

Report of the Scientific Committee

Bled, Slovenia, 24 April-6 May 2018

Annex E Report of the Standing Working Group on Aboriginal Subsistence Whaling Management Procedures

**This report is presented as it was at SC/67b.
There may be further editorial changes (e.g. updated references, tables, figures)
made before publication.**

**International Whaling Commission
Bled, Slovenia, 2018**

Annex E

Report of the Standing Working Group on Aboriginal Subsistence Whaling Management Procedures

Members: Donovan (Convenor), Allison, Aoki, Baba, Baird, Bell, Bickham, Brandão, Brandon, Brierley, Brownell, Burkhardt, Butterworth, Cubaynes, De Moor, DeMaster, Doniol-Valcroze, Double, Ferguson, Ferriss, Fortuna, Frey, Gallego, George, Givens, Haug, Hielscher, Holm, Hubbell, Iñíguez, Jaramillo-Legorreta, Johnson, Kitakado, Lang, Litovka, Lundquist, Mallette, Mckinlay, Morishita, Morita, Moronuki, Nelson, Palka, Pastene, Phillips, Punt, Reeves, R., Reeves, S., Ritter, Rodriguez-Fonseca, Rojas Bracho, Safonova, Scordino, Scott, Simmonds, Skaug, Slugina, Smith, Stachowitsch, Stimmelmayer, Suydam, Svoboda, Taylor, Terai, Thomas, Tiedemann, Vikingsson, Wade, Walløe, Walters, Weinrich, Weller, Wilberg, Witting, Zagrebelnyy, Zerbini, Zharikov.

1. INTRODUCTORY ITEMS

1.1 Convenor's opening remarks

Donovan welcomed the participants. The workload this year was immense. Two priority topics are: (1) work towards completion of the remaining *SLAs* for the Greenland hunts; and (2) developing a recommended Aboriginal Whaling Scheme. Both topics have been the subject of intense intersessional work including two workshops in Copenhagen in October 2017 and March 2018, as well as a small technical meeting in December at OSPAR headquarters in London. He stressed that this year, the Commission would be setting new catch/strike limits for all aboriginal subsistence hunts and therefore the third major topic is to provide advice on these. Finally, the SWG will try to complete the *Implementation Review* for Bering-Chukchi-Bering Sea (B-C-B) bowhead whales. He also reminded participants that we will need to provide a two-year workplan and budget.

Donovan noted that Cherry Allison was unable to attend the meeting in person this year and thanked her greatly for all the intersessional work undertaken as well as providing tremendous support from Cambridge. He also thanked Punt, de Moor, Brandão, Witting who have stepped up even more than usual with computing assistance.

He explained that the work of the intersessional Steering Group on developing *SLAs* for the Greenland hunts is ongoing and will continue during this meeting as the report of this group will assist greatly in discussing Item 2. Similarly, the intersessional group on the AWS is continuing and the group's final report will greatly facilitate discussions under Item 3.

1.2 Election of Chair and appointment of rapporteurs

Donovan and Brandon were named co-Chairs. Brandão, Brandon and Givens acted as rapporteurs with the assistance of the Chair.

1.3 Adoption of Agenda

The agenda was adopted. See Appendix 1.

1.4 Documents available

The documents available included SC/67b/AWMP01rev1, SC/67b/AWMP02-08, SC/67b/AWMP10, SC/67b/AWMP12, SC/67b/AWMP13rev1, SC/67b/AWMP14-19, SC/67b/AWMP20rev1, SC/67b/Rep06, and SC/67b/Rep07.

Donovan drew attention to the fact that Canadian scientists had submitted two papers (Frasier *et al.* (2015) [SC/67a/ForInfo31] and Doniol-Valcroze *et al.* (2015) [SC/67b/ForInfo32]) providing abundance estimates for Eastern Canadian-West Greenland bowhead whales. The SWG **greatly appreciated** these contributions.

2. SLA DEVELOPMENT

2.1 Fin whales (Greenland)

2.1.1 Review results of intersessional workshops – SC/67b/Rep06

Donovan presented SC/67b/Rep06 and provided an overview of progress made during two intersessional Workshops and the small working group meeting.

He reported that considerable progress was made in relation to the following|:

- (a) updated abundance estimates (and see Item 5.6.2);
- (b) finalisation of the trial structure;
- (c) review and approval of conditioning;
- (d) initial consideration of new *SLAs* and results.

2.1.2 Review post-Workshop progress

Most of the work undertaken after the final workshop involved *SLA* development. The final trial specifications are provided as Appendix 2. [Table A.XX](#) summarises the main factors considered in the *Evaluation Trials*.

SC/67b/AWMP13 developed a candidate *SLA* for West Greenland fin whales. The new fin whale trials have a large amount of variation in the point estimates of abundance, and the *SLA* takes an inverse variance weighted average of the last three estimates as an estimate of abundance. The strike limit is then calculated as a growth rate fraction of a lower percentile of the abundance measure, conditional on a trend modifier, a snap to need feature, and a protection level. This *SLA* is somewhat simpler than the earlier fin whale *SLAs* developed by Witting. Those fitted a straight line to the abundance estimates in order to obtain a measure of abundance and trend. However, these estimates were unreliable due to the highly variable abundance estimates of the trials. The *SLA* is proposed in three versions, where the D10 statistics for the 5th percentile of the ‘Influx’ trial F34-1 is tuned to 1.0, 0.9 and 0.8 for the medium (B) need envelope.

SC/67b/AWMP15 presented three potential *SLAs* for West Greenlandic fin whales that are based on a weighted-average interim *SLA* which uses all abundance estimates, but earlier abundance estimates are down-weighted compared to more recent ones. An adjustment to the multiplier of the abundance estimate in the interim *SLA* is applied which depends on the trend of the abundance indices. This approach allows for additional reduction of the *Strike Limit* if the time series of abundances shows a reasonably precise downward trend in abundance. Three candidate *SLAs* are tuned to achieve 1.0, 0.9 and 0.8 for the conservation statistic (D10, relative increase) at the lower 5th percentile for the Influx hypothesis trial GF34-1B with an $MSYR_{1+}$ of 1% and the middle need envelope (B) as suggested at the 2018 Workshop (SC/67b/Rep06). Dropping the D10 statistic to 0.8 for this trial improves need satisfaction by all other trials without sacrificing conservation performance (except for the Influx hypothesis trials at $MSYR_{1+} = 1\%$). It was noted that these *SLAs* do not have a snap to need feature.

2.1.3 Review final results and performance

In total, seven potential *SLAs* (which include the ‘Interim’ *SLA* – a modified version of the *Interim SLA* that has been used to provide advice for the last two blocks) were reviewed. As in previous years, an initial examination of the full set of results was undertaken by a ‘winnowing’ group with the aim to focus the SWG to those aspects of the performance of the *SLAs* that needed to be discussed further. Initially, the focus was on projections of the lower 5th percentiles and medians for 1+ population abundance and ‘Zeh’ plots for various performance statistics. Focus was given to the exploration of the univariate performance statistics D1 (final depletion) and D10 at the lower 5th percentile. The desired performance for these statistics is to obtain a value of D10 greater or equal to one and for D1 to be above 0.6 (MSYL). In other words, satisfactory performance on the conservation criteria by an *SLA* is deemed if either the population is not at MSYL but it is increasing or the population is increasing/decreasing but is above MSYL.

Tables which highlighted which *SLA* was performing well or not relative to the ‘best’ performance amongst all the *SLAs* (including the ‘Interim’ *SLA*) were also examined to evaluate the performance of the proposed *SLAs*. Plots of depletion where examined as the conservation statistics are based on this rather than on population abundance numbers. Trials for which at least one of the proposed *SLAs* failed either the D1 or the D10 conservation statistics were highlighted for further investigation (5 trials). Looking at results on a single dimension was not helpful because the D10 statistic does not need to be at or above one if the population is above MSYL. Thus, further focus on the performance of the *SLAs* was placed rather on the joint statistic of D1 and D10 for these 5 trials.

The bivariate plots of the D1 and D10 statistics (see [Fig. B.1](#) Appendix 3) were examined for all the proposed *SLAs*, with a focus on the simulation results in the quadrant in which $D1 < 0.6$ and $D10 < 1$. The counts of the simulations for all *SLAs* that fall in this quadrant were examined to see if this could help to distinguish the performance amongst the different *SLAs*. Examination of these plots concluded that for all the trials that had failed on at least one of the univariate conservation statistics, only trial F34-1C (a low MSYR, high need case for the Influx model) showed unacceptable conservation performance.

The SWG **agreed** that the proposed *SLAs* performed satisfactorily on the joint conservation statistics for the A and B (but not for C) need envelopes for all trials, and the selection between *SLAs* was narrowed down to those that had been tuned to obtain D10 of 0.8 for the more difficult Influx hypothesis trial F34-1B (B0.8 and L0.8). The focus on selecting amongst the *SLAs* should be on the *SLA* that meets need satisfaction best and that also achieves stability in the catches. ‘Zeh’ plots were examined for all trials, concentrating on the need satisfaction statistics, N9(20) the average need satisfaction over the first 20 years, N9(100) the average need satisfaction over the 100 years and N12 the mean downstep statistic, which is a modified average annual variability statistic.

It was noted that because of the present incorporation into the trial structure of the widely different ‘Influx’ and ‘partial’ hypotheses to explain the variability of the abundance estimates, the need satisfaction over 20 years is more appropriate to consider than over 100 years as it is likely that future *Implementation Reviews* may be able to remove one or other scenario.

After an examination of the full range of results, there was no obvious ‘winner’ between the two *SLAs*. Depending on the trials considered, and which statistic was examined, the different *SLAs* performed slightly differently but their performance overall was equivalent.

Following an approach originally adopted during the development of the *Bowhead SLA*, the SWG **agreed** that an *SLA* which sets the strike limit to the average of the values obtained by the two *SLAs* tuned to a D10 of 0.8 for the influx trial F34-1B (B0.8 and L0.8) would be preferable, providing performance was as good or better than either individual *SLA*; no snap to need for the averaged *SLA* has been applied. The results of the ‘combined *SLA*’ are summarised in Appendix 3.

2.1.4 Conclusions and recommendations

The SWG **agreed** that the *SLA* which sets the strike limit to the average of the values obtained by the two *SLAs* tuned to a D10 of 0.8 for the influx trial F34-1B (B0.8 and L0.8) performed satisfactorily in terms of conservation performance and that it was to be preferred over the individual proposed *SLAs* in terms of need satisfaction. The SWG **agreed** that this ‘*WG-fin SLA*’ be used to provide management advice to the Commission on the subsistence hunt for West Greenland fin whales under need scenarios A and B. For the management advice see Item 5.6.

In conclusion, the SWG expressed its **great thanks** to the developers, Brandão and Witting for the vast amount of work put into the development process. It also expressed similar thanks to Allison and Punt for their extensive work developing the operating models and running the trials. It noted that final validation and archiving would be undertaken by Allison.

The SWG also concurred with the intersessional Workshop (SC/67b/Rep06, item 2.7) that one focus of the next *Implementation Review* would be to examine further stock structure in relation to the two hypotheses being considered at present, and especially the influx model which was developed in the context of low abundance estimates in some years rather than genetic information.

Attention: C-A, SC

The Committee **draws attention** to the extensive work undertaken over recent years to develop an *SLA* for the West Greenland hunt for fin whales. In concluding this work, the Committee:

- (1) **agrees** that the combined *SLA* (which sets the strike limit to the average of the values obtained by the two best *SLAs* considered) performed satisfactorily in terms of conservation performance and was to be preferred over the individual *SLAs* in terms of need satisfaction;
 - (2) **recommends** that this ‘*WG-Fin SLA*’ be used to provide management advice to the Commission on the subsistence hunt for West Greenland fin whales (provided the need request falls within need scenarios A and B);
 - (3) **expresses** its great thanks to the developers, Brandão and Witting for the vast amount of work put into the development process and to Allison and Punt for their extensive work developing the operating models and running the trials; and
 - (4) **agrees** that one focus of the next *Implementation Review* will be to examine further stock structure in relation to the two hypotheses being considered at present, and especially the ‘influx’ model which was developed in the context of low abundance estimates in some years, rather than being based upon genetic information.
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2.2 Common minke whales (Greenland)

2.2.1 Review results of intersessional workshops - SC/67b/Rep06

Donovan summarised report SC/67b/Rep06 and the intersessional progress made on common minke whales. He noted that enormous effort had been devoted to reviewing the new genetic information that had been provided in response to a recommendation at SC/67a. This had greatly assisted in developing the final stock structure hypotheses and mixing matrices to be considered in the trials. These extensive discussions can be found under items 3.3.1 and 3.3.2 of SC/67b/Rep04.

Finally, the Workshop **agreed** that instead of formally using the RMP to set catch limits by sub-area and year for each simulation, the RMP catch limits would be pre-specified based upon baseline hypothesis 1 trials (M01-1 and M01-4). This allows the trials to run more quickly and focus to be given on *SLA* development – the objective of this work. Details can be found in the full trials specification (Appendix 4).

2.2.2 Review post-Workshop progress

Considerable work was undertaken to finalise the list of trials, to ensure that the mixing matrices were correctly specified and to complete and agree conditioning. The final trial specifications are provided as Appendix 4.

Table 4.XX summarises the factors considered in the *Evaluation Trials*.

2.2.3 Candidate *SLAs*

SC/67b/AWMP14 developed a candidate *SLA* for common minke whales off West Greenland. It operates, like the fin whale *SLA* in SC/67b/AWMP13, on an inverse variance weighted average of the last three abundance estimates. The strike limit is calculated as a growth rate fraction of a lower percentile of the abundance measure, conditional on a snap to need feature, and a protection level. The *SLA* for common minke whales, however, does not include a trend modifier, as it is almost impossible to detect an underlying trend from the abundance data in West Greenland.

The *SLA* was tuned to have a 5th percentile of D10 of 0.80 for a flat need envelope of 164 on the most difficult *Evaluation Trial* (trial M04-1A, where there are two sub-stocks in the western North Atlantic, where the mixing between the Central and the Western stock, and the mixing between the putative western sub-stocks, are minimal, and where the MSYR is 1%). Conservation performance on all other measures was adequate for all trials with a flat need of 164, and the *SLA* produces an expected average need satisfaction of 99% (with a lower 5th percentile of 89%) for the first 20 years, and 89% (5th percentile of 61%) for the 100-year simulation period.

2.2.4 Consideration of results

The SWG **agreed** that conditioning of the *Evaluation Trials* had been completed satisfactorily. A summary of the results of the *Evaluation Trials* is provided in Appendix 5.

In determining satisfactory conservation and need performance when evaluating *SLAs*, the SWG considers the full range of results across all of the *Evaluation Trials* not simply the worst-case scenarios. The SWG **agreed** that conservation performance was satisfactory in all but one of the trials. This trial was a trial with low MSYR and two W-stocks and had been originally considered in the context of potential problems for the hunt to simulate possible local depletion in the hunting area rather than for conservation reasons. It was noted that genetic stock structure in the entire North Atlantic is subtle such that even a hypothesis of almost complete panmixia is not rejected by most of the analyses. Hence, differentiation among C and W is very low. This is even more true for substructure within the W stock (if there is any). Given that trials are conservative in so far to overrate isolation among stocks and the very subtle differentiation among stocks and sub-stocks in the North Atlantic, a single trial (which implements fully separate W1 and W2 sub-stocks for which evidence is weak) not meeting the D1/D10 criteria is not of conservation concern.

In developing this advice, the SWG noted that given the unforeseen situation with Secretariat computing, there had been insufficient time to consider the results of the *Robustness Trials* in the SWG. Such trials are not needed to determine an *SLA* but are examined to ensure that the selected *SLA* has no unforeseen properties in extreme trials. Given the importance of being able to provide the best management advice to the Commission, the SWG agreed that the Steering Group set up for *SLA* development should take responsibility to review the results of the *Robustness Trials* as soon as they become available and report to the Plenary session¹.

2.2.4 Conclusions and recommendations

Given the overall satisfactory performance in the *Evaluation Trials* with respect to meeting the Commission's conservation and management objectives for need envelope A (i.e. constant need over the simulation period), the SWG **agreed** to recommend this, the '*WG-common minke SLA*' to the Committee as the best way to provide management advice for the West Greenland hunt of common minke whales. The management advice developed using the *WG-common minke SLA* is provided under Item 5.5.

In accordance with the AWS (see Item 3), the first *Implementation Review* is scheduled for 2023. The SWG **agreed** that one focus of that review should be consideration of the results of analyses of genetic data using additional samples from Canada (as well as the additional samples that will become available from West Greenland and Iceland). To this end it **agrees** that planning for the *Implementation Review* should begin two years before the scheduled review. A small group comprising Tiedemann, Doniol-Valcroze, Witting and Vikingsson was established to facilitate issues related to obtaining samples.

In conclusion, the SWG expressed its **great thanks** to the developers, Brandão and Witting for the vast amount of work put into the development process. It also expressed similar **thanks** to Allison and Punt for their extensive work developing the operating models and running the trials. It noted that final validation/archiving would be undertaken by Allison.

Attention: C-A, SC

*The Committee **draws attention** to the extensive work undertaken over recent years to develop an *SLA* for the West Greenland hunt for common minke whales. In concluding this work, the Committee:*

- (1) **agrees** that the tested *SLA* which performed satisfactorily in terms of conservation performance;*
 - (2) **agrees** that this '*WG-Common minke SLA*' be used to provide management advice to the Commission on the subsistence hunt for West Greenland common minke whales provided the need request falls within need scenario A (i.e. does not exceed 164 annually);*
 - (3) **expresses** its great thanks to the developers, Brandão and Witting for the vast amount of work put into the development process and to Allison and Punt for their extensive work developing the operating models and running the trials; and*
 - (4) **agrees** that one focus of the next *Implementation Review* will be to examine further stock structure in relation to the two hypotheses being considered at present, should be consideration of the results of analyses of genetic data using additional samples from Canada (as well as the additional samples that will become available from West Greenland and Iceland); and*
 - (5) **agrees** to establish an intersessional group to facilitate issues relating to samples.*
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¹Editor's note: this was completed and no problems were detected.

2.3 North Pacific gray whales (Makah whaling)

2.3.1 Management plan proposed by the US for Makah whaling

The Makah Indian Tribe has requested that the US National Marine Fisheries Service (NMFS) authorises a tribal hunt for Eastern North Pacific gray whales in the coastal portion of its 'usual and accustomed fishing area'. The Tribe intends to hunt gray whales from the ENP population, which currently numbers approximately 27,000 animals (Durban *et al.*, 2017). In the management plan, NMFS has taken measures to restrict the number of PCFG whales that are struck or landed in a given 10-year period and to avoid, to the extent possible, striking or killing a Western North Pacific gray whale. The US government has requested that the Committee test this plan to ensure that it meets IWC conservation objectives. An overview of the hunt management plan and how it was operationalised in the coding of the SLA trials is provided in Appendix 1 of SC/67b/Rep/07.

2.3.2 Review intersessional progress including at the Rangewide Workshop - SC/67b/Rep07

Donovan summarised the report of the Fifth Rangewide Workshop on the Status of North Pacific Gray Whales (SC/67b/Rep07rev1). The Workshop was held at the Granite Canyon Laboratory, California of the Southwest Fisheries Science Center from 28-31 March 2018. The primary tasks of the Workshop were to: (a) review the results of the modelling work identified at the Fourth Workshop (IWC, 2018a) and SC/67a (IWC, 2018b); (b) examine the new proposed Makah Management Plan (submitted by the USA – described above and illustrated in the Workshop report under Annex E, Appendix 1) for gray whaling off Washington state; and (c) to update as possible (and develop a workplan for) the scientific components of the Conservation Management Plan (CMP) for western gray whales.

The major focus of the Workshop related to finalising the specifications for modelling to enable results to be available for SC/67b. A new component included the need to incorporate the recently developed Makah Management Plan (SC/67b/Rep07, Annex E, Appendix 1) into the modelling framework; the Plan is somewhat complex and the Workshop focus was on understanding the intended process and ensuring that it was parameterised in an appropriate way. A further key area was finalising the stock structure hypotheses to be given priority. After a review, the Workshop concluded that Hypotheses 3a and 5a would form the reference cases but that sensitivity trials would be conducted for Hypotheses 3b, 3c, 3e and 6b. The full specifications for these hypotheses are provided in SC/67b/Rep07 (Annex E, Appendix 1 and Annex F).

In summary, Hypothesis 3a assumes that whilst two breeding stocks (Western and Eastern) may once have existed, the Western breeding stock (WBS) is extirpated. Whales show matrilineal fidelity to feeding grounds, and the Eastern breeding stock includes three feeding aggregations: PCFG (Pacific Coast Feeding Group), NFG (Northern Feeding Group) and WFG (Western Feeding Group). Hypothesis 5a assumes that both breeding stocks are extant and that the WBS feeds off both coasts of Japan and Korea and in the northern Okhotsk Sea west of the Kamchatka Peninsula. Whales feeding off Sakhalin include both whales that are part of the extant WBS and remain in the western North Pacific year-round, and whales that are part of the Eastern breeding stock and migrate between Sakhalin and the eastern North Pacific (the WFG).

Another important component of the trials relates to bycatch. Considerable effort was put into capturing the uncertainty in past and future estimates of bycatch mortality based upon the available data. The base case for trials was that observed deaths due to bycatch account for only 25% of the true incidental human caused mortality. This fraction was based on a study of bottlenose dolphin stranding data off the coast of California (Carretta *et al.* 2016). Trials were also considered with higher rates of cryptic mortality, including scenarios where observations represent only 5% of true incidental human caused mortality.

Abundance estimates for the eastern North Pacific and the PCFG had been approved by the Committee last year (IWC, 2017). New estimates of abundance for western gray whales were provided by Cooke (SC/67B/ASI/02), and correspond with the various stock structure hypotheses for the western feeding group (WFG), WBS and WST (WFG + WBS). These estimates were reviewed and adopted by the SWG on ASI (Annex Q). Modifications were also made to the mixing matrices in the rangewide model based on the new estimates.

Each stock structure hypothesis was combined with multiple assumptions about other factors (e.g. bycatch rates) and this led to the development of 53 'trials' (see Table 6 of SC/67b/Rep07). Each trial was based on 100 simulations that reflect uncertainty in the estimated parameters of the model. Projections thus lead to a very large amount of model output that needed to be distilled to address questions such as the conservation performance of the new management plan for Makah whaling with respect to the stocks in question (in particular, the PCFG and the WFG). The Rangewide Workshop identified several plots and 'performance statistics' to summarise results from each trial (see Section 4.4.5 of SC/67b/Rep07 and Appendix 4).

Brandon presented an update on the code validation for the model. The first phase of code validation was completed prior to Fifth Rangewide Workshop. That effort focused on the code implementing the operating model and the conditioning process. A summary, including a brief overview of the code and input files was provided to the Workshop (SC/M18/CMP03). Like the first phase, the second phase of code validation involved checking the code against the mathematical and statistical model specifications. The focus of this validation phase was on three aspects of the code: (1) future projections and the updated US management plan concerning strike and landing limits for Makah whaling; (2) input files for the factors considered across conditioning trials and; (3) processing results across simulations into relevant

performance statistics. Code validation was completed prior to the presentation of model results to the SWG.

The sub-committee on CMP reviewed and approved the conditioning results in the context of the full rangewide review. The SWG reviewed the model results with a focus on conservation performance of the management plan for Makah whaling. To aid in this evaluation, bivariate plots were generated for the lower 5th percentiles of the D1 and D10 performance statistics. Trials for which the D1 statistic is less than 0.6 after 100 years (i.e. the stock is not above its MSYL) and the D10 statistic after 100 years is not larger than 1 (i.e. the stock is not increasing towards MSYL) represent a scenario under which the management plan would not be expected to meet the conservation objectives for ASW (this is denoted by the gray quadrant in Fig X of Appendix 6). Several trials were identified in this category, but they corresponded with scenarios that were considered to have the low plausibility (e.g. bycatch mortality of ~ 20 PCFG whales per year). The SWG **agreed** that the performance of the management plan for Makah whaling was adequate to meet the Commission's conservation objectives for the PCFG, WFG and northern feeding group gray whales in the context of the proposed Makah hunt.

2.3.3. Conclusions and recommendations

The SWG **agreed** that the newly proposed hunt management plan for the Makah Tribe's gray whale hunt meets the IWC conservation objectives for PCFG, WFG, and ENP gray whales (see Appendix 6). Similar to its recommendations regarding the hunt plan evaluated during the last *Implementation Review* (IWC, 2012; 2013), the new hunt management plan is dependent on photo-identification studies to estimate PCFG abundance and the mixing proportions of PCFG whales available to the hunt (and bycatch in its range). The SWG's conclusions are dependent on the assumption that these studies will continue in the future.

Attention: C-A, SC

The Committee was asked by the USA to review a US Management Plan for a Makah hunt of gray whales off Washington State (the Committee had evaluated a previous plan in 2011 - IWC, 2011; 2012). The Committee conducted this work using the modelling framework developed for its rangewide review of gray whales (SC/67b/Rep07). In conclusion, the Committee:

- (1) **agrees** that the performance of the Management Plan was adequate to meet the Commission's conservation objectives for the Pacific Coast Feeding Group, Western Feeding Group and Northern Feeding Group gray whales;*
 - (2) **notes** that the proposed management plan is dependent on photo-identification studies to estimate PCFG abundance and the mixing proportions of PCFG whales available to the hunt (and to bycatch in its range);*
 - (3) **stresses** that its conclusions are dependent on the assumption that these studies will continue in the future; and*
 - (4) **expresses** its great thanks to Punt, Brandon and Allison for their excellent work in developing and validating the testing framework and running the trials.*
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2.4 West Greenland bowhead whales

2.4.1 Review results using 400 replicates

Following a previous examination of the precision with which estimates of the 5th percentiles of the performance statistics could be obtained as the number of replicates was increased; an agreement was made that 400 simulations should be used to determine the performance of the selected *SLA* for West Greenland bowhead whales. SC/O17/AWMP03 had showed projection plots for the 5th percentile and the median of the 1+ population for the baseline evaluation trials for this *SLA* based on 400 simulations. For comparison purposes, the projections for the *SLA* under 100 simulations were also shown. These show substantial variability between estimates of the 5th percentile of the distribution of population size.

Wilberg presented an analysis (Appendix 7) based on bootstrapping that was used to determine the effect of the number of simulations on the precision of the estimates of the 5th percentile of several performance measures. Projections for the selected *SLA* for West Greenland bowhead whales showed substantial differences in estimates of the 5th percentile of abundance based on 100 and 400 simulations. With only 100 simulations, the confidence intervals of the 5th percentile were quite wide, but 400 simulations led to a substantial improvement in precision. The investigation concluded that continuing to use 400 trials for the simulations appears to be sufficient to estimate the lower 5th percentile with a reasonable amount of precision.

2.4.2 Testing the Interim Allowance strategy

The SWG noted that the interim relief strategy (see Item 3) has not been examined for this *SLA* yet and **agreed** that this should be added to the workplan.

2.4.3 Conclusions and recommendations

It was agreed that continuing to use 400 replicates for the simulations is sufficient to estimate the lower 5th percentile with adequate precision.

3. ABORIGINAL WHALING MANAGEMENT SCHEME (AWS)

The Scientific Committee's Aboriginal Whaling Management Procedure (AWMP) applies stock-specific *Strike Limit Algorithms (SLAs)* to provide advice on aboriginal subsistence whaling (ASW) strike/catch limits.

ASW management (as part of an AWS, the aboriginal whaling scheme) incorporates several components, several of which have a scientific component:

- (a) *Strike Limit Algorithms* (case-specific) used to provide advice on safe catch/strike limits;
- (b) operational rules (generic to the extent possible) including carryover provisions, block quotas and interim relief allocations;
- (c) Guidelines for *Implementation Reviews*; and
- (d) Guidelines for data and analysis (e.g. guidelines for surveys, other data needs).

3.1 Review intersessional work

In 2017, the Scientific Committee appointed an intersessional correspondence group (Givens (Chair), Allison, Donovan, George, Scordino, Stachowitsch, Suydam, Tiedemann, Witting) to develop draft text regarding the scientific aspects of an Aboriginal Whaling Scheme. The starting place was a previous version agreed by the Scientific Committee (IWC, 2003). Two key components of a new draft AWS were the interim relief allowance and carryover provisions. The report of this group is SC/67b/AWMP21.

Donovan summarised the results from the intersessional workshops on the AWS. In addition to continuation of discussions on the extensive work of the intersessional group under Givens (see above), the Governments of Denmark and the USA had requested advice on the conservation implications of provisions that:

‘...allow for the carry forward of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit’.

This request was tested using the *Bowhead SLA* (applicable to the Bering-Chukchi-Beaufort Seas stock) and the *WG-Humpback SLA* (applicable to West Greenland) and three types of options were examined:

- (1) baseline case - all strikes taken annually (i.e. no need for carryover);
- (2) ‘frontload’ case - strikes taken as quickly as possible within block (+50% limit annually until the block limit is reached); and
- (3) two alternative scenarios where carryover strikes are accrued for one or three blocks, followed by a period of carryover usage subject to the +50% limit.

The three-block scenario considered in (3) served as a direct test of the provision described in the request of USA and Denmark/Greenland. The Committee agreed that the Commission’s conservation objectives were met for both *SLAs* for all of the options above and would also be met for a proposal carrying forward strikes from the previous two blocks.

Attention: CG-A

The Committee received a request from the USA and Denmark/Greenland (SC/67b/Rep06, Annex F, appendix) on the conservation implications of carryover provisions that:

‘...allow for the carry forward of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit’.

The Committee reviewed the request using its simulation frameworks and the two SLAs available for stocks hunted by the USA and Greenland available at the time of the Workshop i.e. the Bowhead SLA (applicable to the Bering-Chukchi-Beaufort Seas stock) and the WG-Humpback SLA (applicable to West Greenland) and

- (1) **agrees** that a carryover provision for up to 3-blocks meets Commission’s conservation objectives; and
- (2) **reiterates** its previous advice, applicable for all *SLAs*, that interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next is acceptable; and
- (3) **agrees** to evaluate the above request for the other Greenland *SLAs* at the 2019 Committee meeting.

3.2 Review proposed updates to the AWS

The SWG considered a proposed update to the previous AWS based upon the work of the intersessional correspondence group. It considers carryover, block quotas, interim relief allocation, *Implementation Reviews* and Guidelines for surveys and data. The agreed text can be found as Appendix 8.

3.3 Conclusions and recommendations

The SWG **recommends** the AWS provided in Appendix 8 to the Committee. It notes that the Commission’s AWS may include additional, non-scientific provisions.

Attention: C-R

The Committee has been working for some years to update the scientific components of an Aboriginal Whaling Scheme. It has completed this work and recommends the AWS provided in Annex E, appendix 8 to the Commission. It has sections on carryover, block quotas, interim relief allocation (and see Annex E, appendix 7), Implementation Reviews and guidelines for surveys and data. It notes that the Commission’s AWS may include additional, non-scientific provisions.

4. IMPLEMENTATION REVIEW OF B-C-B BOWHEAD WHALES

From the Committee's Guidelines (*JCRM* 14 (*Suppl.*): 170-1), the primary objectives of an *Implementation Review* are to:

- (1) review the available information (including biological data, abundance estimates and data relevant to stock structure issues) to ascertain whether the present situation is as expected (i.e. within the space tested during the development of a *Strike Limit Algorithm (SLA)*) and determine whether new simulation trials are required to ensure that the *SLA* still meets the Commission's objectives; and
- (2) to review information required for the *SLA*, i.e. catch data and, when available at the time of the *Review*, new abundance estimates (note that this can also occur outside an *Implementation Review* at an Annual Meeting).

The *Bowhead SLA* was adopted in 2002 (*JCRM* 5 (*Suppl.*): 158) and there was an extensive *Implementation Review* completed in 2007 (*JCRM* 10 (*Suppl.*): 124) with a major focus on stock structure including three intersessional workshops. That included consideration of additional trials investigating management implications of assuming additional population structure even though these were considered of low plausibility. The Committee concluded that the *Bowhead SLA* remained the best tool to provide management advice. The next *Implementation Review* was completed in 2012 (*JCRM* 14 (*Suppl.*): 147); that concluded that there was no need to develop additional trials to those evaluated during the previous *Implementation Review* (IWC, 2008b).

In Committee discussions last year (IWC, 2018), it was agreed that at that time, there was no information that suggested that the situation for this stock was outside the tested parameter space. Given that, the Committee had agreed that it should be possible to complete the *Implementation Review* at the 2018 Annual Meeting. It established a Steering Group (Suydam [Convenor], Donovan, George) to prepare for the *Review* and Donovan confirmed that the Data Availability deadlines were met and that papers on the necessary topics were submitted. Donovan thanked the US colleagues for the extremely hard work that they have put in to providing the SWG with papers to facilitate this review.

Discussions within the SWG benefitted from the discussions within two other sub-committees, SD-DNA (Annex I) and ASI (Annex Q) and, as relevant, conclusions from those groups are briefly summarised under the agenda items below.

4.1 Stock structure: review new information

The Working Group on SD-DNA provided a summary of their discussions relevant to the *Implementation Review*. Genetic analyses (SC/67b/SDDNA01) confirmed that B-C-B bowheads and bowheads in the Sea of Okhotsk constitute two distinct stocks. There may be some weak distinction between B-C-B and EC-WG bowheads, but the majority of the evidence found no significant difference between these two populations. There is one known instance of interchange (from east to west), and one set of overlapping telemetry tracks, although those two whales returned to the populations from which they came. SC/67b/AWMP04 presented data from 64 satellite tagged whales, all but one of which followed the well-known counter-clockwise Bering-Beaufort-Chukchi circuit. The unusual track corresponded to a whale tagged in Utqiagvik (Barrow) in autumn that migrated to the north coast of Chukotka the following spring, rather than swimming east into the Beaufort Sea. Considering the multiple lines of evidence as a whole, the Working Group on SDDNA had concluded that B-C-B bowheads constituted a single population, with no signs of substructure.

The SWG welcomed this information and thanked the hunters for their skill in making the tagging efforts efficient and successful. It **encouraged** continuation of these tagging studies. The SWG **agreed** that there was no need to consider any new *SLA* trials regarding stock structure, since the trials conducted in 2002 and 2007 already covered all plausible stock structure hypotheses.

Attention: SC

With respect to stock structure, considering the multiple lines of evidence, the Committee:

- (1) *agrees that BCB bowheads comprise a single population, with no signs of substructure;*
 - (2) *agrees that there was no need to consider any new SLA trials regarding stock structure, since the trials conducted in 2002 and 2007 already covered all plausible stock structure hypotheses;*
 - (3) *welcomes the telemetry information provided, thanks the hunters involved for their skill and assistance;*
 - (4) *encourages additional telemetry efforts; and*
 - (5) *agrees with the suggestions for future genetic studies in the Arctic provided under Item 11.*
-

4.2 Abundance estimates: review new information

The Working Group on ASI (Annex Q) received new information about the 2011 B-C-B bowhead abundance from a long-term photo-identification capture-recapture study (SC/67b/AWMP01rev1). The estimated 1+ abundance was 27,133 (CV=0.217; 95% CI from 17,809 to 41,337). They concluded that this estimate could be classified as having been examined in detail and found to be suitable for providing management advice and for use in the *SLA*.

The SWG **welcomed** this information and noted that there was a completely independent 2011 abundance estimate from an ice-based survey (Givens *et al.*, 2016). This estimate is 16,820 (CV=0.052; 95% CI 15,176 to 18,643). It is not surprising that these two estimates differ because - in addition to random variability - the ice-based estimate does not count whales that are spatially or temporally excluded from the survey, whereas the photo-id dataset is more likely to

contain false negative matches than false positive matches and this imbalance will tend to inflate the resulting abundance estimate.

There are thus two independent estimates for the same year considered suitable for use in the *SLA* (the ice-based estimate is already used). Discussion on how to consider such circumstances is provided under Items 3 and 5.

The Working Group on ASI (Annex Q) also received two reports on future B-C-B bowhead survey plans (SC/67b/AWMP12 and SC/67b/AWMP16). The first is for an ice-based survey in spring 2019, following methods used in earlier such surveys but not including an acoustic component. The availability of bowhead whales will be estimated from past acoustic data, as has been done with previously accepted estimates. The second survey is an August 2019 aerial line transect survey of unprecedented scope for B-C-B bowheads, covering the eastern edge of the Chukchi Sea and the entire Beaufort Sea (including Canadian waters) with most transects extending to the 200 m isobaths and some to the 2,000m isobaths. Detailed plans for the latter survey were presented in SC/67b/AWMP16, and were thoroughly discussed by the Working Group on ASI (see Annex Q).

The SWG thanked the authors for these papers, noting that their presentation is in accord with the AWS Guidelines (see Item 3) that ‘plans for undertaking a survey/census should be submitted to the Scientific Committee in advance of their being carried out, although prior approval by the Committee is not required. This should normally be at the Annual Meeting before the survey/census is carried out’.

The SWG noted that the degree of precision to be achieved by the 2019 aerial survey is unknown and may be lower than for some other recent abundance estimates. The *Bowhead Evaluation and Robustness Trials* mainly specified CVs of 0.25 or less. If the new CV turns out to be higher than this, additional trials may be required at the next *Implementation Review*.

4.3 Biological parameters: review new information

The SWG received new information about length at sexual maturity and pregnancy rate (SC/67b/AWMP07). Studies of bowhead reproduction have been conducted by the North Slope Borough Department of Wildlife Management (Alaska) over the past 35 years, with the co-operation of Alaska Native hunters. Although low calf counts and few pregnant harvested females were a concern at the inception of the programme, the situation has improved markedly since then. For SC/67b/AWMP07, pregnancy rates were estimated from examinations of reproductively mature bowhead whales ($n=208$) landed during the Alaska Native subsistence harvest from 1976-2016. The estimated pregnancy rate was 0.317 (95% CI 0.251 to 0.385). This suggests an inter-birth interval of just over 3 years. Whales harvested in the autumn at Utqiagvik (Barrow) and Kaktovik comprise the most reliable pregnancy dataset because pregnancies are easier to detect and whales are more carefully examined. From this restricted dataset ($n=33$), the pregnancy rate is estimated to be 0.394 (95% CI 0.211 to 0.553); which the authors considered is at the high end of what is plausible for this species.

Logistic regression was used to estimate length at maturity from a separate dataset ($n=150$) that included whale lengths. Length at maturity was defined, relative to an equally balanced set of mature and immature whales, as the length at which the estimated probability of maturity equals 0.5. Since the actual dataset is neither balanced nor representative, the authors introduced a correction calculation. The resulting length at maturity is estimated to be 13.65m (95% CI 13.29 to 13.94). The authors recognised that their data could be biased by sampling from harvested animals where hunter selectivity occurs and by the approximately 14-month gestation period of bowheads. The estimates are consistent with past investigations and suggest a reproductively robust population. The finding that pregnancy rates are stable or possibly increasing over the past 40 years is also consistent with the increase in population abundance seen over the same time span. Finally, the authors believe that there is no evidence in the reproductive data of density-regulated reproduction or the population approaching carrying capacity.

In discussion, the SWG noted that selectivity patterns in the bowhead harvest make some types of inference from such data difficult. In particular, there are several factors that may affect the determination of pregnancy rate and trends in pregnancy rate. The SWG concluded that it was not possible therefore, to conclude that there had been a long-term increase in pregnancy rate despite the statistically significant positive trend reported in the paper; the authors concurred. However, the SWG noted that the length-at-maturity analysis was specifically corrected for age selectivity in hunting so such concerns do not arise in that analysis.

The SWG welcomed information about the potential use of samples from baleen plates to examine hormone cycles and pregnancy. Since baleen provides up to 20 years of record, it may be possible to correlate reproductive information with other variables such as environmental factors. The SWG **encouraged** future work on this subject.

SC/67b/AWMP03 summarised sightings of bowhead whale calves in the western Beaufort Sea during July-October, 2012-17, from the Aerial Surveys of Arctic Marine Mammals (ASAMM) project. Overall, 76% of the calves recorded were first sighted only after the aircraft broke from the transect line to circle an adult whale sighting. Calves were detected during all months, although more calves were detected in autumn (September-October, 245 calves) than summer (July-August, 160 calves). Total number of calves sighted per year ranged from 22 in 2012 to 155 in 2017. The highest calf ratio (number of calves/number of whales) and sighting rate (number of calves/km of effort) occurred in 2017, although 2013 and 2016 were also high. Preliminary analysis of photo-identification data suggests that it is rare to see an individual calf more than once in a given year.

The SWG welcomed this information, recognising that that it relates to successful pregnancies and, if it can be collected and analysed to provide a calving rate/index representative of the population, can provide valuable information for future *Implementation Reviews*. In discussion, it was also noted that the ASAMM aerial survey data could potentially be useful as an independent index of calf production for comparative purposes with the pregnancy rates presented in SC/67b/AWMP07. The SWG **encouraged** the continuation of the ASAMM surveys and any future collaboration involving life history data from the harvest.

Attention: SC

With respect to biological parameter information, the Committee:

- (1) welcomes the extensive information presented;*
 - (2) encourages the continued collection of such data from the hunt;*
 - (3) encourages the work on the baleen plate analyses to examine hormone levels and pregnancy;*
 - (4) encourages continued aerial surveys under the ASAMM surveys and any future collaboration involving life history data from the harvest; and*
 - (5) agrees that the information presented does not suggest the need to consider any new SLA trials regarding stock structure.*
-

4.4 Removals: review new information

The SWG received updated information about the 2017 harvest (SC/67b/AWMP05) and long-term removals (SC/67b/AWMP06). The authors of SC/67b/AWMP05 reported that in 2017, 57 bowhead whales were struck resulting in 50 animals landed. The total landed for the hunt in 2017 was higher than the average over the past 10 years (2007-16 mean of landed=41.7; SD=6.7). Efficiency (no. landed/no. struck) in 2017 was 88%, which was also higher than the average for the past 10 years (mean of efficiency=75.2%; SD=6.5%). Of the landed whales, 28 were females and 22 were males. Based on total length (>13.4m in length) or pregnancy, 13 females were presumed mature. Six of those animals were examined and two were pregnant, one with a term foetus and another with a mid-term foetus, and one female was lactating. The fact that one third of the mature females were pregnant is consistent with past years.

SC/67b/AWMP06 provided a summary of bowhead whale catches in Alaska between 1974 and 2016. The authors pointed to the excellent cooperation and contribution of the whale hunters from the 11 villages that are members of the Alaska Eskimo Whaling Commission (AEWC). In total, 1,373 whales were landed. Over half (700) were landed in Barrow, while Shaktoolik and Little Diomedé landed only one and two whales, respectively. Five of the 11 villages hunt only in the spring, two hunt only in the autumn whilst the remaining four have landed bowhead whales in both the spring and autumn/winter. Three of those villages (Gambell, Savoonga, and Wainwright) used to primarily hunt in the spring, but they now also hunt in the autumn or winter because changing ice conditions have made hunting more difficult in the spring. The efficiency of the hunt has improved over time. In the late 1970s, the efficiency averaged about 50% - because of improved hunting gear, communication, training and other factors, the efficiency now averages about 80%. Kaktovik and Nuiqsut hunt in the autumn in open water conditions and rarely have struck and lost whales. Some villages (Gambell, Savoonga, and Wainwright) on average land longer whales than others (Barrow and Point Hope). The length of landed whales within a season is correlated with the timing of the hunt. During spring, shorter whales tend to be landed earlier in the season while larger whales tend to be landed later. The opposite occurs in the autumn when larger whales tend to be landed earlier. The sex ratio of landed whales is even.

From 2013 to 2017, four bowhead whales (2 females and 2 males) were harvested near Chukotka, mainly in Anadyr Bay (SC/67b/AWMP20). The average length was 14.5m (minimum 13.0m, maximum 17.0m). Although the portion of the annual strike limit allocated to Russia under their bilateral agreement with the USA is five animals, the actual annual take is usually only 1-2 whales per year, and this has been the case since at least 2004.

The SWG thanked the authors of the provision of this information; catch and strike data are used in the *SLA* calculations (see Item 5.)

4.5 Other anthropogenic threats and health: review new information

New information about detection of carcasses in the eastern Chukchi and western Beaufort seas from the ASAMM project (2009-17, see summary under Item 3 above) was reported in SC/67b/AWMP02. A total of 27 bowhead whale carcasses (21 in the eastern Chukchi Sea) was detected, most in September but with the highest sighting rate in October. Survey effort does not account for the difference between the eastern Chukchi and western Beaufort study areas. A total of six carcasses, including all three of the calf/yearling carcasses sighted, showed signs of killer whale injuries; knowledge of killer whale behaviour and the location of the injuries on the whales, suggested to the authors that killer whale predation not scavenging was the cause of death. One carcass, with subsistence hunting gear (i.e., a line and float) attached, was observed in late October 2015. There were two struck and lost whales reported from about that same time; one at Barrow in late September and one in Wainwright in mid-October. Both of those whales were reported by the whaling captains to have likely died.

SC/67b/AWMP08 reported that during 2017, around 14% of landed whales carried injuries from line entanglement but none had ship strike injuries (consistent with 1990-2012 baselines). Two whales landed at Utqiagvik (Barrow) in spring

2017 were carrying line associated with pot gear and had severe entanglement injuries such that veterinarians and the attending hunters thought that they were dying when captured.

The SWG **agreed** that whilst the present level of unintentional human induced mortality is too low to require new *Implementation* trials or incorporation into the *SLA* calculations, the situation should continue to be monitored and evaluated at the next *Implementation Review*. The SWG **welcomed** information that discussions between the AEWG and the Bering Sea Crabbers Association were ongoing, with the goal of limiting or reducing bowhead mortality attributable to their fishing gear.

The SWG **agreed** with the authors that the carcasses with killer whale injuries were probably a result of predation not scavenging. George expressed his opinion that killer whale/bowhead interactions have increased in the NE Chukchi Sea over the past 40 years. While beachcast gray whale calves killed by killer whales are commonly observed in Alaska along the NE Chukchi coast, dead bowhead calves (or subadults) were first seen only three years ago. There has also been an increase in observations of killer whale predation from ASAMM surveys and from hunters. In fact, a bowhead calf, probably killed by killer whales, was recovered by hunters northeast of Barrow; such a recovery has not happened before in the memory of native Alaskan hunters.

SC/67b/AWMP08 provided a comprehensive review of B-C-B bowhead health. The authors first noted that the strong, steady rate of population increase and the recent estimate of survival rate are possibly the best indicators that this population is healthy. A body condition index has shown a significant increase (fatter whales) over the period 1990-2012 but there is some evidence it has slowed or reduced in the last five years. This may reflect a density dependent effect of a population nearing carrying capacity, but further analysis is required. Post-mortem analyses indicate that whales caught in the spring migration are generally not feeding, while most (75-100%) in the autumn are. This is consistent with past findings and suggests that bowhead whale feeding habitat remains viable and productive.

General health information on landed bowhead whales was obtained from several major retrospective screening survey studies and from pathological analysis of 2017 post-mortem examinations. Key findings included: (i) declining body burden trend (blubber and muscle) in organic pollutants; (ii) limited detection of anthropogenic radionuclides (low levels in muscle); (iii) continued absence of major pathogens that could impact health; (iv) interannual variation of *Giardia* spp. with some suggestion of environmental marine contamination with human faeces; and (v) variable presence of marine biotoxins in faeces suggesting complex environmental drivers of harmful algae blooms in the Arctic. Pathological findings in 2017 were consistent with previous years e.g.: (i) low prevalence of fatty benign tumors in livers and gastric nodules associated with anisakis infection; and (ii) presence of kidney worm infection. Further work is underway on species characterisation of kidney worm specimens. The authors suggest that Arctic climate change (e.g., diminishing sea ice, increased sea surface temperature, opening of the Northwest Passage, range overlap with seasonal southern baleen whale migrants known to carry kidney worms, and prey shifts) may be setting the stage for an evolving host-parasite relationship in B-C-B bowhead whale stock.

The SWG **thanked** the authors for this valuable summary and **agreed** that nothing in the health analyses was cause for concern with respect to the continued application of the *Bowhead SLA*.

Attention: SC

With respect to threats and health to the B-C-B bowhead whales, the Committee:

- (1) **welcomes** the extensive information presented;
- (2) **agrees** that whilst the present level of unintentional human induced mortality is too low to require new *Implementation trials* or incorporation into the *SLA* calculations, the situation should continue to be monitored and evaluated at the next *Implementation Review*;
- (3) **agrees** that the health analyses give no cause for concern with respect to the continued application of the *Bowhead SLA*; and
- (4) **encourages** that the excellent work on health-related issues continues.

4.6 Conclusions and recommendations (and, if needed, workplan to complete Review)

The SWG **concluded** that no additional work was required to complete the *Implementation Review*. It further **concluded** that the range of hypotheses and parameter space already tested in *Bowhead SLA* trials was sufficient and therefore the *Bowhead SLA* could continue to be **recommended** to the Commission as the best way to provide management advice. This advice is presented under Item 5.3.

Attention: SC

With respect to the Implementation Review of B-C-B bowhead whales, the Committee concludes that:

- (1) *the Implementation Review has been satisfactorily completed; and*
- (2) *the range of hypotheses and parameter space already tested in Bowhead SLA trials was sufficient and therefore the Bowhead SLA remains the best way to provide management advice for this stock;*

In addition, it thanks the US scientists for the extremely hard work that they have put into providing comprehensive papers to facilitate this review

5. STOCKS SUBJECT TO ASW (NEW INFORMATION AND MANAGEMENT ADVICE)

The SWG noted that the Commission will be setting new catch/strike limits for at its 2018 biennial meeting in Brazil. It had received written or verbal requests for limits to be considered for each hunt as discussed below.

In addition, there had been a general request to the intersessional workshop from the USA and Denmark (SC/67b/Rep06, annex F, appendix) for advice on whether there would be a conservation issue if there was a one-time seven-year block followed by a return to six-year blocks to address logistical issues from a Commission perspective. The SWG **agreed** with the intersessional workshop that there are no conservation issues associated with this suggestion (and see the block quota section of the ASW Appendix).

5.1 Eastern Canada/West Greenland bowhead whales

5.1.1 New abundance information

Last year, the SWG had recommended that Canadian scientists attend the Committee to present the results of their work on abundance. It was very pleased that Doniol-Valcroze from Department of Fisheries and Oceans Canada and the primary author of the paper on aerial survey abundance estimate was present at the meeting.

The two relevant papers were first discussed by the Standing Working Group on ASI (see Annex Q for details). Doniol-Valcroze *et al.* (2015) provided a fully corrected estimate from the 2013 aerial survey of 6,446 bowheads (CV=0.26, 95% CI 3,722-11,200). The survey covered the major summering area for the Eastern Canada/West Greenland stock. The Working Group on ASI agreed that this was acceptable for management advice and for use within the AWMP. The other paper (ref) contained a genetic mark-recapture estimate that was considered preliminary at this stage.

The SWG **welcomed** this information and recalled that the *WG-Bowhead SLA* had been developed on the conservative assumption that the abundance estimates for the West Greenland area alone (1,274 whales in 2012 (CV=0.12)) represented the abundance of the whole stock, as it believed that it was not possible to assume that a non-member country would continue with regular surveys. Doniol-Valcroze advised the SWG that the present management strategy of Canada does involve obtaining regular abundance estimates. The SWG noted it would be pleased to receive such estimates from Canada being presented to the Committee in the future.

The SWG **welcomed** this information. It **agreed** that consideration of how to incorporate abundance estimates from Canada should be one focus of the next *Implementation Review*. It noted the regular collaboration of Canadian and Greenlandic scientists on other matters such as genetic sampling (*inter alia* for mark-recapture abundance estimation). It **encouraged** further collaboration between Canada, Greenland and the USA for the study of bowhead whales across their range and the presentation of these results at future Committee meetings.

In this regard, Witting reported that Greenland continues its biopsy sampling programme, with 60 biopsy samples collected in 2017. Bickham noted that many SNPs had been developed for B-C-B bowheads (SC/67b/SDDNA01) and that it would be productive for the same markers to be analysed for the Canadian samples since between-lab calibration is straightforward for SNPs and the increased statistical power would improve stock structure analyses, e.g. the ability to identify individual whales could provide information relevant to mixing proportions between areas.

5.1.2 New catch information

SC/67b/AWMP10 provided an update of recent Canadian takes made in the Inuit subsistence harvest of EC-WG bowhead whales. In the eastern Canadian Arctic, the maximum take is 7 bowhead whales per year according to domestic policy, with no carry-over of unused takes between years. Since 2015, five strikes were taken and four bowhead whales were successfully landed (one in 2015, two in 2016 and one in 2017).

The SWG **thanked** Canada for regularly providing catch information. It noted that the reported number of strikes was within the parameter space that was tested for the *WG-Bowhead SLA* and **encouraged** the continued collection of genetic samples from harvested whales.

Witting reported that West Greenland hunters struck no bowheads in 2017. There was one whale of 14.7m in length that died from entanglement in crab gear.

5.1.3 Management advice

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC/67 and no changes were requested for bowhead whales.

The SWG **agreed** that the *WG Bowhead SLA* remains the best available ways for management advice, and noted that this *SLA* had been developed under the conservative assumption that the number of bowhead whales estimated off West Greenland represented the total abundance between West Greenland and Eastern Canada. Based on the agreed 2012 estimate of abundance for West Greenland (1,274, CV=0.12), the catch of one whale in Canada in 2017, and using the agreed *WG-Bowhead SLA*, the SWG **repeated its advice** that an annual strike limit of two whales will not harm the stock and meets the Commissions conservation objectives.

Although the SWG had not yet had time to examine the request from the US/Denmark (SC/67b/Rep06, Annex F, appendix) for this *SLA*, it **agreed**, based on *WG-bowhead SLA* testing thus far, that its previous advice that the interannual

variation of 50% within a block with the same allowance from the last year of one block to the first year of the next was acceptable.

Attention: C-A

A general request had been received from the USA and Denmark (SC/67b/Rep06, annex F, appendix) for advice on whether there would be a conservation issue if there was a one-time 7-year block followed by a return to 6-year blocks to address logistical issues related to the Commission.

The Committee **agrees** there are no conservation issues associated with this suggestion (and see the block quota section of the ASW in Annex E, appendix 8).

Attention: SC

The Committee greatly appreciated the presence of a Canadian scientist at its meeting. The Committee:

- (1) **welcomes** the provision of the abundance estimate for the Eastern Canada/West Greenland stock and (see Item 8.1.2) the regular provision of information on catch data by Canada;
 - (2) **welcomes** the attendance of Canadian scientists at its meetings;
 - (3) **agrees** that consideration of how to incorporate abundance estimates from Canada should be one focus of the next Implementation Review for this stock;
 - (4) **notes** the regular collaboration of Canadian and Greenlandic scientists on other matters such as genetic sampling (inter alia for mark-recapture abundance estimation); and
 - (5) **encourages** further collaboration between Canada, Greenland and the USA for the study of bowhead whales across their range and the presentation of these results at future Committee meetings.
-

Attention: C-A

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC67 and no changes were requested for bowhead whales. The Committee therefore:

- (1) **agrees** that the WG-Bowhead SLA remains the best available way to provide management advice for the Greenland hunt;
 - (2) **notes** that this SLA had been developed under the conservative assumption that the number of bowhead whales estimated off West Greenland represented the total abundance between West Greenland and Eastern Canada;
 - (3) based on the agreed 2012 estimate of abundance for West Greenland (1,274, CV=0.12), the catch of one whale in Canada in 2017, and using the agreed WG-Bowhead SLA, **agrees** that an annual strike limit of two whales will not harm the stock and meets the Commissions conservation objectives; and
 - (4) although the Committee has not yet had time to examine the request from the US/Denmark (SC/67b/Rep06, annex F, appendix) for the WG-Bowhead SLA, reiterates its advice, applicable for all SLAs, that interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next, is acceptable.
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5.2 North Pacific gray whales

The Russian Federation (SC/67b/AWMP17) had requested advice on the following provision:

‘For the seven years 2019, 2020, 2021, 2022, 2023, 2024 and 2025, the number of gray whales taken in accordance with this subparagraph shall not exceed 980 (i.e. 140 per annum on average) provided that the number of gray whales taken in any one of the years 2019, 2020, 2021, 2022, 2023, 2024 and 2025 shall not exceed 140.’

5.2.1 New information (including catch data)

SC/67b/AWMP20 presented a comparison of gray whale catch data off Chukotka during: (i) the Soviet era (i.e. data from the catcher boat *Zvezdny*, from 1969-91); with (ii) recent data from 2013-17. The average length and weight of harvested whales in recent years is smaller than it was during the Soviet era. This discrepancy could be due to a difference in the selectivity patterns between the Soviet era industrial-sized catcher boat and the small boats used by native Chukotkans. The average annual number of whales was also higher during the Soviet era (150 vs 123). The annual biomass of removals in recent years is estimated to be one-third of that during the Soviet era. In recent years, most whales have been taken by the eastern and northeastern settlements of the Chukchi Peninsula – in the Bering Strait and east Chukchi Sea. Authors speculated that more mature whales migrate to the Arctic via the Bering Strait compared to those remaining in Anadyr Bay. Whales caught on Chukotka's Arctic coast were found to be statistically larger with a higher fat index than whales harvested on the eastern coast. Considering the 11% rise of native population in Chukotka since 2010 and also considering the drop in acquired whaling products comparing to 1980s-1990s, the authors concluded that the subsistence need of indigenous people is not satisfied.

Zharikov presented results of the 2017 whaling season in Chukotka. A total of 119 gray whales were struck in 2017 (37 males and 82 females). No whales were struck and lost, and no stinky (inedible) gray whales were taken. Similar whaling methods were employed as in recent years and the overall efficiency of the hunt was almost same as in 2016. It was noted that whale products are a large part of the local diet; there is also exchange with inland aborigines and use for non-nutritional purposes. A total of 615 gray whales have been taken in 2013-17 (SC/67b/AWMP17). Therefore only 105

strikes remain for 2018 under the current block quota, while the average annual take in recent years is 123 whales. The SLA trials performed in 2017 at the request of the Government of the Russian Federation (IWC, 2018) showed that a take of up to 136 whales per year by indigenous people of Chukotka will not harm the population. He noted that a possible overrun of 2013-18 quota by Chukotka native whalers was within this catch level and believed that such needs should be taken into account in the near future.

SC/67b/AWMP17 presented proposed text by the Russian Federation for amendments to Paragraph 13(b)(2) of the Schedule for gray whales. It was noted that a specific native diet has been documented. The consumption of relatively high amounts of proteins and fats is a necessary component of health and longevity in the native population of Chukotka. The importance of aboriginal whaling to the social, cultural and economic structure of Chukotka's coastal villages was also noted. Under the current block quota, the annual strike limit is 140 per year (including any strikes allocated to the Makah tribe). The proposed amendments would extend the duration of this block quota from six to seven years. Under the proposed seven-year block quota, the total number of strikes would be increased to 980 (140x7yrs). This provision would continue to be reviewed biannually by the Commission in light of the annual advice of the Scientific Committee.

5.2.2 Management advice

The SWG **agreed** that the *Gray Whale SLA* remains the best available way for management advice for this stock. It **advised** that an average annual strike limit of 140 whales will not harm the stock and meets the Commission's conservation objectives. It also noted that its previous advice that the interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next was acceptable. It also **advised** that the Makah Management Plan (Item 2.3) is in accord with the Commission's management objectives.

Attention: SC

*In reviewing the results of new genetic analyses of gray whales in the North Pacific, the Committee **agrees** that the genetic and photographic data for this species be combined to better assess stock structure-related questions. Given the potential for genomic data to aid in better evaluating the stock structure hypotheses currently under consideration for North Pacific gray whales, the Committee **encourages** the continuation of work to produce additional genomic data from sampled gray whales.*

Attention: C-A

The Russian Federation (SC/67b/AWMP/17) had requested advice on the following provision:

'For the seven years 2019, 2020, 2021, 2022, 2023, 2024 and 2025, the number of gray whales taken in accordance with this subparagraph shall not exceed 980 (i.e. 140 per annum on average) provided that the number of gray whales taken in any one of the years 2019, 2020, 2021, 2022, 2023, 2024 and 2025 shall not exceed 140.'

The Committee therefore:

- (1) **agrees** that the Gray Whale SLA remains the best available way to provide management advice for the gray whale hunts;
 - (2) **advises** that an average annual strike limit of 140 whales will not harm the stock and meets the Commission's conservation objectives;
 - (3) **notes** that its previous advice that the interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next remains acceptable;
 - (4) **advises** that the Makah Management Plan (see Item 2.3) also is in accord with the Commission's management objectives.
-

5.3 Bering-Chukchi-Beaufort Seas bowhead whale

5.3.1 New information

New information was considered as part of the *Implementation Review* discussed under Item 4.

The USA had indicated that it was proposing no changes to the present catch/strike limits although it may suggest changes to its carryover request in light of the advice received by the Committee as discussed at the intersessional Workshop (SC/67b/Rep06).

The SWG noted that there are now two independent estimates of abundance for this stock in 2011 (see Item 4). Recognising the need to formally consider the general question of how best to combine estimates in such cases as part of the workplan in the next biennium, the SWG noted that if they are combined as a weighted average by the inverse of their variances, there is little difference (it is slightly higher) between the combined estimate and that from the ice-based census estimate that is the approach used to obtain the other estimates used in the SLA. It therefore **agreed** to use the ice-based census estimate for 2011 survey (Givens *et al.*, 2016; 16,820, CV=0.052, 95% CI 15,176 to 18,643) as the most recent estimate of abundance for use in the *Bowhead SLA* this year.

5.3.2 Management advice

The SWG **agreed** that the *Bowhead SLA* remains the best available way for management advice for this stock. It **advised** that a continuation of the present average annual strike limit of 67 whales will not harm the stock and meets the Commission's conservation objectives.

The SWG also **advised** that provisions allowing for the carry forward of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit⁷ has no conservation implications (see SC/67b/Rep04).

Attention: C-A

The USA indicated that it requested advice on the existing catch/strike limits. The Committee therefore:

- (1) **agrees** that the Bowhead Whale SLA remains the best available way to provide management advice for this stock;*
 - (2) **advises** that a continuation of the present average annual strike limit of 67 whales will not harm the stock and meets the Commission's conservation objectives; and*
 - (3) **advises** that provisions allowing for the carry forward of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit, has no conservation implications (see SC/67b/Rep04).*
-

5.4 Common minke whales off East Greenland

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC/67. It requested advice on an annual take of 20 animals (it had previously been 12).

5.4.1 New information on catches

In the 2017 season, 9 common minke whales were landed in East Greenland, and one was struck and lost. Three of the landed whales were males, 6 were females, and genetic samples were obtained from 8 of the landed whales. One common minke whale died from entanglement in fishing gear. The SWG **encouraged** the continued collection of genetic samples and collaborative studies (see Item 5.1.1).

5.4.2 New information on abundance

The Working Group on ASI endorsed the 2015 aerial survey abundance estimate of 2,762 (CV=0.47; 95%CI 1,160-6,574). This is only a small part of the wider Western and Central stocks.

5.4.2 Management advice

The SWG noted that in the past its advice for the East Greenland hunt had been based upon the fact that the catch was a small proportion of the number of animals in the Central Stock. During the process to develop an *SLA* for common minke whales off West Greenland produced a simulation framework that produces a considerably more rigorous way to provide advice for this hunt, taking into account stock structure issues. In addition, there is for the first time a separate estimate of abundance for common minke whales off East Greenland alone (this is only a small part of the wider western and Central stocks from which the catches can be drawn). The results of the simulation trials that incorporated a continuing catch of 20 whales from East Greenland led to no conservation concerns (see Appendix 4). The SWG noted that a formal *SLA* for this hunt should be developed in the future.

Given the above information, the SWG **advised** that an annual strike limit of 20 whales for the next block will not harm the stock and meets the Commission's conservation objectives.

In response to a request for advice on the length of the season for the common minke whale hunts in SC/67b/AWMP19, the SWG **agreed** that changing the length of the season to 12 months had no conservation implications.

Attention: C-A

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC67. It requested advice on an annual take of 20 animals (it had previously been 12). It had also requested advice on any conservation implications of a 12-month hunting season for common minke whales.

The Committee therefore:

- (1) **notes** that in the past its advice for the East Greenland hunt had been based upon the fact that the catch was a small proportion of the number of animals in the Central Stock;*
- (2) **notes** the process to develop an *SLA* for common minke whales off West Greenland resulted in a simulation framework that produces a considerably more rigorous way to provide advice for this hunt than before, by taking into account stock structure issues;*
- (3) **notes** that the results of the simulation trials that incorporated a continuing catch of 20 whales from East Greenland gave rise to no conservation concerns;*
- (4) **notes** that the 2015 aerial survey abundance estimate of 2,762 (CV=0.47; 95%CI 1,160-6,574) is only a small part of the wider western and central stocks;*

- (5) **advises** that a continuation of the present average annual strike limit of 20 whales will not harm the stock and meets the Commission's conservation objectives;
 - (6) **advises** that changing the length of the season to 12 months had no conservation implications; and
 - (7) **agrees** that an SLA should be developed for this hunt in the future; and
 - (8) **encourages** the continued collection of samples for collaborative genetic analyses (and see Item 7.1.2.3).
-

5.5 Common minke whales off West Greenland

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC/67. It requested advice on annual strikes of 164 animals (i.e. no change).

5.5.1 New information on catches

In the 2017 season, 129 common minke whales were landed in West Greenland and four were struck and lost. Of the landed whales, there were 95 females, 33 males and one of unknown sex. Genetic samples were obtained from 104 of these common minke whales in 2017, and the SWG was pleased to note that samples were already part of the data used in the genetic analyses of common minke whales in the North Atlantic. The SWG **encouraged** the continued collection of samples and the collaborative approach of the genetic analysis.

5.5.2 New information on abundance

The Working Group on ASI endorsed the 2015 aerial survey abundance estimate of 5,095 (CV=0.46; 95%CI 2,171-11,961) as discussed in Annex Q.

5.5.3 Management advice

The SWG **agreed** that the new *WG-common minke SLA* (Item 2.2) is the best available way to provide management advice for this stock. It **advised** that an annual strike limit of 164 whales will not harm the stock and meets the Commission's conservation objectives. Although the SWG had not yet had time to examine the request from the US/Denmark (SC/67b/Rep06, Annex F, appendix) for this new *SLA*, it **agreed**, based on *WG-common minke SLA* testing thus far, that its previous advice that the interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next was acceptable.

In response to a request for advice on the length of the season for the common minke whale hunts in SC/67b/AWMP19, the SWG **agreed** that changing the length of the season to 12 months had no conservation implications.

Attention: C-A

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC67. It requested advice on annual strikes of 164 animals (i.e. no change). It had also requested advice on any conservation implications of a 12-month hunting season for common minke whales.

The Committee therefore:

- (1) **agrees** that the *WG-Common minke SLA* is the best available way to provide management advice for this stock under need scenario A;
 - (2) **advises** that a continuation of the present average annual strike limit of 164 whales will not harm the stock and meets the Commission's conservation objectives;
 - (3) *although the Committee has not yet had time to examine the request from the US/Denmark (SC/67b/Rep06, annex F, appendix) for this SLA, reiterates its previous advice, applicable for all SLAs, that interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next is acceptable;*
 - (4) **advises** that changing the length of the season to 12 months had no conservation implications; and
 - (5) **encourages** the continued collection of samples for collaborative genetic analyses (and see Item 7.1.2.3).
-

5.6 Fin whales off West Greenland

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC/67. It requested advice on annual strikes of 19 animals (i.e. no change).

5.6.1 New information on the catch

A total of seven fin whales (five females and two males) was landed, and one was struck and lost, off West Greenland during 2017. The SWG was pleased to note that genetic samples were obtained from five of these, and that the genetic samples are analysed together with the genetic samples from the hunt in Iceland. It **encouraged** the continued collection of samples and collaborative work on analyses.

5.6.2 New information on abundance

The Working Group on ASI endorsed the 2015 aerial survey abundance estimate of 2,215 (CV=0.41; 95%CI 1,017-4,823) as discussed in Annex Q.

5.6.3 Management advice

The SWG **agreed** that the new *WG-fin SLA* (Item 2.2) is the best available way to provide management advice for this stock. It **advised** that an annual strike limit of 19 whales will not harm the stock and meets the Commission's conservation objectives.

Although the SWG had not yet had time to examine the request from the US/Denmark (SC/67b/Rep06, Annex F, appendix) for this new *SLA*, it **agreed**, based on *WG-fin SLA* testing thus far, that its previous advice that the interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next was acceptable.

In response to a request for advice on length limits for fin whales in SC/67b/AWMP19, the SWG **agreed** that removing the length limits had no conservation implications.

Attention: C-A

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC/67. It requested advice on annual strikes of 19 animals (i.e. no change). It also requested advice on whether there were any conservation implications of removing length limits (while retaining the prohibitions relating to calves).

The Committee therefore:

- (1) agrees that the WG-Fin SLA is the best available way to provide management advice for this stock;*
 - (2) advises that a continuation of the present average annual strike limit of 19 whales will not harm the stock and meets the Commission's conservation objectives;*
 - (3) although the Committee has not yet had time to examine the request from the US/Denmark (SC/67b/Rep06, annex F, appendix) for this SLA, reiterates its advice, applicable for all SLAs, that interannual variation of 50% within a block with the same allowance from the last year of one block to the first year of the next is acceptable;*
 - (4) advises that removing the length limits had no conservation implications; and*
 - (5) encourages the continued collection of samples for collaborative genetic analyses (and see Item 7.1.1.3).*
-

5.7 Humpback whales off West Greenland

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC/67. It requested advice on annual strikes of 10 animals (i.e. no change).

5.7.1 New information on catches

A total of two (two females) humpback whales were landed and none were struck and lost in West Greenland during 2017. The SWG was pleased to learn that genetic samples were obtained from all the landed whales. The SWG again **emphasised** the importance of collecting genetic samples and photographs of the flukes from these whales.

The SWG noted that five humpback whales were observed entangled in fishing gear in West Greenland in 2017. Of these, one died, two became free and one was successfully disentangled by a disentanglement team. The remaining animal was alive and still entangled when it was last sighted.

The SWG noted that some bycaught whales had been included in the scenarios for the development of the *Humpback SLA*. If high levels continued, then this would need to be taken into account in any *Implementation Review*. It noted the IWC efforts with respect to disentanglement and prevention and **welcomed** the news that the Greenland authorities requested IWC disentanglement training that took place in 2016 and that they successfully disentangled one humpback whale.

5.7.2 New information on abundance

The Working Group on ASI endorsed the 2015 aerial survey abundance estimate of 993 (CV=0.46; 95%CI 434-2,272) as discussed in Annex Q.

5.7.3 Management advice

The SWG **agreed** that the *WG humpback SLA* remains the best available tool for management advice for this stock. It **advised** that a continuation of the present average annual strike limit of 10 whales will not harm the stock and meets the Commission's conservation objectives.

The SWG also **advised** that provisions allowing for the carry forward of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit' has no conservation implications (see SC/67b/Rep04).

Attention: C-A

SC/67b/AWMP19 reported Greenland's plans for requesting aboriginal whaling provisions at IWC/67. It requested advice on annual strikes of 10 animals (i.e. no change).

The Committee therefore:

- (1) agrees that the WG-Humpback SLA is the best available way to provide management advice for this stock;*

- (2) **advises** that a continuation of the present average annual strike limit of 10 whales will not harm the stock and meets the Commission's conservation objectives;
 - (3) **advises** that that provisions allowing for the carry forward of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit' has no conservation implications (see SC/67b/Rep04); and
 - (4) **encourages** the continued collection of samples and photographs for collaborative analyses.
-

5.8 Humpback whales off St Vincent and The Grenadines

The alternate Commissioner for St Vincent and The Grenadines advised that no change to the present limits were envisaged.

5.8.1 New information on catch

It was reported that one humpback whale was struck and landed in 2017 by St Vincent and The Grenadines.

5.8.2 New information on abundance

Last year, the Committee had requested that the USA provide a new abundance estimate for the western North Atlantic based upon the available NOAA data (IWC, 2018). Clapham and Wade provided a progress report on this work with a focus on information on abundance estimates generated by the MONAH study, conducted in 2004 and 2005 on Silver Bank (a breeding ground in the West Indies) and in the Gulf of Maine feeding ground. The best estimate was judged to be a genotype-based two-year pooled feeding-to-breeding male-only Chapman estimate. This estimate was 6,156 (95% CI 4,344, 7,977), which when doubled (to account for females) equals 12,312. This was slightly higher than, although not significantly different from, the best estimate from the YONAH project from 1992/93, which was 10,400 (8,000, 13,600). The lack of strong population growth was unexpected given information on rates of increase from some other areas of the North Atlantic, and may reflect either a true rate of increase, unidentified sampling bias, and/or the idea that Silver Bank as a habitat has reached a maximum capacity. Given this, it was not clear whether the MONAH estimate is representative of the entire population, nor whether it can be applied to the southeastern Caribbean in the context of the St Vincent hunt. Four animals from the southeastern Caribbean have been linked to animals seen in the Gulf of Maine (one was caught in the hunt).

The SWG also noted the recent new abundance estimates of humpback whales in the North Atlantic including 993 (95% CI: 434-2,272) in West Greenland in 2015, 4,223 (95% CI: 1,845-9,666) in East Greenland in 2015 and Iceland-Faroes with 12,879 (95% CI 5,074; 26455) estimated from the 2007 ship survey

It has now been nearly two decades since the IWC has undertaken an In-Depth Assessment on North Atlantic humpback whales. The SWG **agreed** that it would be a valuable exercise to perform a North Atlantic Rangewide review of humpback whales, similar in scope to the Rangewide Review for North Pacific gray whales and taking into account recent work on stock structure including that of Stevick *et al.* (2018).

5.8.3 Management advice

The SWG noted that it did not have an approved abundance estimate for western North Atlantic since that in 1992. In accord with the advice provided in the AWS (see Appendix 8), it therefore considered the available evidence to see if was sufficient to provide safe management advice. Given the information above on recent abundance in the North Atlantic and the size of the requested catch/strikes (an average of four annually), the SWG **advised** that continuation of the present limits will not harm the stock.

The SWG also **repeats** its earlier advice that:

- (1) the status and disposition of genetic samples collected from past harvested whales be determined and reported next year;
 - (2) photographs for photo-id (where possible) and genetic samples are collected from all whales landed in future hunts; and that
 - (3) the USA (NOAA, NMFS) provides an abundance estimate from the MONAH data as soon as possible for the Committee.
-

Attention: C-A

The alternate Commissioner for St Vincent and The Grenadines advised that no change to the present limits were envisaged. The Committee therefore:

- (1) **notes** that it does not have an approved abundance estimate for western North Atlantic since that in 1992;
- (2) **notes** that in accord with the advice provided in the AWS (see Annex E, Appendix 8), it therefore considered the available evidence to see if was sufficient to provide safe management advice;
- (3) **advises** that, given the information above on recent abundance in the North Atlantic combined with the size of the requested catch/strikes (an average of four annually), continuation of the present limits will not harm the stock;

The Committee also reiterates its previous advice that:

- (1) the status and disposition of genetic samples collected from past harvested whales be determined and reported next year;
- (2) photographs for photo-id (where possible) and genetic samples are collected from all whales landed in future hunts; and that
- (3) the USA (NOAA, NMFS) provides an abundance estimate from the MONAH data as soon as possible for the Committee.

6. WORKPLAN 2019-20 (INCLUDING WORKSHOPS AND INTERSESSIONAL GROUPS)

Table 1 summarises the work plan for work related to aboriginal subsistence whaling.

Simulation testing of interim relief allowances has been conducted for B-C-B bowheads and WG humpbacks (Appendix 8 under Item 3). Interim relief will be tested for eastern NP gray whales at the next *Implementation Review* for that stock. Testing for the remaining ASW stocks will be added to the future workplan of the Committee.

Table 1
Work plan for matters related to aboriginal subsistence whaling.

Topic	Intersessional 2018/19	2019 Annual Meeting (SC/68a)	Intersessional 2019/20	2020 Annual meeting
(1) Annual review of catch/strike limits		Carry out		Carry out
(2) <i>Implementation Review</i>		Gray whales based upon rangewide review		West Greenland humpback whales
(3) SLAs		Consider development of an SLA for the hunt of common minke whales off East Greenland based on operational models developed for the West Greenland hunt		Adopt SLA if it is decided one is necessary
(5) Interim relief allowance testing	Run trials for gray whale hunts	Review results	Run trials for West Greenland common minke whales and fin whales	Review results
(6) Carryover (US/Denmark request)	Run trials for remaining Greenland hunts (West Greenland common minke whales, bowhead whales and fin whales)	Review results		

7. BUDGETARY ITEMS 2019-20

The SWG has no budget requests for the next biennium.

8. ADOPTION OF REPORT

The Chair noted that this meeting represented the end of a long journey – with the adoption of the two new SLAs, the SWG had completed the development tasks it had been assigned by the Commission. He thanked all of the people who have made such a wonderful contribution over the years – the SWG has, in his view, achieved ground-breaking work over the last two decades in a spirit of great collaboration and co-operation, even when there were disagreements as inevitably there were. At this meeting, he thanked the rapporteurs, and especially John Brandon for their hard work. Primarily, though thanks were due to André Punt, Lars Witting and Anabela Brandão for their herculean efforts in developing and running trials and developing SLAs. However, greatest praise should go to Cherry Allison who under extremely difficult circumstances provided superb support from Cambridge. The whole SWG sends their thanks, support and best wishes.

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- International Whaling Commission. 2016b. Report of the AWMP Intersessional Workshop on Developing Strike Limit Algorithms (SLAs) for the Greenland Hunts, 3-5 February 2015, Copenhagen, Denmark. *J. Cetacean Res. Manage. (Suppl.)* 17:471-84.

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Appendix 1

AGENDA

1. INTRODUCTORY ITEMS
 - 1.1 Convenor's opening remarks
 - 1.2 Election of Chair and appointment of rapporteurs
 - 1.3 Adoption of Agenda
 - 1.4 Documents available
2. SLA DEVELOPMENT
 - 2.1 Fin whales (Greenland)
 - 2.1.1 Review results of intersessional Workshops
 - 2.1.2 Review post-Workshop progress
 - 2.1.3 Review final results and performance
 - 2.1.4 Conclusions and recommendations
 - 2.2 Common minke whales (Greenland)
 - 2.2.1 Review results of intersessional Workshops
 - 2.2.2 Review post-Workshop progress
 - 2.2.3 Review description of and results for candidate SLAs
 - 2.2.4 Conclusions and recommendations
 - 2.3 North Pacific gray whales (Makah management plan)
 - 2.3.1 Summarise the plan
 - 2.3.2 Review intersessional progress including at the Rangewide Workshop
 - 2.3.3. Conclusions and recommendations
 - 2.4 WG-bowhead whales
 - 2.4.1 Review results using 400 replicates
 - 2.3.2 Testing the Interim Allowance strategy
 - 2.3.3 Conclusions and recommendations
3. ABORIGINAL WHALING MANAGEMENT SCHEME (AWS)
 - 3.1 Review results of intersessional Workshops
 - 3.2 Review proposed updates to the AWS
 - 3.2 Conclusions and recommendations
4. IMPLEMENTATION REVIEW OF B-C-B BOWHEAD WHALES
 - 4.1 Stock structure: review new information (including advice from SD)
 - 4.2 Abundance estimates: review new information (including advice from ASI)
 - 4.3 Biological parameters: review new information
 - 4.4 Removals: review new information
 - 4.5 Other anthropogenic threats and health: review new information
 - 4.6 Conclusions and recommendations (and, if needed, workplan to complete *Review*)
5. STOCKS SUBJECT TO ASW (NEW INFORMATION AND MANAGEMENT ADVICE)
 - 5.1 Eastern Canada/West Greenland bowhead whales
 - 5.2 North Pacific gray whales
 - 5.3 Bering-Chukchi-Beaufort Seas bowhead whale
 - 5.4 Common minke whales off East Greenland
 - 5.5 Common minke whales off West Greenland
 - 5.6 Fin whales off West Greenland
 - 5.7 Humpback whales off West Greenland
 - 5.8 Humpback whales off St Vincent and The Grenadines
6. WORKPLAN 2019-20 (INCLUDING WORKSHOPS AND INTERSESSIONAL GROUPS)
7. BUDGETARY ITEMS 2019-20
8. ADOPTION OF REPORT

Appendix 2

SPECIFICATIONS FOR THE TESTING OF THE WEST GREENLAND FIN WHALE SLA

[To come]

Appendix 3

WEST GREENLAND FIN WHALE SLA PERFORMANCE STATISTICS

[To come]

[Place holder figure from AWMP WP 15: Insert additional ‘Wilberg-Brandao’ plots from LARS / Bela / Andre re: D1:D10 across simulation replicates etc]

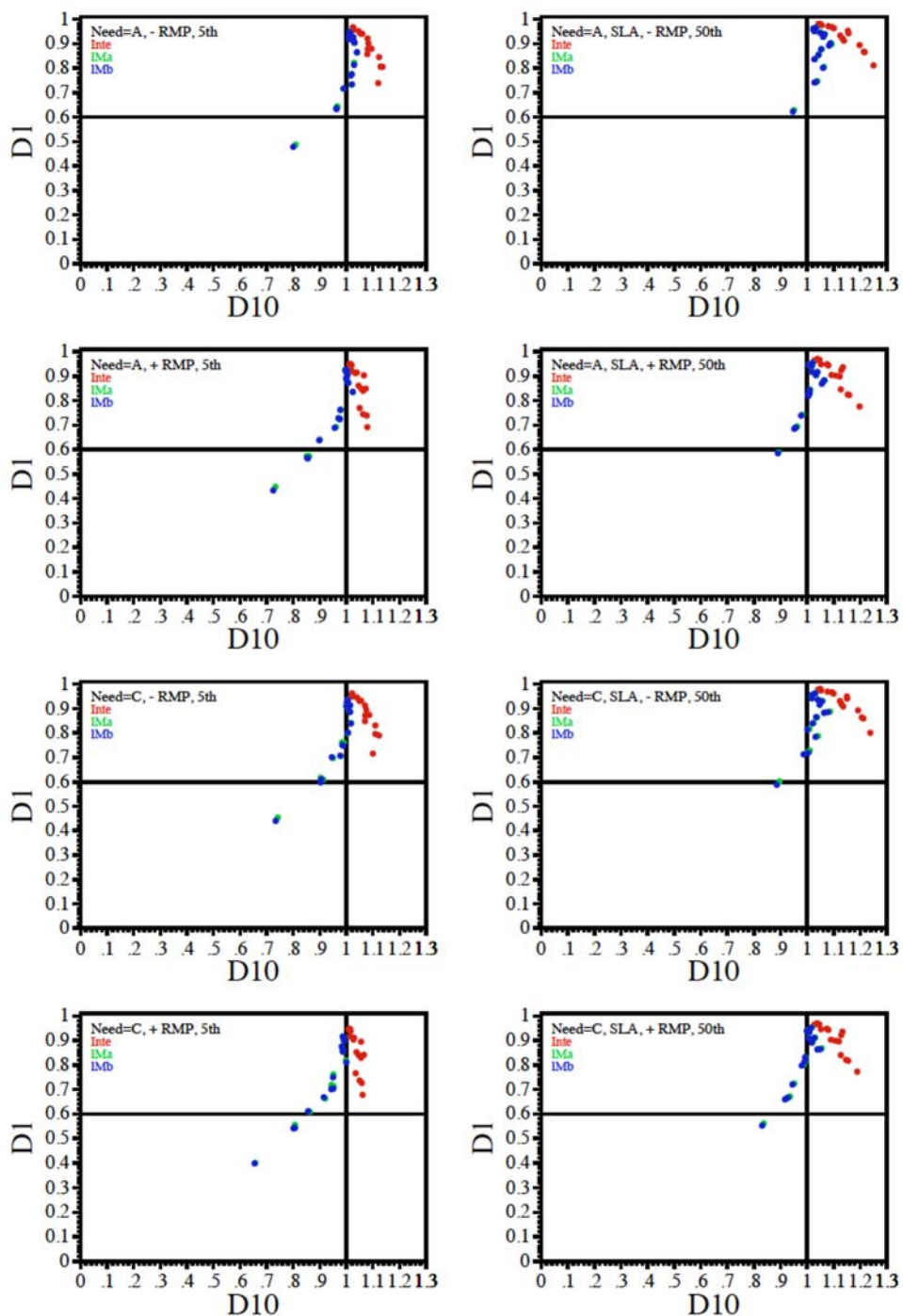


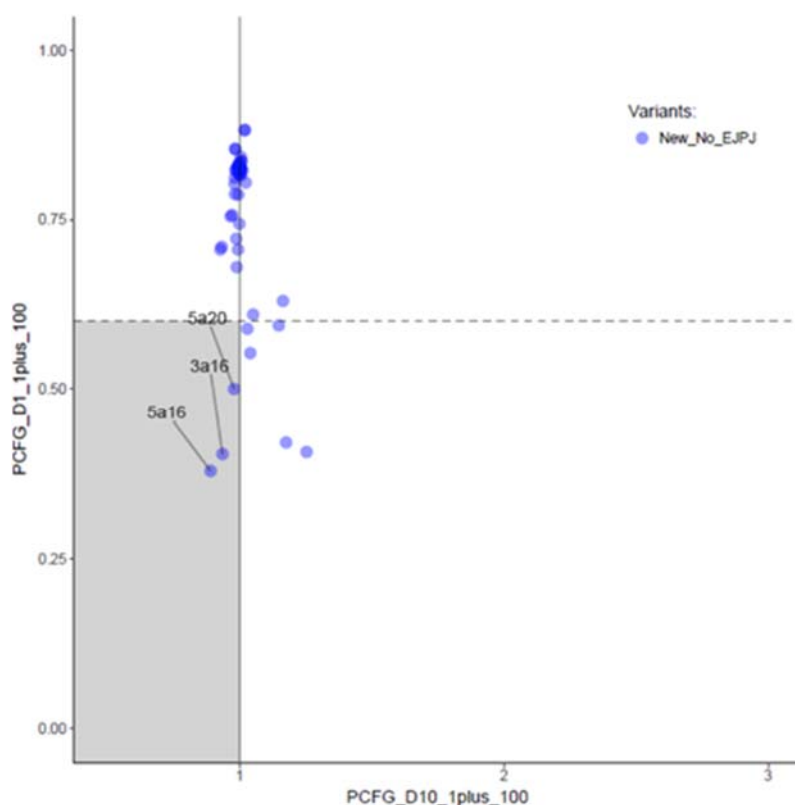
Fig A.1. Points in the lower left quadrant are of interest

Appendix 4

SPECIFICATIONS FOR THE TESTING OF THE WEST GREENLAND COMMON MINKE WHALE SLA

[To come]

Appendix 5
SELECTION OF RESULTS FOR THE MAKAH MANAGEMENT PLAN
 [Trials list to come]



Appendix 6
 [to come]

Appendix 7

INTERIM RELIEF SCENARIOS

Appendix 8 specifies an interim relief provision for the Aboriginal Whaling Scheme. Under this provision, a survey is required at least every 10 years. If no survey is available after that time and third quota block has begun, the Committee has **endorsed** the use of an ‘interim relief’, namely a ‘grace period’ strike limit equal to the limit produced by the applicable Strike Limit Algorithm, without reduction, for a single block.

The 10-year survey interval requirement is complicated by the fact that there will usually be a delay between when the survey is conducted and when the resulting abundance estimate is agreed by the Committee, and because surveys, estimates and quota blocks need not be synchronised, as recognised in IWC (2003). For the sake of counting years, a survey is not considered to have occurred until the resulting abundance estimate is agreed. At that point, the 10-year time window is deemed to have begun in the year during which the survey was conducted. Then, ideally, the next survey would be conducted and the estimate approved within 10 years of the previous survey. However, other scenarios might occur. For example, the next survey might have occurred eight years after the previous one, but the corresponding abundance estimate not agreed until 13 years after the previous survey was conducted (‘the 13th year’). In this case, a survey would be considered overdue during the 11th and 12th years. If the start of a new block occurred during that time, the grace period would be triggered and an interim relief provided. Otherwise, when the abundance estimate is agreed in the 13th year after the last survey was conducted, the fact that the survey actually took place eight years after the last agreed estimate would reset the clock so that the next deadline would be the 18th year, and a grace period would have been averted.

Tables 1 and 2 illustrate several scenarios about how strike limits might evolve with varying survey intervals and grace periods. In these tables, it is assumed for simplicity that the *Strike Limit Algorithm* would output a six-year block strike limit (SL) each time. For the sake of simplicity, carryover is ignored in these tables.

Five different scenarios (A-E) are shown in Tables 1 and 2. These tables cover more than four quota blocks (boxes), with surveys (Surv), abundance estimates (Est) and the establishment of block strike limits (SL) scheduled by year (Yr). The ‘Clock’ counts the number of years remaining before a survey will thereafter be overdue. Thus, when the clock set by the

most recent estimate is negative, a survey is overdue and when a grace period quota is required an interim relief strike limit (IASL) is set.

Scenario A in Table 1 illustrates a situation with regular 8-year survey intervals and estimates two years later. Each strike limit is set using a timely survey; no surveys are overdue and no grace periods are required. Note that in year 13, a block strike limit is set using the survey from year 4. Although the more recent survey (year 12) has occurred, the corresponding abundance estimate has not yet been computed. Scenario B represents an unproblematic case with 10-year survey intervals.

Scenarios C and D illustrate cases where the grace period is invoked in year 13. In Scenario C, immediate revision of the interim relief strike limit (IASL) is assumed and an updated strike limit (USL) is computed. Scenario D presents the same schedule of surveys and estimates, but when the grace period is invoked, the IASL is retained for the entire block, with the year 12 survey first being used in year 19.

Scenario E illustrates that it is possible that surveys could be more than 10 years apart (in this case, 13 years) without triggering the grace period.

Tables 1 and 2

Example schedules of surveys, block strike limits and so forth. See the text for a detailed explanation.

Yr	A	Clock	B	Clock
1	SL		SL	
2				
3				
4	Surv	10		
5		9		
6	Est	8	Surv	10
7	SL	7	Est/SL	9
8		6		8
9		5		7
10		4		6
11		3		5
12	Surv	2		4
13	SL	1	SL	3
14	Est	0		2
15				1
16			Surv	0
17			Est	-1
18				
19	SL		SL	
20	Surv	10		
21		9		
22	Est	8		
23		7		
24		6		
25	SL	5	SL	
26		4	Surv	10

Yr	C	Clock	D	Clock	E	Clock
1	SL		SL		SL	
2	Surv	10	Surv	10		
3		9		9		
4		8		8	Surv	10
5	Est	7	Est	7	Est	9
6		6		6	SL	8
7	SL	5	SL	5		7
8		4		4		6
9		3		3		5
10		2		2		4
11		1		1		3
12	Surv	0	Surv	0		2
13	IASL	-1	IASL	-1	SL	1
14		-2		-2		0
15	Est/USL	-3	Est	-3		-1
16						-2
17					Surv	-3
18					Est	-4
19	SL		SL		SL	
20	Surv	10	Surv	10		
21		9		9		
22	Est	8	Est	8		
23		7		7		
24		6		6		
25	SL	5	SL	5	SL	
26		4		4		

Appendix 8

SCIENTIFIC ASPECTS OF AN ABORIGINAL WHALING SCHEME

The Scientific Committee's Aboriginal Whaling Management Procedure (AWMP) applies stock-specific *Strike Limit Algorithms* (SLAs) to provide advice on aboriginal subsistence whaling (ASW) strike/catch limits.

ASW management (as part of an AWS, the aboriginal whaling scheme) incorporates several components, several of which have a scientific component:

- (a) *Strike Limit Algorithms* (case-specific) used to provide advice on safe catch/strike limits;
- (b) operational rules (generic to the extent possible) including carryover provisions, block quotas and interim relief allocations;
- (c) Guidelines for *Implementation Reviews*; and
- (d) Guidelines for data and analysis (e.g. guidelines for surveys, other data needs)

The scientific components are considered below.

1. CARRYOVER

Carryover is a provision to enable (some) strikes not used in one year to be used in a subsequent year or years, in order to allow for the inevitable fluctuations in the success of hunts (e.g. due to environmental conditions and/or whale availability). Whilst providing flexibility, carryover does not allow hunts to take more than the total number of strikes agreed by the Commission. This flexibility may produce additional benefits for the local management of the hunt. The concept is not new and *ad hoc* provisions incorporating carryover have been included in the Schedule for many years (see the summary provided in *J. Cetacean Res. Manage* 19 (Suppl.), pp. 169-72). As general guidance, the Commission has (in 2001 and 2016), approved examination by the Committee of scenarios incorporating a 50% interannual variation within blocks and 50% allowance to the next block, noting that this did not imply any commitment by the Commission that these values would be used in the Schedule.

1.1 The Committee's role

The Scientific Committee's role is not to recommend a particular carryover approach (there are many possibilities e.g. see IWC *In Press*) but rather to provide advice on the conservation and need performance of carryover options when asked by the Commission or ASW countries. Formal evaluation of the performance of options (see Item 1.2) by the Committee will allow a more consistent approach to carryover across hunts. The Committee's evaluation began in the year 2000 as the Committee began to develop its first recommended components of an AWS (IWC, 2001).

1.2 Examining conservation performance

The Committee examines the conservation performance of options using the same simulation testing approach used to develop SLAs. This allows the Committee to provide guidance as to the acceptable limits within which carryover provisions can be developed. In requesting guidance on carryover provisions, at least the following information should be provided by ASW countries or the Commission:

- (a) an initial start date for the provision (e.g. 2003, start of new block);
- (b) an expiration period (unused strikes cannot be carried over indefinitely); and
- (c) limits on use (e.g. the maximum number of strikes allowed in any one year).

1.3 Additional provision

The Committee's *Implementation Review* process (see section 4 below) includes the monitoring of carryover provisions. Should new information (e.g. abundance data) lead an SLA to indicate a severe decrease in the quota then this will trigger an appropriate review of the existing carryover provisions and any implications for conservation performance. If necessary, the review may lead the Committee to recommend changes in carryover provisions that may, for example, result in a 'reset' of the starting year or other amendments to carryover provisions.

1.4 Schedule language

The Committee advises that the incorporation of carryover provisions in the Schedule should avoid ambiguity. Rather than try to encode general provisions in the Schedule, the Committee offers to assist the Commission in by providing the actual numbers for each hunt in a new quota block, based upon agreed general provisions.

1.5 Example

An example of a response to a request for advice on a carryover option is given in (IWC, *In press*). The request from the USA and Denmark/Greenland was to

'...allow for the carry forward of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit'.

This request was tested using the *Bowhead SLA* (applicable to the Bering-Chukchi-Beaufort Seas stock) and the *WG-Humpback SLA* (applicable to West Greenland) and three types of options were examined:

- (1) baseline case - all strikes taken annually (i.e. no need for carryover);
- (2) ‘frontload’ case - strikes taken as quickly as possible within block (+50% limit annually until the block limit is reached); and
- (3) two alternative scenarios where carryover strikes are accrued for one or three blocks, followed by a period of carryover usage subject to the +50% limit.

The three-block scenario considered in (3) served as a direct test of the provision described in the request of USA and Denmark/Greenland. The Committee agreed that the Commission’s conservation objectives were met for both *SLAs* for all of the options above and would also be met for a proposal carrying forward strikes from the previous two blocks.

2. BLOCK QUOTAS

The Committee has advised the Commission (in the context of moving to biennial meetings) that block quotas of up to 8 years are acceptable (IWC, 2013, p. 22), noting the requirement for abundance estimates every ten years (see Item 3).

3. INTERIM RELIEF

A variety of factors, including environmental conditions, beyond the control of the hunters may prevent the completion of a successful whale population abundance estimate. While recognizing such difficulties, the Committee notes that uncurtailed aboriginal whaling quotas cannot be continued indefinitely in the long-term absence of data. Therefore, the AWS must address what should be done in the event that efforts to obtain an agreed abundance estimate are unsuccessful after some time limit. For the purposes of applying *AWMP Strike Limit Algorithms*, the Committee has agreed that this limit is 10 years (IWC 2003; IWC, 2016a).

A third quota block begun after the 10-year limit has expired is termed a ‘grace period’ and the Committee has endorsed the use of an ‘interim allowance’, namely a grace period strike limit equal to the limit produced by the applicable *Strike Limit Algorithm*, without reduction, for a single block. This approach has been simulation tested for B-C-B bowheads and WG humpbacks to confirm that it meets the conservation and need satisfaction goals of the Commission (IWC, 2016a, pp.190-193; 2016b, pp. 471-484; IWC, 2017, p. 498) and the results are summarized in IWC (2017b; 2018 p. 159). It will be tested for eastern NP gray whales at the next *Implementation Review* for that stock. Testing for the remaining ASW stocks will be added to the future workplan of the Committee.

The 10-year survey interval requirement is complicated by the fact that (a) there will usually be a delay between when a survey is conducted and when the resulting abundance estimate is agreed by the Committee and (b) because surveys, estimates and quota blocks need not be synchronised, as recognised in IWC (2003). For the sake of counting years between surveys, a survey is not considered to have occurred until the resulting abundance estimate is agreed. At that point, the 10-year time window is deemed to have begun in the year during which the survey was conducted. Further details and examples are given in IWC (In press [SC 67b Annex E]).

The Committee recommends (IWC, 2003; 2006) that, during the grace period, a new strike limit is established immediately a new abundance estimate is agreed. this approach. However, it notes that if the Commission refrains from updating the strike limit until the grace period expires, this would not pose a conservation risk. If the strike limit is updated during a grace period block, the number of strikes taken to that point of the grace period should be subtracted from the updated quota, with the remainder being the strike limit for the rest of the grace period. Carryover is not affected.

The Committee emphasises that the interim allowance approach is intended to be applied only in the event that exceptional unforeseen circumstances had delayed obtaining an agreed abundance estimate beyond the end of the second quota block. It should not be interpreted as a routine approach for extending quotas for a third block without a concerted effort to obtain a successful survey prior to that time. Furthermore, the Committee would not recommend two consecutive interim allowances.

It is important to consider a scenario in which no acceptable abundance estimate is obtained by the end of the grace period. *SLAs* are not designed or intended to be applied if new abundance data are not forthcoming after such a long period. Given good faith efforts to obtain an abundance estimate, such a situation would probably have arisen from profound and unexpected environmental change (e.g. related to climate or a disaster such as a massive oil spill). Under such circumstances, an immediate *Implementation Review* (see Item 4.1.2) would probably have been initiated, irrespective of the timing of (un)successful surveys and quota blocks. As soon as it becomes apparent that an abundance estimate may not be obtained in time, researchers should immediately begin to develop alternative approaches to obtaining abundance estimates (or at least indices of abundance) that do not depend on the problematic circumstances. Nevertheless, if no abundance estimate is available the year before the end of the grace period, the Scientific Committee should immediately initiate an *Implementation Review*. The approach of the Committee in the absence of positive alternative evidence would be that the Committee could not provide advice on the quota using the *SLA* and the Commission should exercise great caution when agreeing any further strike limits. The level of caution will depend on the specifics of the situation.

4. IMPLEMENTATION REVIEWS

The concept of an *Implementation Review* is central to the functioning of the AWMP. The primary objectives of an *Implementation Review* are to:

- (1) review the available information (including biological data, abundance estimates and data relevant to stock structure issues) to ascertain whether the present situation is as expected (i.e. within the space tested during the development of a *Strike Limit Algorithm (SLA)*) and determine whether new simulation trials are required to ensure that the *SLA* still meets the Commission's objectives; and
- (2) to review information required for the *SLA*, i.e. catch data and, when available at the time of the *Review*, new abundance estimates (note that this can also occur outside an *Implementation Review* at an Annual Meeting).

4.1 Timing of Implementation Reviews

4.1.1 Regular Implementation Reviews

Implementation Reviews are undertaken regularly, normally every five to six years. This does not have to coincide with the renewal of catch/strike limits in the Commission. For logistical and resource reasons, only one major *Implementation Review* shall be undertaken at a time. The Committee shall begin planning for the *Review* at the Annual Meeting at least two years before the Annual Meeting at which the *Review* is expected to be finished. This is to enable the Committee to schedule additional work or Workshops if it believes that new information or analyses are likely to be presented that will necessitate the development of new simulation trials. Early planning will enhance the likelihood that the Committee will complete an *Implementation Review* on schedule. It is not expected that every *Implementation Review* will entail a large amount of work.

4.1.2 Special Implementation Reviews

In addition to regular *Implementation Reviews*, under exceptional circumstances the Committee may decide to call for special *Implementation Reviews*, should information be presented to suggest that this is necessary and especially if there is a possibility that the Commission's conservation objectives may not be met.

Calling such a *Review* does not necessarily mean revising the Committee's advice to the Commission, although it may do so. The Committee has not tried to compile a formal comprehensive list of what factors might trigger' such an early review, which implies unexpected/unpredictable factors. However, the following list is provided to give examples of some possible factors.

- (1) Major mortality events (e.g. suggested by large numbers of stranded animals).
- (2) Major changes in whale habitat (e.g. the occurrence of natural or anthropogenic disasters or changes, an oil spill, dramatic change in sea-ice, development of a major oil/gas field, etc.).
- (3) Major ecological changes resulting in major long-term changes in habitat or biological parameters.
- (4) A dramatically lower abundance estimate (although the *SLA* has been tested and found to be robust to large sudden drops in abundance, the Committee would review the potential causes of unexpected very low estimates).
- (5) Information from the harvest and hunters (this might include very poor harvest results, reports of low abundance despite good conditions, reports of large numbers of unhealthy animals).
- (6) Changes in biological parameters that may result in changes to management advice (e.g. reproduction, survivorship).
- (7) If there are cases when need is not being satisfied, strong information that might narrow the plausibility range and allow an increase in block limits.

4.1.3 Outcomes of Implementation Reviews

There are a number of possible conclusions of *Implementation Reviews*:

- (1) there is no need to run additional trials and that the existing *SLA* is acceptable;
- (2) the results from the additional trials developed and run reveal that the existing *SLA* is acceptable;
- (3) there is no need for any immediate additional trials or changes to management advice but work is identified that is required for consideration at the next *Implementation Review*; or
- (4) the results of the additional trials require the development of a new (or modified and then retested) *SLA* in which case management advice will have to be reconsidered until that work is complete.

4.1.4 Data availability

Implementation Reviews fall under the Committee's Data Availability Agreement Procedure A (IWC, 2004). By the time of the Annual Meeting prior to that at which the *Implementation Review* is expected to be completed, the scientists from the country or countries undertaking the hunts, or others intending to submit relevant analyses, shall develop a document or documents that explains the data that will/could be used for the *Implementation Review*. Such a document will:

- (a) outline the data that will be available, including by broad data type (e.g. sighting data, catch data, biological data): the years for which the data are available; the fields within the database; and the sample sizes;
- (b) provide references to data collection and validation protocols and any associated information needed to understand the datasets or to explain gaps or limitations; and
- (c) where available, provide references to documents and publications of previous analyses undertaken of data.

The data themselves shall be available in electronic format one month after the close of that Annual Meeting.

In the case of complex *Implementation Reviews* that may last more than one year and involve one or more workshops, new data can be submitted, provided that the data are described and made available at least nine months before the Annual Meeting at which the *Implementation Review* is expected to be completed.

4.1.5 Computer programs

Programs used in analyses submitted to the *Implementation Review* may be requested by the Committee, who may decide that the programmes need independent validation in accordance with its guidelines at the time. All *SLA* simulation testing and evaluation software shall be undertaken by the Secretariat using validated programmes.

5. GUIDELINES FOR SURVEYS

The Committee's general advice on surveys is applicable. Some more specific considerations are given below.

5.1 Survey/census methodology and design

Plans for undertaking a survey/census should be submitted to the Scientific Committee in advance of their being carried out, although prior approval by the Committee is not required. This should normally be at the Annual Meeting before the survey/census is carried out. Sufficient detail should be provided to allow the Committee to review the field and estimation methodology. Considerably more detail would be expected if novel methods are planned.

5.2 Committee oversight

Should it desire, the Scientific Committee may nominate one of its members to observe the survey/census to assess the scientific integrity of the process.

5.3 Data analysis and availability

Data to be used in the estimation of abundance will be made available to the Committee in accordance with Procedure A of the Data Availability Agreement (IWC, 2004). If new estimation methods are used in the data analysis, the Committee may require that computer programs (including documentation to allow such programs to be validated) be provided to the Secretariat for eventual validation.

5.4 Estimates to use in the *SLA*

The most recent estimate(s) accepted by the Committee for any year(s) should be incorporated in the *SLA* calculations. If there is more than one accepted estimate for a given year and the Committee agrees that the estimates are based on sufficiently independent data, then both estimates should be incorporated in the *SLA* calculations. If a revised estimate is obtained for a particular year, then the old one should be replaced before the *SLA* is next used.

6. GUIDELINES FOR DATA/SAMPLE COLLECTION

The Schedule states that data from each harvested animal should be collected and made available to the IWC. The following information should normally be provided for each harvest or individual whale as appropriate:

- (1) species;
- (2) number of animals;
- (3) sex;
- (4) season;
- (5) location of catch (at least to the nearest village); and
- (6) length of catch (to 0.1m).

The Committee recognises the importance of additional information, especially in the context of *Implementation Reviews* e.g. on reproductive status and health. It highlights the importance of collecting tissue samples for genetic studies in accordance with guidance provided by the Committee (e.g. <https://iwc.int/index.php?CID=60&cType=document>), especially in the context of stock structure issues. It notes that photo-identification data can be valuable for estimating biological parameters, assessing anthropogenic injuries, and encourages such research where possible. The value of traditional knowledge is also noted, and such information can also provide valuable input to conducting *Implementation Reviews*.

6.1 Revisions to the AWS

Revisions or additions to this AWS may be recommended by the Committee at any time, including during *Special Implementation Reviews*.

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