Northwest Atlantic Fisheries Organization

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SCIENTIFIC COUNCIL MEETING - SEPTEMBER 2016

Contents

REPORT OF SCIENTIFIC COUNCIL MEETING

19-23 September 2016

Chair: Kathy Sosebee Rapporteur: Tom Blasdale

I. PLENARY SESSIONS

The Scientific Council met at the Convention Center Plaza America, Varadero Beach, Cuba during 19-23 September 2016, to consider the various matters in its agenda. Representatives attended from Canada, Cuba, European Union (France, Portugal, Spain and the United Kingdom), Japan, Norway, the Russian Federation and the United States of America. The Scientific Council Coordinator was in attendance.

The Executive Committee met prior to the opening session of the Council to discuss the provisional agenda and plan of work.

The opening session of the Council was called to order at 0945 hours on 19 September 2016.

The Chair welcomed participants to the 38th Annual Meeting and thanked Cuba for hosting this event.

The provisional agenda was adopted with minor additions. The Council appointed Tom Blasdale, the Scientific Council Coordinator, as rapporteur. The Chair welcomed the Ecology Action Centre as observers to this meeting.

The Council and its Standing Committees met through 19-23 September 2016 to address various items in its agenda. The Council considered and adopted the reports of the STACFIS and STACREC Standing Committees on 23 September 2016. The final session was called to order at 0900 hours on 23 September 2016. The Scientific Council then considered and adopted its report of this meeting. The meeting was adjourned at 15:30 hours on 23 September 2016.

The Reports of the Standing Committees as adopted by the Council are appended as follows: Appendix I - Report of Standing Committee on Research Coordination (STACREC), and Appendix II - Report of Standing Committee on Fisheries Science (STACFIS).

The Agenda, List of Research (SCR) and Summary (SCS) Documents, and the List of Representatives, Advisers and Experts, are given in Appendices III, IV, and VI, respectively.

II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS

There were no recommendations arising from the 2014 or 2015 Scientific Council Meetings.

III. RESEARCH COORDINATION

The Council adopted the Report of the Standing Committee on Research Coordination (STACREC) as presented by the Chair, Brian Healey. The full report of STACREC is at Appendix I.

IV. FISHERIES SCIENCE

The Council adopted the Report of the Standing Committee on Fisheries Science (STACFIS) as presented by the Chair, Joel Vigneau. The full report of STACFIS is at Appendix II.

V. REQUESTS FROM THE FISHERIES COMMISSION

1. Requests deferred from the June Meeting

There were no requests deferred from the June Meeting.

2. Requests received from the Fisheries Commission during the Annual Meeting

The following requests were received during the current meeting. Scientific Council noted that these responses are only for the clarification of the advice and do not in any way alter or change the advice published in the previous reports of the Scientific Council.

Greenland halibut in Divs. 2J+3KLMNO

From the EU. During recent years the trend in most of the commercial species present in the 3NO division of the Grand Bank has been upwards. Cod spawning biomass in division 3NO has increased considerably over the past five years (NAFO SCS Doc. 15-12). The spawning stock biomass (SBB) of American plaice in 3LNO has been increasing since its lowest estimate levels in 1995 (NAFO SCS Doc. 16-14 Rev.). The stock size of yellowtail flounder 3LNO has steadily increased since 1994 and is now well above B_{msy} (NAFO SCS Doc. 15-12). For the Witch Flounder 3NO, the stock size has steadily increased since 1999 and is now at 81% B_{msy} (NAFO SCS Doc. 15-12). Thorny skate biomass in 3LNO has been increasing very slowly from low levels since the mid-1990s (NAFO SCS Doc. 16-14 Rev.). White hake 3NO shows an increase in the biomass index since 2014 to the average level observed from 1996-2014 (NAFO SCS Doc. 15-12).

The Fisheries commission requested:

1. *Could the Scientific council explain if it is possible that the biomass index for Greenland Halibut in shallower areas from the two surveys in Div. 3LNO has been influenced by the increase in abundance of other stocks, be it by substitution or displacement or other reasons?*

Scientific Council responded: SC is unable to answer the question at this time given the complexity of the ecosystem on the Grand Bank.

Determining the effects of species interactions, both in terms of trajectories over time and spatial distribution are difficult to disentangle. Typically, the final outcomes are the consequence of multiple interactions playing all at once. The available information on diet compositions, albeit limited for some of the stocks, indicates that there are some shared prey items between Greenland Halibut and some of the other stocks. This would suggest that trophic interactions are a plausible mechanism for the patterns described.

However, the spatial distribution of these stocks indicates that Greenland halibut biomass mostly occurs in the northern Grand Bank (3L), while for the other species, most of their biomass on the Grand Bank tends to be on the southern areas (3NO), suggesting that interactions among these species may not necessarily have a strong impact on species distributions. In addition, environmental factors like temperature and the related thermal habitat are also potentially important drivers that can affect both, stock trajectories over time, and spatial distributions. The food web in the Grand Bank is complex, and definitive answers to these types of specific questions can only be address through direct analysis, and to the extent the available data and capacity allows.

Multispecies modelling work for the Grand Bank is ongoing, but this work is far from being completed. SC would need to know the level of priority of work on Greenland halibut in relation to other activities.

Greenland Halibut has shown an opposite trend in the biomass index values linked to shallow depths in the Canadian spring survey in Div. 3LNO and the EU Spanish Spring survey in Div. 3NO. These downwards trends for shallower areas in 3LNO have occurred simultaneously to opposite upwards tendencies for the other main commercial species in the same depths.

1.1. *Could the Scientific Council Confirm whether or not the biomass indexes mentioned in 1.1 above reflect the real variations in the total biomass for the whole Greenland Halibut population in the NAFO regulatory area?*

Scientific Council responded: no single survey series covers the entire stock area. The Canadian spring survey index of abundance was considered an index of stock size for younger ages in the most recent assessment. Most research vessel survey series providing information on the abundance of Greenland halibut are deficient in various ways and to varying degrees. However, together these surveys provide coverage of the majority of the spatial distribution of the stock and the area from which the majority of the catches are taken. Moreover, the SC in June stressed that prior to any new assessment, data from all surveys need to be evaluated for internal consistency and compared for consistency across surveys. These analyses will determine if they provide appropriate input to a model of the dynamics of the population.

2. *Could the Scientific Council estimate what would be the derived TAC if only the two remaining 2011-2015 survey slopes (Canadian Fall survey in 2J3K and EU-Spain Flemish Cap survey in 3M) are included in the calculation for 2017 for Greenland halibut in SA2 + Divs. 3KLMNO?*

Scientific Council responded: The computation result (15 539 t) is 5% larger than the 2016 TAC. However, this alternative HCR which considers results from only two surveys is a departure from the work done by WGMSE and it is impossible to comment on whether this strategy is sustainable.

When the HCR was adopted in 2010, a single survey point was missing from each of the Canadian surveys. In such cases, it was agreed that the remaining data points would be used to compute the survey slope. This approach has been applied in subsequent years.

3. Verbal request from Norway. *We note that SC in the STACFIS report says that recruitment has been below average for the most recent 4 years. Can you say what implications that would have for the future development of the stock.*

Scientific Council responded: Because the assessment has not yet been completed, SC is unable to project the impact of these recruits with respect to the short term development of the stock. It is expected that this issue will be addressed in the course of the work plan for the revision of the assessment.

Assessment of significant adverse impact (SAI) on VMEs

FC questions on its 2016 report, the SC answers the request of the FC to assess the risk associated with bottom fishing activities on known and predicted VME species and elements in the NRA. Could the SC clarify the following:

The Fisheries commission requested:

1. Page 29: from quantitative to qualitative. *The 2 tables on page 29 of the SC report constitute the core of the SAI advice. But it is unclear how the quantitative evaluation of SAI criteria made in the first table led to the qualitative attribution of risk scores (the colour codes) in the second table. The SC report talks about the risk scores being "determined by expert evaluation". There is no clarity as to what specific percentage intervals determine a given risk score (a given colour). How did this "expert evaluation" take place? Is there any written methodology where it can be ascertained how the risk scores were attributed, on the basis of the quantitative evaluation?*

Scientific Council responded: SC notes and endorses the conclusion made by WGEAFFM (NAFO FC-SC Doc. 16/03), that is; "the use of colour coding to represent 'low', 'moderate' and 'high' risk categories was less informative than simply having a table with quantitative numbers (percentages), particularly as the thresholds used to determine which category of risk applied were not explicit as they were assigned using expert judgment". SC further concludes that to avoid unnecessary uncertainty and ambiguity, that the assigned colours (red, yellow and green), against the SAI specific criteria for each of the VME types, be disregarded and removed from the tables in the assessment of SAI along with the associated text; "high", "Moderate" and "Low.

The "low risk", "high risk" and "impacted" categories referred to in table 1 refer to a quantitatively defined SAI criteria and should not be confused with the overall risk category (last row of the table). The overall "risk of SAI", as presented in the assessment table (table 1) in the SC advice, and reiterated by WGEAFM (NAFO FC-SC Doc. 16/03), was evaluated using expert judgement and achieved by consensus during the plenary session of WGESA in November 2015. The overall risk category is qualitative rather than quantitative and as such, specific percentage intervals resulting in high, moderate or low risk cannot be assigned.

Table 1.

	Sponge		Sea pen		Large gorgonian	
SAI criteria	Area	Biomass	Area	Biomass	Area	Biomass
Low risk	65%	73%	16%	19%	56%	63%
High risk	21%	17%	46%	39%	12%	14%
Impacted	14%	10%	38%	42%	31%	23%
VMEs overlapping	11%		2%		74%	
Impact cut-off value	0.3		0.5		0.1	
Fragmentation	1%		26%		2%	
Fishing area stability	32%		14%		21%	
Overall Risk of SAI	Low		High		Low	

2. Page 29: biomass and area. *It would seem that, among the criteria used for the SAI assessment, equal weight is given to biomass and area where the VME indicator species occurs. Shouldn't biomass be a predominant factor? Is the weight for all criteria listed the same for all three VME indicator species?*

Scientific Council responded: Biomass is considered to be of greater functional significance for VMEs, however the same overall assessment of SAI is reached irrespective of using either biomass or area based calculations.

The assessment of all the specific SAI criteria was done on equal terms without any weighting. Likewise, no comparative evaluation of the relative importance or significance of VME has been attempted in the current assessment, nor was a distinction made between the relative importance of the specific SAI criteria used in the assessment. For example, all VME were treated as being of equal importance and value (such that a 10% area of impact of sponge VME was evaluated to be lower risk than (say) a 40% area of impact of sea pen VME).

3. Page 29: sensitivity to fishing. *In the quantitative table (percentages) there is a criterion called "sensitivity", which is 0.5 for sea pen, 0.3 for sponges and 0.1 for large gorgonians. Can it be understood that the higher index for sea pen sensitivity means, in fact, that sea pens are less sensitive to fishing than sponges or gorgonians (i.e. more resilient)?*

SC response: Yes. Higher values indicate that a VME may be more resilient, however, all VMEs by definition have low resilience, it is just that some are more resilient than others.

Page 30*: in the three maps with impacted, high and low risk areas (see also a copy below), it would seem that certain portions of current closures are not in any of those cases (neither impacted in the past nor at high risk nor at low risk). In other words, they appear in grey colour in all three maps. Does this mean that those "grey" portions do not serve any VME protection purpose any longer? Examples are circled in red below:*

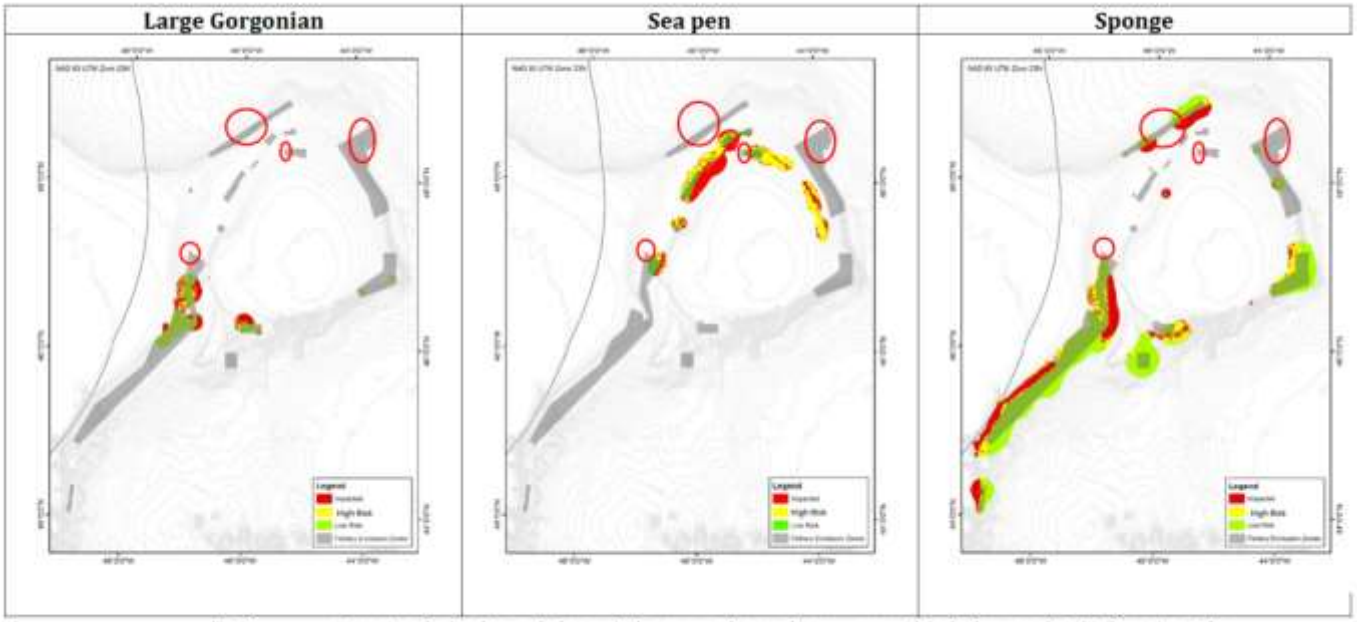


Fig.3. Impacted, high and low risk areas have been quantified for each VME using the corresponding cut-off values (see Annex VIII, section 4.2.5.)

Scientific Council responded: No. There is VME habitat present in the fishery closures beyond the VME polygon boundaries as defined and used in the current assessment. The polygon boundaries as used in the assessment should not be interpreted as the definitive distribution of actual known VME. The polygon boundaries (defined by a combination of KDA and SDM modelling using environmental data) are simply used to ensure that a consistent assessment approach is applied across all VME types. For example, there are additional underwater camera data for some of the closure areas outside of VME polygons, which clearly show VME. However, since all closure areas outside of polygon boundaries have not been consistently sampled using the same techniques, it has not been possible to use the data in the current assessment.

The closures of Candidate areas 13 and 14

In 2013 the Fisheries Commission Working Group of Fishery Managers and Scientists on Vulnerable Marine Ecosystems (WGFMS-VME) (NAFO/FC Doc. 13/3), proposed a measure concerning the creation of closed areas 13 and 14 in order to protect significant concentrations of large sea pens. The initial consideration of closure of the sea pen areas 13 and 14, i.e. around 43 Km2, was based on two surveys tows (1.6 and 2.2 Kg) which showed a sea pen weight over the 1.6 Kg threshold identified for sea pens.

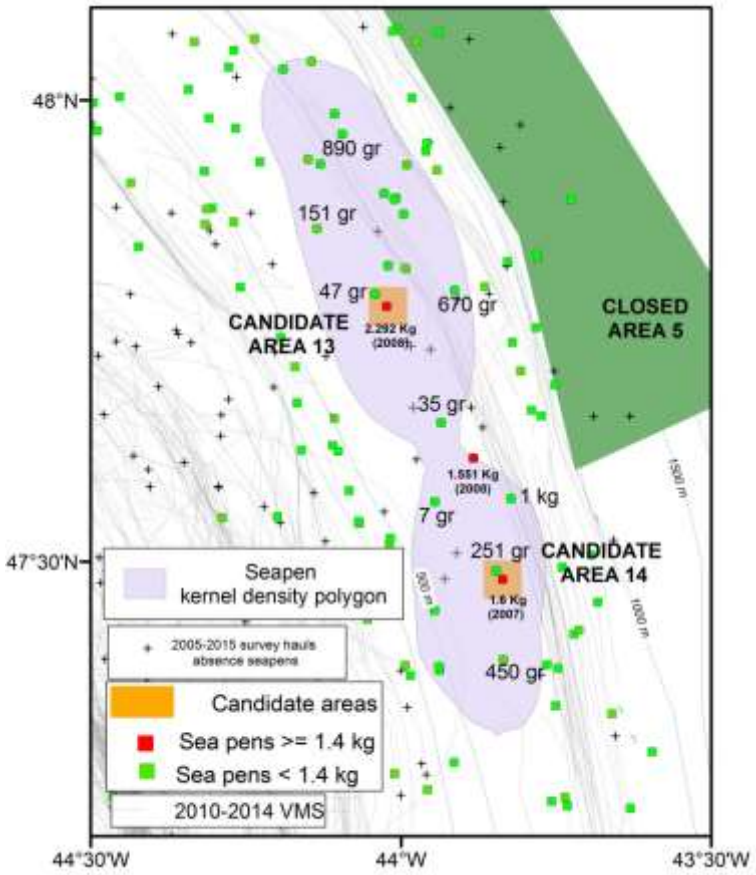
As a result of lowering the sea pens threshold to 1.4 Kg (NAFO SCS Doc. 13/024), a third survey tow (1.5 Kg) was added to those surveys over the threshold, having as a result a proposal for a larger polygonal area over 200 Km^2.

The Fisheries commission requested:

> **1.** *Could the Scientific Council identify the total number of survey tows inside the sea pen Kernel density polygon and the number of those survey tows below the threshold? And more specifically, can the Scientific Council indicate how many of the new scientific surveys tows undertaken since 2014 are over the sea pen threshold?*

Scientific Council responded: The total number of survey tows inside the sea-pen Kernel density polygon around candidate areas 13 and 14, northeast of Flemish Cap for the 2005-2015 period is 37. 27 of these contained sea pens, of which 3 were above the threshold.

During 2014 and 2015 seven new EU Spain and Portugal scientific surveys tows were undertaken inside the sea-pen kernel density polygon around candidate areas 13 and 14, northeast of Flemish Cap. Six of these contained sea pens of which none were over the sea-pen threshold.



Question 1 part 2: *Could the Scientific Council also recall the development on the thresholds for sea pens and why this threshold was lowered from one year to the other in 2013?*

Scientific Council responded. The threshold of 1.6 kg for seapen was estimated in 2008 on the basis of the data available at the time and using a cumulative distribution approach (NAFO SCS 08/24). This method estimated the threshold by considering the point where 97.5% of all seapen biomass was accumulated. This value of 97.5% was arbitrary and defined on the basis on very general statistical arguments and in association with other spatial buffering considerations; it does not reflect any characteristic of the spatial structure of seapen aggregations. The value of 1.4 kg was estimated through the application of the Kernel Density Estimation method that allows detecting natural breaks in the spatial distribution of seapen biomass aggregations (NAFO SCS 13/14, Kenchington et al. 2014). This analysis included a larger dataset, and unlike the cumulative biomass method, it allows considering the actual spatial structure of the distribution of biomass to identify the VME habitat boundaries.

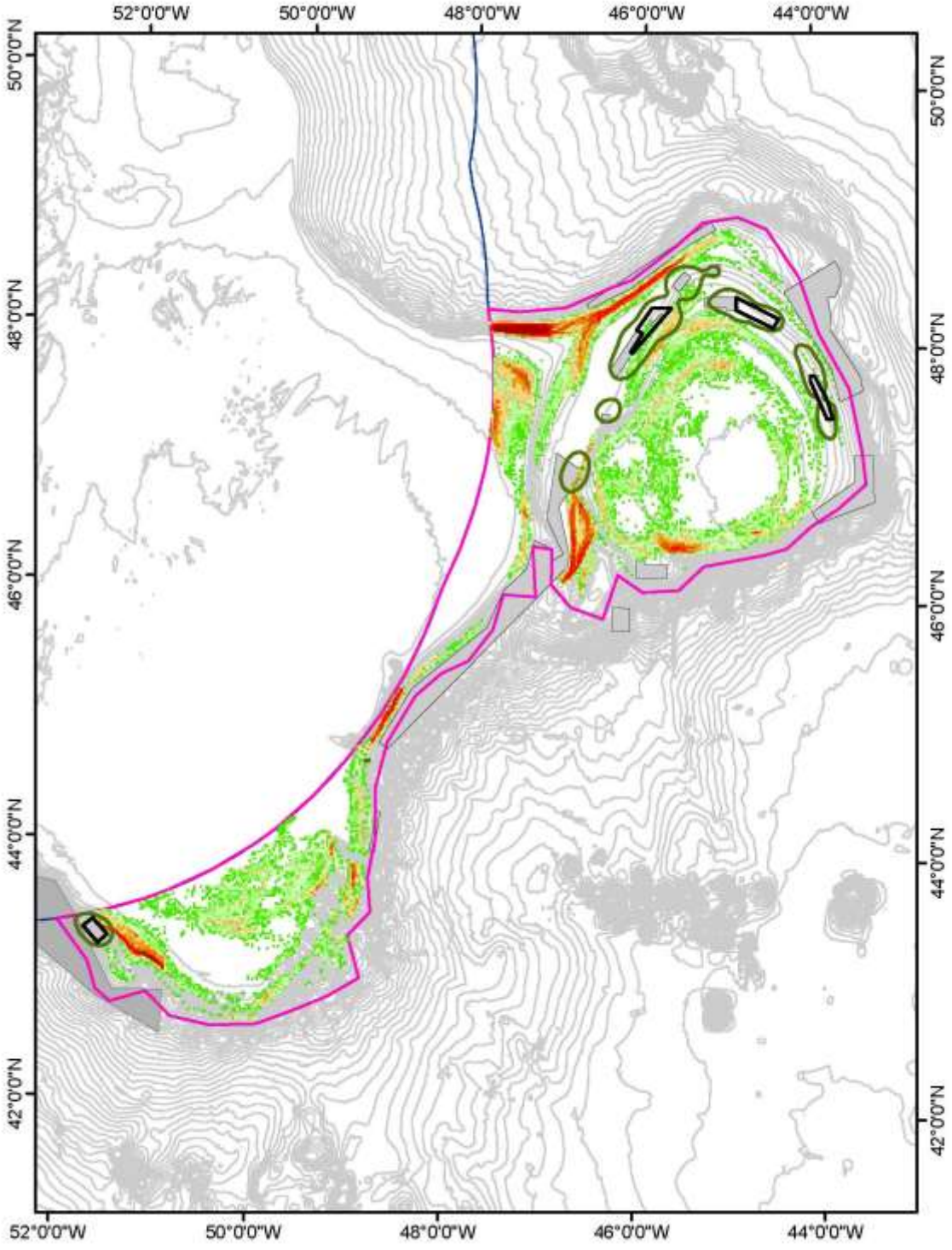
2. *How would the closure of candidate areas 13 and 14 affect the percentages established for the risk criteria under SAI assessment for sea pens and consequently, the attribution of risk categories (colours)?*

Scientific Council responded: The closure of the original proposed areas 13 and 14 does not make any difference in terms of the overall seapen area and biomass protected and consequently would not be expected to result in any change to the overall risk evaluation. The closure of the polygon proposed in 2013 that joins the two original areas provides only marginal improvements on the overall seapen area and biomass protected.

	Current Seapen protection zones		Current Seapen protection zones plus original areas 13 and 14		Current Seapen protection zones plus the previously proposed polygon that joins the original areas 13 and 14	
SAI criteria	**Area**	**Biomass**	**Area**	**Biomass**	**Area**	**Biomass**
Low risk	16%	19%	16%	19%	19%	20%
High risk	46%	39%	46%	39%	43%	38%
Impacted	38%	42%	38%	42%	38%	42%

3. *What size/biomass of the NRA would NAFO need to close so as to ensure that sea pen risk levels go from high to moderate or low.*

Scientific Council responded: In order to bring the protected area/biomass to levels closer to the ones of large gorgonians and sponges, several additional (or expansion) of seapen protection zones would be required. The following map illustrates one possible scenario that could lead to these results. This scenario has been designed to minimize overlap with fishing effort (measured as average VMS effort between 2008-2014). The effort depicted in this map corresponds to the top 90% of the total effort. Changes similar to this scenario would improve the risk status of sea-pens, however, without performing a full expert analysis, it is not possible to definitively say which risk category they would be in.



This illustrative scenario renders the following coverages for area and biomass. The current values for large gorgonians and sponges are also provided for comparative purposes.

	Current Seapen protection zones		Current Seapen protection zones plus illustrative polygons to improve coverage for protected seapen area and biomass		Current Sponge protection zones		Current Large gorgonian protection zones	
SAI criteria	**Area**	**Biomass**	**Area**	**Biomass**	**Area**	**Biomass**	**Area**	**Biomass**
Low risk	16%	19%	32%	39%	65%	73%	56%	63%
High risk	46%	39%	36%	28%	14%	10%	12%	14%
Impacted	38%	42%	32%	33%	21%	17%	31%	23%

4. Does the advice given in 2014 still stand?

Scientific Council responded: Yes. There is no new analysis that would invalidate the previous advice.

5 (Follow up question; working Paper 16/13 – Agenda Item 6.4) *The Scientific Council mentions that, during 2014 and 2015, 7 new scientific surveys tows were undertaken inside the sea-pen kernel density polygon around candidate areas 13 and 14. None of those seven (7) new scientific tows were over the sea pen thresholds. Could the SC explain how do these seven (7) new tows would affect the polygon boundaries if included in its analysis?*

Scientific Council responded: SC is unable to answer this question without a full re-run of the KDE analysis, which is not possible at this meeting. However, the results of this re-run will be affected by all new tows not just those inside the polygon. This re-run would be expected to affect all boundaries not just those for the polygon containing areas 13 and 14, and we can not a priori predict in which direction this changes would be expected to go. This work is due to be completed in time for the re-evaluation of the closures in 2020.

The selectivity trials on cod 3M

In the last NAFO Fisheries Commission Ad hoc Working Group Bycatches, Discards and Selectivity (WG-BDS) (NAFO/FC Doc. 16/05), the EU informed the Working Group of its experiment using sorting grids in fishing gears targeting cod in Division 3M and that, given the promising results (SC WP 16/09), STACREC encouraged further work in collaboration with SC.

The EU will continue the selectivity trials on 2017 thanks to the cooperation, as in 2016, of the Fish Producers' Organisation Ltd.

The Fisheries commission requested:

Could Scientific Council provide guidance on the protocol for carrying out the selectivity trials so the outcome of this trial can be fully used by SC 2017?

Scientific council responded: The lack of standardization in the 2016 experiment prevented a thorough evaluation of the results.

Further ad-hoc studies with improved design (e.g. increased sample size, randomized placement of the experimental gear, standardization of all other net parameters, adherence to a strict fish sampling protocol, etc.) may provide a sound basis for determining the effectiveness of the grid to alter the size composition of landings. This, however, does not constitute a selectivity experiment but may provide a means to demonstrate the effectiveness of the sorting grid. In addition, information on other major species in the catch such as redfish should be collected.

SC notes that a definitive selectivity experiment (e.g. Jorgensen, 2006) is a significant project that requires a sophisticated project design and dedicated resources. The analysis of the outcomes of this selectivity experiment could be applicable with respect to the cod fishery on the Flemish Cap.

References

Kenchington, E., Murillo, F. J., Lirette, C., Sacau, M., Koen-Alonso, M., Kenny, A., Ollerhead, N., Wareham, V., and Beazley, L. 2014. Kernel density surface modelling as a means to identify significant concentrations of vulnerable marine ecosystem indicators. PLoS ONE 9. doi:10.1371/journal.pone.0109365.

VI. MEETING REPORTS

1. Joint Fisheries Commission – Scientific Council – WG Ecosystem Approach Framework to Fisheries Management (WG-EAFFM)

This joint working group met during 10 – 12 August 2016, and was chaired by Andrew Kenny (EU-United Kingdom) (FC-SC Doc 16/04). The Scientific Council was advised of progress in this group by the Chair in their presentation of the report to the joint session of Fisheries Commission and Scientific Council.

3. Joint Fisheries Commission–Scientific Council – WG on Risk-based Management Strategies (WG-BDS)

This joint working group met during 4– 6 April 2016, and was chaired by Carsten Hvingel (Norway) (FC-SC Doc 16/01). The Scientific Council was advised of progress in this group by Dr. Hvingel in his presentation of the report to the joint session of Fisheries Commission and Scientific Council.

4. Joint Fisheries Commission–Scientific Council – Catch Data Advisory Group (WG-CR)

This joint working group met on 16 November, and was co-chaired by SC Chair Kathy Sosebee (United States) and Pat Moran (FC Vice-Chair, United States) (FC-SC Doc. 16/02). The group had follow-up meetings through video tele-conference (WebEx) on 25 February, 17 March, 27 April, 3 May 2016 and 7 July 2016, working intermittently between the WebEx meetings through the document sharing and discussion forum features of SharePoint. The Scientific Council was advised of progress in this group by the Chair in her presentation of the report to the joint session of Fisheries Commission and Scientific Council.

VII. SPECIAL SESSIONS

Scientific Council noted the intent to hold a number of meetings on the Management Strategy Evaluation (MSE) for Greenland Halibut in 2017. This was highlighted in the presentation of the SC budget and an additional $30 000 has been added to the budget in 2017 to ensure resources are available to support participation.

VIII. REVIEW OF FUTURE MEETING ARRANGEMENTS

1. Scientific Council, 1 – 15 June 2017

Scientific Council agreed that its June meeting will be held on 1 – 15 June 2017, at St Mary's University, Halifax.

5. Scientific Council (in conjunction with NIPAG), Sept 27 to Oct 4 2017,

The next Scientific Council shrimp meeting is scheduled to meet in Lysekil, Sweden. The agreed dates are Sept 27 to Oct 4, 2017.

6. Scientific Council, 18-22 Sept 2017

Scientific Council noted that the Annual meeting will be held 18-22 September 2017 in Canada.

7. Scientific Council, 2 – 15 June 2018

Scientific Council agreed that its June meeting will be held on 2 – 15 June 2018, at St Mary's University, Halifax.

8. NAFO/ICES Joint Groups

a) WG-DEC, 20 - 24 March 2017

The next meeting of the ICES–NAFO Working Group on Deepwater Ecosystems is scheduled to take place at ICES Headquarters, Copenhagen, Denmark, during 20 - 24 March 2017.

b) NIPAG, Sept 27 to Oct 4 2017

This meeting will be held Sept 27 to Oct 4 2017, Lysekil, Sweden.

9. NAFO SC Working Groups

a) WG-ESA, 8 - 17 November, 2016

The Working Group on Ecosystem Science and Assessment will meet at IPMA, Lisbon, Portugal, 8 - 17 November, 2016.

IX. OTHER MATTERS

1. Review of the PAF timeline

SC requests WG-ESA review the initial considerations of WG-PAF ToR #2 tabled during the current meeting. Recognising that Ecosystem Management objectives have not yet been established, this review should provide revision as necessary and propose potential next steps.

Timeline for PA Revision	status Sep. 16	16/ M	A	M	J	J	A	S	O	N	D	17/J	F	M	A	M	J
ToR 3.																	
Discuss NAFO PA Successes and failures (done in March 2016)	✓																
Members work on summarizing the PA framework as used in other RFMOs and national plans (April-May 2016)	✓																
Results to be reviewed at the June 2016 SC Meeting.	✓																
ToR 1a. and 1c. (These tasks are related and should be completed together).																	
Review existing PA framework. (started in March 2016)	x																
June-September – Work on these ToRs.	x																
Present work to the joint meeting (September 2016)	✓																
ToR 1f.																	
Discuss spreadsheetstock status(March 2016 and April 2016	✓																
Distribute to DEs to fill in completely (June 2016)	✓																
Classify stocks with regards to assessment level (June 2016).	x																
ToR 1d. Can only be done after 1f	x																
ToR 1e																	
March-May 2016 Members potentially work on ideas for analyses to help with identifying risk levels	x																
Work on analyses for risk levels (June-September 2016)	x																
ToR 1b. Can only be done after 1a, 1c and 1e is finished	x																
ToR 2.																	
Discuss with Chairs of WG-ESA working together on fitting the PA into an Ecosystem Approach (June 2016)	✓																
Work to be done at the November 2016 WG-ESA meeting																	
Work to Reviewed by SC at the June 2017 meeting																	
This ToR may need more time after the June 2017 meeting																	
ToR 1g Along with ToR 2 will be finished after the other ToRs.																	

✓ = completed, x – in progress.

The progress of WGPAF against the timeline for the PA revision is provided in the table above. Given the complexities of the issues involved, SC agreed a dedicated workshop was required. External experts in this area would be required. This time line is likely to be impacted by the prioritization of the Greenland halibut MSE and therefore this meeting is unlikely to be held before the last quarter of 2017.

10. Scientific Merit Award.

On behalf of Scientific Council, the Vice-Chair, Kathy Sosebee (USA), thanked Mariano Koen-Alonso (Canada) for his dedicated service, particularly as co-chair of WG-ESA, and presented him with a NAFO scientific merit award.

X. ADOPTION OF REPORTS

1. Committee Reports of STACREC and STACFIS

The Council reviewed and adopted the Reports of the Standing Committees (STACREC and STACFIS).

11. Report of Scientific Council

The Council at its concluding session on 23 September 2016 considered and adopted its own report, with the usual caveat that there will be minor corrections.

XI. ADJOURNMENT

There being no other business, the meeting was adjourned at 1530 hours on 25 September 2016. The Chair thanked the Scientific Council Coordinator for his support. The Chair thanked Cuba for their hospitality in hosting the annual meeting. Finally, the chair thanked the members of Scientific Council for their hard work and wished everyone a safe journey home.

APPENDIX I. REPORT OF STANDING COMMITTEE ON RESEARCH COORDINATION (STACREC)

Chair: Kathy Sosebee Rapporteur: Tom Blasdale

1. Opening

The Committee met at the Convention Center Plaza America, Varadero Beach, Cuba during 20th September 2016, to consider the various matters in its agenda. Representatives attended from Canada, European Union (France, Portugal, Spain and the United Kingdom), France (with respect to St. Pierre et Miquelon), Norway, the Russian Federation and the United States of America. The Scientific Council Coordinator was in attendance. The Chair opened the meeting and welcomed everyone. Tom Blasdale was appointed the Rapporteur.

2. Fisheries Statistics

a) Review of STATLANT 21

i) Submission of data

The following table updates the situation with the submission of STATLANT. There are still a few outstanding submissions but in general the submission rate is acceptable.

TABLE 1. Dates of receipt of STATLANT 21A and 21B reports for 2012-2015 up to September 2016

Country/component	STATLANT 21A (deadline, 1 May)			STATLANT 21B (deadline, 31 August)		
	2013	2014	2015	2013	2014	2015
CAN-CA	30 Apr 14	24 Apr 15	4 May 16	30 Apr 14	24 Apr 15	
CAN-SF	30 May 17	1 Jun 15	31 May 16	3 Jun 14	31Aug 15	30 Aug 16
CAN-G	24 Dec 14	14 May 15	18 May 16	14 May 15	4 Sep 15	30 Aug 16
CAN-NL	30 Apr 14	25 May 15	21 Apr 16	29 Aug 14		31 Aug 16
CAN-Q						
CUB						
E/BUL						
E/EST	22 May 14	28 Apr-15	20 Apr 16	29 Aug 14	14 Aug 15	23 Aug 16
E/DNK	21 Aug 14	21 May 15		21 Aug 14	4 Sep 15	15 Jun 16
E/FRA	22 May 14					
E/DEU	28 Apr 14	29 Apr 15	28 Apr 16	29 Aug 14	4 sep 15	30 Aug 16
E/LVA		21 Apr 15 (dnf)	10 Mar 16 (dnf)			
E/LTU		21 May 15				
EU/POL		1 Jun 15			21 Sep 15	
E/PRT	22 May 14	8 May 15	26 Apr 16	29 Aug 14	3 Sep 15	25 Aug 16
E/ESP	22 May 14	21 May 15	5 May 16	25 Aug 14	7 Sep 15	8 Aug 16
E/GBR	23 May 14			20 Aug 14		
FRO	12 Jun 14	?	26 May 16	12 Jun 14	7 Jul 15	27 Aug 16
GRL	5 May 14	15 May 15	30 Apr 16	29 Aug 14	1 Sep 15	30 Aug 16

ISL	23 May 14	15 May 15 (dnf)		8 Sep 14		
JPN						
KOR						
NOR	22 MAY 14	7 May 15	26 Apr 16	26 Aug 14	17 Mar 16	30 Aug 16
RUS	12 May 14	21 apr 15	20 May 16	28 Aug 14	2 Jul 15	1 Sep 16
USA	29 May 14	22 May 15	19 July			
FRA-SP	30 Jul 14	20 Apr 15	25 Apr 16	30 Jul 14	6 Jul 15	31 Aug 16
UKR						

3. Research Activities

No new information on surveys was presented.

4. Surveys Planned for 2016 and early 2017

Designated Experts were requested to check and update the information contained in SCS Doc. 16/14.

5. Other Matters

i) Method for estimating Greenland halibut between 2011 and 2014

SC agreed in its June 2016 meeting on a method to estimate catches in order to resolve the inconsistencies identified for the period 2011 to 2014. The method was based on VMS effort, considered as the most reliable information available, and CPUEs estimated from scientific observer data when available. When observer data is not available, average CPUEs from an earlier period will be used to fill any gaps. Progress was reported for the four main Flag States involved in this fishery (i.e. Canada fishing in their national waters, Portugal, Spain and Russia in the NRA), but issues were raised on the reliability of the VMS based estimates of fishing effort (unexplained differences with declared effort or from one year to another). These issues will be thoroughly explored before the end of September, with the objective of proposing revised VMS effort estimates. In the case that the new effort estimates prove insufficiently reliable to support the catch estimates, Flag States will need to revert to their best estimates of effort which will be described in the report of the WebEx meeting in November.

Concerning the CPUEs, it was agreed for each Flag State to emulate as much as possible the methodology used before 2011, in order to ensure consistency in the historical time series. A WebEx meeting will be convened at the end of October, early November to review the estimation made by the four countries and validate a full time-series of catches for all flag States.

It is reminded that the SC in June proposed to use the method recommended by CDAG for the 2015 catches

6. Review of SCR and SCS Documents

There were no documents presented.

7. Other Business

8. Adjournment

The report was reviewed and the meeting was adjourned at 1000 on 24 September 2016.

APPENDIX II. REPORT OF STANDING COMMITTEE ON FISHERIES SCIENCE (STACFIS)

Chair: Brian Healey Rapporteur: Tom Blasdale

1. Opening

The Committee met at the Convention Center Plaza America, Varadero Beach, Cuba during 19-23 September 2016, to consider the various matters in its agenda. Representatives attended from Canada, European Union (France, Portugal, Spain and the United Kingdom), Japan, Norway, the Russian Federation and the United States of America. The Scientific Council Coordinator was in attendance.

12. Nomination of Designated Experts

Ricardo Alpoim (EU Portugal) will take over as the designated expert for 3M golden redfish. There were no other changes proposed.

13. Other Matters

a) Review of SCR and SCS Documents

There were no SCR documents submitted.

2016 invited speaker

Funds are available to support the attendance of an invited speaker at the June 2016 STACFIS meeting. The STACFIS chair endeavor to identify an appropriate speaker at the earliest opportunity to ensure their availability.

Other Business

There was no other business.

14. Adjournment

The meeting was adjourned on 23 September 2016.

APPENDIX III. SCIENTIFIC COUNCIL AGENDA, SEPTEMBER 2016

Provisional Agenda

I. Plenary Session

1. Opening
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Plan of Work
   a) Joint FC – SC Session

II. Review of Scientific Council Recommendations

III. Research Coordination

1. Opening
2. Fisheries Statistics
   a) Progress Reports on Secretariat Activities
   b) Review of STATLANT21
3. Research Activities
   a) Surveys Planned for 2016 and 2017
4. Other Matters
   a) Review of SCR and SCS Documents
   b) Review of Survey SCS Document
   c) Other Business

IV. Fisheries Science

1. Opening
2. Nomination of Designated Experts
3. Other Matters
   a) Review of SCR and SCS Documents
   b) 2017 invited speaker/reviewer
   c) Other Business

V. Requests from the Fisheries Commission

1. Requests deferred from the June Meeting
   a) Scientific Council budget for 2017
2. *Ad hoc* Requests from Current Meeting

VI. Meeting Reports

1. NAFO Joint Fisheries Commission-Scientific Council Working Group on the Ecosystem Framework for Fisheries Management (WG-EAFFM)
2. Report of the NAFO *Ad Hoc* Working Group on Bycatches, Discards and Selectivity (WG-BDS)

VII. Review of Future Meeting Arrangements

VIII. Future Special Sessions

1. Discussion of proposed topics

IX. Other Matters

1. Timeline for the PA framework review

X. Adoption of Reports

1. Committee Reports of STACFIS and STACREC
2. Report of Scientific Council

XI. Adjournment

ANNEX 1. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2017 AND BEYOND OF CERTAIN STOCKS IN SUBAREAS 2, 3 AND 4 AND OTHER MATTERS

1. Fisheries Commission requests that the Scientific Council provide advice for the management of the fish stocks below according to the assessment frequency presented below. The advice should be provided as a range of management options and a risk analysis for each option (rather than a single TAC recommendation).

Yearly basis	Two year basis	Three year basis
Northern shrimp in Div. 3LNO	American plaice in Div. 3LNO Cod in Div. 3M Redfish in Div. 3M Northern shrimp in Div. 3M Thorny skate in Div. 3LNO White hake in Div. 3NO Witch flounder in Div. 3NO	American plaice in Div. 3M Capelin in Div. 3NO Cod in Div. 3NO Northern shortfin squid in SA 3+4 Redfish in Div. 3O Witch flounder in Div. 2J+3KL Yellowtail flounder in Div. 3LNO

To implement this schedule of assessments, the Scientific Council is requested to conduct the assessment of these stocks as follows:

In 2016, advice should be provided for 2017 for Northern shrimp in NAFO Div. 3LNO

In 2016, advice should be provided for 2017 and 2018 for American plaice in Div. 3LNO and for Thorny skate in Div. 3LNO.

In 2016, advice should be provided for 2017, 2018 and 2019 for Redfish in Div.3O, Witch flounder in Div. 2J+3KL and Northern shortfin squid in SA 3+4.

Advice should be provided using the guidance provided in Annexes A or B as appropriate, or using the predetermined Harvest Control Rules in the cases where they exist.

The Fisheries Commission also requests the Scientific Council to continue to monitor the status of all these stocks annually and, should a significant change be observed in stock status (e.g. from surveys) or in bycatch in other fisheries, provide updated advice as appropriate.

2. The Fisheries Commission adopted in 2010 an MSE approach for Greenland halibut stock in Subarea 2 + Division 3KLMNO (FC Doc. 10/12) and agreed to use it until 2017 (FC Doc. 13/23). This approach considers a survey based harvest control rule (HCR) to set a TAC for this stock on an annual basis. The Fisheries Commission requests the Scientific Council to:

    a) Monitor and update the survey slope and to compute the TAC according to HCR adopted by the Fisheries Commission according to Annex 1 of FC Doc. 10/12.
    b) Advise on whether or not an exceptional circumstance is occurring.
3. The Fisheries Commission adopted in 2014 an MSE approach for Redfish in Division 3LN (FC Doc. 14-24). This approach uses a Harvest Control Rule (HCR) designed to reach 18 100 t of annual catch by 2019-2020 through a stepwise biannual catch increase, with the same amount of increase every two years The Fisheries Commission request Scientific Council conduct a full assessment in 2016 to evaluate the effect of removals in 2014 and 2015 on stock status.

4. The Fisheries Commission requests the Scientific Council to continue to develop work on Significant Adverse Impacts in support of the reassessment of NAFO bottom fishing activities required in 2016, specifically an assessment of the risk associated with bottom fishing activities on known and predicted VME species and elements in the NRA.

FC further requests that:

a) that Scientific Council should take into account the protection afforded to VME areas outside the NAFO fisheries footprint in the calculation of the VME area and biomass at risk of bottom fishing impact;
b) that Scientific Council refine VME kernel density analysis polygon boundaries, taking into account current understanding of distribution patterns in relation to environmental variables.

5. FC requests the Scientific Council consider widening the scope of the NAFO coral and sponge identification guides to include other relevant species on seamounts.

6. FC requests that Scientific Council consider options to expedite a risk assessment of scientific trawl surveys impact on VME in closed areas, and the effect of excluding surveys from these areas on stock assessments.

7. FC requests the Scientific Council consider, based on analysis of logbook data and patterns of fishing activity, to be conducted by the Secretariat, to examine relative levels of bycatch and discards of 3M cod/redfish, and stocks under moratoria in the different circumstances (e.g. fisheries, area, season, fleets, depth, timing)

8. It is difficult to match the current F_{lim} proxy with the 3M cod assessment results given by the 2015 Bayesian XSA assessment. These results were presented to SC in June and used for short term (2016-2017) projections under several *F* options (NAFO SCR 15/33 González-Troncoso, 2015); NAFO SC June 2015 Report). Focusing on the last assessment and projections, assuming at the same time a candidate F_{lim}= $F_{30\%}$SPR=0.131, they would imply that:

   - During the past five years (2010-2014) 3M cod has been exploited at an average F_{bar} level over two fold F_{lim}.
   - While SSB was sustained at a high average level representing 87% of the highest estimated SSB of the 1972-2014 interval (36 7041 on 1972).
   - The two highest year classes since 1992 occurred in 2011-2012.

   Under these circumstances the Scientific Council is requested to analyze whether the current F_{lim} value for 3M cod is currently underestimated and to revise if required the relevant fishing mortality and biomass reference points appropriately.

9. The stock of redfish 3M covers catches of three Sebastes species and the scientific advice is based on data of only two species (*S. mentella* and *S. fasciatus*). Golden redfish, *Sebastes marinus* (aka norvegicus), represents part of the catch but has not yet been subject to a full assessment in NAFO. The Scientific Council is requested to explore the possibility and options of an individual assessment of the golden redfish (*S. marinus*, aka norvegicus) and of including this species in the scientific advice for 2018-2019. The Scientific Council is also requested to advice on the implications for the three species in terms of catch reporting and stock management.

10. As part of the Greenland halibut's MSE review scheduled for 2016-2017, the SC is asked to specifically monitor and evaluate Contracting Parties surveys with the aim of optimizing resources in order to avoid duplication of data, identify data gaps and streamline survey methodologies, so that all data is used in the assessment.

11. Article 23 NCEM foresees a reassessment of bottom fishing activities in 2016. The NAFO Roadmap for Developing an Ecosystem Approach to Fisheries extends the work of the Scientific Council to include the assessment of potential impacts of activities other than fishing. Also, impacts of human activities in ecosystems should not be analyzed in isolation since cumulative effects might occur representing more than the sum of the individual factors. The Scientific Council is therefore requested to develop a workplan at its meeting in 2016 that will allow to address and analyze the potential impact of activities other than fishing (eg. oil and gas exploration, marine cables, ocean dumping, marine transportation) on NAFO VMEs, in particular VME closed areas.

12. The Fisheries Commission requests the Scientific Council to conduct a full assessment of Greenland halibut in Subarea 2 + Division 3KLMNO (using both XSA and SCAA[1]) and to consider the weighting of each survey as a first step to inform the 2017 MSE review.

13. The Fisheries Commission requests the Scientific Council to advise on how many SSB points above 30,000t are considered sufficient to conduct a review of B_{lim} of cod in 3NO.

14. The Fisheries Commission requests the Scientific Council to provide survey biomass trend(s) of witch flounder in Div. 3M for as long as data is available.

15. The Fisheries Commission requests the Scientific Council to review the results of the 2015 Canadian in situ photographic surveys for non-coral and sponge VME indicator species on Grand Bank (tail of Grand Bank) in relation to previous analyses presented in 2014 (that modelled their distribution using research vessel survey trawl bycatch data), and to identify areas of significant concentrations of non-coral and sponge VME indicator species using all available information.

16. Recognizing the importance of the 3M cod fishery to NAFO.

    Mindful that even though the current SSB is well above B_{lim}, the recruitment of the two most recent years is low.

    Noting that according to the Scientific Council stock assessment we are currently fishing only on two year-classes – once they are depleted in about two years time prospects for a continued fishery at the current level is not likely to be possible.

    Further noting that recent assessment of the stock has shown some year-to-year instability and that estimation of risk levels associated with given fishing mortalities cannot be calculated at this time, which further adds to our concern for the future of this fishery and its management.

    It is proposed that Scientific Council organize a full benchmark review of the 3M cod assessment in two stages: For 2016 Scientific Council will agree on a standardized approach and prepare a plan for the benchmark process at NAFO including required resources. For 2017 SC will review the benchmark assessment methodology for 3M cod.

[1] SCAA will not be possible unless a contractor can be hired.

ANNEX A: Guidance for providing advice on Stocks Assessed with an Analytical Model

The Fisheries Commission request the Scientific Council to consider the following in assessing and projecting future stock levels for those stocks listed above. These evaluations should provide the information necessary for the Fisheries Commission to consider the balance between risks and yield levels, in determining its management of these stocks:

1. For stocks assessed with a production model, the advice should include updated time series of:

- Catch and TAC of recent years
- Catch to relative biomass
- Relative Biomass
- Relative Fishing mortality
- Stock trajectory against reference points
- And any information the Scientific Council deems appropriate.

Stochastic short-term projections (3 years) should be performed with the following constant fishing mortality levels as appropriate:

- For stocks opened to direct fishing: 2/3 F_{msy}, 3/4 F_{msy} 85% F_{msy}, 75% F_{2015}, F_{2015}, 125% F_{2015},
- For stocks under a moratorium to direct fishing: F_{2015}, F = 0.

The first year of the projection should assume a catch equal to the agreed TAC for that year.

Results from stochastic short term projection should include:

- The 10%, 50% and 90% percentiles of the yield, total biomass, spawning stock biomass and exploitable biomass for each year of the projections
- The risks of stock population parameters increasing above or falling below available biomass and fishing mortality reference points. The table indicated below should guide the Scientific Council in presenting the short term projections.

				Limit reference points													
				P($F>F_{lim}$)			P(B< B_{lim})			P($F>F_{msy}$)			P($B<B_{msy}$)			P(B_{2019} > B_{2016})
F in 2016 and following years*	Yield 2017 (50%)	Yield 2018 (50%)	Yield 2019 (50%)	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	
2/3 F_{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
3/4 F_{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
85% F_{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F_{msy}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
0.75 X F_{2015}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F_{2015}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
1.25 X F_{2015}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F=0	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%

2. For stock assessed with an age-structured model, information should be provided on stock size, spawning stock sizes, recruitment prospects, historical fishing mortality. Graphs and/or tables should be provided for all of the following for the longest time-period possible:

- historical yield and fishing mortality;
- spawning stock biomass and recruitment levels;
- Stock trajectory against reference points

And any information the Scientific Council deems appropriate

Stochastic short-term projections (3 years) should be performed with the following constant fishing mortality levels as appropriate:

- For stocks opened to direct fishing: $F_{0.1}$, F_{max}, 2/3 F_{max}, 3/4 F_{max}, 85% F_{max}, 75% F_{2015}, F_{2015}, 125% F_{2015},
- For stocks under a moratorium to direct fishing: F_{2015}, F = 0.

The first year of the projection should assume a catch equal to the agreed TAC for that year.

Results from stochastic short term projection should include:

- The 10%, 50% and 90% percentiles of the yield, total biomass, spawning stock biomass and exploitable biomass for each year of the projections
- The risks of stock population parameters increasing above or falling below available biomass and fishing mortality reference points. The table indicated below should guide the Scientific Council in presenting the short term projections.

				Limit reference points													
				P($F.>F_{lim}$)			P($B<B_{lim}$)			P($F>F_{0.1}$)			P($F>F_{max}$)			P($B_{2019} > B_{2016}$)
F in 2016 and following years*	Yield 2017	Yield 2018	Yield 2019	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	
$F_{0.1}$	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
66% F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
75% F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
85% F_{max}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
0.75 X F_{2015}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
F_{2015}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%
1.25 X F_{2015}	t	t	t	%	%	%	%	%	%	%	%	%	%	%	%	%

ANNEX B. Guidance for providing advice on Stocks Assessed without a Population Model

For those resources for which only general biological and/or catch data are available, few standard criteria exist on which to base advice. The stock status should be evaluated in the context of management requirements for long-term sustainability and the advice provided should be consistent with the precautionary approach.

The following graphs should be presented, for one or several surveys, for the longest time-period possible:

a) time trends of survey abundance estimates
b) an age or size range chosen to represent the spawning population
c) an age or size-range chosen to represent the exploited population
d) recruitment proxy or index for an age or size-range chosen to represent the recruiting population.
e) fishing mortality proxy, such as the ratio of reported commercial catches to a measure of the exploited population.
f) Stock trajectory against reference points

And any information the Scientific Council deems appropriate.

ANNEX 2. DENMARK (ON BEHALF OF GREENLAND) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2016 OF CERTAIN STOCKS IN SUBAREAS 0 AND 1

1. **Roundnose Grenadier:** For Roundnose Grenadier in Subarea 0 + 1 advice was in 2014 given for 2015-2017. Denmark (on behalf of Greenland) requests the Scientific Council to continue to monitor the status of Roundnose Grenadier in Subareas 0 and 1 annually, and should significant changes in the stock status be observed (e.g. from surveys) the Scientific Council is requested to provide updated advice as appropriate.

2. **Golden Redfish, Demersal Redfish, American Plaice, Atlantic Wolffish and Spotted Wolfish:** Advice on Golden Redfish (*Sebastes marinus*), Demersal Deep-sea Redfish (*Sebastes mentella*) American Plaice (*Hippoglossoides platessoides*), Atlantic Wolffish (*Anarhichas lupus*) and Spotted Wolffish (*Anarhichas minor*) in Subarea 1 was in 2014 given for 2015-2017. Denmark (on behalf of Greenland) requests the Scientific Council to continue to monitor the status of these species annually, and should significant changes in stock status be observed the Scientific Council is requested to provide updated advice as appropriate.

3. **Greenland Halibut, offshore:** Subject to the concurrence of Canada as regards Subareas 0 and 1, the Scientific Council is requested to provide advice on appropriate TAC levels for 2017 and as long time ahead as considered appropriate separately for Greenland Halibut in 1) the offshore areas of NAFO Division 0A and Division 1A plus Division 1B and 2) NAFO Division 0B plus Divisions 1C-1F. The Scientific Council is also asked to advice on any other management measures it deems appropriate to ensure the sustainability of these resources.

4. **Greenland Halibut, inshore:** Advice on Greenland Halibut in Division 1A inshore was in 2014 given for 2015-2016. Denmark (on behalf of Greenland) requests the Scientific Council for advice on Greenland Halibut in Division 1A inshore for 2017-2018.

5. **Northern Shrimp, West Greenland:** Subject to the concurrence of Canada as regards Subarea 0 and 1, Denmark (on behalf of Greenland) requests the Scientific Council before December 2016 to provide advice on the scientific basis for management of Northern Shrimp (*Pandalus borealis*) in Subarea 0 and 1 in 2017 and for as many years ahead as data allows for.

   The Scientific Council is asked to consider, if the advice for Subarea 0 and 1 could be limited in north to 73 °30'N owing to the fact, that stock assessment is based on data from scientific survey and logbooks within the area 60°N to 73°30'N.

6. **Northern Shrimp, East Greenland:** Furthermore, the Scientific Council is in cooperation with ICES requested to provide advice on the scientific basis for management of Northern Shrimp (*Pandalus borealis*) in Denmark Strait and adjacent waters east of southern Greenland in 2017 and for as many years ahead as data allows for.

ANNEX 3. REQUESTS FOR ADVICE FROM CANADA

1. Greenland halibut (Subareas 0 and 1)

The Scientific Council is requested, subject to the concurrence of Denmark (on behalf of Greenland) as regards Subarea 1, to provide an overall assessment of status and trends in the total stock area throughout its range and to specifically advise on TAC levels for 2017, separately, for Greenland halibut in Divisions 0A+1A (offshore) and 1B, and Divisions 0B+1C-F.[1] The Scientific Council is also asked to provide advice on any other management measures it deems appropriate to ensure the sustainability of these resources.

a) It is noted that at this time only general biological advice and/or catch data are available, few standard criteria exist on which to base advice. The stock status should be evaluated in the context of management requirements for long-term sustainability and the advice provided should be consistent with the precautionary approach and include likely risk considerations and implications as much as possible, including risks of maintaining current TAC levels and any risks and available details of observations that would support an increase or decrease in the TACs.[2]

The following graphs should be presented, for one or several surveys, for the longest time-period possible:

- historical catches;
- abundance and biomass indices;
- an age or size range chosen to represent the spawning population;
- an age or size range chosen to represent the exploited population;
- recruitment proxy or index for an age or size-range chosen to represent the recruiting population;
- fishing mortality proxy, such as the ratio of reported commercial catches to a measure of the exploited population;
- stock trajectory against reference points

Any other information the Scientific Council feels is relevant should also be provided.

2. Shrimp (Divisions 0A and Subarea 1)

Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for Shrimp in Subareas 0 and 1:

a) The status of the stock should be reviewed and management options evaluated in terms of their implications for fishable stock size, spawning stock size, recruitment prospect, catch rate and catch over the next 5 years. The implications of catch options ranging from 30,000 t to the catch corresponding to Z MSY, in 5,000 t increments, should be forecast for 2017 through 2021 if possible, and evaluated in relation to precautionary reference points of both mortality and fishable stock biomass. Results should include a partitioning of the future estimable removals between catches and estimable predation for the various catch options requested. The present stock size and fishable stock size should be described in relation to those observed historically and those to be expected in the next 5 years under the various catch options requested, and any other options Scientific Council feels worthy of consideration.

b) Management options should be provided within the Northwest Atlantic Fisheries Organization Precautionary Approach Framework. Uncertainties in the assessment should be evaluated and presented in the form of risk analyses related to the limit reference points of B_{lim} and Z_{MSY}.

[1] The Scientific Council has noted previously that there is no biological basis for conducting separate assessments for Greenland halibut throughout Subareas 0-3, but has advised that separate TACs be maintained for different areas of the distribution of Greenland halibut.

[2] Canada encourages the Scientific Council to continue to explore opportunities to develop risk-based advice in the future, including the implications of increases in the TAC (e.g. by 10, 15 or 25%), noting that data conditions do not allow for such advice at this time.

c) Presentation of the results should include the following:

- a graph and table of historical yield and fishing mortality for the longest time period possible;
- a graph of biomass relative to B_{MSY}, and recruitment levels for the longest time period possible.
- a graph of the stock trajectory compared to B_{lim} and/or B_{MSY} and Z_{MSY}.;
- graphs and tables of total mortality (Z) and fishable biomass for a range of projected catch options (as noted in 2 a) for the years 2017 to 2021 if possible. Projections should include both catch options and a range of cod biomass levels considered appropriate by SC. Results should include risk analyses of falling below B_{MSY} and B_{lim}, and of exceeding Z_{MSY}.;
- a graph of the total area fished for the longest time period possible; and
- any other graph or table the Scientific Council feels is relevant.

APPENDIX IV. LIST SUMMARY (SCS) DOCUMENTS

Summary Documents

SCS Doc. No	Serial No.	Author	Title
SCS Doc. 15-15	N6507	NAFO	Report of the Scientific Council, 21-25 September 2015
SCS Doc. 15-16	N6510	NAFO Secretariat	Available Data from the Commercial Fisheries Related to Stock Assessment (2014) and Inventory of Biological Surveys Conducted in the NAFO Area in 2015 and Biological Surveys Planned for 2015 and Early-2016

APPENDIX V. LIST OF REPRESENTATIVES, ADVISERS, EXPERTS AND OBSERVERS, 2016

CANADA

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