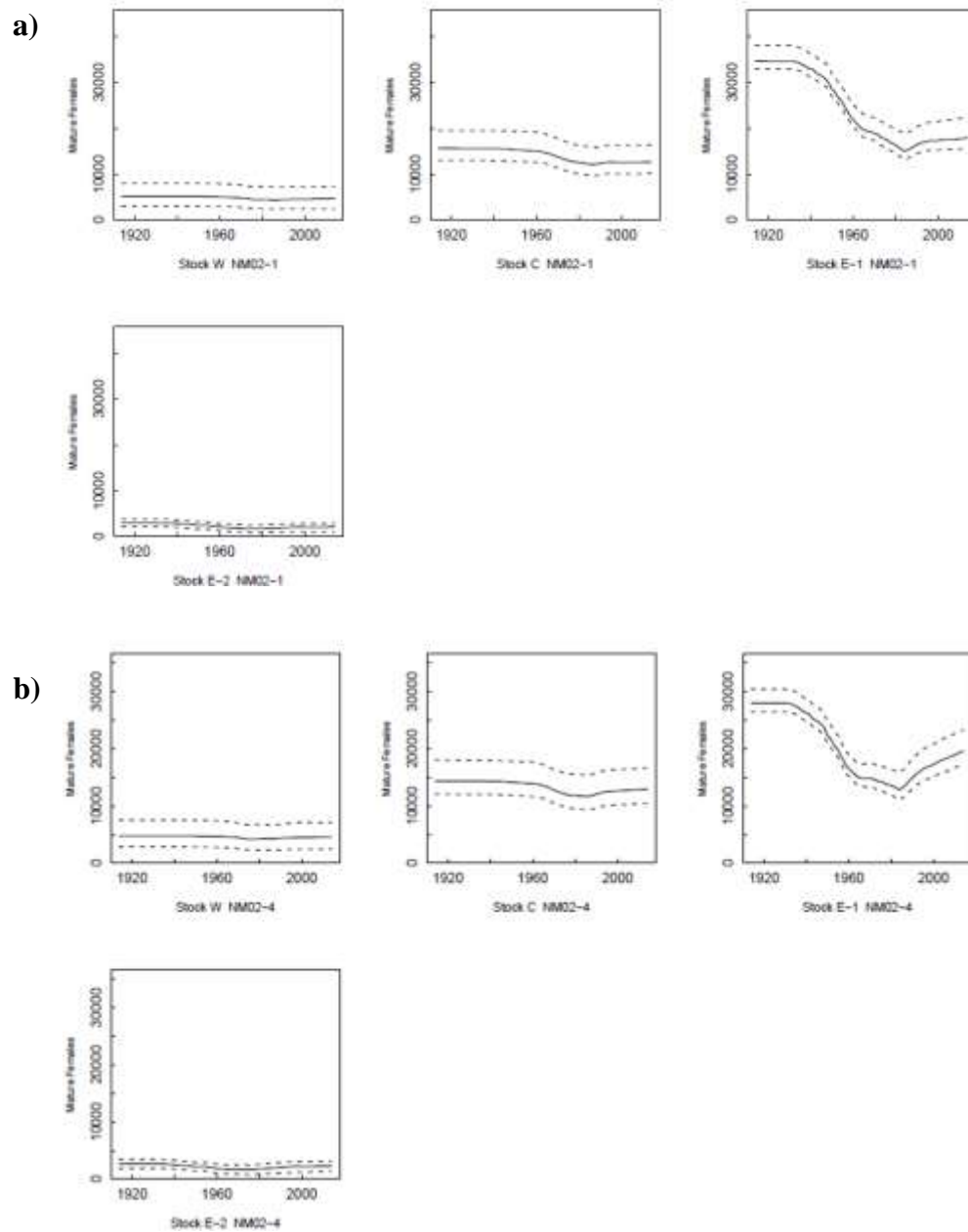


Fig. 2. From IWC (2015) Annex D, Appendix 5. a) NM02-1 median and 90%ile on mature female population for $MSYR_{1+}=1\%$, b) NM02-4; median & 90%ile mature female populations for $MSYR_{mat}=4\%$ by (sub-)stock for North Atlantic common minke whales

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).

Rationale

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*.

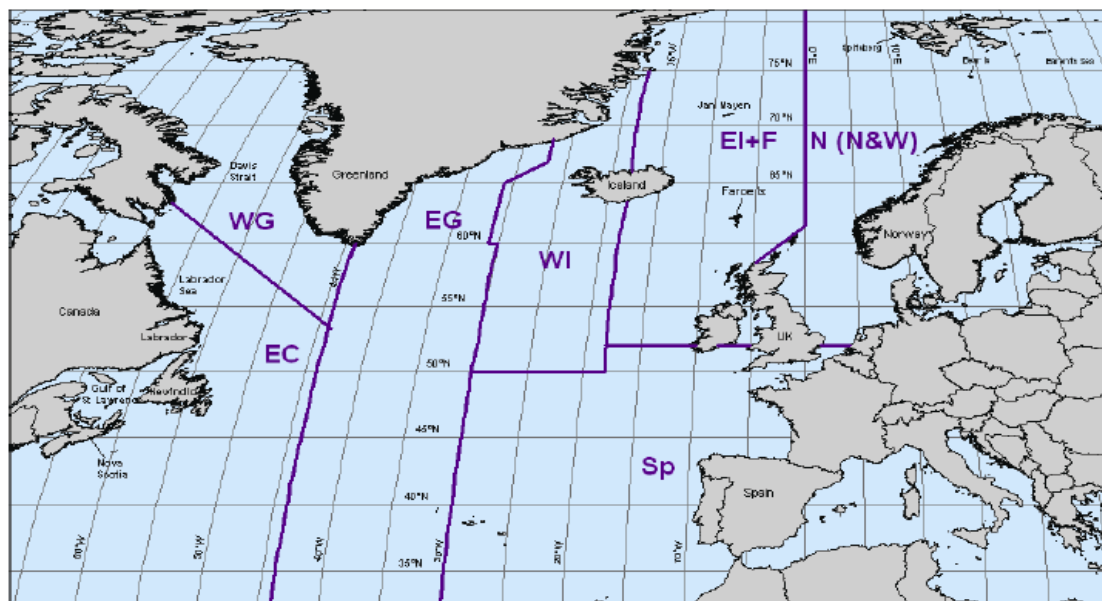


Fig. 3. Map of the North Atlantic showing the *sub-areas* defined for the North Atlantic fin whales

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 decrease 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).

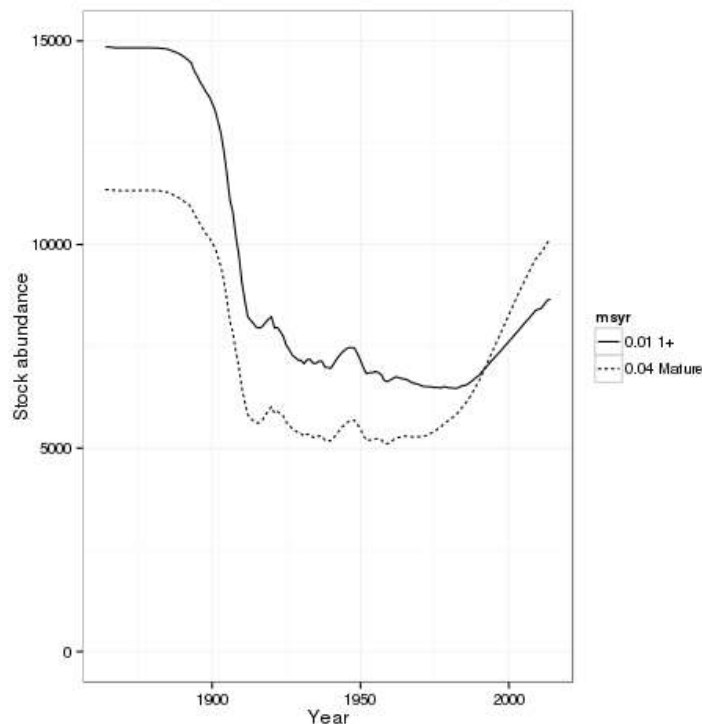


Fig. 4. Mature female population trajectories, estimated for the purposes of *Implementation Simulation Trials*, for the three central sub stocks combined for stock structure Hypothesis III for different MSYR rates.

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.

References

- International Whaling Commission (2014) Report of the AWMP/RMP Joint Workshop on the stock structure of North Atlantic common minke whales. SC/65b/REP04
- International Whaling Commission (2015) Scientific Committee Report 66a. San Diego, CA.
- NAMMCO (2003) NAMMCO Annual Report 2003. North Atlantic Marine Mammal Commission, Tromsø, Norway, 373 pp.
- NAMMCO (2009) NAMMCO Annual Report 2009. North Atlantic Marine Mammal Commission, Tromsø, Norway, 529 pp.
- NAMMCO (2010) Report of the NAMMCO Scientific Committee Working Group on Assessment. 9 - 11 March 2010, Copenhagen, Denmark
- Víkingsson GA, Pike DG, Desportes G, Øien N, Gunnlaugsson T and Bloch D (2009) Distribution and abundance of fin whales (*Balaenoptera physalus*) in the Northeast and Central Atlantic as inferred from the North Atlantic Sightings Surveys 1987-2001. *NAMMCO Sci. Publ.* 7:49-72.
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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**
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