Northwest Atlantic Fisheries Organization

Serial No. N6265 NAFO/GC Doc. 13/4 REV

ASSESSMENT OF THE METHODOLOGY USED BY NAFO SCIENTIFIC COUNCIL TO ESTIMATE CATCHES FOR NAFO STOCKS:

2013 PROGRESS REPORT

By the Expert Panel

BACKGROUND

Scientific Council has relied on several data sources to estimate catches going back to 1979 (NAFO 1980). These have been reported in various forms over the years. In 2009, NAFO established a Performance Assessment Working Group (PAWG) to carry out a performance review addressing NAFO's strengths, weaknesses, challenges and successes. In the PRP report (Hazin et al. 2011), concerns were expressed about the accuracy and quality of data submitted to NAFO and data used by the Scientific Council in its catch estimation procedures. Their Report states *inter alia*:

> "*... the PRP would register concern over apparent discrepancies between STATLANT 21A catch estimates and those of STACFIS (Table 8) (Appendix IX). It recommends that the Fisheries Commission and Scientific Council promptly resolve such discrepancies if possible, or at least provide some guidance on how they arise, including underlying assumptions made and/or consequences anticipated."*

On May 23, 2012 the Executive Secretary of NAFO sent a letter to Heads of Delegations of the General Council requesting a mail-in vote regarding a joint EU – Canada - USA proposal for an external Expert Panel (hereafter called the Panel) to peer-review the STACFIS catch estimation methodology for some NAFO stocks (Annex I). Shortly after distribution of the letter, three nominated scientific experts (D.B. Atkinson – Canada, M. Sissenwine – USA and C. Stransky – EU) were appointed. It was later agreed that D.B. Atkinson would serve as Chair.

The mandate of the Panel was "To carry out a review of the methodology and sources of information used by the NAFO Scientific Council (STACFIS) to provide overall catch estimates."

The 'Explanatory Note' accompanying the Proposal (Annex I) stated *inter alia* "The peer review should thoroughly review the methodology used by STACFIS and clarify the reasons for the discrepancies between the Scientific Council and STATLANT21 data. Such a review may include, but should not be limited to, consideration of different methodologies including any assumptions used to estimate overall catches, sources of information and discards estimates."

The Panel's mandate clearly focuses on the STACFIS estimates, and this is reflected in the title of this report. However, the Panel notes that the PRP "*register concern over apparent discrepancies between STATLANT 21A catch estimates and those of STACFIS*." The broader concern of the PRP points toward examination of both sources of information on catches without prejudice (i.e., inaccuracy in either source, or both, could be the reason for discrepancies), and the Panel shares this perspective.

After extensive consultations during the summer of 2012, the Review Panel submitted a Preliminary Report (Atkinson et al. 2012) to NAFO and a summary document (Atkinson 2012) was also produced for consideration during the 2012 Annual Meeting. The Chair also presented the Panel findings during the Annual Meeting.

REVIEW OF 2012 ACTIVITIES

The activities leading up to preparation of the 2012 Preliminary Report are documented in that report (Atkinson et al. 2012). The Panel summarized its conclusions as follows:

1. Official reports of catch from at least some flag states are not trusted to the degree necessary to translate into advice that scientists feel is defensible. Using the information on catch that scientists believe results in the most scientifically defensible advice is a matter of scientific integrity. However, this does not exempt scientists from documenting their reasons for distrusting official reports, their sources of data used, and their estimation methods. It may be necessary for documentation to be confidential, but confidentiality is not synonymous with undocumented.
2. The approach used by the Scientific Council for estimating catches of some flag states is logical, but the Panel could not judge the merits of the actual estimates.
3. More can be done to review the methodology used by the Scientific Council, but the Panel went as far as it could go under the circumstances. It was not efficient and cost effective for the Panel to further pursue a review of the methodology used by Scientific Council without the documentation noted earlier and due to the tight time frame this could not be produced prior to the Annual Meeting in September 2012.

The Panel was able to determine that the primary reason for the differences was that scientific observer data for a small number of flag states indicated a higher catch per unit of effort than is implicit in STATLANT 21 catch reports.

Based on its findings during 2012, the Panel made a number of recommendations as described in Atkinson (2012). These were that:

- The issue of timely availability of STATLANT 21A data should be addressed as per the recommendations of the NAFO Review Panel (Hazen et al. 2011). It should also be clarified whether Scientific Council adjusts its estimates in subsequent years based on updated STATLANT 21 information.
- Standard protocols be developed and applied for the reporting of NAFO observer information by all flag states.
- It be made a requirement that STATLANT 21B reporting include 'hours fished'.
- That the state of data base management of NAFO observer data and VMS data be examined to assure it meets the needs for both scientific advice and compliance monitoring. Modern information technology should be used to make access and use of the data efficient while also protecting its confidentiality.
- NAFO Scientific Council prepare documentation as described in Annex II and develop a structured work plan including timelines for completion of this documentation. The Panel cautions that there may be reluctance on the part of Scientific Council to produce such documentation due to confidentiality issues. Therefore it is important that the confidentiality of such documents be assured. Access should be strictly limited on a “need to know” basis.
- Flag states with scientific observer information that have not, to date, derived alternate estimates of catch should do so such that Scientific Council can compare those estimates with the STATLANT 21 information. The methodology(ies) used should be fully documented.

Additionally, the Panel **recommended** a Phase 2 review of sources of NAFO catch information. The review should be conducted without prejudice about which sources of information are valid or superior to other sources of information. It prepared a list of documents that should be prepared to support future review of NAFO catch information (Annex II).

DISCUSSION BY NAFO IN LATE 2012 AND 2013 CONCERNING CATCH ESTIMATES:

NAFO was very active during late 2012 and in 2013 addressing concerns about estimates of catch including responding to the Panel's 2012 report. The section following highlights Fisheries Commission, Scientific Council and Secretariat responses to the Panel's 2012 report and it provides the Panel's comments on the responses (in italics). Appendix III also gives an inventory of activities that have come to the attention of the Panel.

Fisheries Commission (STACTIC)

STACTIC addressed the Panel recommendations during an intercessional meeting in May 2013 (NAFO 2013a). With regard to the matter of timely availability of STATLANT 21A data, they indicated "the timeliness of STATLANT data is already addressed in the Rules of Procedure for the Scientific Council (Rule 4.4) and it is not within the purview of STACTIC to amend this provision)." As for the reporting of effort in hours in STATLANT 21B submissions, they stated "It was noted that this recommendation was already a requirement of STATLANT 21B, which falls under the Rules of Procedure for the Scientific Council and therefore outside the purview of STACTIC."

Panel Comment: Although the Panel recognizes that these two issues fall within the Rules of Procedure for Scientific Council, the Panel considers the lack of compliance to be a broader issue that faces NAFO in total and means should be explored for the constituent bodies of NAFO to work together to resolve the issues. It is not enough to have Rules of Procedure. It is up to NAFO to assure they are fulfilled. The Panel has determined that timely reporting of STATLANT 21A information has improved in recent years and encourages further improvements.

The Panel noted that there was a concern expressed by a STACTIC meeting participant regarding the value of effort data. While this type of information may have limited value for stock assessments, since the discrepancies in catch values have been determined to be due to differences in catch rates, comprehensive effort information from a variety of sources would help to resolve the differences.

STACTIC considered that the current VMS practice was adequate to meet conservation and Enforcement Measures (CEM) but agreed to examine possible confidentiality modifications so as to allow for broader use of the data. They also agreed to table a working paper for adoption during the 2013 Annual Meeting that would standardize the reporting by NAFO observers.

Panel Comment: The Panel welcomes the willingness of STACTIC/FC to explore modifications to current practices that will aid in broader use of the VMS data. The Panel also welcomes the proposal to standardize the reporting format for observer data, as the current practices are variable so as to render the data available in the Secretariat to be of limited value.

STACTIC also discussed possible alternate approaches to evaluate the accuracy of STATLANT data as a contribution to the work of the Panel in response to (Shibanov 2013) . It was agreed "STACTIC would create tables to compare STATLANT data against available CEM data to identify possible anomalies or derogations and consider what further amendments to the NAFO CEMs could be adopted to ascertain the reliability of the catch data."

Panel Comment: Information was made available to the Panel for examination and this is appreciated. Generally speaking, the information regarding catches is similar across the different sources but some difficulties in manner of reporting were noted. For example, some reporting is for multiple divisions such as 3LMN. While this may be adequate for species such as Greenland halibut, it is problematic for species such as cod or redfish as the division combination represents three different stocks of each. Thus the information is of limited value as comparisons are not possible. The Panel also notes that there are some questions surrounding independence (or otherwise) of these different sources of information.

Scientific Council

Scientific Council responded to the recommendations of the Panel in a letter circulated in December of 2012 (Shibanov 2012). In it, Scientific Council indicated "sources of data, design of sampling programs and the compilation of raw data are matters for flag states. This information is held at a national level and is not available

to Scientific Council. The Council is not in a position to compel its provision." Scientific Council also reported that data " … is collected by arrangement between individual laboratories and members of their national fishing industries, under a presumption of anonymity. Scientific Council did not reach a consensus regarding a means of presenting this data in the form requested while maintaining this anonymity, as the inclusion of STATLANT 21 figures immediately negates any redaction of flag state information." Lastly, Scientific Council reported, " Although Scientific Council is not in a position to provide the panel with all of the information requested, we feel that the resolution of the discrepancy between STATLANT 21 and STACFIS figures remains an important issue and we will continue to support the work of the panel."

Panel Comment: The Panel understands that access to much of the data used for scientific estimates of catch is up to flag states, but this does not alleviate the responsibility of the Scientific Council to document and quality assure the estimates it uses. The Panel regrets that the data upon which the estimates are based will not be made available. Although the Panel previously reported that the methodologies employed seem reasonable (also see below), without these data it will not be possible to examine the estimates in any more detail.

Scientific Council did not indicate if catch information is adjusted in subsequent years based on updated STATLANT 21 information.

Panel Comment: The Panel considers that Scientific Council should check this and if adjustments are not currently made they should be into the future.

A meeting of Scientific Council was held by WebEx in March 2013 (NAFO 2013b). It was indicated, during this meeting, that similar to the situation in 2011, alternate estimates of catch from traditional sources would not be available for the June meeting although new estimates from Canada would be tabled. As such, the meeting focused on stocks where the discrepancy between STATLANT and STACFIS figures was greatest, and where the absence of reliable STACFIS estimates would pose serious problems to the current assessment method. This exercise identified three stocks which gave cause for concern, Div. 3M Cod, Greenland halibut in Div. 2J3KLMNO and American plaice in Div. 3LNO.

Panel Comment: The Panel emphasizes that although there were again no scientific estimates of catch, the problem has not been solved since their unavailability seems to reflect a process decision not to prepare scientific estimates rather than evidence that the reason for previous estimates has been resolved.

During this meeting, Scientific Council also requested the Secretariat to prepare a summary of VMS effort data, by flag State, Division and year, stratified into four depth categories (<200m, 200m – 400m, 400 – 700m and 700m+), for circulation in advance of the June meeting, in order that the scale of any changes in effort distribution be quantified.

A document summarizing effort trends based on VMS data was prepared by the Secretariat for the June meeting (Campbell and Federizon 2013). Scientific Council found the analysis to be useful and recommended the Secretariat to continue to develop this work by incorporating target species and making the data available via a web extraction tool. There were no discussions of the trends in effort observed.

Panel Comment: The Panel considers this type of analysis useful in examining the fisheries under the purview of NAFO. The analyses provide an alternate source of effort information that will allow useful comparisons with effort from other sources (NAFO observers, STATLANT 21B) that may then provide insights into trends in catches. These possible analyses/comparisons again point to the importance of availability of effort information (hours fished) in the STATLANT 21B database and detailed NAFO observer reports (see above).

During the June 2013 meeting of Scientific Council (NAFO 2013c), a number of documents were tabled related to the issue of catch estimates. Brodie (2013) provided insights into the history of the use of alternate estimates by Scientific Council. Morgan et al. (2013) provided estimates of catch in the Canadian otter trawl fishery for yellowtail flounder based on observer data. They found that for the main species, the estimates were usually within 95% of the reported catches, but for American plaice, reported catch in most years was 70-80% of the estimated catch and for cod it was often less than 80% of the estimated catch although the difference in tons was small. They concluded that further investigations of the methodology are warranted.

Panel Comment: The Panel considers the document by Brodie (2013) to be a valuable contribution that summarizes the history of the use of alternate estimates of catch by Scientific Council. It is clearly not a recent issue with the practice dating back to the 1980s. While the document does indicate that the official statistics are considered unreliable in a number of instances, there were no details provided regarding the rationale, especially during the more recent times. It is interesting that the surveillance estimates and those based on scientific observer data were similar during 2004-2006 but have diverged more recently given that the methodologies used to estimate catches from the scientific observer data have not changed over time (see following).

The Panel also welcomes the contribution by Morgan et al. (2013) and encourages other flag states with scientific observer data to do similar analyses. The Panel agrees that the methodology used to adjust observer data up to catch estimates should be further explored.

Alpoim (2013) and Gonzalez-Costas (2013) both reported on the methodologies employed to estimate catches by their respective flag states during 2000-2010 and 2004 and 2010 respectively.

Panel Comment: The Panel welcomes that the methodologies employed by some flag states are now available in the NAFO SCR document series. These papers give satisfactory descriptions and the methods used seem reasonably sound thus confirming the verbal information provided and conclusions reached during 2012. The quality of scientific estimates therefore depends primarily on the quality of the input data from scientific observers.

Secretariat

The Secretariat provided information in response to requests made by STACTIC (as noted above) and the Panel.

Panel Comment: The Secretariat has been most helpful in the provision of additional information for the Panel's review. As indicated above, databases containing information available to STACTIC for CEM-related evaluations have been provided and have been reviewed by the Panel. These data indicate general similarities between catch estimates from various sources although the quality of the data is such that the possibilities of detailed analyses and comparisons are limited. The VMS information has also been useful as it represents a quite independent source of information (see above).

CONCLUSIONS

The Panel reiterates that accurate reporting and/or estimation of catches is critical for scientific assessment and management. NAFO has a history extending back to at least the 1980s of questionable reporting via STATLANT and/or estimates as indicated by differences between the two, as well as various anecdotal reports. Scientific Council continues to lack faith in the official statistics although the details of their concerns have not been documented.

The fact that there were no alternate scientific estimates available during 2012 or 2013 should not be interpreted as solving the problem since this seems to reflect a process decision not to prepare scientific estimates rather than evidence that the reasons scientists believed previous alternate estimates were necessary have been resolved. If anything, the lack of alternate estimates may actually be exasperating the problems faced by NAFO, especially for 3M cod, 3LNO American plaice and Greenland halibut as discussed by Scientific Council during their March 2013 WebEx meeting (NAFO 2013b).

Scientific papers have been prepared that describe the methods used to prepare scientific estimates. These papers give satisfactory descriptions and the methods used seem reasonably sound. Therefore, the quality of the scientific estimates depends primarily on the quality of the input data from scientific observers. Without access to the data and documentation on how it was collected and quality assured, it is not possible to determine how representative the sampling is and its overall quality. In particular, it is also not possible to know how accurate the tow-by-tow estimates of catch are.

The fundamental reason for the differences seems to be is that scientific observers from Portugal and Spain record values for catch during individual tows that are different from the values recorded by NAFO observers or in logbooks. This is clearly demonstrated in Table 5 of the paper by Gonzalez-Costas (2013) (reproduced below).

Table 5.- One species Scientific Observers catches for the effort surveyed by them and the NAFO Observers catches for the same species and effort by year in percentage. 100% is the Scientific Observers catches.

Catch %	2006	2007	2008	2009	2010
Scientific Observers	100%	100%		100%	
NAFO Observers	52%	51%		59%	

Both Alpoim (2013) and Gonzalez-Costas (2013) indicate that one of the areas of uncertainty is the estimates of catch made by the scientific observers. It is believed that at least some of the NAFO observer information is taken from logbooks. However, the panel had insufficient information to judge the accuracy of either scientific observer or NAFO observer estimates of catch on a tow-by-tow basis.

The rationale followed by Scientific Council to select what they believe is the best estimate of catch is not available. Brodie (2013) has described the history of this, including the reasons for the lack of documentation. Nonetheless, the Panel believes a general description should be possible.

RECOMMEDATIONS

1) The Panel **recommends**

   a) That NAFO work collectively across constituent bodies to ensure that STATLANT 21A data are received by the Secretariat within the timeframes currently established, and

   b) That NAFO work collectively across constituent bodies to ensure that the reporting of effort in hours fished as part of the STATLANT 21B submissions is done as per current requirements.

   In conjunction with these recommendations the Panel is concerned in that it is not enough for NAFO to respond by saying these data issues are addressed by the Convention and Rules of Procedure. There are problems that NAFO needs to resolve.

2) The Panel **recommends** continued exploration of the VMS database and innovative approaches to allowing broader availability while meeting all the necessary confidentiality requirements.

3) The Panel **again recommends** it should be clarified whether Scientific Council adjusts its estimates in subsequent years based on updated STATLANT 21 information. If this is not currently done then procedures should be changed so as to ensure it is done in the future.

4) The Panel **again recommends** that flag states with scientific observer information that have not, to date, derived alternate estimates of catch should do so such that Scientific Council can compare those estimates with the STATLANT 21 information. The methodology(ies) used should be fully documented. The Panel notes that Scientific Council has already given consideration to methodological issues during its March 2013 WebEx meeting (NAFO 2013b).

5) The Panel **recommends** that Scientific Council prepare a document detailing, to the extent possible, the reasons they lack faith in the STATLANT catch information. Such a document could then form the basis for meaningful dialogue between Scientific Council and Fisheries Commission. The Panel notes that Scientific Council has already given consideration to this during its March 2013 WebEx meeting (NAFO 2013b).

6) The Panel **recommends** that Scientific Council prepare a document that describes, at least in general terms, the rationale followed in selecting what is considered the best estimate of catch when different estimates are available.

7) The Panel **recommends** that NAFO (Scientific Council and Fisheries Commission working together) and Flag States document and test (for accuracy) methods used by **scientific observers AND NAFO observers** for estimating catch on a tow-by-tow basis. Discrepancies between tow-by-tow estimates represent the leading candidate for explaining the discrepancy between scientific estimates and STATLANT reports. In examining the accuracy of tow-by-tow estimates by NAFO observers, it is important to understand the

relationship of these estimates to vessel logs and the accuracy of vessel logs. In addition to discrepancies between scientific observer and NAFO observer tow-by-tow estimates, it is also important to consider the possibility that fishing behavior and vessel reporting is influenced by the presence or absence of an observer (i.e., a possible observer effect when there is less than 100% coverage of vessel tows either due to the absence of an observer or their unavailability during certain times of the day).

Even if following recommendation 7 is successful in explaining discrepancies in catch estimates, it may not lead to an easy agreement on how to produce future best estimates of catch and what to do about past discrepancies, including recent years when scientific estimates were not available to Scientific Council. In this regard, and in light of other recommendations and issues raised by the Panel, a face-to-face meeting of NAFO officials (Scientific Council and Fisheries Commission representatives) and the Panel may merit consideration. Panel members could help to facilitate a discussion to ensure all issues are on the table (for example, clearly define the problem, why does Scientific Council feel alternate estimates are necessary, etc.) and to assist NAFO officials in developing an agreement regarding appropriate follow-up actions.

REFERENCES:

Alpoim, R. 2013. Alternative Method to Estimate Catches Based on the Scientific Observers. NAFO SCR Doc. 13/53. Serial No. N6212.

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Morgan, M. J., W. B. Brodie, and D. Power. 2013. Estimates of catch from the Canadian otter trawl fishery directed for yellowtail flounder based on observer data. NAFO SCR Doc. 13/023. Serial No. N6176.

NAFO. 1980. Provisional Report of the Scientific Council. Dartmouth Canada, 3-13 June 1980. NAFO SCS Doc. 80/VI/25. Serial No. N175.

NAFO. 2013a. Report of the Standing Committee on International Control (STACTIC) 7-9 May 2013 London, UK. NAFO FC Doc. 13/4. Serial No. N6149.

NAFO. 2013b. Report of Scientific Council Meeting, 19 March 2013. NAFO SCS Doc. 13/02. Serial No. N6141.

NAFO. 2013c. Report of Scientific Council Meeting, 7-20 June 2013. NAFO SCS Doc. 13/17. Serial No. N6208.

Shibanov, V. 2012, December 3. GC Correspondence GFS/12-359.

Shibanov, V. 2013, March 21. GC Correspondence GFS/13-124.

ANNEX I: Explanatory Note in support of proposal

EU/Canada/US proposal for a peer review of the method of catch estimation of NAFO stocks by STACFIS

Explanatory note

In the course of recent years NAFO Fisheries Commission expressed concerns about the fact that the NAFO Scientific Council estimated catch overruns for a number of NAFO stocks, in particular Greenland halibut in SA 2 + Div. 3KLMNO and 3M cod. At the 2011 Annual Meeting, the Fisheries Commission stated that the Total Allowable catch overrun suggested by the Scientific Council estimate of catch remains a big problem and agreed to identify more concrete steps in addressing this issue.

Similarly, the 2011 NAFO Performance Review (PR) expressed concerns about the accuracy and quality of data submitted, particularly data used by the Scientific Council in its catch estimation procedures. The PR report recommended that "the Fisheries Commission and the Scientific Council promptly resolve any discrepancies between STA TLANT 21 A catch estimates and those of STACFIS, if possible, or at least provide some guidance on how they arise, including underlying assumptions made and/or consequences anticipated."

The Working Group on the Developments of Plan of Actions for the Implementation of the Recommendations of NAFO Performance Review Panel recommended that "the General Council submit the issue of catch discrepancy between STATLANT 21 A catch estimates and those of STACFIS to an external peer review process".

The analysis of the National reports submitted by NAFO scientists to the Scientific Council (SCS documents) shows that the total or nominal catches contained in these reports are of similar value to the catches reported through STATLANT21. This is the case for all NAFO Contracting Parties active in the fishery and in particular for the stocks of Greenland halibut in SA 2 + Div. 3KLMNO and 3M cod.

At the same time, there is a high monitoring and control level of the fishing activity in the NAFO regulatory area. Inspection programmes include regular at sea inspections and mandatory port inspections for Greenland halibut in SA 2 + Div. 3KLMNO. Also, the inspection framework in NAFO has been modernized with an increased number of data available from fishing vessels. Daily catch declarations for all species are mandatory and VMS positions have to be submitted with a one hour frequency. Compliance increased considerably since 2007 and the number of serious infringements related to misreporting of catches has been very low or even 0 in certain years. The results from the monitoring and inspection programme are therefore not consistent with the catch discrepancy estimated by the Scientific Council.

In order to clarify the reason for the discrepancies, it is proposed to carry out an independent peer review of the methodology used by the Scientific Council to estimate catches. The peer review should thoroughly review the methodology used by STACFIS and clarify the reasons for the discrepancies between the Scientific Council and STATLANT21 data. Such a review may include, but should not be limited to, consideration of different methodologies including any assumptions used to estimate overall catches, sources of information and discards estimates.

This peer review could be carried out by a small panel of 3 independent scientific experts between June and August 2012 so that the final results are available for the 2012 Annual Meeting. It is proposed that NAFO allocates CAN$ 40 000 for this purpose.

Given the urgency and intersessional timing of this matter, this issue should be decided by the General Council through a mail vote in accordance with Rule 2.5 of the Rules of Procedure for the General Council.

Decision

Assessment of the methodology used by NAFO Scientific Council to estimate catches for NAFO stocks

I. The General Council tasks the under mentioned scientific experts ("expert panel") to carry out a review of the methodology and sources of information used by the NAFO Scientific Council (STACFIS) to provide overall catch estimates. The review should address the methodology and assumptions being utilized, including the proportion of discards in the estimate. The review will deal with all stocks with a focus on 3M cod and Greenland halibut in SA2 + Div. 3KLMNO. The expert panel will make recommendations as appropriate.

2. The nominated scientific experts are:
- Michael Sissenwine (Chair)
- Christoph Stransky
-Bruce Atkinson

3. The expert panel should carry out the work in the period June - August 2012 and report on the outcomes of its analysis at least 15 days before the 2012 NAFO Annual Meeting.

4. The Scientific Council and NAFO Secretariat should provide the expert panel with the necessary information to perform this assessment. Further noting the role of NAFO inspectors in fishery/ catch monitoring as well as the potential utility of control data (including VMS data) for this process, the expert panel should consult the representatives of NAFO bodies and Contracting Parties, as appropriate, to seek information or knowledge in this regard.

5. It is proposed that NAFO General Council approves the necessary funds to conduct the peer review from the contingency fund.

ANNEX II: List of documentation to be prepared by NAFO prior to commencement of a comprehensive review of STACFIS catch estimates.

1. Scientific Council should review and document its use of STATLANT 21 information in cases where alternate estimates of catch are not available and prepare documentation that shows the estimates as currently used as well as those based on any revisions to STATLANT 21 information so as to allow evaluation of the magnitude of the late reporting issue.
2. The Scientific Council approach to estimating catches should be fully documented including raw data inputs to estimates. The documentation should describe the sources of data and the design of the programs that produced the data. Documentation should be sufficient to allow a third party to reproduce the estimates. The identity of individual countries, vessels, observers, scientists, etc. can be redacted. Also, the documents can be confidential. It must be understood that confidential does not mean undocumented.
3. The breakdown of catch estimates available to Scientific Council by flag state should be documented as well as the specific estimates selected as being the best estimates. This information can be confidential with specific flag state information redacted.
4. An inventory of information collected by scientific observers should be compiled by Scientific Council and maintained through annual updates. This could be facilitated by the Secretariat.
5. Contracting Parties should fully document the information available in the NAFO observer reports from flag states and the NAFO Secretariat should compare this information with the information it has currently coded to determine if additional coding would be useful.

ANNEX III: Inventory of late 2012 and 2013 NAFO activity concerning discrepancy in catch information

NAFO Response to the Panel's 2012 Recommendations

2012 Recommendation	NAFO Response
The Panel **recommends** a Phase 2 review of sources of NAFO catch information. The review should be conducted without prejudice about which sources of information are valid or superior to other sources of information (Atkinson 2012).	Although the Panel has been contracted to conduct further work investigating the catch discrepancies, there has been no specific change in mandate.
The Panel **recommends** that the issue of timely availability of STATLANT 21A data should be addressed as per the recommendations of the NAFO Review Panel (Hazen et al. 2011). It should also be clarified whether Scientific Council adjusts its estimates in subsequent years based on updated STATLANT 21 information (Atkinson 2012).	It was agreed that the timeliness of STATLANT data is already addressed in the Rules of Procedure for the Scientific Council (Rule 4.4) and it is not within the purview of STACTIC to amend this provision (NAFO 2013a).
The Panel **recommends** that standard protocols be developed and applied for the reporting of NAFO observer information by all flag states (Atkinson 2012).	The Chair noted that, at the September 2012 Annual Meeting, the Fisheries Commission had approved FC Doc 12/22, which proposed the standardization of observer program data and reporting requirements in the NRA. Canada presented STACTIC WP 13/14 which proposed adding CEM requirements to use forms currently developed and provided on the NAFO website. Canada explained that this proposal was developed to address recommendations made by the Expert Panel that called for data to be collected, and reported, in a consistent and timely manner to facilitate the compilation and analysis of observer data (NAFO 2013a). It was agreed that STACTIC WP 13/14 would be presented to FC for adoption at the 2013 NAFO Annual meeting (Annex 6) (NAFO 2013a). The EU expressed its intent to present a working paper, regarding preliminary Observer reporting, at the NAFO Annual Meeting (NAFO 2013a).
The Panel **recommends** that it be made a requirement that STATLANT 21B reporting include 'hours fished' (Atkinson 2012).	The NAFO Secretariat noted that this data element was already a requirement of STATLANT 21B, but advised that some CPs were not reporting. Canada reiterated that STATLANT obligations were not part of the CEM, but rather specified in Rules of Procedures for the Scientific Council (Rule 4.4.) (NAFO 2013a). The EU noted that, while some elements of the STATLANT data were not being consistently met, CPs were meeting the CEM requirements for information. DFG questioned how SC used the STATLANT figures and why other sources were not considered. It was noted that STACTIC could provide valuable information based on logbooks and other sources. Others noted that the SC was free to use other sources of data managed by NAFO. DFG further noted that ICES did not use hours fished because of the different fishing methods (trawl vs. longline) being used. Iceland noted that SC would benefit from an explanation of possible other sources of fisheries data that could improve SC effectiveness. The EU noted that the quality of monitoring data had improved over the last number of years in an effort to make available more timely and accurate information and to improve transparency. STACTIC members noted a willingness to work with SC (NAFO 2013a). It was noted that this recommendation was already a requirement of STATLANT 21B, which falls under the Rules of Procedure for the Scientific Council and therefore outside the purview of STACTIC (NAFO 2013a).
The Panel also **recommends** that the state of data base management of NAFO observer data and VMS data be examined to assure it meets the needs for both scientific advice and compliance monitoring. Modern information technology should be used to make access and use of the data efficient while also protecting its confidentiality (Atkinson 2012).	It was agreed that the current VMS enforcement application is adequately addressed within the CEM. STACTIC will continue to reflect on confidentiality issues, and will consider NEAFC amendments on this issue for possible application in the NAFO context. The issue will also be forwarded to the AGDC/ JAGDM (NAFO 2013a).
The Panel **recommends** that NAFO Scientific Council prepare documentation as described in Annex II and develop a structured work plan including timelines for completion of this	See Below.

documentation. The Panel cautions that there may be reluctance on the part of Scientific Council to produce such documentation due to confidentiality issues. Therefore it is important that the confidentiality of such documents be assured. Access should be strictly limited on a "need to know" basis (Atkinson 2012).	
The Panel **recommends** that flag states with scientific observer information that have not, to date, derived alternate estimates of catch should do so such that Scientific Council can compare those estimates with the STATLANT 21 information. The methodology(ies) used should be fully documented (Atkinson 2012).	Canada tabled a SCR document during the June, 2013 SC meeting (Morgan et al. 2013).
Scientific Council should review and document its use of STATLANT 21 information in cases where alternate estimates of catch are not available and prepare documentation that shows the estimates as currently used as well as those based on any revisions to STATLANT 21 information so as to allow evaluation of the magnitude of the late reporting issue (Atkinson 2012) (ANNEX II).	Scientific Council understands that a spreadsheet containing the STATLANT 21 and STACFIS figures available in each year has been prepared by the Secretariat. We believe that this would allow the panel to evaluate the magnitude of the late reporting issue. Alternate catch estimates were not available in 2012, and the use of STATLANT 21 data, or alternative approaches, is documented on a stock-by-stock basis in the most recent STACFIS report. (GFS/12-359)
The Scientific Council approach to estimating catches should be fully documented including raw data inputs to estimates. The documentation should describe the sources of data and the design of the programs that produced the data. Documentation should be sufficient to allow a third party to reproduce the estimates. The identity of individual countries, vessels, observers, scientists, etc. can be redacted. Also, the documents can be confidential. It must be understood that confidential does not mean undocumented (Atkinson 2012) (ANNEX II).	Sources of data, design of sampling programs and the compilation of raw data are matters for flag states. This information is held at a national level and is not available to Scientific Council. The Council is not in a position to compel its provision. (GFS/12-359). The group felt that creating a document describing the methods used by Scientific Council to estimate catch would be a valuable exercise, which could exist as a separate annex, in a manner similar to the current descriptions of surveys. Furthermore, a document outlining the reasons for using alternative catch estimates in assessments would be a valuable contribution to both the understanding of the Fisheries Commission and to the work of the independent peer-review group, in terms of expressing the implications a switch to lower catches will have on perceptions of stock biomass and reference points. It was also suggested that a standard methodology could be developed describing the work of scientific observers and requiring such information to be submitted to Scientific Council from all Contracting Parties (NAFO 2013b).
The breakdown of catch estimates available to Scientific Council by flag state should be documented as well as the specific estimates selected as being the best estimates. This information can be confidential with specific flag state information redacted (Atkinson 2012) (ANNEX II).	This information is collected by arrangement between individual laboratories and members of their national fishing industries, under a presumption of anonymity. Scientific Council did not reach a consensus regarding a means of presenting this data in the form requested while maintaining this anonymity, as the inclusion of STATLANT 21 figures immediately negates any redaction of flag state information. (GFS/12-359)
An inventory of information collected by scientific observers should be compiled by Scientific Council and maintained through annual updates. This could be facilitated by the Secretariat (Atkinson 2012) (ANNEX II).	Scientific Council understands that the Secretariat currently maintains an inventory of metadata, including details of the information collected by scientific observers, and publishes this on an annual basis. (GFS/12-359)
Contracting Parties should fully document the information available in the NAFO observer reports from flag states and the NAFO Secretariat should compare this information with the information it has currently coded to determine if additional coding would be useful (Atkinson 2012) (ANNEX II).	Not addressed by SC.

Additional Commentary provided by NAFO subsequent to the 2012 Annual Meeting:

Report of the SC Ad Hoc Working Group On Catch Estimation 19 March 2013 (NAFO 2013b):

Contracting Parties:

As in 2012, it was noted that there would be no information available to Scientific Council from the scientific observer schemes or from surveillance estimates of Contracting Parties. It may be possible, by the June meeting, to examine figures from Canadian observers in two Grand Banks fisheries (Div. 3NO Cod and Div. 3LNO American plaice), as these are the most intensively observed, however it was noted

that coverage only extends to approximately 5% of the fleet and any figure derived should be treated with caution.

Guidelines for June:

Prior to the meeting, the Chair circulated a spreadsheet to Designated Experts to identify those stocks where the discrepancy between STATLANT and STACFIS figures was greatest, and where the absence of a reliable STACFIS estimate would pose serious problems to the current assessment method. This exercise identified three stocks which gave cause for concern, Div. 3M Cod, Greenland halibut in Div. 2J3KLMNO and American plaice in Div. 3LNO.

Discussion – ways forward after June:

The group felt that creating a document describing the methods used by Scientific Council to estimate catch would be a valuable exercise, which could exist as a separate annex, in a manner similar to the current descriptions of surveys. Furthermore, a document outlining the reasons for using alternative catch estimates in assessments would be a valuable contribution to both the understanding of the Fisheries Commission and to the work of the independent peer-review group, in terms of expressing the implications a switch to lower catches will have on perceptions of stock biomass and reference points. It was also suggested that a standard methodology could be developed describing the work of scientific observers and requiring such information to be submitted to Scientific Council from all Contracting Parties.

SC Review of 2012 Recommendations (NAFO 2013c):

Contracting Parties have the responsibility to report accurate catches to NAFO via STATLANT 21 submissions, and Scientific Council has the responsibility to "compile" these catches for NAFO. Scientific Council considered that it is not its responsibility to provide the best catch figures, nevertheless Scientific Council requests clarification on which NAFO body is responsible for validating the quality of the STATLANT catch figures submitted, to enable the Scientific Council to carry out assessments in a timely manner. If it is the job of Scientific Council, Scientific Council recognizes that the availability of more information will improve the catch quality, for example inspection reports, daily catch reports and VMS data, may be required for this task.

Scientific Council recommends that General Council clarify the responsibilities of NAFO bodies and Contracting Parties with respect to determining the quality of STATLANT 21 data.

STATUS: No progress

Div. 3M Cod (NAFO 2013c):

Due to problems of estimating exact catches for 2011 and 2012, catches for those years were entered as a probability distribution reflecting "best expert estimate" and the uncertainty associated. The use of imprecise catch estimates for the recent two years introduces additional element of uncertainty in the assessment. Without improved estimates of catch this assessment method will be discontinued in 2014.

Greenland Halibut (NAFO 2013c):

According to the indicator based on surveys, exceptional circumstances are presently occurring, however, having a survey observation above the simulated distributions does not constitute a conservation concern. Due to the unavailability of STACFIS catch estimates in 2011 and 2012, SC is unable to determine whether recent catches constitute an exceptional circumstance.

STACFIS catch estimates for 2011 and 2012 are not available. Therefore, SC cannot compare observed catches to the simulated distributions, and is unable to determine if exceptional circumstances are

occurring in respect to this indicator. SC notes the management strategy for Greenland halibut assumed that the simulated catches would exactly equal the TACs generated from the HCR. The 90% confidence intervals for the simulated 2012 catches range from 15794 to 18100 t in the XSA based OMs and in SCAA based OMs, from 16323 to 16323 t. The STATLANT 21 catches for 2012 were 15198 t, against a TAC of 15510 t.

Critical Issues in development of Roadmap for EAF (Table 2) (NAFO 2013c):

- Reliable estimates of fishery catches and stock indicators for their use in stock and ecosystem assessments (stock assessments).
- Lack of full catch information for both commercial and non-commercial spp, including VME-defining spp, on a tow-by-tow basis (bycatches).
- Lack of full catch information for both commercial and non-commercial species, including VME-defining species, on a tow-by-tow basis (SAI on VME's).
- Lack of full catch information for both commercial and non-commercial spp, including VME-defining spp, on a tow-by-tow basis (Monitoring).

Documentation relating to STACFIS catch estimation methods and procedures (NAFO 2013c):

Scientific Council reviewed several presentations on this issue, which will be made available to the [peer review panel] on catch estimation, along with additional relevant details. The following text summarizes the presentations and SC review.

Introduction (SCR Doc. 13/051):

Estimates of catch from surveillance authorities were first introduced to SC in the mid-1980's, and were subjected to various reviews, within NAFO and externally. By the early 1990's, another source of catch estimation, from scientific observers on some fleets, arose within Scientific Council. For a number of years the different estimates of catch agreed with each other but not with STATLANT. Scientific Council has recognized the difficulties resulting from the use of unofficial estimates of catch in its stock assessments, particularly when there are discrepancies between these and the official data. However, it chose to use these estimates, which in many cases were believed to be more reliable than officially reported (STATLANT) data, accepting that the underlying raw data were not always available to Scientific Council, for reasons of confidentiality. Such acceptance of unofficial or undocumented catch data is common in various other scientific assessment bodies, such as ICES and ICCAT.

The issue of reliable catch data has occupied much time in Scientific Council over the years, as it is an important input into stock assessments. Contracting Parties have the responsibility to report accurate catches to NAFO via STATLANT 21 submissions, and Scientific Council has the responsibility to compile these catches for NAFO. Scientific Council has previously stated that it is not its responsibility to provide the best catch figures, and has noted that it would prefer to receive accurate official catch data to conduct its work, rather than have to use unofficial estimates. However, for at least some stocks, Scientific Council still requires the use of unofficial estimates of catch for its stock assessments.

Canada (SCR 13/023):

Observer data from the Canadian fishery directing for yellowtail flounder from 1998 onward was examined. Catch per unit effort (CPUE) for yellowtail flounder, American plaice and cod was estimated using a generalized linear model with gamma error and a log link. Data were combined over the main effects of year, month, division, and tonnage class, all entering the model as factors. The estimated CPUE was then applied to the reported effort to give an estimate of catch

in each year. For yellowtail flounder, in most years reported catch was 95% or more of the estimated catch. For the two bycatch species, reported catch was generally a lower proportion of the estimated catch. For American plaice, reported catch was 70-80% of the estimated catch in most years and for cod it was often less than 80% of the estimated catch but the difference in tons was small. Catch estimates for yellowtail flounder using modelled and unmodelled CPUE from the same data were similar.

EU/Spain (SCR 13/52):

The method used to estimate the Spanish catch by species since 2004 is based on the information collected by the NAFO Observers and the Spanish Scientific Observers. This method does not have a temporal stratum to estimate the catches and it is well known that CPUE for many species are seasonally dependent. The main reason to have no temporal stratum it is that the estimation is carried out by fishery since the species CPUEs between fisheries are very different and there are more variables than just seasonality.

The annual distribution of effort (fishing hours) is split by fishery and Division from the NAFO Observer information. The NAFO Observer Information has almost 100% coverage of the total effort made by the Spanish fleet in the NRA, and so this process gives the annual effort in hours fished by each of the Spanish fisheries in the NRA.

The annual CPUE of different species by fishery and NAFO Division are calculated with the scientific observer data. These CPUEs are multiplied for each fishery and division by the total effort obtained from NAFO observers to get the estimates of the total catch by species division and fishery.

Uncertainty of the catch estimated by this method for certain species was analyzed with a bootstrap, using the scientific observers individual observations (catch by haul) to calculate the confidence intervals of the estimates. The medians of the bootstrap are very close to the estimation made by the method based on the observers information in all Divisions, and the 5 and the 95 percentiles have a deviation around 10% of the mean in all Divisions.

EU/Portugal (SCR 13/53):

The scientific sampling program, implemented by Portugal for the NAFO Area, consists of having scientific observers onboard its fleet. The main objective of this program is to collect length and biological samples associated with the catch and effort data of the hauls they came from. The catch recorded by these observers has the main goal of raising the samples to the total vessel catch, and not to estimate the total fleet catches. Nevertheless the Portuguese catch estimation method is based on these scientific observers. The exercise to estimate catches became routine when it was needed to improve the input data for the assessment of several stocks. The methodology can be summarized in general as an application, by species and division, of the scientific observed CPUE to the total official effort. The percentage of effort observed was also provided for 2000-2012.

EU/France (fisheries statistics validation tool):

EU/France has developed a validation tool (SACROIS) for fisheries statistics, aiming at cross-checking data from different sources, as required in EU control Regulations. The application is crossing information, at the most disaggregated level, from the fishing fleet register, logbooks, fishing forms, sales notes, VMS and the scientific census of fishing activity calendars, in order to build a dataset compiling the most accurate and complete information for each individual fishing trips. The application verifies and controls the different sources of data, with the aim of

displaying validated and qualified landings per species and effort data series. The application provides also several quality indicators and evaluates the completeness of the data flows. In the context of NAFO, France fisheries are all based in St-Pierre and Miquelon where the statistical system does not currently permit the use of the SACROIS application. Nevertheless, all St-Pierre and Miquelon vessels are submitted to the logbook regulation for the monitoring of their spatial catches and effort.

Next steps and recommendations

Scientific Council discussed various options but was unable to find a clear way forward at this point. The ideal solution from the point of view of SC would be for flag states to provide accurate catch estimates and independent means of corroboration. Scientific Council can assist in developing methods of catch verification.

Annex I regarding SC progress in addressing the PRP recommendations (NAFO 2013c):

Documentation produced by the June SC meeting will be passed to the panel to assist in their interim progress report. Given the problems in obtaining a full set of STATLANT figures in advance of the June SC meeting, Scientific Council urges all contracting parties to observe the 1st May deadline for provision of STATLANT 21A to the Secretariat.

STACREC Report (NAFO 2013c):

ANNEX 1. HISTORICAL CATCH DATA BY SPECIES AND DIVISION

Table 1a. STACFIS catch ('000 t) estimates by NAFO Division and species from 2000 to 2012 where available.

Table 1b STACFIS catch ('000 t) estimates for Greenland Halibut by NAFO Division from 2000 to 2011 where available.

STACFIS Report (NAFO 2013c):

As in previous years STACFIS conducted a general review of catches in the NAFO SA 0–4 in 2012. STACFIS noted that an ad hoc working group had deliberated on catch estimates before the meeting and the conclusion were presented to STACFIS and discussed (SCS Doc. 13/02). NAFO Scientific Council (STACFIS) has estimated catch for its stock assessments for many years since the 1980s when large discrepancies were observed between various sources of catch information. The goal of this exercise was to use the best information available to provide the best possible assessments and advice. STACFIS has had available estimates from different sources, but not for all fleets or from all Contracting Parties. These various sources of data have repeatedly led STACFIS to the conclusion that catch estimates from STATLANT have been unreliable for a number of stocks. Again this year, STACFIS only had STATLANT 21A available as estimates of catches. The inconsistency between the information available to produce catch figures used in the previous year’s assessments and that available for the 2011 and 2012 catches has made it impossible for STACFIS to provide the best assessments for some stocks and had lead to increased uncertainties for others for which analytical assessment could be carried. STACFIS notes that if it does not have the information and time available to estimate catches during the June meeting, it will be unable to perform assessments and conduct the necessary work to provide answers to FC requests including advices on TAC levels.

<u>3M Cod (STACFIS) (NAFO 2013c):</u>

In 2011 and 2012, STACFIS only had STATLANT 21A available as estimates of catches. The inconsistency between the information available to produce catch figures used in the previous

year's assessments and that available for 2011 and 2012 has made impossible for STACFIS to provide the best assessments for some stocks. However, the model used for the assessment of this stock estimated catches of 13 640 t for 2011 and 13 670 t for 2012.

The 2011 and 2012 catch posterior medians, estimated by the model, are 13 640 t and 13 670 t, respectively.

3M Redfish (STACFIS) (NAFO 2013c):

No STACFIS catch estimates were available for 2011-2012. Over the previous five years (2006-2010) an average annual bias of 15% plus was recorded between overall STACFIS catch estimate and overall STATLANT nominal catch. In order to mitigate the lack of scientific catch information a 15% surplus was added to the STATLANT catch of each fleet for the last couple of years. This inflated STALANT catches are included in the present assessment as the STACFIS catch estimates.

3LNO American plaice (STACFIS) (NAFO 2013c):

STACFIS only had STATLANT 21A available as estimates of catches in 2011 and 2012. The inconsistency between the information available to produce catch figures used in the previous years' assessments and that available for the 2011 and 2012 catches has made it impossible for STACFIS to provide the best assessment for this stock in 2012. STATLANT 21A catch in 2012 was 1267 t.

SA2 + 3KLMNO Greenland halibut (STACFIS) (NAFO 2013c):

STACFIS only had STATLANT 21A data for 2011 and 2012 to estimate catch. The inconsistency between the information available to produce catch figures used in the previous year's assessments and that available for 2011 and 2012 has made it impossible for STACFIS to provide the best assessments for some stocks.

Fishing Mortality: Unknown, as estimates of total catch were unavailable.

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