



Serial No. N6010

NAFO SCS Doc. 12/02

SCIENTIFIC COUNCIL MEETING – JUNE 2012**Report of the SC Ad Hoc Working Group On Exceptional Circumstances, January – April 2012**

The Ad Hoc Working Group on Exceptional Circumstances with regard to Greenland halibut Management Strategy Evaluation met by WEBEX and Sharepoint between January and April 2012. This is the consolidated report from these meetings.

Contents

1. Introduction	2
1.1 Request for advice	2
1.2 Defining exceptional circumstances in general	2
2. Greenland halibut 2+3KLMNO MSE.....	2
2.1 Required data.....	3
2.2 Analyses previously carried out by SC	3
2.3 Alternative approaches considered	4
2.4 Comments from additional experts – Summary Points.....	4
2.5 Conclusions on the best approach.....	4
3. Advice to Scientific Council with regard to exceptional circumstances.....	5
4. References	6
Appendix I. Terms of Reference for the ad hoc Working Group	7
Appendix II. Working Group participants	8
Appendix III. Agendas of WEBEX meetings held	9
Appendix IV Comments from additional experts	10
Appendix V. List of documents posted on the Sharepoint site	12

1. Introduction

Management Strategy Evaluation (MSE) is a method for computer simulation-testing of candidate management strategies prior to applying a selected strategy to a real fish stock (de la Mare 1986, Butterworth 2007). Work on MSE for the 2+3KLMNO Greenland halibut stock was carried out under the auspices of Scientific Council between 2007 and 2009 funded under the Canadian International Governance Strategy (Shelton 2011). A Fisheries Commission Working Group on Management Strategy Evaluation (WGMSE) was tasked with further development and refinement of the approach during 2010. In September 2010, FC, on the advice of WGMSE, adopted a specific management strategy to be implemented for four years (i.e. as a basis for setting the TACs for 2011-2014).

1.1 Request for advice

The September 2010 meeting of FC requested that SC b) provide guidance on what constitutes “exceptional circumstances”; and c) provide advice on whether or not the “exceptional circumstances” provision should be applied. (FC Request, item 6 of FC Doc. 10/9 Rev.)

SC made an initial response in June 2011 based on available data (SC Response, *NAFO SC Rep.* p. 29-31). At the September 2011 SC meeting (*NAFO SC Rep.* Part B) two documents were tabled providing more extensive data for determining exceptional circumstances (SCR Doc. 11/48 and SCR Doc. 11/76). These SCR Docs were given preliminary review by SC with the decision to refer the issue of exceptional circumstances to an ad hoc SC WG for further consideration, to report to SC prior to the June 2012 meeting. The Terms of Reference for the ad hoc WG are given in Appendix I.

1.2 Defining exceptional circumstances in general

“Exceptional Circumstances” (EC) occur when a resource moves outside the range of parameters compatible with the various scenarios considered in the MSE simulation testing, on which selection of the management strategy for that resource was founded. Acknowledging that such “Exceptional Circumstances” are occurring necessitates a review and possible revision of the management measure (harvest control rule) indicated under implementation of the management strategy.

2. Greenland halibut 2+3KLMNO MSE

FC WGMSE met three times in 2010 (NAFO/FC Doc. 10/2, NAFO/FC Doc. 10/5 and NAFO/FC Doc. 10/30). In the report of its third meeting (NAFO/FC Doc. 10/30), two management strategy options were proposed for further consideration by FC. FC chose one of these strategies at the September 2010 Annual Meeting (MS2; NAFO/FC Doc. 10/29) in which the TAC is adjusted up or down annually depending on recent trends in the survey indices (see Shelton 2011 for more information). This strategy was used to determine the TAC for 2011 and 2012 and will continue to be applied to determine the TAC for 2013 and 2014, unless EC arises. Thus SC needs to determine if EC are occurring when providing TAC advice for 2013 and 2014. After this it is expected that there will be a full review of all aspects of the Greenland halibut MSE.

Annex 4 of the most recent report of WGMSE (NAFO/FC Doc. 11/8) proposes an Exceptional Circumstances Protocol. The Protocol notes that Exceptional Circumstances provisions are intended to respond to an event or observation which is outside of the range of possibilities considered within the MSE. In such cases, Fisheries Commission may have reason to over-ride the TAC provided by the MS and/ or also require the MS to be reviewed/ revised. To this effect, Scientific Council (SC) will annually monitor the situation and provide advice to Fisheries Commission on whether or not ‘exceptional circumstances’ may be occurring. The Protocol recognizes catch and research vessel survey data as primary indicators and data gaps, biological parameters, recruitment, fishing mortality and exploitable biomass as secondary indicators from which to gauge whether or not exceptional circumstances may be occurring. The 90% probability interval is considered as the reference against which exceptional circumstances would be established. In other words, if the new value of an indicator falls below the 5th percentile or above the 95th percentile of the values obtained in the MSE simulation carried out in September 2010, then exceptional circumstances would be judged to be occurring.

The Protocol proposes that Advice provided by Scientific Council which suggests the occurrence of exceptional circumstances should be based on compelling evidence and should include sufficient detail to allow FC to take an informed decision on implementation of the MS and possible next steps. The Protocol proposes that when SC advice indicates that exceptional circumstances may be occurring, FC will consider a range of responses/possible courses of action taking into account the degree and type of circumstance noted. In order, those that would be considered are as follows:

- (1) Review the information, but maintain the MS as the management tool; additional research/monitoring may be recommended to determine if the signal detected warrants moving to step 2;
- (2) Advance the review period (currently 2014), and potentially revise the MS, but implement the MS outputs;
- (3). Set a catch limit that departs from the MS, and revise the MS.

2.1 Required data

Two kinds of data are required in order to determine whether or not exceptional circumstances are occurring, simulated data from the September 2010 MSE carried out under the auspices of FC WGMSE and current values of indicators obtained directly from observations or indirectly from updated operating models based on current data. SCR Doc. 11/48 and SCR Doc. 11/76 provide percentiles to 2030 under MS2 (the management strategy adopted by FC) for primary indicators (age aggregated survey and catch) combined across XSA-based operating models and combined across SCAA based operating models. In addition survey and catch percentiles are provided separately for the base-case XSA OM (CAVXSA) and the base case SCAA OM (SCAA0). SCR Doc. 11/76 also provides secondary indicators (recruitment, fishing mortality and exploitable biomass percentiles to 2030 under MS2 for the CAV (Current Assessment View) XSA.

2.2 Analyses previously carried out by SC

A summary of the results of the analyses in SCR Doc. 11/48 (SCAA) and SCR Doc. 11/76 (XSA) presented to SC in September 2011 are provided here.

For XSA the percentiles and cumulative frequency distributions for MSE generated values for exploitable (age 5-9) biomass values for the three research vessel were compared with the 2010 survey estimates. Both the distribution for the base case CAV OM alone and for all XSAs combined were considered. These estimates did not fall outside the 90% confidence intervals for either CAV or all OMs combined. The percentiles and cumulative frequency distributions for MSE generated values for commercial catch for CAV and all OMs combined were compared with the catch estimated by SC for 2010 and the TACs generated by the harvest control rule for 2011 and 2012. The SC estimate of the 2010 catch is above the MSE simulated distribution for both the CAV OM and all OMs combined indicating EC. With regard to secondary indicators, the percentiles for projected fishing mortality (average 5-10) for the XSA based CAV OM for 2010 were compared with the 2010 estimate from the 2011 SC stock assessment. The assessment estimate of F is at the 98th percentile of the CAV OM distribution, which is a concern.

For SCAA, the 50%, 75% and 90% probability envelopes for each of the three surveys for the Reference Case SCAA operating model (SCAA0) and for the full Reference Set of operating models were compared with the 2010 survey results. Canadian Fall and EU survey results fall well within the probability envelopes shown, though the Canadian Spring survey result was slightly above the upper 5%-ile of the projected distributions for both the Reference Case and the full Reference Set. This weakly suggests a resource at higher abundance than anticipated, but would not seem strong grounds for invoking EC or recommending any associated (upward) revision of the TAC or revision of the management strategy. Catch projections under the adopted MS for both the Reference Case SCAA and the full Reference Set were compared with the catch estimates for 2010 from SC and STATLANT21A. The SC estimate constitutes EC whereas the STATLANT21A estimate does not. With regard to secondary indicators, exploitable biomass projected under the adopted MS for the Reference Case SCAA was plotted but the SCAA assessment was not updated with the new data available to SC in June 2011, so no comparison could be made.

2.3 Alternative approaches considered

A number of alternative approaches can be considered for providing advice on whether or not exceptional circumstances are occurring:

a) The simplest approach would be to only compare the annual observations of the primary indicators, catch and survey biomass indices (age aggregated), with the corresponding values produced by the operating models from the runs carried out by the consultants in September 2010 under the auspices of FC WGMSE. Two options could be considered here, comparing the observed values against each OM distribution separately or combining all the XSA OMs into a single distribution and all the SCAA OMs into a single distribution for the comparison. A further consideration is whether the distributions from XSA-based and SCAA-based OMs should be combined into a single distribution for the comparison. Under this simplest approach, the secondary indicators are not considered. Exceptional circumstances are occurring whenever observed values of either of the primary indicators are outside of the range simulated during September 2010.

b) The most detailed approach would be to update all the XSA-based and SCAA-based OMs each year based on the new survey and catch data and compare the updated values of both primary and secondary indicators (recruitment, fishing mortality and exploitable biomass) with the corresponding values produced by the operating models from the runs carried out in September 2010. The same considerations regarding combining distributions discussed under a) would also pertain, but in this case to both primary and secondary indicators.

c) An intermediate approach would be to update only the two base-case OMs (XSA-CAV and SCAA0) based on the new survey and catch data and compare the updated values of both primary and secondary indicators with the corresponding values produced by the two base-case operating models from the runs carried out in September 2010. The question of whether or not to combine distributions from the two base-case OMs would pertain. It should also be noted that this is a de facto plausibility weighting approach in which the two base-case OMs get a weight of 1 and all other OMs a weight of 0.

2.4 Comments from additional experts – Summary Points

MSE experts, Prof. Doug Butterworth of the University of Cape Town, South Africa, and Dr. David Miller of IMARES, The Netherlands, were asked by correspondence for their opinions on the proposed alternative approaches for determining whether or not exception circumstances were occurring.

Their full comments are provided in Appendix IV and only a summary is provided here. Both experts agreed that option (b) would not make sense and would constitute much more work than a regular stock assessment and would nullify one of the purposes of MSE which is to lessen the burden of frequent re-assessments. One of the experts identified option (a) as the standard approach used in other MSE applications. The experts were not in agreement with regard to whether or not the comparison should be made between the updated primary indicators and the individual distributions from the September 2010 runs for each OM separately or for the combined distribution for all OMs (keeping XSA and SCAA distributions separate). With regard to the secondary indicators, one of the experts could see the value in updated Base Case XSA and SCAA assessments in June 2012 (a simple "turn-the-crank" assessment) to allow a qualitative evaluation that assessment perceptions have not changed greatly from expectations. Both experts agreed that catches continually and appreciably above TACs generate by the harvest control rule would be justification for EC.

2.5 Conclusions on the best approach

SC should only compare the annual observations of the primary indicators, catch and survey biomass indices (age aggregated), with the corresponding values produced by the operating models from the runs carried out by the consultants in September 2010 under the auspices of FC WGMSE. All the results from the XSA OMs should be combined into a single distribution for each year and all the results from SCAA OMs into a separate single distribution for each year. SC would then compare these distributions with the annual values of catch and survey biomass indices. If values fall outside the 90% CIs for either the XSA-based distribution or the SCAA-based distribution then EC will be considered to have occurred.

It is noted that most of the secondary indicators are related to the primary indicators in some way (e.g. F is related to catch and survey biomass) so it would not be necessary to evaluate these in addition to the primary indicators. Further, it is felt by the WG that at least four years would be required to observe trends in the secondary indicators given the amount of variation in estimates between years. Considering only primary indicators would expedite the process for SC.

Every four years SC should update all the XSA-based and SCAA-based OM's based on the new survey and catch data and compare the updated values of both primary and secondary indicators (recruitment, fishing mortality and exploitable biomass) with the corresponding values produced by the operating models from the runs carried out in September 2010. The way to compare, in this case, should be against each OM distribution separately to examine the behaviour of each of the OM's in turn.

By waiting for four years before doing a more detailed evaluation of the secondary indicators (biological parameters, recruitment, F, exploitable biomass), it should be possible to determine trends despite the variability in estimates and this can be compared with the simulated data for each OM separately. With new data it may be appropriate to suggest changes in the management strategy, including operating models, to adapt it to the new information. One or more meetings of a Scientific Council Working Group between fall 2013 and fall 2014 would be required to carry out this work.

3. Advice to Scientific Council with regard to exceptional circumstances

“Exceptional Circumstances” (EC) occur when a resource moves outside the range of parameters compatible with the various scenarios considered in the MSE simulation testing, on which selection of the management strategy for that resource was founded.

If values fall outside the 90% CIs for either the XSA-based distribution or the SCAA-based distribution then EC will be considered to have occurred.

A determination by Scientific Council that such “Exceptional Circumstances” are occurring necessitates a review and possible revision of the harvest control rule.

SC should compare the annual observations of the primary indicators, catch and survey biomass indices (age aggregated), with the corresponding values produced by the operating models from the September 2010 analysis.

All the results from the XSA OM's should be combined into a single distribution for each year and all the results from SCAA OM's into a separate single distribution for each year¹.

SC should then compare these distributions with the annual values of catch and survey biomass indices. If values fall outside the 90% CIs for either, or both, the XSA-based distribution or the SCAA-based distribution then EC will be considered to have occurred.

After the management strategy has been in place for four years, SC should update all the XSA-based and SCAA-based OM's applying the new available data and compare the updated values of both primary and secondary indicators (biological parameters, recruitment, fishing mortality, exploitable biomass) with the corresponding values produced by the operating models from the runs carried out in September 2010.

The four year comparison should be on an OM by OM basis and will require updating each OM with the new data.

With new data it may be appropriate to suggest changes in the management strategy, including operating models, to adapt it to the new information.

Scientific Council should consider the work required to carry out this review at their next meeting.

¹ These data are available in SCR Docs. 11/48 and 11/76.

4. References

- Butterworth, D. S. 2007. Why a management procedure approach? Some positives and negatives. – ICES Journal of Marine Science, 64: 613–617.
- Butterworth, D.S. and Rademeyer, R.A. 2011. On “Exceptional Circumstances” Provisions for the Management Strategy for the Greenland Halibut Stock in Subarea 2 + Divisions 3KLMNO based especially on Survey Results occurring Outside the Range Simulated NAFO SCR Doc. 11/48.
- de la Mare, W. K. 1986. Simulation studies on management procedures. Reports of the International Whaling Commission, 36: 429–450.
- DFO. 2011. Western Component (4Xopqrs5) Pollock Management Strategy Evaluation. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/054.
- Rademeyer, R.A., Fairweather, T., Glazer, J.P., Leslie, R.L., and Butterworth, D.S. 2010. The 2010 Operational Management Procedure for the South African *Merluccius paradoxus* and *M. capensis* Resources. FISHERIES/2010/OCTOBER/SWG-DEM/59.
- Shelton, P.A. 2011. Evolution and implementation of a management strategy for NAFO Subarea 2 and Divs. 3KLMNO Greenland halibut fishery. NAFO SCR Doc. 11/042.
- Shelton, P.A. and Healey, B. P. 2011. Evaluating exceptional circumstances in the context of the Greenland halibut management strategy evaluation based on the 2011 stock assessment. NAFO SCR Doc. 11/76.

APPENDIX I. TERMS OF REFERENCE FOR THE AD HOC WORKING GROUP

SC 20-24 Sep 2011

2. Matters arising from Fisheries Commission Working Group on Management Strategy

Evaluation for Greenland Halibut

At previous meetings Scientific Council has voiced its concerns that it is unable to adequately evaluate whether exceptional circumstances were occurring, due to issues with availability of results of one suite of models used. Two working papers were presented to Scientific Council to frame discussion on the scope of the “Exceptional Circumstances” provisions. The secondary indicators of stock status (exploitable biomass, fishing mortality and recruitment) are derived from the models. Primary indicators (catches and survey trends) are independent of models and should be used to determine whether exceptional circumstances are in effect in the first instance. It was proposed that an ad hoc working group be established to collect the required data and provide further guidance on how to determine if exceptional circumstances are in effect. This group should report to Scientific Council by 1 April 2012, would be coordinated by Peter Shelton and tentative membership would include Brian Healey, Fernando Gonzalez, Ricardo Alpoim, Jean-Claude Mahé and Carsten Hvingel.

APPENDIX II. WORKING GROUP PARTICIPANTS

Healey, Brian P. Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre,
P.O. Box 5667, St. John's, NL A1C 5X1. Phone: +709-772-8674.
E-mail: brian.healey@dfo-mpo.gc.ca

Shelton, Peter (chair) Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre,
P.O. Box 5667, St John's, NL A1C 5X1. Phone +709 772 4148.
Email: peter.shelton@dfo-mpo.gc.ca

Brodie, William B. Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre,
P.O. Box 5667, St John's, NL A1C 5X1. Phone: +709-772-3288.
E-mail: bill.brodie@dfo-mpo.gc.ca

EUROPEAN UNION (EU)

Alpoim, Ricardo Instituto Nacional dos Recursos Biológicos, I.P. INRB/IPIMAR
Av. de Brasilia, 1449-006 Lisbon, Portugal
Phone: +351 21 302 7000 - E-mail: ralpoim@ipimar.pt

Duarte, Rafael European Commission, Directorate General for Fisheries and Maritime Affairs,
Rue Joseph II, 79 (02/217), Brussels, Belgium
Phone: +32 2 299 0955 – E-mail: rafael.duarte@ec.europa.eu

Gonzalez-Costas, Instituto Español de Oceanografía, Aptdo 1552, E-36280 Vigo (Pontevedra), Spain
Fernando Phone: +34 9 86 49 2111 - E-mail: fernando.gonzalez@vi.ieo.es

Mahé, Jean-Claude IFREMER, Station de Lorient, 8, Rue François Toullec, 56100 Lorient, France
Phone: +33 2 9787 3818 - E-mail: jcmahe@ifremer.fr

NORWAY

Hvingel, Carsten Institute of Marine Research, P.O. Box 1870, N-5817 Bergen, Norway
Phone: +47 77609750 - E-mail: carsten.hvingel@imr.no

NAFO SECRETARIAT

Neil Campbell	Scientific Council Coordinator	ncampbell@nafo.int
Barbara Marshall	Information Officer	bmarshall@nafo.int

APPENDIX III. AGENDAS OF WEBEX MEETINGS HELD**11 January 2012**

1. Welcome by Chair
2. Changes to draft agenda and approval
3. Membership – adequate or additional members needed?
4. Workplan
 - 4.1 Review ToR
 - 4.2 Suggest relevant background documents (see those already on the sharepoint site)
 - 4.3 Available data
 - 4.3 Suggest any new analyses required
 - 4.4 Preview potentially important elements of report
 - 4.5 Suggest report structure – sections, figures etc.
 - 4.6 Agree in deadline for first draft of report (1 March?)
5. Other matters
6. Date for next Webex

26 March 2012

1. Review the second draft of the report, especially “2.5 Conclusions on the best approach” and “3. Advice to Scientific Council with regard to Exceptional Circumstances”
2. Make any revisions required
3. Adopt the report if possible or defer pending further revision if required.

APPENDIX IV COMMENTS FROM ADDITIONAL EXPERTS

Dr. Miller made the following comments:

1. I think the level of adherence to the stipulated TACs is important. If TACs have not been adhered to, one should be more concerned about being near the 'edges' of our tested range, and vice versa. The HCR cannot be expected to work as it was simulation tested if the TACs have been ignored. Simulation testing across a range of OM's allows for the fact that natural variations could lead to short term difficulties, but hopefully long term goals should still be achieved. However, if TACs are exceeded constantly, and the indices near the lower end of the expected range, there should be a higher level of concern, because this puts us in a state that has not been simulation tested.
2. Option (b) takes it too far I think. You risk managing according to noise in the inputs if you are constantly doing annual checks.
3. Defining exceptional circumstances based on each OM or the whole reference set of OM's is a slightly tricky question. It is easy to say that the reference set is the correct way of doing things, because it represents our realm of possibility. However, the HCR is supposed to work across all OM's (as we don't know which is the most 'correct'), which suggests that it should be within range of each OM individually. Do we want it within the 90th percentile (or whatever value we used as a risk level) of the entire distribution or just within the 90th percentile of the 'extreme' OM's (at the top and bottom of the distribution)? Looking at it that way you could be more likely to find yourself in 'extreme circumstances' when comparing your observations to the distribution of the whole reference set of OM's.
4. Finally, it must be remembered that surveys are noisy, so looking at annual values may not be the best way. Maybe look at the lambda value that comes out of the HCR. Is this steeper than we ever found in our simulation tests? This ties in more to the dynamics of the stock: is it dropping (or increasing) at a greater rate than we thought possible for sustainable management? Otherwise we would hope the feedback within our HCR would be enough to ensure prudent management.

Prof. Butterworth made the following comments:

(Note, references have been inserted into comments by the WG where required)

Certainly I think a) should be part of the process. That is pretty standard, and you'll find it in Appendix E page 35 for our hake resource (Rademeyer et al. 2010) and for the Canadian pollock MP (DFO 2011). Surveys are noisy as David says, but the simulations take that into account, and they are after all the primary data inputs. You'll note though (pg 36) that we have an additional check (at industry's insistence) which relates to a measure of trends for indices supposedly measuring the same underlying quantity going in different directions - this is a little like David is suggesting. As you can see from Rademeyer et al. (2010), our standard is to use the whole Reference Set to generate these distributions, particularly as that is supposedly designed to be balanced and to encompass the major uncertainties - if you had results outside what one of the more extreme robustness test OM's suggested, more likely that's indicating that the associated scenario is no longer plausible, having been ruled out by new data. In the Greenland halibut case with the SCAA and XSA results being qualitatively different, I'd tend to keep them separate. Finding future values that are consistent with one but not the other may provide insight into which is better representing reality. Since the MP is robust to both, I think you'd need results outside the envelope for both before EC would be justified.

Re: b) I'd agree with David that this is unnecessary overkill. It completely nullifies a major motivation for having an MP, which is to lessen the burden of frequent re-assessments. This would turn the MP process into one more onerous still than the previous assessment basis, which would seem a little silly.

Re: c) I don't follow the rationale of updating and then using the updates to generate data distributions. Given that distributions of predicted survey and related observations are wide, what you suggest would likely lead to considerable distribution overlap with what applied for the OM's used to select the MP, so what conclusions can then be drawn? Our standard approach is simply to do a crank-the-handle update on the Reference Case OM, and to compare the results (typically spawning biomass trajectories as projected) with those at the time the MP was adopted. This is a more qualitative indicator - simply to check that assessment perceptions have not changed greatly from expectations. Certainly for such an exercise I'd keep the XSA and SCAA results separate, though note again

that really only inconsistency with BOTH is an EC justification - with one of the two only, the conclusion again would rather seem to be that the future data have now discriminated between the two alternative modeling approaches.

[In response to a query regarding updating the SCAA base operating model with the data available at SC in June 2012, edited slightly] Re: the SCAA work required for c), it depends on exactly what you want. I suspect a "turn-the-crank" routine update with data inputs updates provided in friendly formats would not be a problem. However, elaborate generation of updated distributions of future indicators (with or without variance estimation update?) might become a rather different story.

I'd agree with David that catches continually and appreciably above TACs would be justification for EC.

APPENDIX V. LIST OF DOCUMENTS POSTED ON THE SHAREPOINT SITE

Anon. 2007. Commonwealth Fisheries Harvest Strategy, Department of Agriculture, Fisheries and Forestry, Government of Australia. 63pp. ISBN 978-0-98037 14-4-4.

Butterworth, D S and R A Rademeyer. 2011. On “Exceptional Circumstances” Provisions for the Management Strategy for the Greenland Halibut Stock in Subarea 2 + Divisions 3KLMNO based especially on Survey Results occurring Outside the Range Simulated. NAFO SC Working Paper 11/45.

DFO. 2011. Western Component (4XOPQRS5) Pollock Management Strategy Evaluation. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/054

Holland, D. S. 2010. Management Strategy Evaluation and Management Procedures: Tools for Rebuilding and Sustaining Fisheries. OECD Food, Agriculture and Fisheries Working Papers, No. 25, OECD Publishing. doi: 10.1787/5kmd77jgvkjf-en

NAFO. 2011. Report of the Working Group on Greenland Halibut Management Strategy Evaluation (WGMSE), 7 September 2011 via WebEx teleconference. 10pp. NAFO FC Doc. 11/08.

Shelton, P.A. 2011. Evolution and implementation of a management strategy for NAFO Subarea 2 and Divs. 3KLMNO Greenland halibut fishery. NAFO SCR Doc. 11/042

Shelton, P.A. and B. P. Healey. 2011. Evaluating exceptional circumstances in the context of the Greenland halibut management strategy evaluation based on the 2011 stock assessment. NAFO SC Working Paper 11/40.